Paper Summary

<!--META_START-->

Title: Integrated Exploration of Data-Intensive Business Processes [Extended Abstract]

Authors: Carlo Combi, Barbara Oliboni, Francesca Zerbato

DOI: 10.1109/SERVICES55459.2022.00038

Year: 2022

Publication Type: Conference (Extended Abstract)

Discipline/Domain: Computer Science / Business Process Management

Subdomain/Topic: Data-aware business process modeling and analysis

Eligibility: Not Eligible

Overall Relevance Score: 20 — Mentions "insights" and "support for process (re-)design and improvem

Operationalization Score: 30 — Operational methods are detailed (Activity View, queries, algorithms) but

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes — Activity View, complex value schema, process–data integration algor

Operationalization Present: Yes — Operational queries and algorithms for integrated process-data analys

Primary Methodology: Conceptual + Controlled Experiment + Proof-of-Concept Implementation

Study Context: Data-intensive business processes with BPMN models linked to conceptual database sch

Geographic/Institutional Context: University of Verona, Italy; University of St. Gallen, Switzerland.

Target Users/Stakeholders: Process modelers, analysts.

Primary Contribution Type: Conceptual framework and analysis method.

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper focuses on process–data integration for analysis and improvement, wit

<!--META_END-->

Title: Integrated Exploration of Data-Intensive Business Processes [Extended Abstract]

Authors: Carlo Combi, Barbara Oliboni, Francesca Zerbato

DOI: 10.1109/SERVICES55459.2022.00038

Year: 2022

Publication Type: Conference (Extended Abstract)

Discipline/Domain: Computer Science / Business Process Management

Subdomain/Topic: Data-aware business process modeling and analysis

Contextual Background: The paper extends previous work on integrating process and data models to

Geographic/Institutional Context: University of Verona (Italy); University of St. Gallen (Switzerland)

Target Users/Stakeholders: Business process modelers and analysts.

Primary Methodology: Conceptual + Controlled Experiment + Proof-of-Concept Implementation

Primary Contribution Type: Conceptual framework, operational queries, and algorithm.

General Summary of the Paper

This extended abstract summarizes a framework for the conceptual modeling and design-time analysis o

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Actionable/Actionability Used in Paper

No — The paper discusses "insights" and "support" for process redesign but does not use or define "actio

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Authors Argue for a Need for Actionability Without Defining It

No — The focus is on data–process integration for improved analysis, not on actionability as a concept.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A — While operationalization is present for process–data analysis, it is not tied to a notion of being acti

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Activity View concept

- BPMN process modeling

- Conceptual database schema design

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The authors build on prior research linking BPMN processes and data models, highlighting limited suppor

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Summary

This extended abstract outlines a framework for the integrated exploration of business processes and the

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Scores

- **Overall Relevance Score:** 20 — The work's "insights" and "support" could indirectly relate to actional

- **Operationalization Score:** 30 — Operational methods (Activity View, queries, algorithms) are well de

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Supporting Quotes from the Paper

- "...we show how such a formal model can be queried to obtain insights into the informational perspective

- "The Activity View... improves the comprehension of conceptual models of integrated processes and da

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Actionable Knowledge Discovery for Increasing Enterprise Profit, Using Domain Driven-Data Mining

Authors: Rakhi Batra; M. Abdul Rehman

DOI: 10.1109/ACCESS.2019.2959841

Year: 2019

Publication Type: Journal (IEEE Access)

Discipline/Domain: Data Mining / Knowledge Discovery

Subdomain/Topic: Actionable Knowledge Discovery (AKD); Domain-Driven Data Mining (D3M); Post-pro

Eligibility: Eligible

Overall Relevance Score: 86

Operationalization Score: 78

Actionable/Actionability Used in Paper: Yes — "Actionability is an important subjective interestingness me

Authors Argue for Need for Actionability Without Defining It: No — They provide an explicit conceptualiza

Contains Definition of Actionability: Yes — "a pattern is interesting or actionable if the user can do someth

Contains Systematic Features/Dimensions: Yes — Objective/Subjective Technical & Objective/Subjective

Contains Explainability: Partial — uses decision-tree rules and pruned rule paths; not framed explicitly as

Contains Interpretability: Partial — rule-based decision paths from C4.5 aid interpretability. (pp. 6–8) :con

Contains Framework/Model: Yes — Two-way Significance formalization; tightly/loosely coupled AKD fram

Operationalization Present: Yes — cost matrices, expected profit, probability gain, pruning, algorithmic st

Primary Methodology: Conceptual + Quantitative experiments (comparative evaluation on UCI datasets)

Study Context: CRM/HR illustrative use-case; evaluation on German/Australian credit, Adult Income, IBM

Geographic/Institutional Context: Sukkur IBA University, Pakistan (authors' affiliation). (p. 1) :contentRefe

Target Users/Stakeholders: Business decision-makers, CRM managers, HR analysts, BI practitioners. (p

Primary Contribution Type: Method/Algorithm + Evaluation (search-space reduction for action extraction v

CL: Partial

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Actionable Knowledge Discovery for Increasing Enterprise Profit, Using Domain Driven-Data Mining

Authors:

Rakhi Batra; M. Abdul Rehman

DOI:

10.1109/ACCESS.2019.2959841

Year:

2019

Publication Type:

Journal (IEEE Access)

Discipline/Domain:

Data Mining / Knowledge Discovery

Subdomain/Topic:

Actionable Knowledge Discovery (AKD); Domain-Driven Data Mining (D3M); Decision-tree post-processing

Contextual Background:

The paper critiques data-centric mining for overlooking business constraints (cost/profit) and proposes AK

Geographic/Institutional Context:

Sukkur IBA University, Pakistan. (p. 1) :contentReference{index=12}

Target Users/Stakeholders:

Decision-makers in CRM/BI/HR seeking profitable, implementable actions. (pp. 1–2, 6) :contentReference

Primary Methodology:

Conceptual framework + algorithmic method; quantitative comparison against Yang (2007) and OF■CEA

Primary Contribution Type:

An action-generation method that prunes negative-class leaves, uses domain knowledge (flexible/stable a

---

General Summary of the Paper

The authors propose a domain-driven AKD method that reduces computation while preserving profit by p

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Actionable/Actionability Used in Paper

Yes.

- "Actionability is an important subjective interestingness measure… a pattern is interesting or actionable

- "Actionable Knowledge… transforms the knowledge into business-friendly actions that are both concret

- "Basically, actions suggest how and which attribute values can be changed in order to achieve maximum

---

Authors Argue for a Need for Actionability Without Defining It

No. They provide both a conceptual grounding (Two-way Significance) and a procedural/algorithmic d

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How Actionability is Understood

"Actionable Knowledge reflects business needs and end-user preferences and helps business people in

> "a pattern is interesting or actionable if the user can do something about it to his or her advantage." (p.

What Makes Something Actionable

- **Bidirectional significance (technical + business):**

  > "This framework measures actionability from both technical and business perspectives… Objective/Su

- **Change-oriented, feasible attribute manipulation:**

  > "actions suggest how and which attribute values can be changed in order to achieve maximum profit…

- **Profit impact (expected profit & probability gain vs cost):**

  > "$P\_net = P\_e \times P\_gain - \Sigma\ Cost\_i$." (p. 8) :contentReference{index=24}

- **Domain knowledge alignment:**

  > "selection of Flexible and Stable attributes, cost matrix for Flexible attributes and expected profit… de

- **Validity with respect to desired class:**

  > pruning negative-class leaves so actions actually move objects to the desired status. (pp. 7–8, 12) :co

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):**

  Two-way Significance (technical/business); Loosely vs. Tightly Coupled AKD; Proposed D3M-ba

Paper Summary

<!--META_START-->

Title: A framework for analyzing the relationships between cancer patient satisfaction, nurse care, patient

Title:

A framework for analyzing the relationships between cancer patient satisfaction, nurse care, patient attitu

Authors:

Ng Kim-Soon, Alyaa Idrees Abdulmaged, Salama A. Mostafa, Mazin Abed Mohammed, Fadia Abdalla Mu

Discipline/Domain:

Healthcare Management / Patient Experience

Subdomain/Topic:

Cancer patient satisfaction, nurse care, attitudes, hospital service quality

Contextual Background:

The study examines how nurse care, nurse attitude, and patient attitude affect cancer patient satisfaction.

Geographic/Institutional Context:

Libya, National Institute of Oncology (Misurata)

Target Users/Stakeholders:

Hospital managers, nurses, healthcare policy makers

Primary Methodology:

Quantitative

Primary Contribution Type:

Empirical framework and statistical analysis

General Summary of the Paper

This paper develops and tests a framework linking cancer patient satisfaction with nurse care, nurse attitu

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is understood as producing "actionable insights to improve the healthcare services" by identi

> "Measuring the level of satisfaction provides actionable insights to improve the healthcare system" (p. 8

> "It pointed to several important areas to enhance the satisfaction of cancer patients by analyzing the lev

What Makes Something Actionable

- Identifiable, measurable service quality attributes (tangibility, empathy, responsiveness, reliability, assur

- Modifiable interpersonal and efficiency aspects of nurse care

- Positive patient attitudes (trust, willingness to engage in treatment discussions, confidence in nurses)

- Hospital service empathy and responsiveness

- Alignment of nurse care with patient needs

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Cancer patient satisfaction–nurse care–attitude model

- **Methods/Levers:** Quantitative survey, Likert-scale items on service quality and attitudes

- **Operational Steps / Workflow:** Identify satisfaction determinants → Measure through patient surveys

- **Data & Measures:** 5-point Likert scale for nurse care, nurse attitude, patient attitude, service quality;

- **Implementation Context:** National Cancer Institute, Misurata, Libya

> "A comprehensive approach… conceptualized to assess the service quality" (p. 87)

> "Descriptive statistics, correlation, and multiple regression were applied in the analyses" (p. 87)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clarity in communication and service processes improves satisfaction (linked to

- **CR (Contextual Relevance):** Yes — Service quality assessment tailored to Libyan cancer care conte

- **FE (Feasibility):** No — No explicit mention of implementation feasibility.

- **TI (Timeliness):** No — Not explicitly linked to being actionable.

- **EX (Explainability):** No — Statistical results are reported but not tied to explainability of interventions

- **GA (Goal Alignment):** Partial — Aligns nurse care improvements with patient satisfaction goals.

- **Other Dimensions Named by Authors:** Empathy, responsiveness, interpersonal skills.

Theoretical or Conceptual Foundations

- Expectation Confirmation Theory (Oliver, 1980)

- Theory of Reasoned Action (Fishbein & Ajzen, 1980)

Indicators or Metrics for Actionability

- Likert scale scores on nurse care, attitudes, and service quality attributes

- Beta coefficients from regression analysis indicating strongest predictors of satisfaction

Barriers and Enablers to Actionability

- **Barriers:** Limited prior research in Libya; patient illness severity limiting survey participation; lower le

- **Enablers:** Structured measurement instruments; high reliability (Cronbach's alpha ≥ 0.70); strong sta

Relation to Existing Literature

The paper extends existing satisfaction research by jointly considering nurse and patient attitudes alongs

Summary

This study presents a framework linking nurse care, nurse attitude, and patient attitude to cancer patient s

Scores

- **Overall Relevance Score:** 78 — Strong conceptual link to actionability with systematic features ident

- **Operationalization Score:** 65 — Clear operational steps and statistical testing, but limited discussion

Supporting Quotes from the Paper

- "Measuring the level of satisfaction provides actionable insights to improve the healthcare system" (p. 8

- "It pointed to several important areas to enhance the satisfaction of cancer patients by analyzing the lev

- "A comprehensive approach… conceptualized to assess the service quality" (p. 87)

- "Patient attitude significantly affected cancer patient satisfaction" (p. 98)

Actionability References to Other Papers

- Oliver, R.L. (1980) Expectation Confirmation Theory

- Fishbein, M., & Ajzen, I. (1980) Theory of Reasoned Action

- Al-Borie & Damanhouri (2013) SERVQUAL analysis in hospitals

- Kang & Oh (2015) Hospital service quality attributes and satisfaction

Paper Summary

<!--META_START-->

Title: YarnSense: Automated Data Storytelling for Multimodal Learning Analytics

Authors: Gloria Milena Fernández-Nieto, Vanessa Echeverria, Roberto Martinez-Maldonado, Simon Buck

DOI: N/A

Year: 2024

Publication Type: Conference (Workshop Proceedings)

Discipline/Domain: Learning Analytics / Educational Technology

Subdomain/Topic: Automated Data Storytelling, Multimodal Learning Analytics, Nursing Simulation Traini

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Reference Implementation

Study Context: Clinical nursing simulation with 254 students, 6 teachers

Geographic/Institutional Context: Monash University (Australia), University of Technology Sydney, Escue

Target Users/Stakeholders: Students, Teachers, Researchers in education/training

Primary Contribution Type: Architecture & System Implementation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

YarnSense: Automated Data Storytelling for Multimodal Learning Analytics

Authors:

Gloria Milena Fernández-Nieto, Vanessa Echeverria, Roberto Martinez-Maldonado, Simon Buckingham S

DOI:

N/A

Year:

2024

Publication Type:

Conference (Workshop Proceedings)

Discipline/Domain:

Learning Analytics / Educational Technology

Subdomain/Topic:

Automated Data Storytelling, Multimodal Learning Analytics, Nursing Simulation Training

Contextual Background:

The paper addresses the challenge of making complex multimodal learning analytics data interpretable a

Geographic/Institutional Context:

Monash University (Australia), University of Technology Sydney (Australia), Escuela Superior Politecnica

Target Users/Stakeholders:

Students, Teachers, Educational Researchers

Primary Methodology:

Conceptual architecture development with in-the-wild reference implementation

Primary Contribution Type:

System architecture + case study

General Summary of the Paper

The authors present *YarnSense*, a multi-tier architecture for automatically generating educational data s

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed implicitly as the ability of multimodal data outputs to **support reflection, identify pe

> "Based on the notion of data storytelling as a means of extracting actionable insights from data…" (Abs

> "…weaving complex data into coherent narratives that align with the teacher's pedagogical intentions" (

What Makes Something Actionable

- Alignment with teacher's pedagogical intentions and learning design

- Translation of raw sensor data into meaningful constructs

- Integration of contextual knowledge (roles, resources, assessment criteria)

- Clear visual and narrative presentation to non-experts

- Timely delivery to support post-activity reflection

- Inclusion of error detection and performance feedback linked to guidelines

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** YarnSense Architecture

- **Methods/Levers:** Pedagogical rule definition, sensor-based multimodal data capture, QE modelling,

- **Operational Steps / Workflow:**

  1. Teachers define learning context & pedagogical intentions (Context Modeller)

  2. Collect multimodal data from machine and human sensing

  3. Transform into learner models via multimodal matrices and QE modelling

  4. Generate DS outputs combining data, visuals, and teacher feedback

- **Data & Measures:** Positioning data, physiological data, audio/video, logged actions

- **Implementation Context:** Nursing simulations with defined critical actions and teamwork assessment

> "Data from the Learner Model are visualised and combined with narratives to convey a story for an indiv

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — DS principles include removing unnecessary elements, highlighting important fe

- **CR (Contextual Relevance):** Yes — tied to pedagogical intentions and activity specifics

- **FE (Feasibility):** Yes — aligned with realistic instructional and technological constraints

- **TI (Timeliness):** Yes — aimed at post-activity debriefs in near-real time

- **EX (Explainability):** Yes — multimodal constructs and DS enhance interpretability

- **GA (Goal Alignment):** Yes — narratives tied directly to teacher's learning goals

- **Other Dimensions Named by Authors:** User agency in modifying rules; integration with teacher feedb

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Theoretical or Conceptual Foundations

- Data Storytelling principles (purposeful communication, meaningful visuals, narrative structures)

- Quantitative Ethnography (QE)

- Multimodal Matrix methodology

- Theory of Proxemics for spatial interaction analysis

Indicators or Metrics for Actionability

- Error detection types (Sequence, Timeliness, Frequency)

- Time spent in proximity to patients or team members

- Adherence to clinical guideline-timed actions

Barriers and Enablers to Actionability

- **Barriers:** Complexity of multimodal data; automation challenges for certain modalities; need for conte

- **Enablers:** Teacher-defined rules; automated DS generation; integration of multiple sensing modalitie

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Relation to Existing Literature

Builds on prior work in multimodal learning analytics and DS, extending from high-fidelity prototypes to fu

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Summary

YarnSense operationalises actionability in educational analytics as the transformation of raw multimoda

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Scores

- **Overall Relevance Score:** 88 — Strong conceptualisation of actionability through DS and pedagogica

- **Operationalization Score:** 90 — Comprehensive architecture, clearly defined workflow, demonstrated

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Supporting Quotes from the Paper

- "[...] based on the notion of data storytelling as a means of extracting actionable insights from data…" (A

- "... weaving complex data into coherent narratives that align with the teacher's pedagogical intentions" (

- "Data from the Learner Model are visualised and combined with narratives to convey a story for an indiv

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Actionability References to Other Papers

- Martinez-Maldonado et al. (2020) — Layered storytelling approach for multimodal learning analytics

- Echeverria et al. (2018) — Educational data storytelling for teacher attention

- Fernández-Nieto et al. (2022) — Combining visualisation, narrative, and storytelling for student data ins

Paper Summary

<!--META_START-->

Title: Why-Not Explainable Graph Recommender

Authors: Herve-Madelein Attolou, Katerina Tzompanaki, Kostas Stefanidis, Dimitris Kotzinos

DOI: 10.1109/ICDE60146.2024.00178

Year: 2024

Publication Type: Conference

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Explainable Recommender Systems, Counterfactual Explanations, Graph-based Reco

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit through actionable explanation design)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (EMiGRe)

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental Evaluation

Study Context: Graph-based recommendation systems with user–item interaction data

Geographic/Institutional Context: CY Cergy Paris University, Tampere University

Target Users/Stakeholders: End-users of RS, system developers/debuggers

Primary Contribution Type: Algorithm/Framework Proposal with Evaluation

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Why-Not Explainable Graph Recommender

Authors:

Herve-Madelein Attolou, Katerina Tzompanaki, Kostas Stefanidis, Dimitris Kotzinos

DOI:

10.1109/ICDE60146.2024.00178

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Computer Science / Artificial Intelligence

Subdomain/Topic:

Explainable Recommender Systems, Counterfactual Explanations, Graph-based Recommendations

Contextual Background:

The work is situated in the area of explainable AI for recommendation systems, particularly in addressing

Geographic/Institutional Context:

CY Cergy Paris University (France), Tampere University (Finland)

Target Users/Stakeholders:

End-users seeking transparency; system developers for debugging and improving recommender perform

Primary Methodology:

Conceptual framework development + algorithm design + experimental evaluation on Amazon product re

Primary Contribution Type:

Algorithm/Framework (EMiGRe) and empirical validation

General Summary of the Paper

This paper introduces **EMiGRe**, a framework for generating *Why-Not explanations* in graph-based re

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as providing explanations that *suggest concrete, feasible actions a user can take

> "We opt for a form of Counterfactual Explanations… proposing a possible world that could have led to t

> "…provides… actionable insights on the source data and their interrelations" (p. 1)

What Makes Something Actionable

- Directly modifiable by the user (edges rooted at the user node)

- Feasibility within privacy constraints (only user's own actions)

- Causally linked to producing the desired recommendation (must result in WNI being top-1)

- Specificity (identifies exact edges to add or remove)

- Adaptability to system constraints and user preferences

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** EMiGRe (Explainable Missing Graph Recommendation)

- **Methods/Levers:** Counterfactual graph modifications via edge addition (Add Mode) or removal (Rem

- **Operational Steps / Workflow:**

  1. Define Why-Not item (WNI)

  2. Identify candidate edges (user-rooted) influencing WNI ranking using Personalized PageRank contrib

  3. Search for minimal modification set (Incremental, Powerset, Exhaustive Comparison)

  4. Validate candidate explanations against top-1 constraint

- **Data & Measures:** Personalized PageRank scores, contribution metrics, runtime, success rate, expla

- **Implementation Context:** Post-hoc explanation for graph-based RS, tested on Amazon product revie

> "…set of edges rooted at the user u node… to replace rec by WNI as the recommendation" (p. 5)

> "…propose… missing pertinent edges to be added… or existing edges to be removed" (p. 5)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — explicitly identifies specific, understandable actions (edges)

- **CR (Contextual Relevance):** Yes — actions are user-specific and relevant to target item

- **FE (Feasibility):** Yes — constrained to actions the user can perform

- **TI (Timeliness):** No — no explicit discussion of time sensitivity

- **EX (Explainability):** Yes — method provides causal reasoning via counterfactuals

- **GA (Goal Alignment):** Yes — directly tied to achieving WNI recommendation

- **Other Dimensions Named by Authors:** Privacy-preserving scope

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Theoretical or Conceptual Foundations

- Counterfactual explanations (AI interpretability literature)

- Graph-based recommendation and Personalized PageRank

- Why-Not questions in databases and ranking functions

Indicators or Metrics for Actionability

- Success rate (ability to achieve WNI in top-1)

- Size of explanation (fewer edges preferred)

- Runtime efficiency (practicality of producing the explanation)

Barriers and Enablers to Actionability

- **Barriers:**

  - Cold start/low activity users (few modifiable edges)

  - Highly popular competing items (structurally difficult to displace)

  - Out-of-scope cases where only edge additions or removals are insufficient

- **Enablers:**

  - Availability of rich user–item interaction data

  - Graph-based structure allowing edge-level manipulation

- Efficient PPR computation methods

Relation to Existing Literature

Extends explainable RS literature from *Why* to *Why-Not* scenarios, differing from PRINCE by:

1. Focusing on missing recommendations

2. Providing both past-action and future-action explanations

Builds on prior Why-Not work in databases and adapts it to graph RS with privacy-preserving constraints.

Summary

The paper introduces EMiGRe, a novel framework for producing actionable Why-Not explanations in grap

---

Scores

- **Overall Relevance Score:** 90 — Strong conceptualization of actionability with explicit operational fea

- **Operationalization Score:** 95 — Detailed algorithms, heuristics, and evaluation directly tied to produ

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Supporting Quotes from the Paper

- "We opt for a form of Counterfactual Explanations… proposing a possible world that could have led to th

- "…set of edges rooted at the user u node… to replace rec by WNI as the recommendation" (p. 5)

- "We provide more actionable explanations, by proposing not only existing actions… but also new action

- "This form of explanation provides user-comprehensible and actionable evidence of the trustworthiness

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Actionability References to Other Papers

- Ghazimatin et al. (2020) — PRINCE: Provider-side Interpretability with Counterfactual Explanations in R

- Miller (2017, 2021) — Contrastive explanation theory

- Database and IR Why-Not literature (e.g., Bidoit et al. 2014, Chapman & Jagadish 2009)

Paper Summary

<!--META_START-->

Title: When Rigor Meets Relevance: the Development of Hybrid Actionable Knowledge Production Syster

Authors: Thomaz Wood Jr, Edvalter Becker Holz, Renato Souza

DOI: https://doi.org/10.1007/s11213-022-09596-x

Year: 2023

Publication Type: Journal

Discipline/Domain: Management / Organizational Studies

Subdomain/Topic: Actionable Knowledge, Hybrid Research Systems, Rigor–Relevance Gap

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (Hybridization process model)

Operationalization Present: Yes

Primary Methodology: Qualitative (Inductive, interpretive case studies; grounded theory)

Study Context: Business schools as hybrid research systems

Geographic/Institutional Context: Canada and Brazil

Target Users/Stakeholders: Business school researchers, practitioners, institutional leaders (deans, direc

Primary Contribution Type: Conceptual + Empirical (Model development)

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: No

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

When Rigor Meets Relevance: the Development of Hybrid Actionable Knowledge Production Systems

Authors:

Thomaz Wood Jr, Edvalter Becker Holz, Renato Souza

DOI:

https://doi.org/10.1007/s11213-022-09596-x

Year:

2023

Publication Type:

Journal

Discipline/Domain:

Management / Organizational Studies

Subdomain/Topic:

Actionable Knowledge, Hybrid Research Systems, Rigor–Relevance Gap

Contextual Background:

The paper examines how business schools can develop research systems that produce knowledge that i

Geographic/Institutional Context:

Canadian Business School (CBS) and Brazilian Business School (BBS), both top-tier, AACSB/EFMD/AM

Target Users/Stakeholders:

Researchers, practitioners, institutional leaders (e.g., deans, directors), policymakers in higher education

Primary Methodology:

Qualitative — inductive, interpretive case studies using grounded theory and "knowing-from-within" episte

Primary Contribution Type:

Conceptual + empirical — development of a three-stage hybridization model for AK generation.

General Summary of the Paper

The paper challenges the dominant "bridging theories" of actionable knowledge, which assume rigor and

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

AK is defined as knowledge that is both **rigorous** (advances theoretical understanding) and **relevant**

> "AK refers to knowledge that both advances the theoretical understanding of phenomena and allows fo

> "…embodying the features of both systems in a way that one could not distinguish them in the final mat

---

What Makes Something Actionable

- Integrates **scientific rigor** and **practical relevance** in the same output.

- Involves **multi-stakeholder participation** and recognition.

- Supported by **institutional structures** that embed this integration.

- Produces outputs (e.g., reports, journal articles, cases) **valued by both academic and practitioner audi

- Sustains **legitimacy** across both academic and practice communities.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Research Hybridization (three stages: coexistence, juxtaposition, mi

- **Methods/Levers:** Institutional entrepreneurial/supportive actions; structural mechanisms for regulatio

- **Operational Steps / Workflow:**

  1. **Coexistence** — bring together rigor- and relevance-oriented components via projects, partnership

  2. **Juxtaposition** — formalize and couple processes, regulations, revenue models.

  3. **Mingling** — produce outputs embodying both rigor and relevance seamlessly.

- **Data & Measures:** Project portfolios, partnerships, publication and dissemination outputs, stakeholde

- **Implementation Context:** Business schools with research offices and hybrid research units.

> "We developed a conceptual model to describe the process by which… knowledge systems are hybridi

> "Institutional entrepreneurial and supportive actions aimed at creating multivoiced knowledge-based pro

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clarity in communicating research values to both academics and practitioners (p

- **CR (Contextual Relevance):** Yes — strong emphasis on solving real, context-specific problems (p. 1

- **FE (Feasibility):** Yes — structurally embedded processes ensure actionable outputs are deliverable (

- **TI (Timeliness):** Partial — urgency of emerging topics noted as a challenge (p. 13).

- **EX (Explainability):** No explicit linkage to actionability.

- **GA (Goal Alignment):** Yes — alignment between institutional mission, academic outputs, and societa

- **Other Dimensions Named by Authors:** Institutional legitimacy, stakeholder participation, economic su

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Theoretical or Conceptual Foundations

- Hybridism (Battilana & Dorado 2010; Battilana & Lee 2014)

- Actionable knowledge literature (Tenkasi & Hay 2004; Sharma & Bansal 2020)

- Grounded theory methodology

- Knowing-from-within epistemology (Shotter 2008)

Indicators or Metrics for Actionability

- Publication in both **top-tier academic journals** and **practice-oriented outlets**.

- Stakeholder recognition and engagement levels.

- Revenue generation from practice-linked projects.

- Diversity of dissemination formats (books, cases, reports, events).

Barriers and Enablers to Actionability

- **Barriers:**

  - Loss of academic talent to private sector (p. 13)

  - Pressure to diversify revenue (p. 13)

  - Bureaucratic overload (p. 16)

  - Skepticism from traditional academics (p. 18)

- **Enablers:**

  - Institutional entrepreneurial actions (p. 21)

  - Structural governance mechanisms (p. 23)

  - Multi-stakeholder networks (p. 24)

Relation to Existing Literature

Contrasts with bridging theories, which rely on temporary, discretionary collaboration between researcher

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Summary

This paper reconceptualizes actionable knowledge (AK) generation by replacing the "bridging" paradigm

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Scores

- **Overall Relevance Score:** 92 — Strong conceptual clarity on actionability, explicit features, and nove

- **Operationalization Score:** 88 — Detailed three-stage process with mechanisms and institutional prac

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Supporting Quotes from the Paper

- "AK refers to knowledge that both advances the theoretical understanding of phenomena and allows for

- "…views, norms, forms and practices… are materialized in the form of outputs that embody characterist

- "Institutional entrepreneurial and supportive actions aimed at creating multivoiced knowledge-based pro

- "Support from contract experts is also important because some projects involve researchers from other

---

Actionability References to Other Papers

- Babüroglu & Ravn (1992) — Normative action research

- Tenkasi & Hay (2004) — Theory–practice linkages

- Sharma & Bansal (2020) — Co-creating rigorous and relevant knowledge

- Battilana & Dorado (2010); Battilana & Lee (2014) — Hybrid organizations

- Beer (2020) — Developing actionable knowledge for practice and theory

Paper Summary

<!--META_START-->

Title: What Is "Actionable" Science for Climate and Environment?

Authors: Ziheng Sun

DOI: 10.1007/978-3-031-41758-0_1

Year: 2023

Publication Type: Book Chapter

Discipline/Domain: Environmental Science / Climate Science

Subdomain/Topic: Actionable science; climate change adaptation and mitigation; environmental decision

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with quantitative framework proposal

Study Context: Climate and environmental science research, with focus on science-to-action translation

Geographic/Institutional Context: Global, with examples from the USA (California), coastal resilience, and

Target Users/Stakeholders: Policymakers, engineers, scientists, local communities, funding agencies, inc

Primary Contribution Type: Conceptual framework and evaluation model

CL: Yes

CR: Yes

FE: Yes

TI: Partial

Title:

What Is "Actionable" Science for Climate and Environment?

Authors:

Ziheng Sun

DOI:

10.1007/978-3-031-41758-0_1

Year:

2023

Publication Type:

Book Chapter

Discipline/Domain:

Environmental Science / Climate Science

Subdomain/Topic:

Actionable science; climate change adaptation and mitigation; environmental decision support

Contextual Background:

This chapter addresses the concept, necessity, and evaluation of "actionable" science within climate and

Geographic/Institutional Context:

Global scope, with examples including California climate adaptation, NOAA coastal resilience programs,

Target Users/Stakeholders:

Decision-makers, scientists, engineers, industry stakeholders, local communities, and funding agencies.

Primary Methodology:

Conceptual framework development, supported by illustrative case studies and proposed quantitative for

Primary Contribution Type:

Conceptual definition and operationalization model for actionability.

General Summary of the Paper

The chapter defines "actionable science" as research explicitly designed to produce knowledge, recomme

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable science is "oriented towards answering inquiries such as 'What actions should we take in this

> "Actionable science requires a meticulous examination of ideas within the confines of practical constrai

> "An actionable science endeavor should not run counter to the overarching consensus goals shared by

---

What Makes Something Actionable

- Alignment with real-world challenges and operational application goals.

- Practical application potential for significant societal challenges.

- Consideration of "what-if" engineering questions and operational uncertainties.

- Feasibility within resource, scalability, political, and economic constraints.

- Public understanding through clarity and transparency.

- Measurable societal, environmental, economic, and cultural impacts.

- Practicality from the operators' perspective.

- High engagement with stakeholders and end users.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Quantitative actionability assessment model.

- **Methods/Levers:** Six-factor model: Relevance, Feasibility, Public Understanding, Societal Impact, Pr

- **Operational Steps / Workflow:**

  1. Define project objectives and societal alignment.

  2. Assess each factor using quantitative/qualitative indicators.

  3. Identify barriers (e.g., policy, economics) and design mitigation strategies.

  4. Engage stakeholders early and iteratively.

  5. Use feedback to refine applicability and implementation readiness.

- **Data & Measures:** Accessibility scores, scalability indices, impact metrics (economic, environmental,

- **Implementation Context:** Climate and environmental projects at local, regional, and global scales.

> "If the answer is 'yes' to all three questions, the research falls within the high basket of actionable scien

> "The overarching goal is to provide decision-makers with the tools and information they need to make v

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Explicitly tied to public understanding and communication effectiveness.

> "Effective communication is essential for promoting public understanding and support." (p. 14)

- **CR (Contextual Relevance):** Yes – Research must align with specific societal and operational needs

> "Aligned with real-world challenges and part of a broader community effort." (p. 7)

- **FE (Feasibility):** Yes – Multi-factor feasibility assessment provided.

> "Another important factor for actionable research is the feasibility of implementing the results into real-w

- **TI (Timeliness):** Partial – Timeliness is implied via real-time science discussion but not formalized as

- **EX (Explainability):** Yes – Linked to transparency, clarity, and addressing "what-if" questions.

- **GA (Goal Alignment):** Yes – Must not run counter to shared societal/scientific goals.

- **Other Dimensions Named by Authors:** Stakeholder engagement, practicality by operators, societal in

---

Theoretical or Conceptual Foundations

- Knowledge transfer frameworks (Chai et al., 2003; Agrawal, 2001).

- Co-production of knowledge (Beier et al., 2017).

- Climate information usability literature (Kirchhoff et al., 2013).

- Life cycle and environmental impact assessment methods.

Indicators or Metrics for Actionability

- Quantitative scores for relevance, feasibility, public understanding, societal impact, practicality, and eng

- Sub-metrics: accessibility, scalability, reproducibility, political/economic feasibility, clarity, transparency,

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Barriers and Enablers to Actionability

- **Barriers:** Funding constraints, policy misalignment, technological immaturity, public misunderstandin

- **Enablers:** Early stakeholder engagement, clear communication, alignment with policy goals, interdisc

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Relation to Existing Literature

Positions itself as integrating and extending prior definitions of actionable knowledge by proposing a com

---

Summary

This chapter provides one of the most comprehensive conceptualizations and operational frameworks for

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Scores

- **Overall Relevance Score:** 95 – Highly explicit definition, detailed attributes, and strong conceptual cl...

- **Operationalization Score:** 95 – Provides structured, measurable framework with concrete metrics, e...

Supporting Quotes from the Paper

- "Actionable science requires a meticulous examination of ideas within the confines of practical constrair...

- "An actionable science endeavor should not run counter to the overarching consensus goals shared by ...

- "If the answer is 'yes' to all three questions, the research falls within the high basket of actionable scien...

- "Effective communication is essential for promoting public understanding and support." (p. 14)

Actionability References to Other Papers

- Beier et al. (2017) – Co-production of actionable science.

- Kirchhoff et al. (2013) – Actionable knowledge usability.

- Meinke et al. (2006) – Actionable climate knowledge.

- Chai et al. (2003); Agrawal (2001) – Knowledge sharing/transfer.

- Lemos et al. (2012) – Climate information usability gap.

Paper Summary

<!--META_START-->

Title: What About Her? Increasing the Actionability of HUMINT in Paternalistic Cultures by Considering F...

Authors: Stephan Lau & Farina T. S. Bauer

DOI: 10.1080/08850607.2022.2068890

Year: 2022

Publication Type: Journal

Discipline/Domain: Intelligence Studies / Security Studies

Subdomain/Topic: Human Intelligence (HUMINT), Gender Integration, Paternalistic Cultures

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 80

Contains Definition of Actionability: Yes (explicitly in context of HUMINT diversity and flexibility)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes (conceptual framework linking female integration to actionability)

Operationalization Present: Yes (survey, interview data, training, recruitment, targeting recommendations

Primary Methodology: Mixed Methods (Survey + Interviews + Literature Review)

Study Context: Military HUMINT operations in paternalistic cultures (primarily Afghanistan, also Iraq, Kosc

Geographic/Institutional Context: Bundeswehr (German military) & NATO operations

Target Users/Stakeholders: Military intelligence planners, HUMINT operatives, defense policymakers

Primary Contribution Type: Conceptual framework + empirical practitioner insights

CL: Yes — "effective and actionable human intelligence collection" linked to gender-sensitive planning (p.

CR: Yes — strong emphasis on cultural context (paternalistic norms) affecting access and utility of opera

FE: Yes — operational feasibility discussed via recruitment, training, interpreters (p. 15–16)

TI: Partial — timeliness not a major theme, though linked implicitly to live collection flexibility ("actionabilit

EX: Partial — explainability emerges in clarifying myths and assumptions but not as formal feature

GA: Yes — alignment with mission goals stressed via "targeting" and "actionability" as central concepts (p

Reason if Not Eligible: n/a

<!--META_END-->

Title:

What About Her? Increasing the Actionability of HUMINT in Paternalistic Cultures by Considering Female

Authors:

Stephan Lau & Farina T. S. Bauer

DOI:

10.1080/08850607.2022.2068890

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Intelligence Studies / Security Studies

Subdomain/Topic:

Human Intelligence (HUMINT), Gender Integration, Paternalistic Cultures

Contextual Background:

The study addresses the integration of women as both operators and targets in military human intelligenc

Geographic/Institutional Context:

German Bundeswehr HUMINT units in NATO missions (Afghanistan, Iraq, Kosovo).

Target Users/Stakeholders:

Military HUMINT planners, operators, NATO leadership, defense policymakers.

Primary Methodology:

Mixed Methods (Survey of 40 operatives + 2 interviews + literature review).

Primary Contribution Type:

Conceptual framework and operational recommendations.

General Summary of the Paper

The article examines the role of "female intelligence" — the gender-sensitive integration of women as bot

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the increased operational flexibility and diversity in options available to HUMINT

> "We advocate the integration of female and male operators in the same units by creating and supportin

> "Actionability… [is] the general flexibility and the elbow room to play with the circumstances" (p. 17)

What Makes Something Actionable

- Inclusion of both male and female operators to broaden operational scenarios.

- Ability to engage otherwise inaccessible targets (especially across gender lines in paternalistic cultures)

- Flexibility in adapting team composition and role-playing to exploit cultural dynamics.

- Adequate logistical, linguistic, and training support (e.g., interpreters, cultural competence).

- Targeting strategy that includes both male and female sources.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Female Intelligence Integration for Actionability (conceptual).

- **Methods/Levers:** Targeting female sources, mixed-gender team integration, debunking myths, syste

- **Operational Steps / Workflow:** Assessment of current beliefs, recruitment and training, inclusion in m

- **Data & Measures:** Survey (Likert-scale) and interviews with Bundeswehr HUMINT operators; descri

- **Implementation Context:** Military HUMINT in Afghanistan, Iraq, Kosovo.

> "Two concepts are essential: targeting female sources and increasing actionability" (p. 14)

> "Including female targets and… combining male and female capabilities… would increase the actionab…

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — linked to clear operational understanding of female capabilities and myth correct…

- **CR (Contextual Relevance):** Yes — integration strategies rooted in cultural norms of paternalistic so…

- **FE (Feasibility):** Yes — feasibility tied to recruitment, interpreters, training (p. 15–16).

- **TI (Timeliness):** Partial — implied through live flexibility in engagements.

- **EX (Explainability):** Partial — addresses misconceptions but no formal explainability model.

- **GA (Goal Alignment):** Yes — female integration linked to mission success and HUMINT collection ef…

- **Other Dimensions Named by Authors:** Diversity, mixed-team synergy, cultural competence.

Theoretical or Conceptual Foundations

- Gender-sensitive HUMINT theory in counterinsurgency.

- Cultural access theory (third gender perception).

- Intelligence actionability as operational flexibility.

Indicators or Metrics for Actionability

- Operator access levels to male/female targets.

- Availability of female interpreters.

- Proportion of female targets included in mission planning.

- Role of female operators in achieving mission objectives.

Barriers and Enablers to Actionability

- **Barriers:** Myths/stereotypes, lack of interpreters, unclear targeting strategy, insufficient training, sma…

- **Enablers:** Mixed-gender teams, cultural role exploitation, persistent engagement, rigorous training (tr…

Relation to Existing Literature

Builds on critiques of FET and CST programs, integrates prior cultural engagement research, and adds B…

Summary

This paper presents a comprehensive conceptual and empirical examination of integrating women as bot…

Scores

- **Overall Relevance Score:** 88 — Strong explicit conceptualization of actionability in HUMINT, clear lir

- **Operationalization Score:** 80 — Offers concrete operational strategies (targeting, training, recruitmer

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Supporting Quotes from the Paper

- "Female intelligence… recognizes females as targets of collection but also considers females as operat

- "Mixed teams would increase the actionability of intelligence collection entities" (p. 17)

- "Two concepts are essential: targeting female sources and increasing actionability" (p. 14)

- "Access to local women was significantly less denied to female operators" (p. 12)

- "Lack of female interpreters… constitutes an implementation problem with a high priority" (p. 15)

Actionability References to Other Papers

- Pottinger, Jilani, & Russo (2010) on Afghan women's influence.

- Azarbaijani-Moghaddam (2014) on FET evaluations.

- Rohwerder (2015) on lessons from FETs.

- Brandon et al. (2018) on science-based interviewing and elicitation.

Paper Summary

<!--META_START-->

Title: User Perceptions of Actionability in Data Dashboards

Authors: Madeleine Sorapure

DOI: 10.1177/10506519231161611

Year: 2023

Publication Type: Journal Article

Discipline/Domain: Technical and Professional Communication / Data Visualization

Subdomain/Topic: COVID-19 Dashboards, Actionability, User Perceptions

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (Ivankovi■ et al.'s 7 criteria + added dimensions)

Operationalization Present: Yes

Primary Methodology: Qualitative (usability study with thematic analysis)

Study Context: Evaluation of two COVID-19 county-level dashboards (Santa Barbara County, CAN)

Geographic/Institutional Context: Santa Barbara County, California, USA; University of California, Santa

Target Users/Stakeholders: Nonexpert public users of public health dashboards

Primary Contribution Type: Empirical study expanding conceptual framework of dashboard actionability

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Partial

GA: No

Reason if Not Eligible: N/A

<!--META_END-->

Title:

User Perceptions of Actionability in Data Dashboards

Authors:

Madeleine Sorapure

DOI:

10.1177/10506519231161611

Year:

2023

Publication Type:

Journal Article

Discipline/Domain:

Technical and Professional Communication / Data Visualization

Subdomain/Topic:

COVID-19 Dashboards, Actionability, User Perceptions

Contextual Background:

The study examines how nonexpert users interact with COVID-19 dashboards, particularly regarding acti

Geographic/Institutional Context:

Santa Barbara County, California; University of California, Santa Barbara

Target Users/Stakeholders:

Nonexpert, general public users of public health dashboards

Primary Methodology:

Qualitative usability study with think-aloud protocols, thematic analysis, and post-interview survey

Primary Contribution Type:

Empirical evaluation and conceptual extension of dashboard actionability framework

General Summary of the Paper

The article reports on a multiphase usability study of ten nonexpert participants interacting with two COVI

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is explicitly defined as the ability of data dashboards to inform and support user decision mal

> "Actionable data—that is, data that can inform decisions that users need to make" (p. 257)

> "There needs to be a 'fit' between the information, the user, and the purposes for which the information

What Makes Something Actionable

- Alignment with audience needs and contexts

- Appropriate type, amount, and organization of information

- Clear data sources and methodology

- Time trends linked to relevant decisions

- Locally granular data

- Demographic subgroup breakdowns

- Storytelling and intuitive visual cues

- Emotional engagement that does not overwhelm decision making

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Ivankovi■ et al.'s seven criteria for actionable dashboards (adapted

- **Methods/Levers:** Usability design principles (navigation structure, composite indicators, visual simpli

- **Operational Steps / Workflow:** Audience analysis → Data selection → Display design (tabs, color co

- **Data & Measures:** Infection rates, vaccination rates, hospitalizations, mortality, demographic breakd

- **Implementation Context:** COVID-19 public health dashboards at county level

> "Participants frequently discussed wanting to find data that met their information needs, was relatively e

> "Accounting for the emotional impact of data dashboards… would be a helpful addition to an analysis o

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clarity of visual presentation and navigation linked to actionability (p. 267)

- **CR (Contextual Relevance):** Yes — local and personally relevant data emphasized (p. 265)

- **FE (Feasibility):** Partial — some acknowledgment of limits on user actions in pandemic context (p. 2

- **TI (Timeliness):** No — timeliness not explicitly tied to actionability beyond data recency

- **EX (Explainability):** Partial — accessible explanations provided but often underutilized by users (p. 2

- **GA (Goal Alignment):** No explicit mention

- **Other Dimensions Named by Authors:** Emotional impact of data viewing; need for prioritization of cri

Theoretical or Conceptual Foundations

- Ivankovi■ et al.'s seven actionability criteria

- Concepts of "fitness for purpose" and "fitness for use" in dashboard design

- User-centered design principles from TPC and data visualization literature

Indicators or Metrics for Actionability

- Composite risk scores with visual color scales

- Survey agreement ratings on actionability criteria (Likert scale)

- User-reported clarity, relevance, and decision-making support

Barriers and Enablers to Actionability

- **Barriers:** Information overload; low granularity; inaccessible explanations; emotional stress; scrolling

- **Enablers:** Local data; concise summaries; familiar visual metaphors; intuitive navigation; demograph

Relation to Existing Literature

Positions findings within ongoing debates on COVID-19 dashboards' effectiveness, contributing empirical

Summary

Sorapure's study offers an in-depth empirical look at how nonexpert users perceive and use public health

Scores

- **Overall Relevance Score:** 92 — Strong explicit and implicit conceptualization of actionability, detailed

- **Operationalization Score:** 88 — Clear application of an existing framework to dashboard design and

Supporting Quotes from the Paper

- "Actionable data—that is, data that can inform decisions that users need to make" (p. 257)

- "There needs to be a 'fit' between the information, the user, and the purposes for which the information

- "Participants frequently discussed wanting to find data that met their information needs, was relatively e

- "Accounting for the emotional impact of data dashboards… would be a helpful addition to an analysis of

Actionability References to Other Papers

- Ivankovi■ et al. (2021) — Features constituting actionable COVID-19 dashboards

- Barbazza et al. (2021) — Assessment of dashboard actionability over time

- Yigitbasioglu & Velcu (2012) — Fitness for purpose/use in dashboards

- Pappas & Whitman (2011) — User-centered design for dashboard development

Paper Summary

<!--META_START-->

Title: TriCTI: an actionable cyber threat intelligence discovery system via trigger-enhanced neural networ

Authors: Jian Liu, Junjie Yan, Jun Jiang, Yitong He, Xuren Wang, Zhengwei Jiang, Peian Yang, Ning Li

DOI: https://doi.org/10.1186/s42400-022-00110-3

Year: 2022

Publication Type: Journal

Discipline/Domain: Cybersecurity

Subdomain/Topic: Cyber threat intelligence, NLP, threat detection

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 92

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (conceptual + experimental model implementation)

Study Context: Automated extraction of actionable CTI from unstructured cybersecurity reports using NLF

Geographic/Institutional Context: Chinese Academy of Sciences; Capital Normal University

Target Users/Stakeholders: Security operations centers (SOC), cybersecurity analysts, threat intelligence

Primary Contribution Type: Methodological framework and system development (TriCTI)

CL: Yes – clarity of campaign stage and IOC association explicitly tied to actionability (p.2)

CR: Yes – contextual relevance via mapping IOCs to campaign stages (p.2)

FE: Yes – feasibility demonstrated by operational system tested on 29k reports (p.1, p.12)

TI: Partial – system processes historical and near-real-time data, but not explicitly constrained by latency

EX: Yes – interpretability through "campaign triggers" enhancing classification explainability (p.2, p.6)

GA: Yes – goal alignment through prioritizing defense actions based on campaign stage severity (p.8–9)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

TriCTI: an actionable cyber threat intelligence discovery system via trigger-enhanced neural network

Authors:

Jian Liu, Junjie Yan, Jun Jiang, Yitong He, Xuren Wang, Zhengwei Jiang, Peian Yang, Ning Li

DOI:

https://doi.org/10.1186/s42400-022-00110-3

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Cybersecurity

Subdomain/Topic:

Cyber threat intelligence, NLP, threat detection

Contextual Background:

The paper addresses the challenge of extracting actionable cyber threat intelligence (CTI) from the vast a

Geographic/Institutional Context:

Institute of Information Engineering, Chinese Academy of Sciences; University of Chinese Academy of Sc

Target Users/Stakeholders:

Security operations centers (SOC), incident response teams, cybersecurity researchers.

Primary Methodology:

Mixed methods: conceptual framework design, NLP-based system architecture, experimental validation o

Primary Contribution Type:

Novel system (TriCTI) and methodology for discovering actionable CTI with enhanced interpretability.

General Summary of the Paper

The authors propose TriCTI, a trigger-enhanced neural network system for discovering actionable cyber t

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable CTI is defined as CTI that "conveys a richer context of IOCs by revealing their campaign stage

> "Actionable CTI can provide incident response teams with actionable insights and recommendations to

> "If actionable CTI is integrated into intrusion detection systems, SOC teams can take appropriate mitiga

---

What Makes Something Actionable

- Coupling IOCs with campaign stages for context.

- Providing interpretability for prioritization of threats.

- Supporting direct mitigation decisions aligned with attack phase.

- Being complete across all stages of the attack lifecycle.

- Accurate extraction to avoid false positives.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** TriCTI (Trigger-enhanced Cyber Threat Intelligence discovery syste

- **Methods/Levers:** Campaign trigger annotation, IOC detection and filtering, BERT-based trigger vecto

- **Operational Steps / Workflow:** Data crawling $\rightarrow$ preprocessing (purification, segmentation, IOC fangi

- **Data & Measures:** 29,686 cybersecurity reports; annotated datasets DS-1 and DS-2; evaluation met

- **Implementation Context:** Applied to unstructured vendor reports spanning 2000–2021; verified using

> "The sooner the detection is done, the less loss the organization under attack will suffer" (p.8)

> "Applying actionable CTI to intrusion detection systems can guide security operators to make faster, be

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – clear association of IOCs to campaign stages is essential (p.2).

- **CR (Contextual Relevance):** Yes – mapping to campaign stages ensures relevance to defense conte

- **FE (Feasibility):** Yes – operationalized on large dataset with automation (p.1, p.12).

- **TI (Timeliness):** Partial – while timely response is stressed, the system is not explicitly real-time.

- **EX (Explainability):** Yes – campaign triggers improve interpretability (p.2, p.6).

- **GA (Goal Alignment):** Yes – enables prioritization according to severity of campaign stage (p.8–9).

- **Other Dimensions Named by Authors:** Completeness across all campaign stages; interpretability; re

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Theoretical or Conceptual Foundations

- Cyber Kill Chain model (Hutchins et al., 2011) for campaign stage definitions.

- NLP concepts: BERT, CBERT augmentation, trigger-based attention mechanisms.

Indicators or Metrics for Actionability

- Campaign stage correctly assigned to IOC.

- Classification performance (Accuracy, F1 score).

- Coverage across all campaign stages.

- Verified maliciousness via VirusTotal relationships.

Barriers and Enablers to Actionability

- **Barriers:** Scarcity of annotated cybersecurity corpora; complexity of sentences with multiple stages;

- **Enablers:** Trigger-based explainability; data augmentation; automated large-scale processing; valida

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Relation to Existing Literature

The paper critiques prior IOC extraction and threat action identification work for lacking campaign stage o

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Summary

This paper presents TriCTI, an NLP-based, trigger-enhanced neural network framework for discovering a

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Scores

- **Overall Relevance Score:** 95 – Strong, explicit conceptualization of actionability with comprehensive

- **Operationalization Score:** 92 – Detailed, step-by-step operationalization with system architecture, wo

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Supporting Quotes from the Paper

- "[Actionable CTI] conveys a richer context of IOCs by revealing their campaign stages" (p.2)

- "SOC teams can take appropriate mitigation actions based on contextual information of the alerts" (p.2)

- "We introduce the 'campaign trigger'… to improve the performance of the classification model" (p.1)

- "Applying actionable CTI to intrusion detection systems can guide security operators to make faster, bet

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Actionability References to Other Papers

- Hutchins et al. (2011) – Cyber Kill Chain model.

- Yadav and Rao (2015) – Technical aspects of the cyber kill chain.

- Liao et al. (2016), Zhou et al. (2018), Long et al. (2019) – IOC extraction methods.

- Zhu and Dumitras (2018) – Campaign stage identification with rule-based approach.

Paper Summary

<!--META_START-->

Title: Towards User Guided Actionable Recourse

Authors: Jayanth Yetukuri, Ian Hardy, Yang Liu

DOI: https://doi.org/10.1145/3600211.3604708

Year: 2023

Publication Type: Conference

Discipline/Domain: Artificial Intelligence / Human-Centered Computing

Subdomain/Topic: Actionable Recourse, User Preferences in ML Explanations

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, user-preference-centered)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (UP-AR optimization & workflow)

Operationalization Present: Yes

Primary Methodology: Conceptual with empirical evaluation

Study Context: Actionable recourse in ML decision-making across domains such as credit, hiring, insuran

Geographic/Institutional Context: University of California, Santa Cruz; U.S.

Target Users/Stakeholders: End-users affected by ML decisions (e.g., loan applicants), ML system desig

Primary Contribution Type: Method/Framework Proposal with Empirical Validation

CL: Yes — "communicating in terms of preference scores… improves the explainability of a recourse ger

CR: Yes — "actionability… centered explicitly around individual preferences… may not necessarily be eq

FE: Yes — "feasible action set… actionable by Alice" (p.1)

TI: Partial — timeliness not a primary dimension, but operational efficiency is addressed

EX: Yes — "preference scores… improves the explainability of a recourse generation mechanism" (p.1)

GA: Yes — goal alignment with user's own constraints and desires (p.1–2)

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Towards User Guided Actionable Recourse

Authors:

Jayanth Yetukuri, Ian Hardy, Yang Liu

DOI:

https://doi.org/10.1145/3600211.3604708

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence / Human-Centered Computing

Subdomain/Topic:

Actionable Recourse, User Preferences in ML Explanations

Contextual Background:

The paper addresses the challenge of making ML-generated recourse actionable for individuals adversel

Geographic/Institutional Context:

University of California, Santa Cruz; U.S.

Target Users/Stakeholders:

End-users denied desired outcomes by ML systems; system designers and policymakers interested in tru

Primary Methodology:

Conceptual framework and algorithm development with empirical evaluation across multiple datasets.

Primary Contribution Type:

Method/Framework Proposal with Empirical Validation

General Summary of the Paper

The authors introduce **User Preferred Actionable Recourse (UP-AR)**, a novel method for generating a

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined implicitly as the **viability of taking a suggested action** within the constraints and

> "Actionability… is centered explicitly around individual preferences, and similar recourses… may not ne

> "AR aims to provide… a feasible action set which is both actionable by Alice and… as low-cost [as pos

---

What Makes Something Actionable

- Alignment with individual user constraints and desires (hard and soft rules)

- Ability to operationalize within user's own cost and effort parameters

- Feasibility in practice (e.g., avoiding impossible or undesirable feature changes)

- Explainability of why the action is suggested and how it fits user preferences

- Personalization beyond general feasibility rules

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** User Preferred Actionable Recourse (UP-AR)

- **Methods/Levers:** Gradient-based iterative optimization weighted by user preference scores; tempera

- **Operational Steps / Workflow:**

  1. Elicit three types of preferences (scoring, bounding, ranking) from the user.

  2. Embed these as constraints in optimization.

  3. Generate candidate recourse via stochastic gradient-based updates informed by user preference-wei

  4. Apply redundancy and cost correction to finalize recourse.

- **Data & Measures:** Percentile shift cost function; pRMSE to evaluate preference adherence; tradition

- **Implementation Context:** Credit lending, income prediction, recidivism risk prediction.

> "We start by enabling Alice to provide three types of user preferences… We embed them into an optimi

> "The proposed method minimizes the cost of a recourse weighted by $\Gamma\blacksquare$ for all actionable features" (p.3

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — user preference scores increase explainability (p.1)

- **CR (Contextual Relevance):** Yes — recourse tailored to individual user profile (p.1–2)

- **FE (Feasibility):** Yes — constraints ensure recommendations are viable for that user (p.1–3)

- **TI (Timeliness):** Partial — efficiency in generation is discussed, but timeliness as a decision-making

- **EX (Explainability):** Yes — preference-based reasoning improves explainability (p.1)

- **GA (Goal Alignment):** Yes — recourse aligned with user's stated objectives (p.1–2)

- **Other Dimensions:** Diversity only as secondary contrast to preference tailoring

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Theoretical or Conceptual Foundations

- Builds on **Actionable Recourse (AR)** as per Ustun et al. (2019)

- Local feasibility concept from Mahajan et al. (2019)

- Preference elicitation parallels human-in-the-loop approaches (De Toni et al., 2022)

- Optimization inspired by gradient-based adversarial example generation

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Indicators or Metrics for Actionability

- pRMSE between desired and achieved feature cost proportions

- Constraint violations (lower is better)

- Redundancy (steps that don't affect outcome)

- Sparsity (number of features changed)

- Proximity (l2 distance from original point)

Barriers and Enablers to Actionability

- **Barriers:** Ignoring user-specific constraints; reliance on universal cost functions; high redundancy; ex

- **Enablers:** Explicit preference capture; flexible optimization accommodating hard/soft constraints; cos

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Relation to Existing Literature

The authors note most AR literature focuses on universal feasibility and cost minimization, sometimes ad

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Summary

This paper reframes **actionability** in ML recourse as inherently **user-specific** and **preference-drive

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Scores

- **Overall Relevance Score:** 92 — Strong, explicit integration of user-centered definition of actionability

- **Operationalization Score:** 95 — Detailed algorithm and empirical workflow directly aimed at achievin

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Supporting Quotes from the Paper

- "Actionability… is centered explicitly around individual preferences…" (p.1)

- "We start by enabling Alice to provide three types of user preferences… embed them into an optimizatio

- "Communicating in terms of preference scores… improves the explainability of a recourse generation m

- "The proposed method minimizes the cost of a recourse weighted by $\Gamma\blacksquare$ for all actionable features" (p.3

Actionability References to Other Papers

- Ustun et al. (2019) — Actionable Recourse in Linear Classification

- Mahajan et al. (2019) — Local Feasibility

- De Toni et al. (2022) — Human-in-the-loop preference elicitation

- Wachter et al. (2017) — Counterfactual Explanations

- Poyiadzi et al. (2020) — FACE method

Paper Summary

<!--META_START-->

Title: Towards an Extensible Web Usage Mining Framework for Actionable Knowledge

Authors: N. Pushpalatha, S. Sai Satyanarayana Reddy

DOI: n/a

Year: 2017

Publication Type: Conference Paper

Discipline/Domain: Computer Science / Data Mining

Subdomain/Topic: Web Usage Mining, Actionable Knowledge, Fuzzy Clustering

Eligibility: Eligible

Overall Relevance Score: 78

Operationalization Score: 82

Contains Definition of Actionability: Implicit

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (XWUMF)

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental (Prototype implementation)

Study Context: Web log analysis for user behaviour and business intelligence

Geographic/Institutional Context: India (JNTU Hyderabad, Vardhaman College of Engineering)

Title:

Towards an Extensible Web Usage Mining Framework for Actionable Knowledge

Authors:

N. Pushpalatha, S. Sai Satyanarayana Reddy

DOI:

n/a

Year:

2017

Publication Type:

Conference Paper

Discipline/Domain:

Computer Science / Data Mining

Subdomain/Topic:

Web Usage Mining, Actionable Knowledge, Fuzzy Clustering

Contextual Background:

The study focuses on developing a flexible, extensible web usage mining framework (XWUMF) to transfo

Geographic/Institutional Context:

India (JNTU Hyderabad, Vardhaman College of Engineering)

Target Users/Stakeholders:

Businesses, Web Analysts, Decision-Makers

Primary Methodology:

Conceptual + Experimental (Prototype implementation with empirical evaluation)

Primary Contribution Type:

Framework and Algorithm Proposal (XWUMF, SWUM)

General Summary of the Paper

The paper introduces the eXtensible Web Usage Mining Framework (XWUMF) designed to process web

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors implicitly define actionability as the transformation of web usage patterns into "business intel

> "The patterns when interpreted by domain experts can result in business intelligence." (p. 1)

> "Our empirical results revealed that the framework helps in discovering actionable knowledge." (p. 1)

What Makes Something Actionable

- Derives from **meaningful usage patterns** that reflect actual user behaviour.

- Must be interpretable by **domain experts** to support decision-making.

- Should enable **customer-centric strategies** in competitive environments.

- Requires **quality thresholds** (MinTime, MinConfidence) to ensure reliability of patterns.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** XWUMF (eXtensible Web Usage Mining Framework)

- **Methods/Levers:** Hybrid fuzzy clustering + user behaviour analysis; sequential mining with quality th

- **Operational Steps / Workflow:** Pre-processing → Fuzzy clustering → Usage mining → Pattern disco

- **Data & Measures:** Execution time, memory usage; MinTime and MinConfidence thresholds.

- **Implementation Context:** Tested on WDC dataset + 3 synthetic datasets.

> "The framework supports a hybrid approach which can have fuzzy clustering techniques and web minir

> "Sequential Web Usage Miner… generates patterns that reflect user behaviour." (p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Patterns must be interpretable by domain experts.

- **CR (Contextual Relevance):** Yes – Patterns tied to customer behaviour for strategic business use.

- **FE (Feasibility):** Yes – Extensible design allows integration of algorithms suitable for different domai

- **TI (Timeliness):** Partial – Execution time evaluated, but real-time capability not central.

- **EX (Explainability):** Partial – Domain expert interpretation required; not fully automated explainability

- **GA (Goal Alignment):** Yes – Focused on customer-centric business intelligence.

- **Other Dimensions Named by Authors:** Extensibility, personalization, performance efficiency.

Theoretical or Conceptual Foundations

- Business intelligence theory (data-to-decision processes)

- Web usage mining and fuzzy logic principles

Indicators or Metrics for Actionability

- Execution time

- Memory usage

- Minimum time threshold (MinTime)

- Minimum confidence threshold (MinConfidence)

Barriers and Enablers to Actionability

- **Barriers:** Domain dependence for interpretation; quality of raw web logs; computational constraints.

- **Enablers:** Extensible framework; hybrid methodology; performance tuning via parameters.

Relation to Existing Literature

The authors situate their work in the context of prior research in fuzzy logic, neural networks, case-based

Summary

Pushpalatha and Reddy (2017) propose XWUMF, an extensible, hybrid framework for mining actionable

Scores

- **Overall Relevance Score:** 78 – Strong implicit definition and explicit feature linkages, but lacking forr

- **Operationalization Score:** 82 – Clear operational workflow and algorithm with performance metrics; h

Supporting Quotes from the Paper

- "The patterns when interpreted by domain experts can result in business intelligence." (p. 1)

- "The framework supports a hybrid approach which can have fuzzy clustering techniques and web minin

- "Sequential Web Usage Miner… generates patterns that reflect user behaviour." (p. 3)

- "Our empirical results revealed that the framework helps in discovering actionable knowledge." (p. 1)

Actionability References to Other Papers

- Lin & Hong (2013) – Fuzzy web mining survey

- He (2013) – Case-based reasoning + text mining for UX improvement

- Abello et al. (2015) – Semantic web for OLAP exploration

Paper Summary

<!--META_START-->

Title: Actionable Recommendations in the Bright Futures Child Health Supervision Guidelines

Authors: S.M.E. Finnell, J.L. Stanton, S.M. Downs

DOI: http://dx.doi.org/10.4338/ACI-2014-02-RA-0012

Year: 2014

Publication Type: Journal Article

Discipline/Domain: Clinical Informatics / Pediatrics

Subdomain/Topic: Pediatric preventive care guidelines, clinical decision support, guideline implementabil

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 80

Contains Definition of Actionability: Yes (explicit via GLIA criteria)

Contains Systematic Features/Dimensions: Yes (decidability, executability)

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes (Service Interval Diagram, GLIA)

Operationalization Present: Yes

Primary Methodology: Qualitative (guideline content analysis)

Study Context: Evaluation of Bright Futures pediatric preventive care guideline for computer implementat

Geographic/Institutional Context: United States; Indiana University School of Medicine / Regenstrief Instit

Target Users/Stakeholders: Pediatricians, clinical decision support developers, public health agencies

Primary Contribution Type: Conceptual and methodological assessment

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Partial

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Actionable Recommendations in the Bright Futures Child Health Supervision Guidelines

Authors:

S.M.E. Finnell, J.L. Stanton, S.M. Downs

DOI:

http://dx.doi.org/10.4338/ACI-2014-02-RA-0012

Year:

2014

Publication Type:

Journal Article

Discipline/Domain:

Clinical Informatics / Pediatrics

Subdomain/Topic:

Pediatric preventive care guidelines, clinical decision support, guideline implementability

Contextual Background:

Bright Futures is the most widely accepted pediatric preventive health care guideline in the U.S., organize

Geographic/Institutional Context:

United States; Indiana University School of Medicine / Regenstrief Institute

Target Users/Stakeholders:

Pediatricians, clinical decision support developers, public health agencies

Primary Methodology:

Qualitative (guideline content analysis)

Primary Contribution Type:

Conceptual and methodological assessment

General Summary of the Paper

This study evaluates the Bright Futures pediatric preventive care guidelines to determine their suitability f

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is explicitly defined through GLIA as requiring:

- **Decidability**: Clear specification of the conditions under which to apply a recommendation.

- **Executability**: Specific, unambiguous, detailed description of what action to take.

> "Actionable recommendation statements are both decidable (…clinical circumstances… clearly enough

> "It is impossible to create computer implementable decision rules if the guideline statements are vague

What Makes Something Actionable

- Precise conditions for applicability (decidability)

- Specific, detailed, unambiguous action steps (executability)

- Consistency in recommendation wording

- Potential adaptation to continuous age-based intervals for missed or delayed visits

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** GuideLine Implementability Appraisal (GLIA) v2.0; Service Interval D

- **Methods/Levers:** Consolidation of action statements, GLIA-based assessment, representation of rec

- **Operational Steps / Workflow:**

  1. Consolidate duplicate and fragmented actions into discrete recommendations

  2. Apply decidability criterion first; if met, apply executability

  3. Develop SID to map recommendations across ages

- **Data & Measures:** 2,161 Bright Futures actions; reduced to 245 recommendations; 52 actionable

- **Implementation Context:** Pediatric preventive care; EHR-based clinical decision support

> "The SID spans… from birth to 21 years… represents the appropriate time for delivering services as a c

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clarity in conditions and actions is essential.

- **CR (Contextual Relevance):** Yes — recommendations should be relevant to specific ages and conte

- **FE (Feasibility):** Partial — feasibility implied but not systematically assessed.

- **TI (Timeliness):** No explicit link to actionability.

- **EX (Explainability):** Partial — some detail provided, but not uniformly.

- **GA (Goal Alignment):** Partial — linked indirectly via alignment with preventive care objectives.

- **Other Dimensions Named by Authors:** None beyond GLIA's standard eight dimensions.

Theoretical or Conceptual Foundations

- GLIA v2.0 (Shiffman et al., 2005) for implementability assessment

- CDC immunization schedule concept for SID format analogy

Indicators or Metrics for Actionability

- Meets GLIA decidability and executability criteria

- Count and proportion of recommendations deemed actionable

Barriers and Enablers to Actionability

- **Barriers:**

  - Vague recommendations lacking specificity

  - Organization by visit rather than age interval

  - Inconsistent wording across visits

  - Lack of detail for sensitive topics (e.g., mental health)

- **Enablers:**

  - Clear, specific age-based criteria

- Standardized, detailed action descriptions

  - Consolidation of redundant actions

Relation to Existing Literature

Authors build on prior GLIA applications in multiple clinical domains and extend the method to pediatric p

Summary

The paper provides a rigorous, criteria-based evaluation of Bright Futures guidelines' actionability, focusi

Scores

- **Overall Relevance Score:** 88 — Explicit definition of actionability via GLIA; comprehensive applicatio

- **Operationalization Score:** 80 — Clear process for assessing and representing actionability; SID offe

Supporting Quotes from the Paper

- "Actionable recommendation statements are both decidable… and executable…" (p. 652)

- "It is impossible to create computer implementable decision rules if the guideline statements are vague

- "The SID spans… from birth to 21 years… represents the appropriate time for delivering services as a

- "Only 52 (21%) meet criteria for actionability…" (p. 657)

Actionability References to Other Papers

- Shiffman RN et al. (2005) on GLIA

- CDC immunization schedules as a model for SID

- Multiple GLIA applications in other specialties (Hill et al., Peleg & Garber, Nagler et al., van Dijk et al.)

Paper Summary

<!--META_START-->

Title: The Heuristic Uses of Four 'Knows' for Managing Knowledge in Education

Authors: Chung Hong Tam

DOI: n/a

Year: n/a

Publication Type: Journal

Discipline/Domain: Education / Knowledge Management

Subdomain/Topic: Heuristic frameworks for knowledge management in educational contexts

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit via "relevant or actionable knowledge" in Kn

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with applied case discussion

Study Context: Knowledge Management in schools and "Knowledge Community" projects (Hong Kong a

Geographic/Institutional Context: Hong Kong (primary/secondary education), cross-national projects

Target Users/Stakeholders: Teachers, school leaders, educational policymakers, students

Primary Contribution Type: Conceptual framework revision and application to education

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

The Heuristic Uses of Four 'Knows' for Managing Knowledge in Education

Authors:

Chung Hong Tam

DOI:

n/a

Year:

n/a

Publication Type:

Journal

Discipline/Domain:

Education / Knowledge Management

Subdomain/Topic:

Heuristic frameworks for knowledge management in educational contexts

Contextual Background:

The paper addresses the persistent confusion between knowledge management (KM) and information m

Geographic/Institutional Context:

Hong Kong schools, with examples from global collaborative projects.

Target Users/Stakeholders:

Teachers, school leaders, education policymakers, students.

Primary Methodology:

Conceptual with applied case discussion.

Primary Contribution Type:

Conceptual framework revision and operationalization for education.

General Summary of the Paper

This paper revises the "Four Knows" (Know-Why, Know-Who, Know-What, Know-How) framework to add

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as transforming knowledge into "relevant or actionable knowledge" for the benefici

> "Know-How…transforms the knowledge creator's knowledge into the relevant or actionable knowledge

> "Knowledge must be placed in context so that it is actionable" (p. 5)

What Makes Something Actionable

- Clear purpose and value for decision-making (Know-Why)

- Defined stakeholders and governance of roles/responsibilities (Know-Who)

- Adequate, relevant, and pedagogically aligned content (Know-What)

- Structured processes for transforming and delivering knowledge so it can be used (Know-How)

- Codification into accessible, usable formats

- Timely updating and quality assurance

- Contextualization to user needs

- Alignment with institutional goals

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Revised Four Knows; Knowledge Community (KC)

- **Methods/Levers:** Six-step KM cycle: create, capture, codify, store, manage, disseminate

- **Operational Steps / Workflow:** Identify drivers, assign roles, define content needs, follow KM cycle w

- **Data & Measures:** Repository content quality, user engagement, avoidance of duplication, alignment

- **Implementation Context:** Applied in Hong Kong primary/secondary schools and cross-national collab

> "Six steps… create, capture, codify, store, manage, disseminate" (p. 5)

> "Codification strategies to ensure all subject knowledge… can be transferred to the right person" (p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Define KM clearly at the early stage to understand its contours and challenges"

- **CR (Contextual Relevance):** Yes — "Knowledge must be placed in context so that it is actionable" (p

- **FE (Feasibility):** Yes — "Education strategies should manage resource allocation so that variation in

- **TI (Timeliness):** Partial — Implied in need for timely updating and dissemination

- **EX (Explainability):** Partial — Codification into understandable formats is emphasized, but not explic

- **GA (Goal Alignment):** Yes — KM tied to school/learning community objectives

- **Other Dimensions Named by Authors:** Sustainability, governance, stakeholder engagement

Theoretical or Conceptual Foundations

- Lundvall & Johnson's (1994) Four Knows

- Wenger's (1998) Communities of Practice

- Tacit/explicit knowledge distinction (Polanyi, 1958)

Indicators or Metrics for Actionability

- Repository usability and access

- Quality and relevance of stored materials

- Evidence of knowledge reuse and sharing

- Reduction in duplication of materials

Barriers and Enablers to Actionability

- **Barriers:** Role ambiguity; lack of codification strategies; resource constraints; poor quality content; re

- **Enablers:** Clear definition of KM; role clarity; codification; knowledge-sharing culture; adequate infras

Relation to Existing Literature

Positions the revised Four Knows as a bridge between KM theory and educational practice, enhancing Lu

Summary

The paper reframes the Four Knows—Know-Why, Know-Who, Know-What, and Know-How—for educatio

Scores

- **Overall Relevance Score:** 92 — Strong conceptual framing of actionability via "relevant or actionable

- **Operationalization Score:** 95 — Detailed, step-by-step KM process explicitly aimed at achieving actio

Supporting Quotes from the Paper

- "Know-How…transforms the knowledge creator's knowledge into the relevant or actionable knowledge

- "Knowledge must be placed in context so that it is actionable" (p. 5)

- "Six steps… create, capture, codify, store, manage, disseminate" (p. 5)

- "Codification strategies to ensure all subject knowledge… can be transferred to the right person" (p. 3)

Actionability References to Other Papers

- Lundvall & Johnson (1994) — original Four Knows

- Wenger (1998) — Communities of Practice

- Polanyi (1958) — tacit knowledge concept

- Turban et al. (2002) — KM processes

Paper Summary

<!--META_START-->

Title: The Emerging Role of Global Situational Awareness 2.0 Resources in Disaster Response

Authors: Carl Taylor

DOI: 10.1117/12.853113

Year: 2010

Publication Type: Conference Proceedings

Discipline/Domain: Public Health / Disaster Response

Subdomain/Topic: Situational Awareness, Health Informatics, Emergency Management

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit – situational awareness as acquiring relevant event data

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (Situational Awareness 2.0 concept)

Operationalization Present: Yes

Primary Methodology: Conceptual / Use-Case Review

Study Context: Disaster response with public health and medical integration

Geographic/Institutional Context: Global; examples from Haiti, Chile, UK; U.S.-based institutional perspec

Target Users/Stakeholders: Public health officials, disaster responders, healthcare providers, NGOs, gov

Primary Contribution Type: Conceptual framework with practical technology examples

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The Emerging Role of Global Situational Awareness 2.0 Resources in Disaster Response

Authors:

Carl Taylor

DOI:

10.1117/12.853113

Year:

2010

Publication Type:

Conference Proceedings

Discipline/Domain:

Public Health / Disaster Response

Subdomain/Topic:

Situational Awareness, Health Informatics, Emergency Management

Contextual Background:

The paper addresses the integration of emerging web-based, open-source, and social networking tools in

Geographic/Institutional Context:

Global application with examples from Haiti, Chile, the UK; institutional perspective from the U.S. (Univers

Target Users/Stakeholders:

Public health officials, emergency managers, healthcare providers, NGOs, governmental and military age

Primary Methodology:

Conceptual / Use-case review

Primary Contribution Type:

Conceptual framework and operational examples

General Summary of the Paper

This paper presents "Situational Awareness 2.0" as a next-generation approach to disaster response, inte

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Situational awareness is described as "acquiring all relevant information about the event and translating t

> "True situational awareness means acquiring all relevant information about the event and translating th

> "Awareness without transactional capability may allow you to view the event but only as a mostly passiv

What Makes Something Actionable

- Inclusion of both community and patient-centric data

- Ability to foresee developments ("see around corners")

- Integration of multi-source data (structured/unstructured, validated/unvalidated)

- Real-time adaptability to update strategies

- Linkage to response mechanisms (transactional capacity)

- Contextual relevance to affected populations

- Engagement with social networks and emergent coherence

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Situational Awareness 2.0

- **Methods/Levers:** Integration of open-source mapping (Ushahidi, Google Evolve), SMS reporting, pat

- **Operational Steps / Workflow:** Pre-event modeling; multi-channel data collection; community/patient

- **Data & Measures:** Structured hospital data, structured mobile survey data, unstructured social media

- **Implementation Context:** Disaster response scenarios (H1N1, Haiti earthquake)

> "With appropriate integration of situational awareness 2.0 tools, public health can both manage the com

> "Situational awareness (2.0) is a fundamental component of preparedness." (p. 5)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Clarity in data patterns is necessary for effective response (p. 7)

- **CR (Contextual Relevance):** Yes – Data must be relevant to community and patient context (p. 3–4)

- **FE (Feasibility):** Yes – Tools must be usable under disaster constraints (low bandwidth, mobile acce

- **TI (Timeliness):** Yes – Real-time or near-real-time data critical (p. 4)

- **EX (Explainability):** Partial – Emphasis on understanding patterns but less on model transparency

- **GA (Goal Alignment):** Yes – Aligns awareness and response with public health mission (p. 2–3)

- **Other Dimensions Named by Authors:** Emergent coherence, transactional capability

Theoretical or Conceptual Foundations

- Ashby's Law of Requisite Variety

- Science 2.0 (Ben Shneiderman)

- Concepts of emergent coherence in social networks

Indicators or Metrics for Actionability

- Ability to prioritize patients based on comorbidities and risk

- Surge capacity avoidance through patient diversion

- Accuracy and timeliness of data flows

Barriers and Enablers to Actionability

- **Barriers:** Overly hospital-centric approaches; fragmented data sources; unreliable/unvalidated data;

- **Enablers:** Open-source/free tools; multi-modal data collection; social network engagement; pre-even

Relation to Existing Literature

Positions itself as extending Science 2.0 concepts to disaster management, combining predictive modelin

Summary

Taylor's paper reframes situational awareness as inherently linked to actionability, arguing that data must

Scores

- **Overall Relevance Score:** 85 – Strong implicit definition of actionability, clear list of features linked to

- **Operationalization Score:** 90 – Detailed processes, tools, and workflows directly tied to achieving ac

Supporting Quotes from the Paper

- "True situational awareness means acquiring all relevant information about the event and translating tha

- "Awareness without transactional capability may allow you to view the event but only as a mostly passiv

- "With appropriate integration of situational awareness 2.0 tools, public health can both manage the com

- "Situational awareness (2.0) is a fundamental component of preparedness." (p. 5)

Actionability References to Other Papers

- Toner, E. (2009) Creating Situational Awareness: A Systems Approach

- Taylor & Stephens (2009) Situational Awareness 2.0

- Patrick Meier & Jen Ziemke (2010) Crisis Mapping

- Ben Shneiderman (Science 2.0 concepts)

Paper Summary

<!--META_START-->

Title: The assessment of urban eco-efficiency of Brazilian municipalities based on directional distance fun

Authors: Andreia Zanella, Renata Oliveira

DOI: 10.1108/JM2-11-2024-0369

Year: 2025

Publication Type: Journal

Discipline/Domain: Urban Sustainability / Environmental Management

Subdomain/Topic: Eco-efficiency assessment, Data Envelopment Analysis (DEA), Sustainable Developm

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit in "actionable insights" framing)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (Expanded Urban Eco-efficiency DEA-DDF model)

Operationalization Present: Yes

Primary Methodology: Quantitative (DEA with Directional Distance Function)

Study Context: Urban eco-efficiency in large Brazilian municipalities (>300k inhabitants)

Geographic/Institutional Context: Brazil, Sustainable Cities Program (ICS-SDSN)

Target Users/Stakeholders: Municipal policymakers, urban planners, environmental agencies

Primary Contribution Type: Empirical assessment model and benchmarking tool for urban eco-efficiency

CL: Yes – clarity in KPI definitions linked to actionability

CR: Yes – contextual relevance tied to Brazilian urban and regional disparities

FE: Yes – feasibility considered through realistic improvement scenarios and GDP constraint

TI: Partial – scenarios consider current data but not explicit urgency thresholds

EX: Yes – model explainability via indicator weights and peer benchmarking

GA: Yes – alignment with SDGs and municipal sustainability goals

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The assessment of urban eco-efficiency of Brazilian municipalities based on directional distance functions

Authors:

Andreia Zanella, Renata Oliveira

DOI:

10.1108/JM2-11-2024-0369

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Urban Sustainability / Environmental Management

Subdomain/Topic:

Eco-efficiency assessment, DEA, Sustainable Development Goals

Contextual Background:

Evaluates eco-efficiency of Brazilian cities using SDG-linked KPIs, combining desirable and undesirable

Geographic/Institutional Context:

Brazil; Instituto Cidades Sustentáveis (ICS) and Sustainable Development Solutions Network (SDSN) da

Target Users/Stakeholders:

Municipal decision-makers, environmental managers, policy analysts.

Primary Methodology:

Quantitative (DEA with Directional Distance Functions).

Primary Contribution Type:

Methodological innovation in urban eco-efficiency measurement and operational policy guidance tool.

General Summary of the Paper

This study develops and applies an optimization model based on Data Envelopment Analysis (DEA) and

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the ability to provide "actionable insights" to policymakers through eco-efficiency

> "The model specified can identify best practices and areas for targeted improvement, offering actionabl

> "…highlights their specific strengths and weaknesses, providing decision-makers with alternative scena

---

What Makes Something Actionable

- Clear linkage to specific, measurable KPIs.

- Ability to benchmark against high-performing peers.

- Scenario-specific improvement pathways.

- Alignment with SDG targets.

- Interpretability via weight assignment to indicators.

- Feasibility maintained by keeping GDP (wealth proxy) constant.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Expanded Urban Eco-efficiency Framework (DEA-DDF with SDG-lin

- **Methods/Levers:** DEA with directional distance functions; weight restrictions to ensure KPI relevance

- **Operational Steps / Workflow:**

  1. Select 8 KPIs (inputs, desirable outputs, undesirable outputs) aligned with SDGs.

  2. Collect municipal data (2019–2022) from ICS-SDSN.

  3. Apply DEA-DDF model under weight constraints.

  4. Run three improvement scenarios with fixed GDP per capita.

  5. Identify peer cities for benchmarking.

  6. Analyze indicator weights to detect strengths/weaknesses.

- **Data & Measures:** GDP per capita, % water/sewage/waste collection, % conservation area, waste g

- **Implementation Context:** Brazilian municipalities with >300,000 inhabitants.

> "…enables the reflection of alternative decision scenarios…providing actionable insights to support the

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – KPIs precisely defined and linked to SDGs.

  > "…enables local governments to prioritize their efforts effectively…" (p. 8)

- **CR (Contextual Relevance):** Yes – tailored to Brazilian regional disparities.

- **FE (Feasibility):** Yes – keeps GDP constant to reflect realistic constraints.

- **TI (Timeliness):** Partial – scenarios reflect current data but no explicit urgency metric.

- **EX (Explainability):** Yes – indicator weights and peer benchmarking enhance interpretability.

- **GA (Goal Alignment):** Yes – fully aligned with SDG targets.

- **Other Dimensions Named by Authors:** Equity in service provision; environmental burden mitigation.

Theoretical or Conceptual Foundations

- WBCSD eco-efficiency principles.

- Expanded eco-efficiency definition from Oliveira et al. (2017).

- DEA literature on environmental performance with undesirable outputs (Chung et al., 1997; Seiford & Zh

---

Indicators or Metrics for Actionability

- 8 SDG-linked KPIs (input, desirable outputs, undesirable outputs).

- Eco-efficiency scores from DEA-DDF model.

- Peer similarity coefficients (λ values).

- Scenario-specific performance differentials.

Barriers and Enablers to Actionability

- **Barriers:**

  - Data variability and quality.

  - Regional inequalities in infrastructure and governance.

  - Environmental pressures in Amazonian cities.

- **Enablers:**

  - SDG-aligned indicator framework.

  - Benchmarking culture.

  - Scenario-specific targeting of improvements.

Relation to Existing Literature

Builds on DEA-based eco-efficiency studies but is the first to apply multiple directional vectors to urban e

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Summary

This paper operationalizes actionability in urban sustainability assessment through a DEA-DDF model tha

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Scores

- **Overall Relevance Score:** 90 — Strong conceptual clarity on actionability (via actionable insights fra

- **Operationalization Score:** 95 — Fully specified DEA-DDF operational workflow with real-world data,

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Supporting Quotes from the Paper

- "The model specified can identify best practices and areas for targeted improvement, offering actionable

- "…highlighting specific strengths and weaknesses, providing decision-makers with alternative scenarios

- "…enables the reflection of alternative decision scenarios…providing actionable insights to support the a

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Actionability References to Other Papers

- Oliveira et al. (2017, 2019, 2020) – Expanded eco-efficiency assessment methods.

- Chung et al. (1997) – Incorporating undesirable outputs in DEA.

- Seiford & Zhu (2002) – Desirable input modeling.

- WBCSD (2000) – Eco-efficiency definition.

Paper Summary

<!--META_START-->

Title: Telling stories: Exploring the relationship between myths and ecological wisdom

Authors: Esther Eidinow

DOI: 10.1016/j.landurbplan.2016.04.014

Year: 2016

Publication Type: Journal

Discipline/Domain: Environmental Studies / Classics

Subdomain/Topic: Myths, ecological wisdom, scenario planning

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicitly through ecological wisdom and its actionable transmiss

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (scenario planning as mechanism)

Operationalization Present: Yes

Primary Methodology: Conceptual / Theoretical synthesis with illustrative case studies

Study Context: Interdisciplinary exploration linking classical mythology, indigenous knowledge, and enviro

Geographic/Institutional Context: Global, with case studies from Greece, Indonesia, and Borneo; Univers

Target Users/Stakeholders: Environmental planners, policymakers, indigenous communities, scholars

Primary Contribution Type: Conceptual framework and methodological suggestion

CL: Yes

CR: Yes

FE: Partial

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Telling stories: Exploring the relationship between myths and ecological wisdom

Authors:

Esther Eidinow

DOI:

10.1016/j.landurbplan.2016.04.014

Year:

2016

Publication Type:

Journal

Discipline/Domain:

Environmental Studies / Classics

Subdomain/Topic:

Myths, ecological wisdom, scenario planning

Contextual Background:

The paper bridges classical studies, indigenous ecological knowledge, and environmental planning to arg

Geographic/Institutional Context:

Global scope; cases from ancient Greece, Komodo Island (Indonesia), and Borneo. Author based at Univ

Target Users/Stakeholders:

Environmental planners, policymakers, indigenous communities, academics across humanities and envir

Primary Methodology:

Conceptual synthesis with illustrative historical and ethnographic case studies.

Primary Contribution Type:

Conceptual framework linking myth-making with ecological wisdom and operational suggestion for scena

General Summary of the Paper

This paper proposes that myths function as repositories and transmitters of ecological wisdom, integrating

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed through the lens of ecological wisdom as both theoretical ideas (sophia) and practi

> "Myths… can provide a framework for… capturing ecological wisdom… [and] transmitting it as actionab

> "They are practical, they provoke action, and they shape our perception of the world" (p. 49)

What Makes Something Actionable

- Integration of theoretical and practical wisdom.

- Embedding knowledge in culturally resonant narratives.

- Ability to provoke context-relevant action.

- Retention of multiple perspectives and plurality of narratives.

- Connection to lived, practical experience and socio-political realities.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Myth-making; Scenario Planning.

- **Methods/Levers:** Use of culturally embedded narratives; stakeholder engagement across knowledge

- **Operational Steps / Workflow:** Identify existing myths; preserve plurality; integrate via scenario plann

- **Data & Measures:** Narrative content, stakeholder perspectives, scenario quality metrics (information

- **Implementation Context:** Multi-stakeholder environmental planning, integrating indigenous and scien

> "Scenario-planning… offers a mechanism for creating new myths… facilitating the integration of multipl

> "Scenarios… encapsulate and transmit new information… developing shared mental models… and stre

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — scenarios must have "ergonomic design" and coherent sequence (p. 51).

- **CR (Contextual Relevance):** Yes — myths emerge from and reflect local ecological and socio-politic

- **FE (Feasibility):** Partial — implied in practical wisdom but not systematically defined.

- **TI (Timeliness):** Partial — responsiveness of myths to contemporary events noted (p. 48).

- **EX (Explainability):** Yes — myths' cultural logic and resonance explained via cognitive and aesthetic

- **GA (Goal Alignment):** Yes — aligning myths with ecological wisdom goals and integrated planning o

- **Other Dimensions Named by Authors:** Multiplicity; flexibility; integration without dilution.

Theoretical or Conceptual Foundations

- Aristotelian sophia and phronesis.

- Cognitive metaphor theory (Fauconnier & Turner).

- Indigenous knowledge integration literature (Bohensky & Maru, 2011).

- Scenario planning theory (Schwartz, Wack).

Indicators or Metrics for Actionability

- Narrative's ability to provoke action.

- Participant engagement and shared mental model formation in scenarios.

- Scenario attributes: vividness, coherence, plausible unexpectedness.

Barriers and Enablers to Actionability

- **Barriers:** Difficulty integrating diverse knowledge systems; risk of erasing local perspectives; domina

- **Enablers:** Plurality of myths; culturally embedded narratives; scenario planning methodology.

Relation to Existing Literature

Builds on Xiang's (2014) ecological wisdom framework, expands by integrating classical and indigenous

Summary

Eidinow positions myths as dual carriers of theoretical and practical ecological wisdom, capable of makin

Scores

- **Overall Relevance Score:** 90 — Strong conceptual clarity linking actionability to integrated theoretica

- **Operationalization Score:** 85 — Concrete mechanism (scenario planning) tied to actionability, with d

Supporting Quotes from the Paper

- "Myths… can provide a framework for… capturing ecological wisdom… [and] transmitting it as actionabl

- "They are practical, they provoke action, and they shape our perception of the world" (p. 49)

- "Scenario-planning… offers a mechanism for creating new myths… facilitating the integration of multiple

- "Scenarios… encapsulate and transmit new information… developing shared mental models… and stre

Actionability References to Other Papers

- Xiang (2014) on ecological wisdom.

- Bohensky & Maru (2011) on integrating indigenous and scientific knowledge.

- Schwartz (1996), Wack (1985a,b) on scenario planning.

- Schwartz & Sharpe (2010) on practical wisdom.

Paper Summary

Subdomain/Topic: School Analytics, Educational Data Analytics, ICT in Education, fsQCA

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 88

Contains Definition of Actionability: Yes (implicit and explicit in "actionable insights" context)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (School Analytics model)

Operationalization Present: Yes (fsQCA methodology and configurations)

Primary Methodology: Quantitative (fsQCA with validation protocols)

Study Context: European K-12 schools; focus on fostering students' digital skills through ICT

Geographic/Institutional Context: Cross-European dataset (~3000 schools)

Target Users/Stakeholders: School leaders, policymakers, educational researchers

Primary Contribution Type: Conceptual model and applied methodological demonstration

CL: Yes

CR: Yes

FE: Yes

TI: No explicit link

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Supporting school leadership decision making with holistic school analytics: Bridging the qualitative-quan

Authors:

Stylianos Sergis, Demetrios G. Sampson, Michail N. Giannakos

DOI:

https://doi.org/10.1016/j.chb.2018.06.016

Year:

2018

Publication Type:

Journal Article

Discipline/Domain:

Educational Technology / School Leadership

Subdomain/Topic:

School Analytics, Educational Data Analytics, ICT in Education, fsQCA

Contextual Background:

The paper addresses the challenge of enabling school leaders to make informed strategic decisions by le

Geographic/Institutional Context:

European schools (~3000 schools across multiple countries)

Target Users/Stakeholders:

School leaders, educational policymakers, educational researchers

Primary Methodology:

Quantitative (fsQCA applied to large-scale survey data, with contrarian analysis, predictive validity testing

Primary Contribution Type:

Conceptual model and methodological application

General Summary of the Paper

This study develops and applies a *School Analytics* model for K-12 educational leadership decision-ma

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper defines actionable insights as **informative suggestions on what decisions need to be made**

> "...do not offer support for translating these needs into actionable insights (i.e., informative suggestions

> "…could provide school leaders with actionable insights, in the form of school-wide informative suggest

---

What Makes Something Actionable

- Based on comprehensive, holistic data across multiple school layers.

- Identifies specific *configurations* of conditions, not just isolated factors.

- Links directly to strategic goals (e.g., improving digital skills).

- Supports targeted, context-aware interventions.

- Validated through robust statistical and comparative analysis.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** School Analytics Model + fsQCA methodology

- **Methods/Levers:** Complexity theory, configuration theory, fuzzy-set QCA, contrarian analysis, predic

- **Operational Steps / Workflow:**

  1. Define strategic goal (e.g., enhancing digital skills).

  2. Identify and measure relevant school ecosystem factors.

  3. Apply fsQCA to identify multiple sufficient configurations for desired outcomes.

  4. Validate results through predictive testing and statistical comparisons.

  5. Translate configurations into school-specific improvement pathways.

- **Data & Measures:** Multi-actor surveys (leaders, teachers, students), Likert-scale measures of attitud

- **Implementation Context:** European K-12 school leadership, ICT integration.

> "…eight distinct configurations of school factors…describe how school leaders can potentially generate

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — insights presented as clear configurations.

- **CR (Contextual Relevance):** Yes — tailored to specific school contexts.

- **FE (Feasibility):** Yes — configurations consider real-world constraints.

- **TI (Timeliness):** No explicit link.

- **EX (Explainability):** Yes — grounded in theory, configurations explained.

- **GA (Goal Alignment):** Yes — all configurations tied to strategic improvement goals.

- **Other Dimensions Named by Authors:** Equifinality, causal asymmetry (from complexity theory).

Theoretical or Conceptual Foundations

- Complexity Theory

- Configuration Theory

- School Analytics framework (Sergis & Sampson, 2014, 2016)

- ICT Competence Profiling models (various cited works)

Indicators or Metrics for Actionability

- fsQCA consistency and coverage scores.

- Predictive validity results.

- T-test comparisons between experimental and control groups.

Barriers and Enablers to Actionability

Barriers:

- Limited translation of analytics to actionable steps in existing tools.

- Complexity of multi-layered school ecosystems.

- Variability in infrastructure, culture, and leadership attitudes.

Enablers:

- Holistic data collection across micro, meso, macro layers.

- Theoretical grounding in complexity/configuration.

- fsQCA's capacity to reveal multiple valid improvement paths.

Relation to Existing Literature

Positions itself as extending prior ICT-in-schools studies by moving from factor identification to *configura

---

Summary

This paper operationalizes the concept of *actionability* in educational decision-making by defining it as t

---

Scores

- **Overall Relevance Score:** 90 — Strong conceptualization of actionability with explicit link to decision

- **Operationalization Score:** 88 — Detailed multi-step methodology (fsQCA) with validation, directly tie

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Supporting Quotes from the Paper

- "...do not offer support for translating these needs into actionable insights (i.e., informative suggestions

- "…could provide school leaders with actionable insights, in the form of school-wide informative suggesti

- "...eight distinct configurations of school factors…describe how school leaders can potentially generate

---

Actionability References to Other Papers

- Sergis & Sampson (2014, 2016) — School Analytics framework

- Tondeur et al. (2008), Solar et al. (2013), Aesaert et al. (2015) — ICT integration models

- Fiss (2007, 2011), Ragin (2000, 2008) — fsQCA and configuration theory

- Woodside (2014) — Complexity theory and contrarian analysis

Paper Summary

<!--META_START-->

Title: Stream Reasoning for the Internet of Things: Challenges and Gap Analysis

Authors: Xiang Su, Ekaterina Gilman, Peter Wetz, Jukka Riekki, Yifei Zuo, Teemu Leppänen

DOI: Not provided (conference proceedings WIMS '16, Nîmes, France)

Year: 2016

Publication Type: Conference

Discipline/Domain: Computer Science / Internet of Things

Subdomain/Topic: Stream reasoning, semantic web, IoT data processing

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 70

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (general architecture + experimental IoT system)

Operationalization Present: Yes (C-SPARQL example implementation)

Primary Methodology: Conceptual + Experimental

Study Context: IoT systems in domains such as smart city, intelligent transportation, healthcare, home au

Geographic/Institutional Context: University of Oulu (Finland), TU Wien (Austria)

Target Users/Stakeholders: IoT system designers, semantic reasoning researchers, real-time data proces

Primary Contribution Type: Gap analysis and recommendations for stream reasoning in IoT

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Stream Reasoning for the Internet of Things: Challenges and Gap Analysis

Authors:

Xiang Su, Ekaterina Gilman, Peter Wetz, Jukka Riekki, Yifei Zuo, Teemu Leppänen

DOI:

Not provided (conference paper WIMS '16)

Year:

2016

Publication Type:

Conference

Discipline/Domain:

Computer Science / Internet of Things

Subdomain/Topic:

Stream reasoning, semantic web, IoT data processing

Contextual Background:

The paper addresses the challenge of producing actionable knowledge from heterogeneous, dynamic IoT

Geographic/Institutional Context:

University of Oulu (Finland), TU Wien (Austria)

Target Users/Stakeholders:

IoT researchers, semantic reasoning system developers, IoT application architects

Primary Methodology:

Conceptual review, comparative analysis, small-scale experimental demonstration

Primary Contribution Type:

Gap analysis with recommendations for stream reasoning in IoT

General Summary of the Paper

The paper examines how stream reasoning can address the need for actionable, real-time insights in IoT

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly framed as the ability to deduce **timely, sufficiently accurate, and reliable knowle

> "It is critical to deduce timely, sufficiently accurate, and reliable knowledge from IoT systems to take act

> "Stream reasoning… enables handling of dynamic and heterogeneous data… implementing real-time s

---

What Makes Something Actionable

- Timeliness: knowledge generated before it becomes outdated

- Contextual integration: combining sensor data with domain ontologies and user rules

- Semantic enrichment: deriving higher-level insights from low-level sensor readings

- Scalability: ability to handle large, heterogeneous, fast data

- Robustness: coping with incomplete, out-of-order, or incorrect data

- Efficiency: low-latency reasoning even in resource-constrained environments

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** General IoT-stream reasoning architecture; experimental smart offic

- **Methods/Levers:** Semantic data modeling (RDF), continuous queries (C-SPARQL), background kno

- **Operational Steps / Workflow:** IoT devices → JSON sensor data → RDF transformation → continuou

- **Data & Measures:** Sensor data (light, motion, door position, Wi-Fi signal); processing latency, reaso

- **Implementation Context:** Smart office proof-of-concept; generalizable to other IoT domains

> "Data streams are processed on-the-fly and do not require a considerable amount of resources to make

> "Combining on-the-fly several data streams… would enable much more interesting scenarios." (p.6)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — reasoning results must be unambiguous and interpretable in context.

- **CR (Contextual Relevance):** Yes — data combined with background knowledge/domain ontologies.

- **FE (Feasibility):** Yes — solutions must run on resource-constrained IoT nodes.

- **TI (Timeliness):** Yes — low-latency reasoning emphasized.

- **EX (Explainability):** No explicit discussion.

- **GA (Goal Alignment):** Partial — reasoning often tied to application-specific user-defined rules.

- **Other Dimensions Named by Authors:** Robustness, scalability, uncertainty management.

Theoretical or Conceptual Foundations

- Semantic Web standards (RDF, OWL, SPARQL)

- Stream reasoning definition by Unel & Roman (2009)

- Time-aware semantic models (TA-RDF, Temporal RDF, stRDF)

Indicators or Metrics for Actionability

- Reasoning latency relative to data arrival

- Throughput (data processing rate)

- Accuracy/completeness of inferred knowledge under time constraints

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Limited scalability of current stream reasoners

  - Lack of uncertainty handling

  - Inflexible time models

  - Resource constraints of IoT devices

- **Enablers:**

  - Semantic data integration

  - Continuous query models

  - Lightweight/incremental reasoning

Relation to Existing Literature

Positions stream reasoning as an extension to Semantic Web reasoning, addressing IoT's dynamic, high

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Summary

This paper presents a comprehensive analysis of how stream reasoning can be used to produce actionab

---

Scores

- **Overall Relevance Score:** 88 — Strong implicit definition of actionability and detailed mapping of ne

- **Operationalization Score:** 70 — Provides a working prototype and specific implementation steps, tho

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Supporting Quotes from the Paper

- "It is critical to deduce timely, sufficiently accurate, and reliable knowledge from IoT systems to take acti

- "Stream reasoning… enables handling of dynamic and heterogeneous data… implementing real-time se

- "Combining on-the-fly several data streams… would enable much more interesting scenarios." (p.6)

Actionability References to Other Papers

- Unel & Roman (2009) — definition of stream reasoning

- Barbieri et al. — C-SPARQL

- Koubarakis & Kyzirakos — stRDF

- Rodríguez et al. — TA-RDF

- Gutierrez et al. — Temporal RDF

Paper Summary

<!--META_START-->

Title: SmartReviews: Towards Human- and Machine-Actionable Representation of Review Articles

Authors: Allard Oelen, Markus Stocker, Sören Auer

DOI: https://doi.org/10.1007/978-3-030-91669-5_9

Year: 2021

Publication Type: Conference

Discipline/Domain: Information Science / Digital Libraries

Subdomain/Topic: Semantic Publishing, Scholarly Knowledge Graphs, Review Article Authoring

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit via functional characteristics)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with Implementation and Use Case Demonstration

Study Context: Scholarly review article authoring and publishing

Geographic/Institutional Context: L3S Research Center & TIB Leibniz Information Centre, Germany

Target Users/Stakeholders: Academic authors, publishers, research communities, digital library develope

Primary Contribution Type: Conceptual framework and software tool implementation

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

SmartReviews: Towards Human- and Machine-Actionable Representation of Review Articles

Authors:

Allard Oelen, Markus Stocker, Sören Auer

DOI:

https://doi.org/10.1007/978-3-030-91669-5_9

Year:

2021

Publication Type:

Conference

Discipline/Domain:

Information Science / Digital Libraries

Subdomain/Topic:

Semantic Publishing, Scholarly Knowledge Graphs, Review Article Authoring

Contextual Background:

The paper addresses limitations in traditional scholarly review articles—lack of updates, low collaboration

Geographic/Institutional Context:

L3S Research Center & TIB Leibniz Information Centre for Science and Technology, Hannover, Germany

Target Users/Stakeholders:

Academic authors, publishers, research communities, and developers of digital library infrastructure

Primary Methodology:

Conceptual framework, technical implementation, and demonstration via a use case

Primary Contribution Type:

Conceptual model, operational framework, and software tool

General Summary of the Paper

This paper presents *SmartReviews*, a new authoring and publishing framework for scholarly review arti

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability here is framed in terms of both *human* and *machine* use: a review is actionable if it can b

> "The key limitation is the inability of machines to access and process knowledge presented within revie

> "The use of these technologies improves the machine-actionability of data and provides a means to ma

---

What Makes Something Actionable

- **Updatable** (living document concept with version control)

- **Collaboratively authored** (community-based contributions with provenance tracking)

- **Structured & semantic representation** (linked data, ontologies, RDF)

- **Accessible** (HTML format, WCAG compliance)

- **Interoperable** (machine-readable formats, FAIR data principles)

- **Contextually linked** (properties tied to ontologies to enhance interpretability)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** SmartReviews within ORKG

- **Methods/Levers:** Use of RDF, ontologies (DOCO, Fabio, DEO), semantic comparison tables, living d

- **Operational Steps / Workflow:**

  1. Create sections (text, comparisons, visualizations, ontology tables, resource/property tables)

  2. Populate with structured, linked data from ORKG

  3. Maintain head version with version history for updates

  4. Enable collaborative editing and attribution via acknowledgements

- **Data & Measures:** RDF triples, SPARQL queries for retrieval, ontology-linked properties

- **Implementation Context:** Digital library / semantic publishing infrastructure

> "Comparison sections form the core of each review article." (p. 108)

> "The data itself can be accessed via… SPARQL endpoint, RDF dump, and REST interface." (p. 110)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – clear structured representation via tables/visuals

- **CR (Contextual Relevance):** Yes – ontology linking ensures contextual meaning

- **FE (Feasibility):** Yes – enabled by ORKG platform and existing ontologies

- **TI (Timeliness):** Partial – supports updates but depends on community activity

- **EX (Explainability):** Partial – ontology tables explain properties but not all content

- **GA (Goal Alignment):** Yes – aligns with FAIR principles and open science goals

- **Other Dimensions Named by Authors:** Accessibility, Collaboration, Coverage

---

Theoretical or Conceptual Foundations

- Living documents concept (Shanahan 2015)

- Semantic Web and Linked Data principles (Berners-Lee et al., RDF, SPARQL)

- FAIR data principles (Wilkinson et al., 2016)

Indicators or Metrics for Actionability

- Ability to execute SPARQL queries over review content

- Presence of ontology-linked properties

- Version history and update frequency

- Accessibility compliance (HTML, WCAG)

Barriers and Enablers to Actionability

- **Barriers:** Researcher habits, resistance to change, lack of incentives for ongoing updates

- **Enablers:** Collaborative platform, attribution system, FAIR data standards, semantic web technologie

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Relation to Existing Literature

The authors situate their approach within semantic publishing research, citing prior calls for machine-rea

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Summary

The paper conceptualizes actionability in scholarly reviews as a combination of dynamic updatability, sen

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Scores

- **Overall Relevance Score:** 90 — Strong, detailed implicit definition of actionability with explicit dimens

- **Operationalization Score:** 95 — Full technical and procedural workflow for achieving actionability is p

---

Supporting Quotes from the Paper

- "The key limitation is the inability of machines to access and process knowledge presented within review

- "Comparison sections form the core of each review article." (p. 108)

- "The data itself can be accessed via… SPARQL endpoint, RDF dump, and REST interface." (p. 110)

- "The use of these technologies improves the machine-actionability of data and provides a means to mal

---

Actionability References to Other Papers

- Shanahan (2015) — Living documents concept

- Berners-Lee et al. (2001) — Semantic Web and Linked Data

- Wilkinson et al. (2016) — FAIR data principles

- Garcia-Castro et al. (2010) — Semantic living documents in life sciences

Paper Summary

<!--META_START-->

Title: Smart computing based student performance evaluation framework for engineering education

Authors: Prabal Verma, Sandeep K. Sood, Sheetal Kalra

DOI: https://doi.org/10.1002/cae.21849

Year: 2017

Publication Type: Journal Article

Discipline/Domain: Computer Science / Engineering Education

Subdomain/Topic: IoT-based performance evaluation, educational data mining, game-theory decision ma

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit – "turn data into actionable insight" and detailed propertie

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (five-layer IoT-based framework)

Operationalization Present: Yes (detailed algorithms, workflows, decision-making logic)

Primary Methodology: Conceptual + Experimental

Study Context: Engineering education, student performance monitoring and evaluation

Geographic/Institutional Context: Guru Nanak Dev University, Punjab, India

Target Users/Stakeholders: Engineering college management, faculty, students

Primary Contribution Type: Conceptual framework + implementation and evaluation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Smart computing based student performance evaluation framework for engineering education

Authors:

Prabal Verma, Sandeep K. Sood, Sheetal Kalra

DOI:

https://doi.org/10.1002/cae.21849

Year:

2017

Publication Type:

Journal Article

Discipline/Domain:

Computer Science / Engineering Education

Subdomain/Topic:

IoT-based performance evaluation, educational data mining, game-theory decision making

Contextual Background:

The paper addresses how IoT technologies, combined with cloud computing, RFID sensing, and data min

Geographic/Institutional Context:

Guru Nanak Dev University, Punjab, India

Target Users/Stakeholders:

Engineering college management, faculty, students

Primary Methodology:

Conceptual + Experimental

Primary Contribution Type:

Conceptual framework + implementation and evaluation

General Summary of the Paper

The study proposes and tests a five-layer IoT-based "smart computing" framework to evaluate engineerin

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the transformation of IoT-derived student interaction and activity data into insigh

> "IoT technology… allow[s] educators and administrators to turn data into actionable insight" (p. 977)

> "Based on student sessional performance score, decisions are taken by management authority to incre

---

What Makes Something Actionable

- Continuous, automated collection of relevant performance data (academic + activity)

- Integration of diverse datasets into a unified performance score

- Timely analysis to inform session-based interventions

- Decision models (game theory) to translate performance metrics into concrete management actions

- Context-aware activity classification to ensure relevance

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Five-layer IoT-based student performance evaluation framework

- **Methods/Levers:** RFID/GPS/wearable sensing, cloud data preprocessing, Bayesian Belief Network

- **Operational Steps / Workflow:**

  1. Data acquisition & synchronization (sensors, RFID, gateway devices)

  2. Cloud storage & preprocessing (noise removal, classification into daily/occasional activities)

  3. Activity recognition & temporal visualization

  4. Data mining & performance score calculation (weighted daily/occasional activity integration)

  5. Game-theoretic decision making for institutional actions

- **Data & Measures:** Sensor data, attendance logs, activity metadata, academic marks, interaction sco

- **Implementation Context:** Engineering college with RFID-enabled monitoring and cloud analytics

> "Layer 4 computes the student performance score… integrating IoT-based data mining… with academi

> "Game-based decision component takes automated decisions based on student performance score" (p

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – performance score formula and activity classification are explicitly defined

- **CR (Contextual Relevance):** Yes – activity types and weights tailored to engineering education conte

- **FE (Feasibility):** Yes – demonstrated with actual deployment and tested scalability

- **TI (Timeliness):** Yes – real-time data acquisition and session-based decision-making

- **EX (Explainability):** Yes – decision rules, algorithms, and weighting schemes are transparent

- **GA (Goal Alignment):** Yes – aligns with improving student performance and institutional reputation

- **Other Dimensions Named by Authors:** Integration of behavioral, locational, academic, and interactive

---

Theoretical or Conceptual Foundations

- Ubiquitous learning

- Educational data mining

- Game theory (non-cooperative model)

Indicators or Metrics for Actionability

- Student Performance Score (PS) – weighted integration of activity and academic scores

- Reputation Score (RS) – aggregated institutional performance metric

- Activity-specific participation indices (PageRank, co-location metrics)

Barriers and Enablers to Actionability

- **Barriers:** Sensor data noise/incompleteness, integration complexity, privacy/security concerns

- **Enablers:** IoT infrastructure, cloud analytics, established decision-theory models, automated data pi

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Relation to Existing Literature

Positions itself at the intersection of IoT-based smart learning environments, educational data mining, an

---

Summary

This paper operationalizes actionability by systematically linking sensor-derived behavioral and interactio

---

Scores

- **Overall Relevance Score:** 92 – Strong implicit and explicit conceptualization of actionability with clea

- **Operationalization Score:** 95 – Detailed, stepwise methodology, algorithms, and decision logic direct

---

Supporting Quotes from the Paper

- "IoT technology… allow[s] educators and administrators to turn data into actionable insight" (p. 977)

- "Based on student sessional performance score, decisions are taken by management authority…" (p. 97

- "Layer 4 computes the student performance score… integrating IoT-based data mining… with academic

- "Game-based decision component takes automated decisions based on student performance score" (p.

Actionability References to Other Papers

- Kaur & Sood (2015) – Game-theoretic IoT performance evaluation in industry

- Zhu et al. (2016) – Smart education conceptual framework

- Wu et al. (2014) – Cognitive IoT paradigm

- Lauria & Duchessi (2006) – Bayesian belief networks for decision support

Paper Summary

<!--META_START-->

Title: Situation Recognition Using EventShop

Authors: Vivek K. Singh, Ramesh Jain

DOI: 10.1007/978-3-319-30537-0

Year: 2016

Publication Type: Book

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Situation Recognition, Spatiotemporal Data Integration, Actionable Insights

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 95

Contains Definition of Actionability: Yes (explicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + System Implementation + Case Studies

Study Context: Real-time, heterogeneous spatiotemporal multimedia data processing for situation-aware

Geographic/Institutional Context: Applications in USA, Thailand, California; Institutions: Rutgers Universit

Target Users/Stakeholders: Application designers, data scientists, policy makers, public safety officials, h

Primary Contribution Type: Conceptual framework + operational toolkit (EventShop) + case studies

CL: Yes – "explicit, computable blueprints" for situation modeling must be clear to enable action-taking (p

CR: Yes – Situations must be contextually relevant to user needs and local conditions (macro, meso, per

FE: Yes – Must be feasible through available data sources, computational operators, and real-time proce

TI: Yes – Emphasis on real-time evaluation and data half-life (p. 40)

EX: Yes – Framework supports explicit mapping from spatiotemporal descriptors to actionable classificati

GA: Yes – Goal-driven modeling is central; situations are defined for a purpose (p. 29)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Situation Recognition Using EventShop

Authors:

Vivek K. Singh, Ramesh Jain

DOI:

10.1007/978-3-319-30537-0

Year:

2016

Publication Type:

Book

Discipline/Domain:

Computer Science / Information Systems

Subdomain/Topic:

Situation Recognition, Spatiotemporal Data Integration, Actionable Insights

Contextual Background:

The book addresses the challenge of deriving actionable insights from heterogeneous, real-time, spatiote

Geographic/Institutional Context:

Case studies in USA (asthma/allergy alerts, seasonal pattern detection), California (wildfire detection), Th

Target Users/Stakeholders:

Application designers, researchers, public safety and health agencies, policy makers, and developers of s

Primary Methodology:

Conceptual framework development, computational modeling, operational system implementation (Event

Primary Contribution Type:

Conceptual + Operational framework for actionable situation recognition.

General Summary of the Paper

The book defines "situation" as *"an actionable abstraction of observed spatiotemporal descriptors"* and

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Situations are *"actionable abstractions of observed spatiotemporal descriptors"* — meaning they are hig

- Observability (must be based on measurable data)

- Abstraction (aggregating raw data into meaningful states)

- Application-specific decision support (classification into states that trigger actions)

> "An actionable abstraction of observed spatiotemporal descriptors." (p. 13)

> "Top-level descriptors and abstractions need to be chosen based on the application domain and the as

---

What Makes Something Actionable

- **Goal-based definition:** Purpose-driven modeling for a specific application

- **Spatiotemporal grounding:** Anchored in measurable coordinates and time

- **Observability:** Derived only from observable, sensor-measurable data

- **Abstraction:** Higher-level constructs derived from raw data

- **Relevance:** Must support concrete decision-making

- **Personalization:** Ability to tailor situations to individual contexts

- **Timeliness:** Real-time processing to match data half-life and decision needs

- **Feasibility:** Use of available data sources and computational methods

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** EventShop Situation Recognition Framework

- **Methods/Levers:** Situation-to-Source (S2S) modeling; spatiotemporal data unification; operator-base

- **Operational Steps / Workflow:**

  1. Model situation via S2S diagrams (goal-driven feature decomposition)

  2. Select and ingest relevant data streams

  3. Unify into STT (space-time-theme) tuples

  4. Aggregate into E-mages (spatiotemporal grids)

  5. Apply analysis operators to derive situation classifications

  6. Personalize using individual-level data streams

  7. Trigger alerts/actions via E-C-A style rules

- **Data & Measures:** Spatiotemporal descriptors, statistical features, thresholds, similarity metrics, ope

- **Implementation Context:** Real-time heterogeneous data streams, web-based GUI for rapid prototypi

> "Provides a situation modeling kit… translate mental models into explicit, actionable, and computable m

> "Unified representation (E-mage) and situation recognition algebra for diverse spatiotemporal data." (p.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Explicit blueprints for situations (p. 47–49)

- **CR (Contextual Relevance):** Yes – Macro, meso, personal scale relevance (p. 24–25)

- **FE (Feasibility):** Yes – Based on available data, unified representation, reusable operators (p. 23–25

- **TI (Timeliness):** Yes – Real-time evaluation, data half-life concept (p. 40)

- **EX (Explainability):** Yes – Clear mapping from descriptors to actionable classifications (p. 13)

- **GA (Goal Alignment):** Yes – Goal-driven modeling emphasized (p. 29)

- **Other Dimensions Named by Authors:** Personalization, scalability, interoperability

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Theoretical or Conceptual Foundations

- Situation awareness literature (Endsley 1988; Barwise & Perry 1980)

- GIS, complex event processing, multimedia concept recognition

- Situation calculus and event calculus from AI

- E-C-A (event-condition-action) rules

- Image algebra analogies for spatiotemporal data

Indicators or Metrics for Actionability

- Precision/recall vs. ground truth in case studies (e.g., >90% wildfire detection)

- Real-time responsiveness (matching data update cycles)

- Discriminative power of features

- User adoption/engagement (e.g., retweets in flood alerts)

Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of standard definition of "situation"

  - Data heterogeneity and missing values

  - Real-time scalability challenges

  - Privacy concerns for personal data

- **Enablers:**

  - Unified STT/E-mage representation

  - Modular operator-based framework

  - GUI-based modeling and prototyping tools

  - Support for personalization and multiple decision scales

Relation to Existing Literature

Positions itself as the first systematic, end-to-end approach for combining heterogeneous, real-time multi

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Summary

This work offers a comprehensive, computationally grounded framework for transforming heterogeneous,

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Scores

- **Overall Relevance Score:** 95 — Explicit, well-grounded definition of actionability, comprehensive list

- **Operationalization Score:** 95 — Detailed, stepwise framework, implemented system, tested across n

---

Supporting Quotes from the Paper

- "We define a situation as 'An actionable abstraction of observed spatiotemporal descriptors.'" (p. 13)

- "Top-level descriptors and abstractions need to be chosen based on the application domain and the ass

- "Provides a situation modeling kit… translate mental models into explicit, actionable, and computable m

- "Unified representation (E-mage) and situation recognition algebra for diverse spatiotemporal data." (p.

- "Lower the floor… Raise the ceiling." (p. 20)

- "Generate personalized actionable situations." (p. 40)

Actionability References to Other Papers

- Endsley, M. (1988). *Situation awareness global assessment technique*.

- Barwise, J., & Perry, J. (1980). *Situations and attitudes*.

- Yau, S., & Liu, J. (2006). *Hierarchical situation modeling and reasoning for pervasive computing*.

- Event-condition-action frameworks in active databases.

- GIS and spatial data analysis literature.

Paper Summary

<!--META_START-->

Title: Sharing science through shared values, goals, and stories: an evidence-based approach to making

Authors: Bethann Garramon Merkle, Evelyn Valdez-Ward, Priya Shukla, Skylar R. Bayer

DOI: 10.2307/27316303

Year: 2021

Publication Type: Journal Article

Discipline/Domain: Science Communication / Human–Wildlife Interactions

Subdomain/Topic: Values-based science communication, stakeholder engagement, storytelling in science

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit and explicit through a values-goals-stories model)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (values–goals–stories framework, backward design approach)

Operationalization Present: Yes (stepwise guidance, tools, worksheets, examples)

Primary Methodology: Conceptual / Practice-based synthesis

Study Context: Science communication across academic and non-academic contexts, with emphasis on

Geographic/Institutional Context: Primarily U.S.-based examples, cross-disciplinary applicability

Target Users/Stakeholders: Scientists, science communicators, policymakers, community stakeholders

Primary Contribution Type: Conceptual framework and applied guidance

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Sharing science through shared values, goals, and stories: an evidence-based approach to making scien

Authors:

Bethann Garramon Merkle, Evelyn Valdez-Ward, Priya Shukla, Skylar R. Bayer

DOI:

10.2307/27316303

Year:

2021

Publication Type:

Journal Article

Discipline/Domain:

Science Communication / Human–Wildlife Interactions

Subdomain/Topic:

Values-based science communication, stakeholder engagement, storytelling

Contextual Background:

This article addresses the persistent challenge of making scientific research relevant and useful to decisi

Geographic/Institutional Context:

Primarily U.S.-based examples; applicable across global contexts.

Target Users/Stakeholders:

Scientists, science communicators, policy makers, educators, local communities, conservation managers

Primary Methodology:

Conceptual framework supported by practical tools and examples.

Primary Contribution Type:

Conceptual framework and applied recommendations.

General Summary of the Paper

The paper presents a conceptual and practical approach for making science communication more effecti

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper conceptualizes actionability as the extent to which science communication is designed to conr

> "We emphasize the essential interplay between values, goals, and stories… which scientists can active

> "Actionable recommendations and tools scientists can immediately use to articulate their values, identif

What Makes Something Actionable

- Centering communication on **shared values** between scientists and stakeholders.

- Setting **explicit, stakeholder-informed goals** for science communication.

- Using **storytelling** to make science relatable and emotionally resonant.

- Employing **backward design** to ensure activities serve communication goals.

- Actively **listening to and understanding stakeholder perspectives**.

- Building **trust and long-term relationships**.

- Considering **cultural, political, and historical contexts**.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Values–Goals–Stories framework; Backward Design for Scicomm

- **Methods/Levers:** Values articulation exercises; stakeholder mapping and listening; goal setting tools

- **Operational Steps / Workflow:**

  1. Identify and articulate personal and scientific values.

  2. Learn and integrate stakeholder values.

  3. Co-develop goals aligned with shared values.

  4. Use backward design to plan activities.

  5. Develop and deliver stories that embody values and goals.

- **Data & Measures:** Qualitative stakeholder input, values worksheets, narrative feedback.

- **Implementation Context:** Applicable across environmental, policy, education, and outreach settings.

> "We recommend a stepwise process to identify your values, those of your stakeholders, and how to rela

> "Backward design… prioritizes key concepts that lead to long-term understanding… keeping our focus

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Emphasis on plain language, avoiding jargon to reach stakeholders.

- **CR (Contextual Relevance):** Yes – Stakeholder contexts and sociopolitical realities must inform com

- **FE (Feasibility):** Yes – Offers stepwise, resource-backed processes adaptable to scientist constraint

- **TI (Timeliness):** Partial – Encourages goal setting early in projects, but timeliness is not a primary fo

- **EX (Explainability):** Yes – Stresses explaining science in relatable, narrative forms.

- **GA (Goal Alignment):** Yes – Goals are co-developed or informed by shared values.

- **Other Dimensions Named by Authors:** Trust-building, inclusivity, cultural awareness.

Theoretical or Conceptual Foundations

- Backward Design (Wiggins & McTighe, 2004)

- Science–advocacy continuum (Donner, 2014)

- Impact identity framework (Risien & Storksdieck, 2018)

- Narrative persuasion and storytelling literature (Dahlstrom, 2014)

Indicators or Metrics for Actionability

- Presence of stakeholder-informed goals.

- Evidence of trust and relationship building.

- Stakeholder use or application of communicated science.

- Narrative resonance and engagement levels.

Barriers and Enablers to Actionability

- **Barriers:** Systemic disincentives in academia; lack of scicomm training; political polarization; inequiti

- **Enablers:** Co-production approaches; values alignment; trust-based relationships; accessible tools a

Relation to Existing Literature

The approach integrates science communication theory, stakeholder engagement principles, and applied

Summary

This paper provides a robust conceptual and practical guide to making science actionable through intenti

Scores

- **Overall Relevance Score:** 88 – Strong conceptual clarity on actionability via the values–goals–stories

- **Operationalization Score:** 90 – Provides explicit, stepwise instructions, tools, and applied examples f

Supporting Quotes from the Paper

- "We emphasize the essential interplay between values, goals, and stories… which scientists can activel

- "Backward design… prioritizes key concepts that lead to long-term understanding… keeping our focus

- "We recommend a stepwise process to identify your values, those of your stakeholders, and how to rela

- "Actionable recommendations and tools scientists can immediately use to articulate their values, identify

Actionability References to Other Papers

- Donner (2014) – Science–advocacy continuum

- Risien & Storksdieck (2018) – Impact identities framework

- Wiggins & McTighe (2004) – Backward design

- Dahlstrom (2014), Dahlstrom & Ho (2012) – Storytelling in science

- Elliott & Resnik (2014) – Transparency of values in science

Paper Summary

<!--META_START-->

Title: Secondary findings from next-generation sequencing: what does actionable in childhood really mea

Authors: Julie Richer, Anne-Marie Laberge

DOI: https://doi.org/10.1038/s41436-018-0034-4

Year: 2019

Publication Type: Journal

Discipline/Domain: Medical Genetics

Subdomain/Topic: Genomic screening, secondary findings, pediatric actionability

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with applied framework review

Study Context: Evaluation of disorders on ACMG SF v2.0 list for pediatric actionability

Geographic/Institutional Context: Canada (Children's Hospital of Eastern Ontario; Université de Montréal

Target Users/Stakeholders: Clinical geneticists, pediatricians, policy makers, genomic screening committe

Primary Contribution Type: Conceptual framework and applied disorder evaluation

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: No

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Secondary findings from next-generation sequencing: what does actionable in childhood really mean?

Authors:

Julie Richer, Anne-Marie Laberge

DOI:

https://doi.org/10.1038/s41436-018-0034-4

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Medical Genetics

Subdomain/Topic:

Genomic screening, secondary findings, pediatric actionability

Contextual Background:

The paper addresses the concept of "actionability" in reporting secondary genetic findings from next-gene

Geographic/Institutional Context:

Canada — Children's Hospital of Eastern Ontario, Université de Montréal, CHU Sainte-Justine

Target Users/Stakeholders:

Clinical geneticists, pediatricians, healthcare policy makers, genomic testing guideline committees

Primary Methodology:

Conceptual analysis with applied framework-based review of disorders

Primary Contribution Type:

Conceptual framework plus systematic evaluation of conditions

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General Summary of the Paper

This paper critically examines what "actionable in childhood" means in the context of secondary genomic

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as a disorder for which surveillance and/or preventive/treatment measures are ava

(i) Childhood onset with measures initiated in childhood, or

(ii) Adult onset but proven-effective measures when started in childhood.

> "An actionable finding can be defined as a disease-causing pathogenic variant for a disorder for which s

> "…we consider a disorder 'actionable in childhood' if… the disorder has either (i) childhood onset… or (

What Makes Something Actionable

- Proportion of cases presenting in childhood

- Availability of preventive/treatment measures in childhood

- Demonstrated effectiveness in childhood

- Quality of supporting evidence

- Acceptability and risk-benefit balance of interventions

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** WHO screening criteria applied to genomic secondary findings

- **Methods/Levers:** Disorder categorization by onset proportion; evidence grading for interventions; ass

- **Operational Steps / Workflow:**

  1. Apply WHO criteria related to actionability

  2. Gather natural history and management data

  3. Categorize disorders by childhood onset proportion

  4. Assess evidence quality for interventions

- **Data & Measures:** Published guidelines, GeneReviews, natural history studies

- **Implementation Context:** Pediatric genomic testing in Canadian/Western healthcare systems

> "…we categorized disorders based on the proportion of cases that presented in childhood…" (p. 124)

> "We propose… disclosure in childhood would be limited to disorders for which a majority of cases prese

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear definition of pediatric actionability and decision framework (p. 129)

- **CR (Contextual Relevance):** Yes — applies specifically to pediatric genomic disclosure context (p. 1

- **FE (Feasibility):** Yes — requires availability and acceptability of interventions (p. 126)

- **TI (Timeliness):** No — no explicit link of timeliness as necessary criterion

- **EX (Explainability):** No — explainability not discussed

- **GA (Goal Alignment):** Partial — alignment with child's best medical interests emphasized (p. 126)

- **Other Dimensions Named by Authors:** Evidence quality threshold, proportion of cases affected, bala

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Theoretical or Conceptual Foundations

- WHO Wilson & Jungner screening criteria

- Berg et al.'s semiquantitative metric for actionability

- Distinction between medical vs. patient-initiated actionability

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Indicators or Metrics for Actionability

- Proportion of cases with childhood onset

- Quality of evidence grading (very low, low, moderate, high)

- Existence and professional consensus of guidelines

Barriers and Enablers to Actionability

- **Barriers:**

  - Low or very low quality of evidence for many conditions

  - Variable disease penetrance and expressivity

  - Potential psychological and social harms

  - Resource limitations for opportunistic screening

- **Enablers:**

  - Professional guidelines supporting early intervention

  - Evidence of effective prevention/treatment in childhood

Relation to Existing Literature

The paper builds on ACMG recommendations, critiques the lack of pediatric-specific thresholds, and inco

---

Summary

Richer and Laberge (2019) present a structured approach to defining and operationalizing "actionable in

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Scores

- **Overall Relevance Score:** 92 — Provides explicit definition, clear pediatric criteria, and detailed dime

- **Operationalization Score:** 88 — Offers an applied framework and systematic evaluation; slightly limit

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Supporting Quotes from the Paper

- "[An] actionable finding can be defined as a disease-causing pathogenic variant… to significantly improv

- "…the disorder has either (i) childhood onset… or (ii) adult onset, but such measures have been demon

- "…disclosure in childhood would be limited to disorders for which a majority of cases present in childhoo

---

Actionability References to Other Papers

- Berg JS et al. (2016) — Semiquantitative metric for evaluating clinical actionability

- Moret C et al. (2017) — Categorization of medical vs. patient-initiated actionability

- Wilson JMG, Jungner G (1968) — WHO screening principles

Paper Summary

<!--META_START-->

Title: Return of non-ACMG recommended incidental genetic findings to pediatric patients: considerations

Authors: Kevin M. Bowling, Michelle L. Thompson, Melissa A. Kelly, Sarah Scollon, Anne M. Slavotinek, I

DOI: https://doi.org/10.1186/s13073-022-01139-2

Year: 2022

Publication Type: Journal

Discipline/Domain: Genomics / Medical Genetics

Subdomain/Topic: Incidental findings in pediatric genomic sequencing

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 75

Contains Definition of Actionability: Yes (implicit, framed in return-of-results context)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: No formal named model, but structured criteria for return

Operationalization Present: Yes

Primary Methodology: Mixed Methods (case series across multiple genomic studies + conceptual analysi

Study Context: Four pediatric genomic sequencing studies (SouthSeq, KidsCanSeq, P3EGS, COAGS) re

Geographic/Institutional Context: USA (multiple academic medical centers, diverse patient populations)

Target Users/Stakeholders: Clinical geneticists, laboratory directors, policy-makers, pediatric healthcare p

Primary Contribution Type: Empirical cases + conceptual considerations for return of incidental genetic fi

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Return of non-ACMG recommended incidental genetic findings to pediatric patients: considerations and c

Authors:

Kevin M. Bowling, Michelle L. Thompson, et al.

DOI:

https://doi.org/10.1186/s13073-022-01139-2

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Genomics / Medical Genetics

Subdomain/Topic:

Incidental findings in pediatric genomic sequencing

Contextual Background:

The paper addresses the emerging challenge of incidental genetic findings (IFs) outside ACMG-recomme

Geographic/Institutional Context:

USA — University of Alabama at Birmingham, Baylor College of Medicine, UCSF, HudsonAlpha Institute

Target Users/Stakeholders:

Clinical geneticists, genetic counselors, policy-makers, laboratory directors, pediatricians.

Primary Methodology:

Mixed Methods — descriptive case series of 23 IFs in 21 pediatric patients across four genomic studies,

Primary Contribution Type:

Empirical case data + conceptual framework for decision-making in returning non-ACMG IFs in pediatric

General Summary of the Paper

This study examines the identification and return of incidental genetic findings (IFs) in pediatric patients fr

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper implicitly defines actionability in the context of IF return as the potential for a genetic finding to

> "If the finding will alter patient care… then return of the result will be useful to the provider, patient, and

> "Actionability… exists on a continuum… Actionability may also encompass… awareness… to avoid a fu

What Makes Something Actionable

- Alters patient care (management, treatment, surveillance) in a beneficial way.

- Potential to prevent adverse outcomes or misdiagnosis.

- Enables timely screening or monitoring.

- Associated with conditions where preventive or mitigating actions exist.

- Can provide important awareness for at-risk family members.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** No formal named model; uses structured considerations (Table 3).

- **Methods/Levers:** Case-by-case assessment using penetrance, severity, age of onset, family history,

- **Operational Steps / Workflow:** Phenotype-independent variant analysis → classification (ACMG-AMI

- **Data & Measures:** Variant pathogenicity, disease penetrance estimates, onset age, family history, tre

- **Implementation Context:** Pediatric genomic sequencing across diverse clinical sites.

> "Laboratories… [should] proactively plan for how they intend to characterize what constitutes an IF and

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — need to differentiate IFs from primary findings, especially in young patients.

  > "…differentiating incidental and primary findings can be difficult… especially when age of onset is high

- **CR (Contextual Relevance):** Yes — family history and patient context inform decision to return.

- **FE (Feasibility):** Yes — considers whether findings are clinically manageable or preventable.

- **TI (Timeliness):** Partial — early-onset conditions prioritized; timing influences utility.

- **EX (Explainability):** Partial — cases show explanation of variant-disease links, but not a formal emph

- **GA (Goal Alignment):** Partial — return aligned with patient/family health planning and prevention goa

- **Other Dimensions Named by Authors:** Severity of disease, penetrance, personal utility.

Theoretical or Conceptual Foundations

- ACMG guidelines for SFs.

- Ethical discourse on predictive testing in children.

- Concepts of clinical and personal utility from prior literature (e.g., Bunnik et al. 2015).

Indicators or Metrics for Actionability

- Age of onset distribution for the condition.

- Disease penetrance estimates.

- Availability of screening or preventive interventions.

- Severity of condition.

Barriers and Enablers to Actionability

- **Barriers:** Variable penetrance, uncertain onset, incomplete phenotype data, potential anxiety, lack of

- **Enablers:** Clear preventive/treatment pathways, strong family history, high penetrance, severe disea

Relation to Existing Literature

Builds on debates around returning genomic findings in children, extending from ACMG SF frameworks t

Summary

This paper provides one of the most detailed empirical and conceptual analyses of returning non-ACMG i

Scores

- **Overall Relevance Score:** 88 — Strong implicit definition of actionability, rich feature set, empirical g

- **Operationalization Score:** 75 — Detailed process descriptions and decision criteria; operationalized t

Supporting Quotes from the Paper

- "[Actionability]… if the finding will alter patient care… then return of the result will be useful…" (p. 11, Ta

- "Actionability… exists on a continuum… may also encompass… awareness… to avoid… misdiagnosis.'

- "Diferentiating incidental and primary findings can be difficult… especially when… age of onset… is high

Actionability References to Other Papers

- ACMG SF v2.0 and v3.0 recommendations (Kalia et al., 2017; Miller et al., 2021)

- Bunnik EM et al., 2015 (personal utility in genomic testing)

- NCCN guidelines for cancer screening

- ClinGen Actionability Working Group protocols

Paper Summary

<!--META_START-->

Title: Reconciling evidence-based medicine and precision medicine in the era of big data: challenges and

Authors: Jacques S. Beckmann, Daniel Lew

DOI: 10.1186/s13073-016-0388-7

Year: 2016

Publication Type: Journal Article

Discipline/Domain: Medicine / Clinical Bioinformatics

Subdomain/Topic: Precision Medicine, Evidence-Based Medicine, Big Data Integration

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 70

Contains Definition of Actionability: Yes (implicit, in terms of "clinically actionable knowledge")

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Partial (conceptual integration model)

Operationalization Present: Yes (data integration, bioinformatics workflow)

Primary Methodology: Conceptual / Review

Study Context: Integration of precision medicine and evidence-based medicine in big data healthcare

Geographic/Institutional Context: Switzerland (SIB Swiss Institute of Bioinformatics), global implications

Target Users/Stakeholders: Clinicians, bioinformaticians, healthcare policymakers, patients/citizens

Primary Contribution Type: Conceptual framework and challenges/opportunities analysis

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Reconciling evidence-based medicine and precision medicine in the era of big data: challenges

Authors: Jacques S. Beckmann, Daniel Lew

DOI: 10.1186/s13073-016-0388-7

Year: 2016

Publication Type: Journal Article

Discipline/Domain: Medicine / Clinical Bioinformatics

Subdomain/Topic: Precision Medicine, Evidence-Based Medicine, Big Data Integration

Contextual Background: The paper addresses the tension and complementarity between precision me

Geographic/Institutional Context: Switzerland; global healthcare systems

Target Users/Stakeholders: Clinicians, bioinformaticians, policymakers, healthcare IT developers, pat

Primary Methodology: Conceptual / Review

Primary Contribution Type: Conceptual framework and challenge–opportunity mapping for integration

General Summary of the Paper

This paper outlines how high-resolution, high-throughput biomedical technologies and big data can drive

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors frame actionability as the **translation of big, heterogeneous biomedical datasets into "clinica

> "Proper data mining and translation of the vast datasets into clinically actionable knowledge will require

> "The real challenge… will be to curate, store, federate, integrate, share, mine, interpret, and transform t

What Makes Something Actionable

- Standardization and interoperability of clinical and laboratory datasets

- Integration of multi-layered data (genomics, microbiome, lifestyle, environmental)

- Statistical robustness from large cohorts combined with individual-level granularity

- Ethical, legal, and privacy safeguards for trust in data sharing

- Explainable outputs that can guide clinical decisions at the point of care

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Evidence-Based Precision Medicine

- **Methods/Levers:** Big data integration, bioinformatics analysis, interoperability standards, meta-analy

- **Operational Steps / Workflow:** Data collection (EHR, wearables, genomics, etc.) → Standardization

- **Data & Measures:** Omics, imaging, clinical measures, behavioral and lifestyle data, environmental e

- **Implementation Context:** Multi-institutional, transnational data-sharing systems

> "…collation and meta-analyses of big data from cross-institutional and transnational large-scale registe

> "…create sustainable federated, safe data commons or warehouses…" (p. 6)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — data must be interpretable for clinicians and patients.

- **CR (Contextual Relevance):** Yes — personalized care requires context-specific relevance.

- **FE (Feasibility):** Yes — operational constraints considered in prevention focus.

- **TI (Timeliness):** Partial — early detection emphasized, but not deeply operationalized.

- **EX (Explainability):** Yes — clinical bioinformatics bridges data complexity and clinical understanding.

- **GA (Goal Alignment):** Yes — alignment to prevention, wellness, and patient-centered care.

- **Other Dimensions Named by Authors:** Interoperability, standardization, patient empowerment.

Theoretical or Conceptual Foundations

- Systems medicine (P4: predictive, preventive, personalized, participatory)

- Holistic integration of biological and environmental determinants of health

- N-of-one to N-of-many cohort aggregation

Indicators or Metrics for Actionability

- Early detection of symptoms

- Identification of pre-symptomatic individuals

- Delay or prevention of disease onset

- Integration and usability of diverse data streams in decision-making

Barriers and Enablers to Actionability

- **Barriers:** Heterogeneous EHR systems, lack of interoperability, semantic complexity, data silos, priva

- **Enablers:** Federated safe data commons, standardized vocabularies/ontologies, citizen participation

Relation to Existing Literature

Positions precision and evidence-based medicine as complementary paradigms; builds on P4 medicine, s

Summary

Beckmann and Lew (2016) argue for integrating the population-level rigor of evidence-based medicine wi

Scores

- **Overall Relevance Score:** 85 — Strong conceptual framing of actionability in a healthcare big data c

- **Operationalization Score:** 70 — Provides a clear conceptual workflow and enabling infrastructure, bu

Supporting Quotes from the Paper

- "Proper data mining and translation of the vast datasets into clinically actionable knowledge…" (p. 1)

- "The real challenge… will be to… transform these extensive heterogeneous data into scalable, medicall

- "…collation and meta-analyses of big data from cross-institutional and transnational large-scale register

- "Shifting emphasis of medicine more from therapy to prevention, and from disease to wellness" (Table 1

Actionability References to Other Papers

- Auffray et al. (2009, 2015) on systems medicine

- Hood & Price (2014) on prevention-focused precision medicine

- Schwaederle & Kurzrock (2015) on actionability in oncology

- Collins (2015) on NIH precision medicine perspective

Paper Summary

<!--META_START-->

Title: Prospective Longitudinal ctDNA Workflow Reveals Clinically Actionable Alterations in Ovarian Canc

Authors: Jaana Oikkonen, Kaiyang Zhang, Liina Salminen, Ingrid Schulman, Kari Lavikka, Noora Anders

DOI: https://doi.org/10.1200/PO.18.00343

Year: 2019

Publication Type: Journal

Discipline/Domain: Oncology / Precision Medicine

Subdomain/Topic: Circulating Tumor DNA (ctDNA) in High-Grade Serous Ovarian Cancer (HGSOC)

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, clinically oriented)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (workflow pipeline)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (prospective clinical cohort, bioinformatics pipeline)

Study Context: Clinical workflow for longitudinal ctDNA analysis to guide treatment in HGSOC

Geographic/Institutional Context: Turku University Hospital & University of Helsinki, Finland

Target Users/Stakeholders: Oncologists, molecular tumor boards, translational cancer researchers

Primary Contribution Type: Clinical proof-of-concept & open-source workflow

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Prospective Longitudinal ctDNA Workflow Reveals Clinically Actionable Alterations in Ovarian Cancer

Authors:

Jaana Oikkonen, Kaiyang Zhang, Liina Salminen, Ingrid Schulman, Kari Lavikka, Noora Andersson, Erika

DOI:

https://doi.org/10.1200/PO.18.00343

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Oncology / Precision Medicine

Subdomain/Topic:

ctDNA analysis in high-grade serous ovarian cancer (HGSOC)

Contextual Background:

The study addresses the challenge of guiding treatment in metastatic solid cancers, particularly HGSOC,

Geographic/Institutional Context:

University of Helsinki & Turku University Hospital, Finland

Target Users/Stakeholders:

Oncologists, molecular tumor boards, translational researchers, precision medicine programs

Primary Methodology:

Mixed methods — prospective clinical cohort of 12 HGSOC patients (78 plasma samples, 21 tissue samp

Primary Contribution Type:

Clinical proof-of-concept and open-source workflow for actionable ctDNA detection

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General Summary of the Paper

This study presents a clinical and bioinformatics workflow for detecting clinically actionable alterations in I

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Implicitly defined as the presence of genomic alterations in ctDNA that can be linked to existing therapies

> "Potentially clinically actionable alterations were validated… classified as most prominent (ESCAT… So

> "The provided approach allows the selection of treatment options that target subclones that persist duri

---

What Makes Something Actionable

- Direct association with existing or investigational therapies

- Sufficient evidence of clinical relevance (ESCAT ranking)

- Persistence in tumor subclones during treatment

- Validation in tumor tissue (IHC/ISH)

- Concordance with patient's mutational profile and disease context

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Clinical ctDNA workflow integrating sequencing, bioinformatics pipel

- **Methods/Levers:** >500-gene targeted panel sequencing, variant/CNA calling, filtering, prioritization v

- **Operational Steps / Workflow:** Longitudinal plasma sampling → sequencing → bioinformatics filtering

- **Data & Measures:** VAF dynamics, mutation counts, CNA ratios, CA-125 levels

- **Implementation Context:** Prospective monitoring before, during, after chemotherapy in HGSOC

> "Longitudinal ctDNA sampling can be used to detect response… and identify clinically applicable mutat

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear link between detected alteration and therapeutic relevance (ESCAT criteri

- **CR (Contextual Relevance):** Yes — therapy matching based on patient-specific ctDNA profile.

- **FE (Feasibility):** Yes — minimally invasive sampling, open-source tools.

- **TI (Timeliness):** Yes — early detection of poor responders after 1–2 chemo cycles.

- **EX (Explainability):** Yes — biological pathway context and evidence level for each alteration.

- **GA (Goal Alignment):** Yes — aligns with goal of improving survival in HGSOC by targeting resistant

- **Other Dimensions Named by Authors:** Concordance with tumor tissue; evidence-based prioritization

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Theoretical or Conceptual Foundations

- ESCAT (ESMO Scale for Clinical Actionability of Molecular Targets)

- Concepts from precision oncology: mTOR, HR deficiency, EGFR pathway targeting

- Longitudinal biomarker monitoring

Indicators or Metrics for Actionability

- Variant Allele Frequency (VAF) trends

- CNA ratios

- CA-125 tumor marker correlation

- ESCAT evidence tier assignment

Barriers and Enablers to Actionability

- **Barriers:** Low VAF subclonal mutations, ctDNA heterogeneity, validation requirements, therapy avail

- **Enablers:** Open-source pipeline, integration with knowledgebase, high plasma-tumor concordance, r

---

Relation to Existing Literature

Builds on prior ctDNA monitoring studies (e.g., TP53 tracking in HGSOC) but extends to broad-panel acti

---

Summary

This paper delivers a robust, clinically relevant framework for using longitudinal ctDNA profiling to guide t

---

Scores

- **Overall Relevance Score:** 90 — Clear conceptualization of clinical actionability and explicit criteria fo

- **Operationalization Score:** 95 — Comprehensive, step-by-step clinical workflow integrating sampling,

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Supporting Quotes from the Paper

- "We identified high-confidence, potentially clinically actionable mutations or CNAs in seven patients (58

- "The provided approach allows the selection of treatment options that target subclones that persist durin

- "Treatment… was changed on the basis of detection of ERBB2 amplification… followed by significant tu

- "Longitudinal ctDNA sampling can be used… to identify poor-responding patients after first cycles of che

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Actionability References to Other Papers

- ESCAT framework: Mateo et al., 2018

- TP53 monitoring in HGSOC: Parkinson et al., 2016

- Pathway-specific targeting references for mTOR, HR deficiency, EGFR, CDK alterations

Paper Summary

<!--META_START-->

Title: Policy Helix and Antecedents of Cybersecurity Policymaking Agility

Authors: Masoud Afshari-Mofrad, Babak Abedin, Alireza Amrollahi

DOI: Not provided

Year: 2023

Publication Type: Conference Paper

Discipline/Domain: Information Systems / Cybersecurity Policy

Subdomain/Topic: Cybersecurity policymaking agility; dynamic policy cycles; organisational resilience

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicitly—actionability as agility in policymaking)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes (Cybersecurity Policy Helix)

Operationalization Present: Yes

Primary Methodology: Qualitative (semi-structured expert interviews)

Study Context: Cybersecurity policymaking in dynamic threat environments

Geographic/Institutional Context: Australia; Macquarie University; multi-sector expert sample

Target Users/Stakeholders: Policymakers, CISOs, cybersecurity managers, organisational boards

Primary Contribution Type: Conceptual framework + empirical antecedents

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Partial

Title:

Policy Helix and Antecedents of Cybersecurity Policymaking Agility

Authors:

Masoud Afshari-Mofrad, Babak Abedin, Alireza Amrollahi

DOI:

Not provided

Year:

2023

Publication Type:

Conference Paper

Discipline/Domain:

Information Systems / Cybersecurity Policy

Subdomain/Topic:

Agility in cybersecurity policymaking; policy-cycle adaptation; cyber resilience

Contextual Background:

Addresses the need for agile cybersecurity policymaking (CSPM) in dynamic cyber threat environments,

Geographic/Institutional Context:

Macquarie University, Australia; expert interview participants from multiple sectors (ICT, finance, telecom

Target Users/Stakeholders:

Policymakers, CISOs, CIOs, CTOs, cybersecurity managers, boards, risk committees.

Primary Methodology:

Qualitative—inductive thematic analysis of semi-structured expert interviews (n=10).

Primary Contribution Type:

Conceptual model and empirically derived antecedents of CSPM agility.

General Summary of the Paper

This paper investigates agility in cybersecurity policymaking as a strategic capability for organisations fac

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly framed as *policymaking agility*—the capacity to promptly adapt cybersecurity po

> "Policies are not an ideology that cannot be changed… they should instead be perceived as a means to

> "CSPM agility… means tailoring policies to both changes in the threat landscape and the organisation's

What Makes Something Actionable

- Continuous sensing of threat landscape (internal/external)

- Policy adaptation to organisational risk appetite and maturity

- Integration of intelligence into agenda-setting and decision-making

- Feedback-informed reformulation and implementation

- Stakeholder awareness and engagement

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Cybersecurity Policy Helix

- **Methods/Levers:** Continuous intelligence gathering, iterative agenda-setting, flexible decision-making

- **Operational Steps / Workflow:** Sense → Synthesise → Agenda-setting → Policy formulation/decisio

- **Data & Measures:** Threat intelligence (internal/external), vulnerability scans, risk assessments, incid

- **Implementation Context:** Cross-sectoral, adaptable to organisational size/maturity

> "Intelligence for policy formulation/reformulation can come from both internal and external sources… Th

> "Evaluation can occur locally at each stage… results might return to agenda-setting" (p. 8)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — training, awareness, common policy language stressed (p. 9)

- **CR (Contextual Relevance):** Yes — policy must align with organisational maturity and risk appetite (

- **FE (Feasibility):** Yes — workarounds for legacy systems and phased maturity building (p. 6)

- **TI (Timeliness):** Yes — adapt policies before scheduled review cycles (p. 6)

- **EX (Explainability):** Partial — rationale for changes linked to risk mitigation, though not explicitly fram

- **GA (Goal Alignment):** Yes — align policy with business risk mitigation and enabling operations (p. 6)

- **Other Dimensions Named by Authors:** Awareness, adaptability, stakeholder collaboration

Theoretical or Conceptual Foundations

- Digital agility and organisational agility literature (Pinsonneault & Choi, 2022; Grover, 2022)

- Policy cycle framework (Lasswell, Brewer, Howlett et al.)

- Dynamic policy cycle (Valle-Cruz et al., 2020)

Indicators or Metrics for Actionability

- Frequency and responsiveness of policy updates

- Reduction in unmitigated vulnerabilities

- Employee policy compliance rates

- Outcomes of "top table" simulations

Barriers and Enablers to Actionability

- **Barriers:** Board inexperience, lack of asset visibility, resistance to change, poor communication, lega

- **Enablers:** Informed leadership, structured asset/vulnerability management, dedicated risk committee

Relation to Existing Literature

Builds on organisational agility and dynamic policy cycle research, addressing a gap in operationalising a

Summary

The paper reframes "actionability" as agility in cybersecurity policymaking, grounded in the ability to integ

Scores

- **Overall Relevance Score:** 88 — Strong implicit conceptualisation of actionability as policymaking agi

- **Operationalization Score:** 90 — Concrete framework, workflow, and organisational practices directly

Supporting Quotes from the Paper

- "[CSPM agility] means tailoring policies to both changes in the threat landscape and the organisation's i

- "Many companies… don't have an asset management system… If you're trying to formulate a cybersec

- "Evaluation can occur locally at each stage… results might return to agenda-setting" (p. 8)

- "Change management is necessary… comprehending the risks" (p. 9)

Actionability References to Other Papers

- Valle-Cruz et al. (2020) — dynamic policy cycle

- Pinsonneault & Choi (2022) — digital agility

- Grover (2022) — digital culture/ambidexterity

- Siregar & Chang (2019) — cybersecurity agility

- Malatji et al. (2022) — asset management in cybersecurity

Paper Summary

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes

Contains Framework/Model: Yes (patient-derived xenograft validation approach)

Operationalization Present: Yes

Primary Methodology: Experimental (patient-derived xenografts, ex vivo/in vivo drug testing)

Study Context: High grade serous epithelial ovarian carcinoma (HGS-EOC)

Geographic/Institutional Context: Italy (Candiolo Cancer Institute, University of Torino) & UK (University o

Target Users/Stakeholders: Cancer researchers, molecular oncologists, clinical trial designers, translatio

Primary Contribution Type: Empirical validation of rare actionable mutation in ovarian cancer

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Contextual Background:

The study focuses on identifying and validating rare but actionable genetic mutations in HGS-EOC, partic

General Summary of the Paper

This paper reports the discovery and validation of a rare PIK3R1 W624R mutation in high-grade serous o

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the functional property of a mutation that (1) renders tumour cells dependent ("

> "Mutations have also been defined as 'actionable', not only because their functional outcome makes ca

> The study uses PDX models "to validate low frequency mutations as biomarkers for targeted therapy" (

What Makes Something Actionable

- Functional impact on a key signalling pathway relevant to oncogenesis.

- Presence of a targeted drug that inhibits the altered pathway.

- Evidence from functional assays in relevant tumour models (PDX/PDTC).

- Truncal nature of the mutation (present in all tumour cells).

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** PDX–PDTC functional validation pipeline for rare mutations.

- **Methods/Levers:** Whole exome sequencing, pyrosequencing for allele frequency, pathway activation

- **Operational Steps / Workflow:**

  1. Identify candidate mutation via WES and CNA analysis.

  2. Confirm truncal status via allele frequency in tumour and PDX.

  3. Predict functional consequences via in silico analysis and structural modelling.

  4. Test pathway activation via immunohistochemistry (P-S6).

  5. Test drug sensitivity in PDTCs to multiple inhibitors.

  6. Validate in vivo efficacy in PDX tumour growth and biomarker changes.

- **Data & Measures:** Allele frequency, GR metrics in viability assays, IHC quantification of Ki67 and P-

- **Implementation Context:** HGS-EOC PDX biobank.

> "PDX model… invaluable for functional validation, as it allowed overcoming questionable assays in test

> "PIK3R1 W624R carrying cells [were] addicted… to inhibitors of the PI3K/AKT/mTOR pathway." (Abstra

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — functional consequences demonstrated through targeted assays and clear drug-

- **CR (Contextual Relevance):** Yes — relevance to ovarian cancer context stressed; rare mutation vali

- **FE (Feasibility):** Yes — presence of clinically available inhibitors; mutation is targetable.

- **TI (Timeliness):** No explicit link.

- **EX (Explainability):** Partial — mechanistic explanation offered but structural modelling inconclusive.

- **GA (Goal Alignment):** Yes — aligns with precision oncology aim of matching mutations to therapies.

- **Other Dimensions Named by Authors:** Truncality, pathway addiction.

Theoretical or Conceptual Foundations

- Precision oncology model of "driver" vs. "passenger" mutations.

- Concept of mutation "addiction" to specific signalling pathways.

- Basket/umbrella trial rationale for cross-cancer therapeutic targeting.

Indicators or Metrics for Actionability

- Mutation truncal status.

- Drug-response curves (GR metrics).

- Biomarker modulation (P-AKT, P-S6) upon inhibitor treatment.

- In vivo tumour growth delay and reduced proliferation index.

Barriers and Enablers to Actionability

- **Barriers:** Low frequency of mutation; inconclusive structural modelling; lack of prior functional charac

- **Enablers:** Availability of relevant inhibitors; PDX/PDTC models mimicking patient tumour biology; hig

Relation to Existing Literature

The authors note that while PIK3R1 mutations are common in other cancers, they are rare in HGS-EOC.

Summary

This study identifies and functionally validates a rare PIK3R1 W624R mutation as actionable in high-grad

Scores

- **Overall Relevance Score:** 82 — Clear conceptualisation of actionability with explicit definition, trunca

- **Operationalization Score:** 90 — Detailed, reproducible pipeline from mutation identification to functio

Supporting Quotes from the Paper

- "Mutations… defined as 'actionable', not only because their functional outcome makes carrier cells resp

- "PIK3R1 W624R carrying cells [were] addicted… to inhibitors of the PI3K/AKT/mTOR pathway." (Abstra

- "PDX model… invaluable for functional validation, as it allowed overcoming questionable assays in test

- "The PIK3R1 W624R #475 PDTCs… were sensitive to… buparlisib… alpelisib… dactolisib… but not…

Actionability References to Other Papers

- COSMIC (CGCv84) database [28]

- DGidb drug–gene interaction database [31]

- References on PI3K/AKT/mTOR inhibitors in clinical development [20, 48–51]

- Prior functional studies on PIK3R1 mutations [32, 38–40]

Paper Summary

<!--META_START-->

Title: Opportunity Map: A Visualization Framework for Fast Identification of Actionable Knowledge

Authors: Kaidi Zhao, Bing Liu, Thomas M. Tirpak, Weimin Xiao

DOI: 10.1145/1099554.1099684

Year: 2005

Publication Type: Conference

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Data Mining, Visualization, Actionable Knowledge Discovery

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit and explicit elements)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes

Contains Framework/Model: Yes (Opportunity Map)

Operationalization Present: Yes

Primary Methodology: Conceptual with applied case study

Study Context: Post-mining analysis of large rule sets from data mining to identify actionable patterns

Geographic/Institutional Context: University of Illinois at Chicago; Motorola Labs (USA)

Target Users/Stakeholders: Data analysts, product designers, decision-makers in industrial contexts

Primary Contribution Type: Visualization framework and interactive analysis method

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Opportunity Map: A Visualization Framework for Fast Identification of Actionable Knowledge

Authors: Kaidi Zhao, Bing Liu, Thomas M. Tirpak, Weimin Xiao

DOI: 10.1145/1099554.1099684

Year: 2005

Publication Type: Conference

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Data Mining, Visualization, Actionable Knowledge Discovery

Contextual Background: This work addresses the challenge of sifting through large volumes of mined

Geographic/Institutional Context: University of Illinois at Chicago; Motorola Labs, USA

Target Users/Stakeholders: Data analysts, product engineers, product managers, decision-makers in

Primary Methodology: Conceptual development with real-world industrial case study

Primary Contribution Type: Framework/methodology (Opportunity Map) with interactive visualization f

General Summary of the Paper

The paper proposes the **Opportunity Map**, a visual data mining framework designed to quickly identify

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the ability of a rule or pattern to guide concrete interventions within the user's d

> "An attribute is actionable if the user is able to do something with that attribute to achieve some desired

> "Actionability is the key… It depends on the task that the user wants to perform." (p. 1)

What Makes Something Actionable

- The attribute must be controllable within the user's context.

- The class or problem addressed must be important to the user's goals.

- The relationship between attribute and class should be clear, strong (support/confidence), and interpreta

- Patterns must be applicable to real-world decision-making, not just surprising.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Opportunity Map

- **Methods/Levers:** Visual prioritization matrix; user-driven sorting by importance and actionability; drill-

- **Operational Steps / Workflow:**

  1. Mine rules (e.g., with class association rule miner CBA).

  2. Visualize as attribute–class matrix.

  3. Arrange classes (by importance) and attributes (by actionability).

  4. Focus on top-left priority sector (important + actionable).

  5. Drill down into attribute–class pairs to find finer-grained actionable rules.

  6. Compare rule sets across subsets (e.g., product versions).

- **Data & Measures:** Support and confidence of rules; number of rules per cell; coverage of data points

- **Implementation Context:** Post-mining analysis in industrial product design/failure diagnosis.

> "This isolates a small area in the matrix… that may contain actionable rules." (p. 2)

> "The insights from these rules are immediately actionable, as engineers can… identify/propose possible

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — visualization aids interpretation and explicit linking of attributes to classes.

- **CR (Contextual Relevance):** Yes — prioritization is based on user/application importance.

- **FE (Feasibility):** Yes — actionable attributes are defined as those under user control.

- **TI (Timeliness):** Partial — focuses on efficiency in identification, but not time-to-implementation.

- **EX (Explainability):** Partial — interpretability via visualization; not formal model explainability.

- **GA (Goal Alignment):** Yes — prioritization matrix directly aligns with application objectives.

- **Other Dimensions Named by Authors:** Unexpectedness (as contrast with actionability).

Theoretical or Conceptual Foundations

- Quality Function Deployment (House of Quality)

- Rule interestingness measures (objective vs. subjective) from data mining literature

Indicators or Metrics for Actionability

- Support and confidence of rules in priority sectors

- Number of rules covering key attribute–class intersections

- Coverage percentage of rules over relevant data points

Barriers and Enablers to Actionability

- **Barriers:** Imbalanced datasets, non-actionable attributes, overwhelming number of rules

- **Enablers:** Visualization of priorities, interactive drill-down, comparative analysis

Relation to Existing Literature

The framework integrates subjective interestingness with visual analytics, diverging from existing visualiz

Summary

The **Opportunity Map** framework offers a systematic and interactive way to identify actionable knowle

Scores

- **Overall Relevance Score:** 88 — Strong conceptualization of actionability linked to operational needs

- **Operationalization Score:** 90 — Detailed, step-by-step framework with tooling, workflow, and industr

Supporting Quotes from the Paper

- "Actionability is the key… It depends on the task that the user wants to perform." (p. 1)

- "An attribute is actionable if the user is able to do something with that attribute to achieve some desired

- "This isolates a small area in the matrix… that may contain actionable rules." (p. 2)

- "The insights from these rules are immediately actionable…" (p. 8)

Actionability References to Other Papers

- [1] Adomavicius & Tuzhilin (1997) — Action hierarchy approach.

- [17] Liu et al. (2001) — Identifying non-actionable association rules.

- [22] Piatesky-Shapiro & Matheus (1994) — Interestingness of deviations.

- [26] Silberschatz & Tuzhilin (1996) — Patterns interestingness framework.

Paper Summary

<!--META_START-->

Title: Ontological Approach in the Smart Data Paradigm as a Basis for Open Data Semantic Markup

Authors: Julia Rogushina

DOI: n/a

Year: 2023

Publication Type: Conference Paper

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Smart Data, Semantic Markup, Ontologies, Open Data

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicit, linked to "Smart Data" as actionable knowledge)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with Applied Case Study

Study Context: Semantic markup and ontological structuring in Smart Data processing for open data reso

Geographic/Institutional Context: Institute of Software Systems, National Academy of Sciences of Ukrain

Target Users/Stakeholders: Researchers, ontology engineers, open data curators, semantic web develop

Primary Contribution Type: Conceptual framework with practical application

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Ontological Approach in the Smart Data Paradigm as a Basis for Open Data Semantic Markup

Authors:

Julia Rogushina

DOI:

n/a

Year:

2023

Publication Type:

Conference Paper

Discipline/Domain:

Computer Science / Information Systems

Subdomain/Topic:

Smart Data, Semantic Markup, Ontologies, Open Data

Contextual Background:

The paper is situated within the Smart Data paradigm, focusing on transforming raw, often unstructured d

Geographic/Institutional Context:

Institute of Software Systems, National Academy of Sciences of Ukraine; case study on the Great Ukrain

Target Users/Stakeholders:

Researchers, semantic data engineers, open data platform managers, cultural heritage digitization projec

Primary Methodology:

Conceptual framework with applied implementation case study.

Primary Contribution Type:

Conceptual modeling + applied system implementation.

General Summary of the Paper

The paper explores how unstructured or semi-structured data can be transformed into Smart Data—data

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Smart Data is defined as data that has been processed into "actionable insights or knowledge" to support

- Trusted, contextualized, relevant, cognitive, predictive, and consumable data.

- Structured or semi-structured representation enabling machine-actionable use.

> "Smart data mines semantics from Big data and provide information that can be used to make decisions

> "…transform input 'raw' data into machine-understandable, machine-processable, and machine-actiona

---

What Makes Something Actionable

- **Semantic enrichment** via ontologies and metadata.

- **Contextual relevance** to specific tasks or domains.

- **Feasibility of processing** (appropriate ontology expressiveness and size).

- **Trust and quality** of data (FAIR principles).

- **Goal alignment** with user needs and analysis objectives.

- **Explainability and interpretability** via formalized semantics.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Semantic markup using ontology-based Smart Data transformation;

- **Methods/Levers:** Ontology selection/reduction; task thesauri; semantic templates; linking markup tag

- **Operational Steps / Workflow:**

  1. Retrieve relevant external ontology.

  2. Transform/reduce ontology to task needs.

  3. Map ontology elements to markup tags.

  4. Implement markup in SMW (categories, templates, semantic properties).

- **Data & Measures:** Metadata completeness, ontology expressiveness, query support.

- **Implementation Context:** Great Ukrainian Encyclopedia portal (e-VUE).

> "…formalize models for such special cases of ontologies as Wiki ontology and task thesaurus." (p. 14)

> "…retrieval of external domain ontology… transformation according to semantic markup requirements…

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear semantic markup rules and ontology alignment.

  > "Understandability of the markup language… standardized notations…" (p. 6)

- **CR (Contextual Relevance):** Yes — Ontology must be relevant to task domain.

- **FE (Feasibility):** Yes — Ontology size/complexity must allow efficient processing.

- **TI (Timeliness):** Partial — Discusses ongoing enrichment but not explicit temporal constraints.

- **EX (Explainability):** Yes — Formal semantics enable reasoning.

- **GA (Goal Alignment):** Yes — Ontology and markup designed per specific information needs.

- **Other Dimensions:** Interoperability (FAIR principles), standard compliance.

Theoretical or Conceptual Foundations

- DIKW pyramid adapted for Big Data.

- FAIR data principles.

- Ontology theory (Gruber 1993).

- Semantic Web standards (RDF, OWL).

Indicators or Metrics for Actionability

- Degree of semantic enrichment.

- Ontology-task alignment (coverage and absence of redundancy).

- Query expressiveness in SMW.

Barriers and Enablers to Actionability

- **Barriers:**

  - Overly large or irrelevant ontologies.

  - Lack of domain standards in ontology form.

  - Computational overhead in complex reasoning.

- **Enablers:**

  - Ontology reduction methods.

  - Use of open knowledge sources.

  - SMW semantic templates.

Relation to Existing Literature

Builds on semantic markup and ontology integration in Smart Data, extending concepts with a formal mod

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Summary

This paper positions "actionability" within the Smart Data paradigm, framing it as the transformation of ra

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Scores

- **Overall Relevance Score:** 88 — Strong conceptualization of actionable data via Smart Data, with sys

- **Operationalization Score:** 85 — Clear, task-oriented methods for achieving actionability through onto

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Supporting Quotes from the Paper

- "Smart data mines semantics from Big data and provide information that can be used to make decisions

- "…transform input 'raw' data into machine-understandable, machine-processable, and machine-actiona

- "…retrieval of external domain ontology… transformation according to semantic markup requirements…

- "Understandability of the markup language… standardized notations…" (p. 6)

Actionability References to Other Papers

- DIKW hierarchy (Hey, 2004)

- FAIR data principles (FAIR_data, 2021)

- Gruber (1993) on ontology specifications

- Semantic Web foundational works (RDF, OWL)

- Zeng (2017) on Smart Data for digital humanities

Paper Summary

<!--META_START-->

Title: Next-generation sequencing, should I use anti-HER2 therapy for HER2-amplified tumors off-label? I

Authors: Doah Cho, Sarah J. Lord, John Simes, Wendy Cooper, Michael Friedlander, Susie Bae, Chee K

DOI: 10.1177/17588359221112822

Year: 2022

Publication Type: Journal

Discipline/Domain: Oncology / Precision Medicine

Subdomain/Topic: HER2-targeted therapy; Off-label treatment decision frameworks

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit and explicit in biomarker–treatment context)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes (biological rationale, biomarker testing validity)

Contains Framework/Model: Yes (seven-question extrapolation framework)

Operationalization Present: Yes (detailed framework and application example)

Primary Methodology: Conceptual / Framework development with illustrative application

Study Context: Clinical decision-making for off-label HER2-targeted therapy in HER2-amplified cancers w

Geographic/Institutional Context: Australia; University of Sydney and collaborating institutions

Target Users/Stakeholders: Oncologists, molecular tumor boards, clinical researchers, policymakers

Primary Contribution Type: Conceptual framework + practical guidance for extrapolation in precision onco

CL: Yes — clarity in biomarker definition and testing necessary for actionability

CR: Yes — explicitly ties contextual relevance to extrapolation appropriateness

FE: Yes — feasibility linked to cost/access and biomarker testing capability

TI: Partial — timeliness implied in using current testing and treatment options before disease progression

EX: Yes — explainability through step-wise rationale and biological plausibility

GA: Yes — alignment with clinical goals of improved patient outcomes and informed consent

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Next-generation sequencing, should I use anti-HER2 therapy for HER2-amplified tumors off-label? Illustra

Authors:

Doah Cho, Sarah J. Lord, John Simes, Wendy Cooper, Michael Friedlander, Susie Bae, Chee Khoon Lee

DOI:

10.1177/17588359221112822

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Oncology / Precision Medicine

Subdomain/Topic:

HER2-targeted therapy; Off-label treatment decision frameworks

Contextual Background:

This paper addresses the growing clinical challenge of whether targeted cancer therapies—proven in spe

Geographic/Institutional Context:

Australia; National Health and Medical Research Council Clinical Trials Centre, University of Sydney; coll

Target Users/Stakeholders:

Oncologists, molecular tumor boards, precision oncology decision-makers, clinical researchers, and polic

Primary Methodology:

Conceptual framework development with illustrative clinical application.

Primary Contribution Type:

Decision-making framework for extrapolating biomarker–treatment evidence to off-label contexts.

General Summary of the Paper

The paper presents a structured framework for deciding whether to use targeted therapies off-label when

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the co-dependency between a biomarker and a targeted treatment—where sele

> "A biomarker is 'actionable' if treatment selection based on biomarker status improves clinical outcomes

> "Actionability may differ between cancers due to differences in intratumoral heterogeneity, tumor microe

---

What Makes Something Actionable

- Reliable and validated biomarker testing (analytical validity)

- Clearly defined biomarker positivity criteria for the cancer type

- Strong evidence from clinical trials or high-quality non-randomized studies linking biomarker presence t

- Biological plausibility and consistency across tumor types

- Distinction between prognostic and predictive value

- Consideration of surrogate endpoint validity

- Comparable safety profile in new cancer context

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Seven-question extrapolation framework

- **Methods/Levers:** Analytical validity check, biomarker criteria validation, evidence tiering (ESCAT), na

- **Operational Steps / Workflow:** Sequential question-based evaluation; uncertainty scoring for each do

- **Data & Measures:** Concordance metrics (NGS vs. evidentiary standard tests), prevalence data, pred

- **Implementation Context:** Applied by clinicians and molecular tumor boards when trial data are lackin

> "Questions 1 to 6 should be considered individually, and judgment for the level of uncertainty for extrap

> "Recommendations should be individualized and consider the estimated benefit versus risks of off-labe

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — need for transparent, validated biomarker definition.

- **CR (Contextual Relevance):** Yes — extrapolation must consider tumor-specific biology.

- **FE (Feasibility):** Yes — feasibility tied to cost, access, and testing capabilities.

- **TI (Timeliness):** Partial — urgency implied to decide before disease progression.

- **EX (Explainability):** Yes — framework explicitly explains rationale for decisions.

- **GA (Goal Alignment):** Yes — focused on aligning treatment with patient outcome goals.

- **Other Dimensions Named by Authors:** Safety similarity, surrogate endpoint validity, cost and equity i

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Theoretical or Conceptual Foundations

- ESMO Scale for Clinical Actionability of molecular Targets (ESCAT)

- GRADE Evidence-to-Decision (EtD) frameworks

- PICO model for framing clinical questions

Indicators or Metrics for Actionability

- Concordance rates between NGS and standard HER2 testing

- Sensitivity, specificity, PPV, and NPV of biomarker assays

- Survival and response outcomes from RCTs or high-quality observational studies

- Surrogate endpoint validation status in the cancer type of interest

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Barriers and Enablers to Actionability

- **Barriers:** Biological heterogeneity; lack of validated criteria in new tumor type; unvalidated surrogate

- **Enablers:** Strong biomarker–treatment evidence in analogous cancers; validated testing; patient willi

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Relation to Existing Literature

Positions the framework within ongoing discussions about precision oncology actionability, building on ES

Summary

This paper develops and illustrates a structured seven-question framework to guide off-label targeted the

---

Scores

- **Overall Relevance Score:** 95 — Strong explicit/implicit definition of actionability, comprehensive feat

- **Operationalization Score:** 90 — Detailed and actionable framework with clear application steps, thou

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Supporting Quotes from the Paper

- "A biomarker is 'actionable' if treatment selection based on biomarker status improves clinical outcomes

- "Have the criteria used to define HER2 positivity been assessed in the cancer type for off-label trastuzu

- "Questions 1 to 6 should be considered individually, and judgment for the level of uncertainty for extrapo

- "Off-label therapy may be justified if sufficient evidence exists to support a positive benefit-risk assessm

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Actionability References to Other Papers

- ESCAT (Mateo et al., 2018)

- Wolff et al., 2018 HER2 testing guidelines

- Multiple RCTs: Slamon et al., 2001; Bang et al., 2010; Fader et al., 2020

- Haslam et al., 2019 surrogate endpoint correlation study

Paper Summary

<!--META_START-->

Title: Navigating Uncertainty: Challenges in Visualizing Ensemble Data and Surrogate Models for Decisio

Authors: Kristi Potter, Sam Molnar, J.D. Laurence-Chasen, Yuhan Duan, Julie Bessac, Han-Wei Shen

DOI: 10.1109/MCG.2025.3549665

Year: 2025

Publication Type: Journal

Discipline/Domain: Computer Graphics / Visualization

Subdomain/Topic: Uncertainty visualization, ensemble simulation, surrogate modeling, decision support s

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 80

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (conceptual)

Operationalization Present: Yes

Primary Methodology: Conceptual + Case Study (Flood Modeling)

Study Context: Visualization design for integrating ensemble data and AI-based surrogate models to sup...

Geographic/Institutional Context: National Renewable Energy Laboratory (USA), The Ohio State Universi...

Target Users/Stakeholders: Decision-makers, scientists, engineers, emergency planners

Primary Contribution Type: Conceptual framework + applied case study

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Navigating Uncertainty: Challenges in Visualizing Ensemble Data and Surrogate Models for Dec...

Authors: Kristi Potter, Sam Molnar, J.D. Laurence-Chasen, Yuhan Duan, Julie Bessac, Han-Wei Sher...

DOI: 10.1109/MCG.2025.3549665

Year: 2025

Publication Type: Journal

Discipline/Domain: Computer Graphics / Visualization

Subdomain/Topic: Uncertainty visualization, ensemble simulation, surrogate modeling, decision supp...

Contextual Background: The paper addresses how uncertainty visualization can transform ensemble ...

Geographic/Institutional Context: USA – National Renewable Energy Laboratory, The Ohio State Univ...

Target Users/Stakeholders: Decision-makers in domains such as disaster response, infrastructure pla...

Primary Methodology: Conceptual + applied case study (flood modeling scenario)

Primary Contribution Type: Conceptual framing with practical illustration

General Summary of the Paper

The paper examines how uncertainty visualization can support decision-making when combining ensemb...

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors implicitly define actionability as enabling decision-makers to confidently interpret, navigate, a

> "Uncertainty visualization plays a critical role in transforming ensemble simulation data into actionable i

> "…ensuring users can access relevant information, evaluate it accurately, and have confidence in their

What Makes Something Actionable

- Clear communication of uncertainty types (ensemble vs. surrogate)

- Support for both global exploration (ensembles) and localized queries (surrogates)

- Ability to interact flexibly with input and output spaces

- Representation of joint and conditional parameter relationships

- Support for tradeoff analysis when objectives conflict

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Not named formally, but uses a conceptual integration framework (F

- **Methods/Levers:** Visual parameter space exploration, forward and inverse surrogate modeling, widg

- **Operational Steps / Workflow:** Explore ensemble data → Use forward surrogate for prediction → Us

- **Data & Measures:** Ensemble simulation outputs, surrogate predictions, quantified uncertainty metrics

- **Implementation Context:** Flood modeling (dam breach scenario)

> "…present the intricate connections between input parameters and output predictions in an intuitive ma

> "…highlight sets of inputs that satisfy each output individually as well as input configurations that achiev

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear representation of uncertainty is essential for decision-making.

- **CR (Contextual Relevance):** Yes — Tailoring visualizations to specific decision-makers (engineers v

- **FE (Feasibility):** Yes — Identifying when scenarios are feasible and when constraints are unrealistic.

- **TI (Timeliness):** Partial — Surrogates enable faster exploration but timeliness is not emphasized as a

- **EX (Explainability):** Yes — Differentiating uncertainty sources and mapping input–output dependenc

- **GA (Goal Alignment):** Yes — Linking visualization design to stakeholder objectives.

- **Other Dimensions Named by Authors:** Tradeoff analysis, interpretability, interactivity.

Theoretical or Conceptual Foundations

- Ensemble simulation theory

- Uncertainty visualization literature

- Surrogate modeling (Gaussian Processes, deep learning)

- Visual parameter space analysis frameworks

Indicators or Metrics for Actionability

- Degree to which uncertainty is distinguishable (ensemble vs. surrogate)

- Accuracy and stability of surrogate predictions

- Ability to generate feasible and goal-consistent input–output configurations

Barriers and Enablers to Actionability

- **Barriers:** Surrogate accuracy variability; difficulty reconciling uncertainty types; usability challenges i

- **Enablers:** Integration of ensemble + surrogate strengths; interactive constraint setting; visualization

Relation to Existing Literature

The paper extends prior work on uncertainty visualization by focusing on the integration of ensemble and

Summary

This paper provides a detailed conceptual and applied exploration of how uncertainty visualization can m

Scores

- **Overall Relevance Score:** 88 — Strong implicit conceptualization of actionability with multiple explici

- **Operationalization Score:** 80 — Provides a clear applied example (flood modeling) and concrete inte

Supporting Quotes from the Paper

- "Uncertainty visualization plays a critical role in transforming ensemble simulation data into actionable in

- "Communicate diverse uncertainties: Clearly distinguish and convey the different uncertainties associate

- "Clarify input–output relationships: Present the intricate connections between input parameters and outp

- "Highlight sets of inputs that satisfy each output individually as well as input configurations that achieve

Actionability References to Other Papers

- Bonneau et al. (2014) – State-of-the-art in uncertainty visualization

- Sedlmair et al. (2014) – Visual parameter space analysis framework

- Obermaier & Joy (2014) – Challenges in ensemble visualization

- Shen et al. (2025) – Flow-based surrogate models for uncertainty quantification

Paper Summary

<!--META_START-->

Subdomain/Topic: ESCAT framework, biomarker-drug ranking, interrater agreement

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 65

Contains Definition of Actionability: Yes (explicit via ESCAT definition)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (ESCAT)

Operationalization Present: Yes

Primary Methodology: Quantitative (statistical analysis of expert rankings)

Study Context: Multi-institutional assessment of agreement in ranking biomarker-drug pairs by ESCAT Le

Geographic/Institutional Context: Multi-national, including institutions in Russia, France, Italy, USA

Target Users/Stakeholders: Precision oncology experts, molecular tumor boards, guideline developers

Primary Contribution Type: Empirical evaluation of framework reproducibility

CL: Yes — clarity is implied as necessary for agreement on LOE rankings

CR: Yes — contextual relevance to tumor type and biomarker-drug association explicitly tied to actionabi

FE: Yes — feasibility indirectly addressed via standard of care vs. experimental therapy distinction

TI: Partial — timeliness not central but implied in need for up-to-date literature

EX: Yes — explainability tied to evidence-based LOE assignment

GA: Yes — goal alignment with improving clinical decision-making for targeted therapy

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Multi-Institutional Evaluation of Interrater Agreement of Biomarker-Drug Pair Rankings Based on the ESM

Authors:

Alexandra Lebedeva, Ekaterina Belova, Alexandra Kavun, Anastasiia Taraskina, Michele Bartoletti, Ivan

DOI:

https://doi.org/10.1007/s40291-024-00748-4

Year: 2025

Publication Type:

Journal

Discipline/Domain:

Precision Oncology / Molecular Diagnostics

Subdomain/Topic:

ESCAT framework, biomarker-drug ranking, interrater agreement

Contextual Background:

The study examines whether the ESMO Scale for Clinical Actionability of Molecular Targets (ESCAT) pro

Geographic/Institutional Context:

Multi-national collaboration (Russia, France, Italy, USA).

Target Users/Stakeholders:

Precision oncology experts, molecular tumor boards, guideline developers.

Primary Methodology:

Quantitative statistical agreement analysis (Cohen's kappa, Kolmogorov–Smirnov test, regression analys

Primary Contribution Type:

Empirical evaluation of framework reproducibility.

General Summary of the Paper

This study evaluates how consistently precision oncology experts assign ESCAT Levels of Evidence to b

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper adopts ESCAT's definition: actionability reflects the **clinical significance of a biomarker-drug

> "The ESMO Scale of Clinical Actionability of molecular Targets (ESCAT) classification system… classif

> "Framework… designed to provide guidance on how the genomic findings should be used in clinical pra

---

What Makes Something Actionable

- Strong published clinical evidence supporting efficacy of the biomarker-drug pairing.

- Contextual relevance to tumor type.

- Evidence from well-designed clinical trials.

- Alignment with existing guidelines and standard-of-care definitions.

- Consideration of genomic context (multiple biomarkers, resistance mechanisms).

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ESCAT

- **Methods/Levers:** Literature review, expert evaluation, LOE classification (IA–X).

- **Operational Steps / Workflow:**

  1. Select biomarker-drug pairs (both common and rare).

  2. Provide tumor type, mutation origin, detection method to experts.

  3. Experts assign LOE following ESCAT criteria.

  4. Aggregate responses, determine consensus LOE, calculate agreement statistics.

- **Data & Measures:** Consensus LOE, Cohen's kappa, standard deviation from consensus, regression

- **Implementation Context:** Multi-institutional expert setting.

> "The median of LOE rankings… was considered the consensus LOE" (p. 93).

> "General agreement rate… estimated using two methods: Cohen's kappa and the Kolmogorov–Smirno

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — essential for agreement on LOE.

- **CR (Contextual Relevance):** Yes — tumor-specific and biomarker-specific context required.

- **FE (Feasibility):** Yes — addressed through distinction between standard-of-care and experimental th

- **TI (Timeliness):** Partial — literature currency implied but not central.

- **EX (Explainability):** Yes — LOE assignments tied to strength of evidence.

- **GA (Goal Alignment):** Yes — aimed at improving targeted therapy selection.

- **Other Dimensions:** Reproducibility, evidence strength, framework consistency.

Theoretical or Conceptual Foundations

- ESCAT framework (Mateo et al., 2018).

- Comparative mention of OncoKB and variant interpretation guidelines.

Indicators or Metrics for Actionability

- ESCAT Level of Evidence (IA–X).

- Consensus vs. individual LOE deviation.

- Agreement statistics (Cohen's kappa).

Barriers and Enablers to Actionability

- **Barriers:** Subjectivity in LOE assignment; lack of negative trial data consideration; uncertainty in clas

- **Enablers:** Standard-of-care status; clear guideline backing; multidisciplinary tumor board discussions

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Relation to Existing Literature

Positions ESCAT as the most comprehensive existing framework but notes parallels with variant interpret

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Summary

This multi-institutional study critically examines the reproducibility of ESCAT-based biomarker-drug rankin

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Scores

- **Overall Relevance Score:** 90 — Explicit definition of actionability, systematic dimensions, and critica

- **Operationalization Score:** 65 — Clear methodology for LOE assignment and consensus-building, bu

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Supporting Quotes from the Paper

- "[ESCAT] classify molecular aberrations based on the available evidence… and matching the clinical be

- "The most important drawback… is the potential subjectivity of the assigned LOE depending on the pers

- "The median of LOE rankings… was considered the consensus LOE" (p. 93).

- "Our results outline the concerning rate of discordances when using the ESCAT framework" (p. 99).

Actionability References to Other Papers

- Mateo et al., 2018 — ESCAT framework origin.

- OncoKB (Chakravarty et al., 2017).

- AMP/ASCO/CAP guidelines (Sirohi et al., 2020).

- ACMG-AMP guidelines (Amendola et al., 2020; Lyon et al., 2022).

Paper Summary

<!--META_START-->

Title: Metrics for What, Metrics for Whom: Assessing Actionability of Bias Evaluation Metrics in NLP

Authors: Pieter Delobelle, Giuseppe Attanasio, Debora Nozza, Su Lin Blodgett, Zeerak Talat

DOI: N/A

Year: 2024

Publication Type: Conference

Discipline/Domain: Natural Language Processing / Responsible AI

Subdomain/Topic: Bias evaluation metrics, Actionability in measurement, Fairness in NLP

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Actionable/Actionability Used in Paper: Yes — "we define actionability as the degree to which a measure

Authors Argue for Need for Actionability Without Defining It: No — definition is explicit

Contains Definition of Actionability: Yes — "the degree to which a measure's results enable informed acti

Contains Systematic Features/Dimensions: Yes — explicit desiderata: motivation, underlying bias constru

Contains Explainability: Partial — interpretability of measures discussed, but not central

Contains Interpretability: Partial — discussed as related but distinct from actionability

Contains Framework/Model: Yes — conceptual framework of desiderata for actionability

Operationalization Present: Yes — desiderata serve as operationalization criteria

Primary Methodology: Mixed Methods (Conceptual + Systematic Literature Review)

Study Context: Bias evaluation metrics in NLP

Geographic/Institutional Context: Global research community; institutions from Europe, North America, M

Target Users/Stakeholders: NLP researchers, AI practitioners, policymakers, regulators

Primary Contribution Type: Conceptual framework + empirical literature review

CL: Yes — clarity of bias construct, interval, intended use stressed

CR: Yes — emphasis on socio-historical context and matching to user needs

FE: Yes — feasibility implied in intended use and mechanical conditions

TI: Partial — timeliness not explicitly a desideratum but relevant in examples

EX: Partial — interpretability discussed but secondary

GA: Yes — goal alignment via bias construct and intended outcomes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Metrics for What, Metrics for Whom: Assessing Actionability of Bias Evaluation Metrics in NLP

Authors:

Pieter Delobelle, Giuseppe Attanasio, Debora Nozza, Su Lin Blodgett, Zeerak Talat

DOI:

N/A

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Natural Language Processing / Responsible AI

Subdomain/Topic:

Bias evaluation metrics, Actionability in measurement, Fairness in NLP

Contextual Background:

The paper addresses a gap in NLP bias evaluation: while metrics exist, many lack information to enable

Geographic/Institutional Context:

Work conducted by researchers from KU Leuven, Instituto de Telecomunicações (Lisbon), MilaNLP/Bocc

Target Users/Stakeholders:

NLP researchers, AI practitioners, dataset curators, policymakers, regulators.

Primary Methodology:

Mixed Methods — conceptual framework + systematic literature review (PRISMA 2020-guided)

Primary Contribution Type:

Conceptual framework and empirical survey

General Summary of the Paper

This paper formalizes *actionability* in bias evaluation metrics for NLP as "the degree to which a measure

---

Actionable/Actionability Used in Paper

Yes —

- "We define actionability as the degree to which a measurement's results enable informed action" (p. 1)

- "Actionability refers to the degree to which a measure's results enable decision-making or intervention" (

Authors Argue for a Need for Actionability Without Defining It

No — the paper provides an explicit definition.

How Actionability is Understood

> "Actionability refers to the degree to which a measure's results enable decision-making or intervention;

What Makes Something Actionable

- **Clear motivation**

  > "A clearly described motivation can increase a measure's actionability by helping people… assess wh

- **Well-defined bias construct**

  > "…clarity in the conceptualization of a bias measure's underlying construct can increase the measure'

- **Interval and ideal result**

  > "Understanding, and therefore acting, on the results… requires clearly articulated information about th

- **Intended use**

  > "Proposed bias measures should specify under what circumstances or conditions the measure should

- **Reliability**

  > "…reliability of a bias measure [is] a prerequisite for actionability." (p. 5)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Desiderata for actionability in bias measures
- **Methods/Levers:** Conceptual criteria drawn from fairness, measurement modeling, AI auditing
- **Operational Steps / Workflow:**

  1. Specify motivation

  2. Define bias construct

  3. Report interval & ideal result

  4. State intended use (mechanical & socio-historical)

  5. Assess and report reliability

- **Data & Measures:** Applied to 146 papers from ACL Anthology
- **Implementation Context:** Bias evaluation in NLP

> "We outline desiderata for bias measures—i.e., information that a measure should provide and justify to

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "clarity in the conceptualization… can increase the measure's actionability" (p. 4

- **CR (Contextual Relevance):** Yes — "bound… application space… assess whether the measure is a

- **FE (Feasibility):** Yes — implicit in "mechanical conditions" and stakeholder capacity (p. 5, p. 9)

- **TI (Timeliness):** Partial — timeliness not a formal desideratum, but implied in intervention contexts (p

- **EX (Explainability):** Partial — interpretability discussed as distinct but related (p. 2)

- **GA (Goal Alignment):** Yes — "ideal result… connected to the underlying bias construct and… socio-

- **Other Dimensions Named by Authors:** Reliability; transparency; stakeholder empowerment.

Theoretical or Conceptual Foundations

- Measurement modeling (Jacobs & Wallach, 2021)

- Validity theory (consequential, predictive, hypothesis validity)

- Fairness in ML/NLP frameworks

- AI auditing and accountability literature

Indicators or Metrics for Actionability

No quantitative KPI, but binary and qualitative annotation against desiderata (motivation, construct, interv

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Barriers and Enablers to Actionability

- **Barriers:** Missing motivation; vague or absent construct definition; mismatch between construct and

- **Enablers:** Clear conceptualization; linking results to impacts/harms; specifying applicability; reliability

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Relation to Existing Literature

Builds on prior critiques of bias metric clarity (Blodgett et al., 2020; Jacobs & Wallach, 2021), fairness ber

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Summary

This paper pioneers a formal definition of *actionability* in NLP bias measures and translates it into concr

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Scores

- **Overall Relevance Score:** 95 — Strong explicit definition, rich conceptual framework, direct focus on

- **Operationalization Score:** 90 — Clear, detailed desiderata operationalize actionability; some aspects

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Supporting Quotes from the Paper

- "We define actionability as the degree to which a measurement's results enable informed action" (p. 1)

- "Actionability refers to the degree to which a measure's results enable decision-making or intervention" (

- "A clearly described motivation can increase a measure's actionability…" (p. 4)

- "Proposed bias measures should specify under what circumstances… the measure should be expected

- "We view the reliability of a bias measure as a prerequisite for actionability" (p. 5)

Actionability References to Other Papers

- Jacobs & Wallach (2021) — Measurement modeling, validity

- Blodgett et al. (2020, 2021) — Conceptual clarity in bias definitions

- Raji et al. (2020), Birhane et al. (2024) — AI auditing and accountability

- Mitchell et al. (2021) — Fairness in ML frameworks

Paper Summary

<!--META_START-->

Title: Managing social media recovery: The important role of service recovery transparency in retaining cu

Authors: Andreawan Honora, Wen-Hai Chih, Kai-Yu Wang

DOI: https://doi.org/10.1016/j.jretconser.2021.102814

Year: 2022

Publication Type: Journal

Discipline/Domain: Marketing / Consumer Services

Subdomain/Topic: Service recovery, social media transparency, customer forgiveness

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicit — service recovery transparency is treated as actionable

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial (implicit through transparency and clarity concepts)

Contains Framework/Model: Yes (conceptual model with mediation and moderation)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Survey + Experimental)

Study Context: Social media service recovery after service failures

Geographic/Institutional Context: Indonesia; National Dong Hwa University; Brock University

Target Users/Stakeholders: Service providers, customer service managers, social media teams

Primary Contribution Type: Empirical validation of conceptual model

CL: Yes

CR: Yes

FE: No

Title: Managing social media recovery: The important role of service recovery transparency in retainin

Authors: Andreawan Honora, Wen-Hai Chih, Kai-Yu Wang

DOI: https://doi.org/10.1016/j.jretconser.2021.102814

Year: 2022

Publication Type: Journal

Discipline/Domain: Marketing / Consumer Services

Subdomain/Topic: Service recovery, social media transparency, customer forgiveness

Contextual Background: The paper investigates how transparency in handling customer complaints or

Geographic/Institutional Context: Indonesia; National Dong Hwa University; Brock University

Target Users/Stakeholders: Service providers, customer service managers, social media managers

Primary Methodology: Mixed methods (Survey + Experiment)

Primary Contribution Type: Empirical testing of conceptual model integrating transparency, forgivenes

General Summary of the Paper

The paper explores how *service recovery transparency* — making complaint-handling visible to all on s

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is conceptualized implicitly as the capacity of *service recovery transparency* to trigger cust

> "Service recovery transparency refers to the extent to which the responses of a service provider to its c

> "Providing transparent service recovery by handling complaints in the presence of others helps generat

What Makes Something Actionable

- Public visibility of complaint handling

- Honesty, clarity, accuracy, and openness in communication

- Creating positive emotional reactions (forgiveness) in customers

- Leveraging social influence via audience effects

- Incorporating emotional recovery elements (apology, explanation) when transparency is low

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Conceptual mediation-moderation model linking transparency, forgi

- **Methods/Levers:** Public replies on social media, offering sincere apologies, providing detailed explan

- **Operational Steps / Workflow:**

  1. Identify and respond to complaints publicly where possible

  2. Include emotional recovery strategies if transparency is low or absent

  3. Monitor forgiveness and switching intentions as key outcomes

- **Data & Measures:** 7-point Likert scales for transparency, forgiveness, switchover intention, apology,

- **Implementation Context:** Social media complaint handling

> "Public response… enables other consumers access to complaints and allows them to view on social m

> "When an apology/explanation is absent, higher levels of service recovery transparency will be importa

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "honesty, clarity, accuracy, and openness" as part of transparency (p. 2)

- **CR (Contextual Relevance):** Yes — recovery process visibility to other customers directly relevant to

- **FE (Feasibility):** No explicit link to feasibility as part of actionability

- **TI (Timeliness):** Not explicitly linked to actionability in findings (though timeliness noted in prior literat

- **EX (Explainability):** Yes — explanation moderates the effect of transparency on forgiveness (p. 4)

- **GA (Goal Alignment):** Partial — goal of retaining customers via forgiveness aligns with firm objective

- **Other Dimensions Named by Authors:** Social presence effects; emotional recovery strategies

Theoretical or Conceptual Foundations

- Social influence theory (Latane, 1981)

- Emotional recovery vs. economic recovery distinction

Indicators or Metrics for Actionability

- Customer forgiveness score (Likert scale)

- Switchover intention score (Likert scale)

- Measured interaction effects of apology and explanation

Barriers and Enablers to Actionability

- **Barriers:** Absence of apology/explanation reduces forgiveness in low-transparency settings; chatbot

- **Enablers:** Public responses; sincerity; open explanations; alignment with customer expectations for t

Relation to Existing Literature

Extends prior social media recovery studies by focusing on emotional constructs (forgiveness) rather than

Summary

This paper positions service recovery transparency as a critical, actionable element in social media comp

Scores

- **Overall Relevance Score:** 90 — Clear conceptualization of transparency as actionable, explicit medi

- **Operationalization Score:** 85 — Well-specified model, measured constructs, and actionable steps fo

Supporting Quotes from the Paper

- "Service recovery transparency refers to the extent to which the responses of a service provider to its cu

- "The higher the level of service recovery transparency is, the higher the level of customer forgiveness a

- "When an apology/explanation is absent, higher levels of service recovery transparency will be importar

- "Providing transparent service recovery… helps generate customer forgiveness, which… reduces switch

Actionability References to Other Papers

- Hogreve et al., 2019; Schaefers & Schamari, 2016 — transparency in online recovery

- Wei et al., 2020 — emotional vs. economic recovery

- Latane, 1981 — social influence theory

- Wang et al., 2020 — public vs. private apologies

Paper Summary

<!--META_START-->

Title: Machine Learning-Based Framework for the Analysis of Project Viability

Authors: Jean Marie Tshimula, Atsushi Togashi

DOI: 10.1109/CCOMS.2018.8463273

Year: 2018

Publication Type: Conference

Discipline/Domain: Data Science / Development Economics

Subdomain/Topic: Machine Learning for Investment Decision Support in African Development Projects

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Data Mining, Machine Learning, Topic Modeling)

Study Context: African Development Bank (AfDB) project portfolio analysis for investment guidance

Geographic/Institutional Context: Africa / AfDB (headquartered in Côte d'Ivoire)

Target Users/Stakeholders: Investors, policy makers, AfDB analysts

Primary Contribution Type: Machine Learning workflow for actionable investment guidance

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Machine Learning-Based Framework for the Analysis of Project Viability

Authors:

Jean Marie Tshimula, Atsushi Togashi

DOI:

10.1109/CCOMS.2018.8463273

Year:

2018

Publication Type:

Conference

Discipline/Domain:

Data Science / Development Economics

Subdomain/Topic:

Machine Learning for Investment Decision Support in African Development Projects

Contextual Background:

The study focuses on transforming African Development Bank (AfDB) project data into actionable insights

Geographic/Institutional Context:

Africa / African Development Bank

Target Users/Stakeholders:

Potential investors, AfDB officials, development economists, policy makers

Primary Methodology:

Mixed Methods (Machine Learning classification + NLP topic modeling)

Primary Contribution Type:

Design and implementation of a machine learning-based workflow for actionable investment recommenda

General Summary of the Paper

The paper presents a machine learning framework designed to process and analyze AfDB project data, c

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly understood as the ability of the analytical framework to transform raw project data

> "…transforming the project data…into actionable insights and…giving investment directions to follow ba

> "…generate the knowledge required for orienting people…willing to know more details…with insightful g

What Makes Something Actionable

- Connection to AfDB's strategic "High Five" priorities

- Clear identification of sectors and countries with investment potential

- Data-driven classification of promising projects using RF accuracy and LDA topic extraction

- Reduction of uncertainty and investment risk through predictive modeling

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Machine Learning-Based Workflow (AfDB investment analysis)

- **Methods/Levers:** Web scraping (afdbr R package), MongoDB storage, Random Forests, LDA topic r

- **Operational Steps / Workflow:** Data extraction → Structured storage → Data cleaning & translation →

- **Data & Measures:** Project descriptions, status, sector, elapsed time, reappraisal status

- **Implementation Context:** AfDB project portfolio

> "…workflow…consists of two phases: data collection and storage, and analysis module." (p. 2)

> "…built a model with 100 trees…then built an LDA model to outline the data with 20 topics." (p. 4)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear sector classification and thematic topic identification aid understanding.

- **CR (Contextual Relevance):** Yes — Links directly to AfDB's High Five priorities and African market tr

- **FE (Feasibility):** Yes — Uses existing AfDB data and scalable ML methods.

- **TI (Timeliness):** No explicit reference.

- **EX (Explainability):** Partial — RF feature importance is used, but model interpretability is not deeply a

- **GA (Goal Alignment):** Yes — Explicitly tied to AfDB's strategic priorities.

- **Other Dimensions Named by Authors:** Risk reduction, investment prioritization.

Theoretical or Conceptual Foundations

- AfDB High Five priorities

- Random Forest classification theory (Breiman, 2001)

- LDA topic modeling (Blei et al., 2003)

Indicators or Metrics for Actionability

- RF classification accuracy (99.8%)

- Identification of top 7 sectors for investment

- Topic frequency and relevance to strategic priorities

Barriers and Enablers to Actionability

- **Barriers:** Missing project descriptions (7.1%), language inconsistencies requiring translation

- **Enablers:** Comprehensive AfDB dataset, automated continuous data scraping, alignment with strate

Relation to Existing Literature

Positions itself as extending previous AfDB project evaluation models (e.g., Mubila et al. 2002) by focusin

Summary

This paper develops and demonstrates a machine learning-based workflow to make AfDB project data ac

Scores

- **Overall Relevance Score:** 82 — Strong implicit definition of actionability and clear link to features (se

- **Operationalization Score:** 90 — Detailed workflow, concrete ML methods, data sources, and sector o

Supporting Quotes from the Paper

- "Transforming the project data…into actionable insights and…giving investment directions to follow bas

- "…generate the knowledge required for orienting people…with insightful guidance." (p. 2)

- "…built a model with 100 trees…then built an LDA model to outline the data with 20 topics." (p. 4)

Actionability References to Other Papers

- Mubila & Lufumpa (2002) — Statistical model for project success factors

- Blei et al. (2003) — LDA model

- Breiman (2001) — Random Forests

Paper Summary

<!--META_START-->

Title: Learning analytics dashboard: a tool for providing actionable insights to learners

Authors: Teo Susnjak, Gomathy Suganya Ramaswami, Anuradha Mathrani

DOI: https://doi.org/10.1186/s41239-021-00313-7

Year: 2022

Publication Type: Journal

Discipline/Domain: Educational Technology / Learning Analytics

Subdomain/Topic: Learning Analytics Dashboards (LADs), Actionable Insights, Predictive and Prescriptiv

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (proposed LAD integrating descriptive, predictive, prescriptive, interpret

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Systematic Literature Review + System Design)

Study Context: Higher Education, learner-facing dashboards

Geographic/Institutional Context: Massey University, New Zealand

Target Users/Stakeholders: Students (primary), instructors, higher education institutions

Primary Contribution Type: Conceptual framework + prototype implementation

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Learning analytics dashboard: a tool for providing actionable insights to learners

Authors:

Teo Susnjak, Gomathy Suganya Ramaswami, Anuradha Mathrani

DOI:

https://doi.org/10.1186/s41239-021-00313-7

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Educational Technology / Learning Analytics

Subdomain/Topic:

Learning Analytics Dashboards, Actionable Insights, Predictive and Prescriptive Analytics

Contextual Background:

The paper addresses the design, capabilities, and challenges of learner-facing Learning Analytics Dashb

Geographic/Institutional Context:

Massey University, New Zealand

Target Users/Stakeholders:

Students (primary), instructors, institutional decision-makers

Primary Methodology:

Mixed Methods (Systematic Literature Review + Prototype Dashboard Design & Implementation)

Primary Contribution Type:

Conceptual framework, synthesis of literature, and novel LAD prototype integrating multiple analytics laye

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General Summary of the Paper

The study systematically reviews 17 recently published LADs (2018–2021) to assess their capabilities, fo

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the LAD's ability to provide learners with insights that can trigger informed, spe

> "…understand why a model produced given predictions… what insights can be derived… in order to trig

> "Prescriptive outputs… tailored to each learner… issue advice on behavioral adjustments and learning

---

What Makes Something Actionable

- Interpretability and explainability of predictive models.

- Presentation of counterfactuals showing how specific changes could improve outcomes.

- Contextually relevant, personalized recommendations.

- Evidence-based and data-driven suggestions.

- Clarity and avoidance of cognitive overload.

- Integration of predictive accuracy and confidence communication.

- Goal alignment with learner objectives.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Proposed Multi-Panel LAD with descriptive, predictive, prescriptive,

- **Methods/Levers:** Machine learning models (CatBoost, scikit-learn), model interpretability tools (Anch

- **Operational Steps / Workflow:** Data collection from LMS (Moodle) → preprocessing → predictive mo

- **Data & Measures:** Engagement metrics, assignment/test scores, demographic info, predictive risk sc

- **Implementation Context:** Higher education institution pilot, 20 classes, ~4000 student dataset.

> "…counterfactuals indicate… minimal changes… would produce… more positive outcomes…" (p. 17)

> "…conversion of a black-box predictive model into a glass-box, human interpretable model…" (p. 16)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Minimal use of colors, clear data-to-ink ratio (p. 17).

- **CR (Contextual Relevance):** Yes — Learner-specific metrics and comparisons (p. 16).

- **FE (Feasibility):** Yes — Recommendations based on minimal changes in controllable factors (p. 17).

- **TI (Timeliness):** Partial — Emphasis on early predictions for timely intervention, but no explicit real-ti

- **EX (Explainability):** Yes — Feature importance, anchors, counterfactuals (p. 17–18).

- **GA (Goal Alignment):** Yes — Advice aimed at maximizing course completion and learning outcomes

- **Other Dimensions:** Ethical transparency, cognitive load minimization.

Theoretical or Conceptual Foundations

- Explainable AI (XAI)

- Counterfactual explanations (Wachter et al., 2017)

- Learning analytics layers (descriptive, predictive, prescriptive)

- Cognitive load theory in dashboard design (Tufte, 2001; Bera, 2016)

Indicators or Metrics for Actionability

- Predictive model accuracy (%)

- Feature importance rankings

- Risk classification (high/low)

- Minimal change thresholds for outcome improvement

Barriers and Enablers to Actionability

- **Barriers:** Lack of interpretability in most LADs, technical complexity, concept drift, small datasets, eth

- **Enablers:** Emerging XAI tools, counterfactual generation methods, integrated data sources, agile ins

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Relation to Existing Literature

Positions itself as first LAD to fully integrate descriptive, predictive, and data-driven prescriptive analytics

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Summary

This paper identifies significant gaps in the ability of existing LADs to deliver actionable insights, emphasi

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Scores

- **Overall Relevance Score:** 92 — Strong conceptual framing of actionability with explicit features and

- **Operationalization Score:** 95 — Fully articulated operational model with specific tools, data sources,

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Supporting Quotes from the Paper

- "Models need to possess explanatory characteristics… in order to trigger actionable behavioral adjustm

- "Prescriptive outputs… tailored to each learner… advice on behavioral adjustments…" (p. 4)

- "Counterfactuals indicate… minimal changes… would produce… more positive predictive outcomes." (p

- "Conversion of a black-box predictive model into a glass-box… so that they can understand how their pr

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Actionability References to Other Papers

- Wachter et al. (2017) – Counterfactual explanations

- Ribeiro et al. (2018) – Anchors for interpretability

- Adadi & Berrada (2018) – Explainable AI

- Baneres et al. (2019, 2021) – Early warning systems and predictive analytics in LA

- Rets et al. (2021), Valle et al. (2021) – Need for prescriptive recommendations in LADs

Paper Summary

<!--META_START-->

Title: Latent classes from complex assessments: What do they tell us?

Authors: Jake McMullen, Ryan W. Lewis, Drew H. Bailey

DOI: https://doi.org/10.1016/j.lindif.2020.101944

Year: 2020

Publication Type: Journal

Discipline/Domain: Educational Psychology

Subdomain/Topic: Latent Class Analysis in Mathematics Achievement Assessment

Eligibility: Eligible

Overall Relevance Score: 70

Operationalization Score: 55

Contains Definition of Actionability: Implicit

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Partial (applied LCA process)

Operationalization Present: Yes

Primary Methodology: Quantitative

Study Context: Application of LCA to 5th-grade math benchmark assessments to explore predictive value

Geographic/Institutional Context: Mid-sized, socioeconomically and racially diverse U.S. school district (W

Target Users/Stakeholders: Educators, school districts, educational policymakers

Primary Contribution Type: Empirical study with methodological evaluation

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Yes

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title: Latent classes from complex assessments: What do they tell us?

Authors: Jake McMullen, Ryan W. Lewis, Drew H. Bailey

Discipline/Domain: Educational Psychology

Subdomain/Topic: Latent Class Analysis in Mathematics Achievement Assessment

Contextual Background: The study tests whether LCA applied to district-wide math benchmark asses

Geographic/Institutional Context: Mid-sized, socioeconomically and racially diverse school district in th

Target Users/Stakeholders: Educators, curriculum planners, district administrators, policymakers.

Primary Methodology: Quantitative

Primary Contribution Type: Empirical study evaluating methodological and practical utility of LCA.

General Summary of the Paper

This study investigates the practical and predictive value of applying Latent Class Analysis (LCA) to large

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly defined as the ability of latent classes to yield *meaningful and useful patterns of

> "...such latent classes actually reflects actionable information for educators" (p. 3)

> "…identifying students whose patterns of knowledge suggest they are at greater risk…than their curren

What Makes Something Actionable

- Produces knowledge patterns that explain performance differences *beyond* overall scores.

- Identifies groups where targeted instruction in specific skills would be more effective than alternatives.

- Reflects knowledge states with different causal effects on future learning.

- Is interpretable in relation to domain theory (e.g., fractions as a pivotal skill).

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Latent Class Analysis (LCA)

- **Methods/Levers:** Application of LCA to pass/fail benchmark standards to group students by knowled

- **Operational Steps / Workflow:**

  1. Fit multiple-class LCA models to benchmark pass/fail data.

  2. Select model based on BIC and interpret profiles.

  3. Compare profiles with similar overall performance but different knowledge patterns.

  4. Assess predictive validity for end-of-year standardized tests, controlling for covariates.

- **Data & Measures:** Pass/fail by curriculum standard, prior year standardized test scores, demographi

- **Implementation Context:** District-level assessments; could be implemented by school systems with e

> "...gleaning such actionable patterns…would be highly beneficial for educators" (p. 3)

> "...estimate an approximate range of effects…by statistically controlling…" (p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Profiles must be interpretable and coherent.

- **CR (Contextual Relevance):** Yes – Linked to specific curriculum standards and grade-level benchma

- **FE (Feasibility):** Partial – Method is implementable with existing district data, but practical gains are s

- **TI (Timeliness):** No – Study uses assessments months before the end-of-year exam, but timeliness i

- **EX (Explainability):** Yes – Classes must be interpretable in terms of cognitive development and curri

- **GA (Goal Alignment):** Partial – Supports targeted instruction toward high-leverage skills like fractions

- **Other Dimensions Named by Authors:** None explicitly labeled beyond above.

Theoretical or Conceptual Foundations

- Integrated theory of numerical development (Siegler et al., 2011)

- Prior LCA applications in cognitive development tasks (e.g., Piagetian tasks, conceptual change studies

- Theories on fractions as critical to mathematical development (Siegler et al., 2012)

Indicators or Metrics for Actionability

- Differences in predictive power of latent classes after controlling for overall performance and covariates.

- Magnitude of residual effects (SD units) indicating potential causal importance of specific skill deficits.

Barriers and Enablers to Actionability

- **Barriers:**

  - Broad, complex tests mask specific cognitive states.

  - Pass/fail aggregation loses fine-grained information.

  - Small added predictive value after controls.

- **Enablers:**

  - Coherent, interpretable class structures.

  - Potential for identifying skill-specific deficits relevant to intervention.

Relation to Existing Literature

Positions LCA as promising in theory-driven contexts with narrow, well-defined constructs but cautions ag

Summary

This study evaluates whether latent class analysis applied to broad, curriculum-based math benchmark a

Scores

- **Overall Relevance Score:** 70 – Provides implicit, substantive criteria for actionability and ties feature

- **Operationalization Score:** 55 – Presents a replicable method for deriving and testing actionability fro...

Supporting Quotes from the Paper

- "...such latent classes actually reflects actionable information for educators" (p. 3)

- "…identifying students whose patterns of knowledge suggest they are at greater risk…than their current...

- "…gleaning such actionable patterns…would be highly beneficial for educators" (p. 3)

- "...estimate an approximate range of effects…by statistically controlling…" (p. 3)

Actionability References to Other Papers

- Siegler, Thompson, & Schneider (2011) – Integrated theory of numerical development.

- Siegler et al. (2012) – Fractions as central to math learning.

- Embretson & Yang (2012) – Theoretically grouped test items.

- Jansen & van der Maas (1997, 2002) – LCA in Piagetian balance scale tasks.

Paper Summary

<!--META_START-->

Title: Knowledge Fusion for Distributed Situational Awareness driven by the WAx Conceptual Framework

Authors: Antonio De Nicola, Maria Luisa Villani, Francesco Costantino, Andrea Falegnami, Riccardo Patr...

DOI: n/a

Year: 2021

Publication Type: Conference

Discipline/Domain: Crisis Management / Information Systems

Subdomain/Topic: Distributed Situational Awareness, Knowledge Fusion, WAx Framework

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 82

Contains Definition of Actionability: Yes (explicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (WAx Framework)

Operationalization Present: Yes

Primary Methodology: Conceptual with illustrative case study

Study Context: Crisis management with distributed actors in cyber-socio-technical systems

Geographic/Institutional Context: Italy (ENEA, Sapienza University of Rome)

Target Users/Stakeholders: Crisis managers, rescue operators, analysts, decision-makers

Primary Contribution Type: Conceptual framework application and modelling method

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Knowledge Fusion for Distributed Situational Awareness driven by the WAx Conceptual Framework

Authors:

Antonio De Nicola, Maria Luisa Villani, Francesco Costantino, Andrea Falegnami, Riccardo Patriarca

DOI:

n/a

Year:

2021

Publication Type:

Conference

Discipline/Domain:

Crisis Management / Information Systems

Subdomain/Topic:

Distributed Situational Awareness, Knowledge Fusion, WAx Framework

Contextual Background:

The paper addresses the challenge of achieving distributed situational awareness in large crisis scenario

Geographic/Institutional Context:

Italy (ENEA, Sapienza University of Rome)

Target Users/Stakeholders:

Crisis managers, rescue operators, analysts, decision-makers

Primary Methodology:

Conceptual with illustrative case study (mountain rescue after avalanche)

Primary Contribution Type:

Conceptual framework application and modelling method

General Summary of the Paper

The authors propose a conceptual modelling approach for integrating distributed knowledge in crisis man

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is defined as the output of knowledge fusion that is "consistent, accurate, and usef

> "We define knowledge fusion as the process of integrating multiple knowledge entities to produce actio

> "[...] make it actionable requires to achieve a shared understanding among the different involved actors

What Makes Something Actionable

- Consistency across multiple knowledge sources.

- Accuracy of information relative to the operational reality.

- Usefulness for the specific decision-making purpose.

- Integration of heterogeneous knowledge entities (human, cyber, tacit, explicit).

- Alignment with operational goals and constraints.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** WAx Framework with Knowledge Conversion Maps

- **Methods/Levers:** Identification of agents, classification of WAx entities, mapping of knowledge conve

- **Operational Steps / Workflow:**

  1. Identify key agents (blunt-end, sharp-end, analysts).

  2. Identify WAx knowledge entities for each agent.

  3. Build knowledge conversion map (matrix linking source and target entities with conversion type).

- **Data & Measures:** WAx entity types, knowledge conversion activities (introspection, internalisation, e

- **Implementation Context:** Crisis management lifecycle phases (preparedness, response, recovery, m

> "The final aim is to build a knowledge conversion map for each phase of the crisis management lifecycl

> "The imagined reconstructed situation...is originated by a knowledge fusion activity that takes into acco

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Actionable knowledge must be interpretable by diverse actors.

- **CR (Contextual Relevance):** Yes — Knowledge must fit specific crisis context.

- **FE (Feasibility):** Partial — Implied via operational constraints but not explicitly detailed.

- **TI (Timeliness):** No — Timeliness not explicitly linked to actionability.

- **EX (Explainability):** Partial — WAx structure promotes traceability but not fully elaborated.

- **GA (Goal Alignment):** Yes — Explicitly aligned to crisis management decision goals.

- **Other Dimensions Named by Authors:** Consistency, accuracy, usefulness.

Theoretical or Conceptual Foundations

- WAx framework (Work-As-x representations from resilience engineering).

- Nonaka & Konno's knowledge conversion model (tacit/explicit).

- Ontology integration for knowledge fusion.

Indicators or Metrics for Actionability

No formal quantitative metrics; qualitative criteria include coherence, integration completeness, and align

Barriers and Enablers to Actionability

- **Barriers:** Conflicting perspectives, incomplete information, communication losses, differing objectives

- **Enablers:** Ontology-based shared understanding, structured knowledge conversion mapping, multi-a

Relation to Existing Literature

Positions itself against prior ontology-based situational awareness approaches by focusing on modelling

Summary

This paper applies the WAx conceptual framework to the challenge of distributed situational awareness in

Scores

- **Overall Relevance Score:** 88 — Strong explicit definition and conceptual clarity on actionability, with

- **Operationalization Score:** 82 — Clear multi-step method (agent/entity identification, conversion map

Supporting Quotes from the Paper

- "We define knowledge fusion as the process of integrating multiple knowledge entities to produce action

- "Make it actionable requires to achieve a shared understanding among the different involved actors." (p.

- "The final aim is to build a knowledge conversion map for each phase of the crisis management lifecycle

- "The imagined reconstructed situation...is originated by a knowledge fusion activity that takes into accou

Actionability References to Other Papers

- Nonaka, I., & Konno, N. (1998). *The concept of "Ba"* — knowledge conversion.

- Patriarca et al. (2021) — WAx framework.

- Osman et al. (2021) — ontology integration for knowledge fusion.

- Benaben et al. (2020) — crisis knowledge meta-model.

Paper Summary

<!--META_START-->

Title: Investigating the electric vehicle adoption initiatives for achieving sustainable development goals

Title:

Investigating the electric vehicle adoption initiatives for achieving sustainable development goals

Authors:

Shashi Kant Tripathi, Ravi Kant, Ravi Shankar

Publication Type:

Journal

Discipline/Domain:

Sustainable Transportation / Industrial Engineering

Subdomain/Topic:

Electric Vehicle Adoption; Sustainable Development Goals; Multi-Criteria Decision-Making

Contextual Background:

The study focuses on identifying and prioritizing Electric Vehicle Adoption Initiatives (EVAIs) to advance s

Geographic/Institutional Context:

India; conducted by SVNIT Surat and IIT Delhi

Target Users/Stakeholders:

National and state policymakers, EV manufacturers, charging infrastructure developers, environmental re

Primary Methodology:

Mixed Methods — Systematic Literature Review (PRISMA), Expert Elicitation, Multi-Criteria Decision-Mak

Primary Contribution Type:

Decision-support framework for aligning EV adoption with prioritized SDG targets

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General Summary of the Paper

The paper develops a hybrid decision-making and machine learning framework to identify, prioritize, and

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is conceptualized as the ability of initiatives to directly and measurably advance specific SDG

> "The priority of these EV adoption initiatives (EVAIs) will aid policymakers and stakeholders in streamlin

> "These assessments offer valuable insights for EV stakeholders, assisting them in stratifying critical init

---

What Makes Something Actionable

- Direct contribution to measurable SDG targets

- Contextual relevance to national sustainability and transport policies

- Feasibility in terms of infrastructure, technology, and socio-economic conditions

- Policy alignment and potential for government or stakeholder support

- Scalability and replicability across regions

- Integration of environmental, social, and economic considerations

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Hybrid Spherical Fuzzy MCDM + Machine Learning Framework

- **Methods/Levers:** Systematic literature review, expert elicitation, SF-BBWM, SF-CM, SF-EDAS

- **Operational Steps / Workflow:**

  1. Identify EVAIs and associated SDG targets via PRISMA-guided SLR and PyPDF2 sentence extraction

  2. Expert validation and categorization of EVAIs and SDGs

  3. Prioritization of initiatives using SF-BBWM

  4. SDG clustering with SF-CM to find most critical ones

  5. SDG ranking with SF-EDAS

  6. Sensitivity analysis and method comparison with SF-TOPSIS and SF-CODAS

- **Data & Measures:** Expert weight assignments, linguistic scale to fuzzy number conversion, appraisa

- **Implementation Context:** Indian EV market, national and state policy framework

> "The findings… highlight the top two key initiatives, namely, subsidizing solar-powered EV charging, an

> "SF-BBWM… to prioritize these EVAIs… SF-EDAS ranks the shortlisted SDGs." (p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clearly defined initiative categories and sub-initiatives linked to SDGs (p. 5)

- **CR (Contextual Relevance):** Yes — tailored to Indian EV sector and policy framework (p. 2)

- **FE (Feasibility):** Yes — initiatives assessed on policy, infrastructure, and economic viability (p. 10–1

- **TI (Timeliness):** Yes — urgent alignment with 2030 SDG targets (p. 2)

- **EX (Explainability):** Yes — transparent methodology and ranking process (p. 7–9)

- **GA (Goal Alignment):** Yes — explicit linkage to specific SDG targets (p. 6–12)

- **Other Dimensions Named by Authors:** Policy coherence, scalability, environmental impact reduction

---

Theoretical or Conceptual Foundations

- Fuzzy set theory (Zadeh, 1965)

- Spherical fuzzy sets (Kutlu Gündo■du & Kahraman, 2019)

- Best-Worst Method (Rezaei, 2015) and Bayesian BWM

- Multi-Criteria Decision-Making and clustering methods

Indicators or Metrics for Actionability

- Criteria weights from SF-BBWM

- SDG appraisal scores from SF-EDAS

- Spearman's rank correlation in sensitivity testing

Barriers and Enablers to Actionability

- **Barriers:** Limited charging infrastructure, high upfront costs, coal-dependent charging, low public awa

- **Enablers:** Government incentives (FAME I & II), renewable integration in charging, battery swapping

---

Relation to Existing Literature

Positions itself as filling a gap in linking specific EV initiatives to prioritized SDG targets using a formalize

---

Summary

This study presents a novel hybrid methodology combining Spherical Fuzzy Bayesian Best-Worst Method

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Scores

- **Overall Relevance Score:** 90 — Strong conceptual framing of actionability through explicit linkages t

- **Operationalization Score:** 95 — Highly detailed, step-by-step operationalization with tested robustne

---

Supporting Quotes from the Paper

- "The priority of these EV adoption initiatives (EVAIs) will aid policymakers and stakeholders in streamlin

- "Identification of the main and sub-categories of EVAIs and the achievable SDGs… Prioritization… Shor

- "Affordable and sustainable transportation (SDG11.2) is found to be the most significant SDG… followe

---

Actionability References to Other Papers

- Lipu et al. (2022) — EV benefits and SDG alignment

- Asgarian et al. (2023) — Policy support and sustainable transportation

- Peng & Bai (2023) — Holistic policy approaches

- Hannan et al. (2021) — Battery energy storage and SDGs

- Omahne et al. (2021) — Social aspects and SDG connections

Paper Summary

<!--META_START-->

Title: Individual and Group-level considerations of Actionable Recourse

Authors: Jayanth Yetukuri, Yang Liu

DOI: https://doi.org/10.1145/3600211.3604758

Year: 2023

Publication Type: Conference

Discipline/Domain: Artificial Intelligence / Human-Centered Computing

Subdomain/Topic: Actionable Recourse, Fairness in Machine Learning, User Preferences, Plausibility

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 78

Contains Definition of Actionability: Yes (explicitly in context of recourse viability)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial (linked to transparency and trust)

Contains Interpretability: Partial (discussed via counterfactual explanation methods)

Contains Framework/Model: Yes (proposed optimization approach incorporating preferences and plausib

Operationalization Present: Yes

Primary Methodology: Conceptual + Quantitative Experiments

Study Context: Machine learning decision systems in lending, insurance, hiring

Geographic/Institutional Context: University of California, Santa Cruz; USA

Target Users/Stakeholders: Negatively impacted individuals seeking recourse; developers of ML decision

Primary Contribution Type: Conceptual framework + algorithmic method proposal with empirical demonst

CL: Yes — "Such a transparent mechanism also builds trust in decision-making by enabling adversely aff

CR: Yes — "Plausibility draws strong signals from group-level population information, which must be cons

FE: Yes — "Considering that she belongs to the sub-population of denied single parent, the recourse may

TI: Partial — Timeliness is not explicitly discussed as a feature of actionability.

EX: Partial — Linked to transparency and trust but not fully unpacked.

GA: Yes — "Identify specific, actionable steps in agreement with the approved single parent sub-populati

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Individual and Group-level considerations of Actionable Recourse

Authors:

Jayanth Yetukuri, Yang Liu

DOI:

https://doi.org/10.1145/3600211.3604758

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence / Human-Centered Computing

Subdomain/Topic:

Actionable Recourse, Fairness in Machine Learning, User Preferences, Plausibility

Contextual Background:

The paper addresses how actionable recourse—recommendations enabling individuals to achieve desire

Geographic/Institutional Context:

University of California, Santa Cruz (USA)

Target Users/Stakeholders:

Negatively impacted individuals seeking to reverse unfavorable algorithmic decisions; developers and po

Primary Methodology:

Conceptual framework combined with empirical experiments on real-world datasets.

Primary Contribution Type:

A conceptual and computational approach integrating user preferences and group-level plausibility into re

---

General Summary of the Paper

The paper explores how actionable recourse in ML decision systems can better account for individual use

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the *viability of taking a suggested action* within the context of recourse for ML

> "Ensure the actionability (the viability of taking a suggested action) of recourse." (p. n/a)

> "Plausibility draws strong signals from group-level population information… to achieve low-cost recours

---

What Makes Something Actionable

- **Alignment with user preferences** (continuous feature scores, categorical rankings, feature bounds)

- **Feasibility** given personal constraints

- **Plausibility** based on similarity to approved cases in the individual's subgroup

- **Transparency** to build trust

- **Fairness** across groups with different distributional characteristics

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Not formally named, but described as constrained optimization inco

- **Methods/Levers:** Optimization function embedding individual preferences; plausibility score constrai

- **Operational Steps / Workflow:**

  1. Collect individual user preferences (three types).

  2. Integrate these as constraints in recourse optimization.

  3. Calculate group-level plausibility score.

  4. Generate recourse maximizing plausibility while respecting user constraints.

- **Data & Measures:** Real-world datasets; plausibility score; recourse cost metrics.

- **Implementation Context:** Lending, insurance, hiring decisions.

> "We propose to capture… three types of user preferences… and embed them into an optimization func

> "We quantify plausibility of recourse with respect to the approved sub-population of the individual's grou

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — linked to transparency and understandability in recourse generation.

- **CR (Contextual Relevance):** Yes — plausibility relies on subgroup context.

- **FE (Feasibility):** Yes — explicitly tied to personal constraints and preferences.

- **TI (Timeliness):** Partial — not directly addressed as a criterion.

- **EX (Explainability):** Partial — present via transparency but not deeply analyzed.

- **GA (Goal Alignment):** Yes — recourse must align with the individual's goal of entering the approved

- **Other Dimensions Named by Authors:** Plausibility; User Preference Diversity.

Theoretical or Conceptual Foundations

- Actionable Recourse in Linear Classification (Ustun et al., 2019)

- Counterfactual explanation generation methods (FACE, GS, CCHVAE)

- Local feasibility constraints (Mahajan et al., 2019)

Indicators or Metrics for Actionability

- Plausibility score based on proximity to approved subgroup manifold

- Recourse cost (individual and group-level)

- Adherence to stated user preferences

Barriers and Enablers to Actionability

- **Barriers:**

  - Universal cost metrics ignoring personal constraints

  - Distributional idiosyncrasies across groups

  - Lack of integration of user preferences in current methods

- **Enablers:**

  - Explicit collection of user preferences

  - Group-level plausibility constraint

  - Transparent recourse generation

Relation to Existing Literature

The paper builds upon existing counterfactual explanation and actionable recourse literature but extends

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Summary

This paper advances the concept of actionable recourse by explicitly integrating **individual-level prefere

---

Scores

- **Overall Relevance Score:** 85 — Strong conceptual framing of actionability with explicit dimensions (

- **Operationalization Score:** 78 — Provides a clear methodology for integrating individual and group-le

---

Supporting Quotes from the Paper

- "[Actionability is] the viability of taking a suggested action…" (p. n/a)

- "We propose to capture Alice's three types of user preferences… and embed them into an optimization

- "We quantify plausibility of recourse with respect to the approved sub-population of the individual's grou

- "Considering that she belongs to the sub-population of denied single parent, the recourse may not be ac

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Actionability References to Other Papers

- Ustun et al. (2019) — Actionable Recourse in Linear Classification

- Mahajan et al. (2019) — Local feasibility in counterfactual explanations

- Mothilal et al. (2020) — Diverse counterfactual explanations

- Poyiadzi et al. (2020) — FACE method

- Laugel et al. (2017) — Inverse classification interpretability

- Pawelczyk et al. (2020) — CCHVAE counterfactual generation

Paper Summary

<!--META_START-->

Title: In Search of an Alternative Framework for the Creation of Actionable Knowledge: Table-Tennis Res

Authors: Niclas Adler, Rami Shani

DOI: n/a

Year: 2001

Publication Type: Book Chapter

Discipline/Domain: Organizational Studies / Management Science

Subdomain/Topic: Participatory Inquiry, Actionable Knowledge, Knowledge-Based Firms

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial (through intermediate theories)

Contains Framework/Model: Yes (Table-Tennis Research process model)

Operationalization Present: Yes

Primary Methodology: Qualitative, Conceptual with Longitudinal Case Study

Study Context: Knowledge-based firm (Ericsson), participatory research projects (10 projects over 6 year

Geographic/Institutional Context: Sweden (Ericsson HQ), Chalmers University of Technology, Stockholm

Target Users/Stakeholders: Academic researchers, practitioner researchers, organizational leaders in kno

Primary Contribution Type: Conceptual framework and methodological innovation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: In Search of an Alternative Framework for the Creation of Actionable Knowledge: Table-Tennis I

Authors: Niclas Adler, Rami Shani

DOI: n/a

Year: 2001

Publication Type: Book Chapter

Discipline/Domain: Organizational Studies / Management Science

Subdomain/Topic: Participatory Inquiry, Actionable Knowledge, Knowledge-Based Firms

Contextual Background: The chapter addresses how actionable knowledge can be generated throug

Geographic/Institutional Context: Sweden; Chalmers University of Technology, Stockholm School of E

Target Users/Stakeholders: Organizational researchers, knowledge managers, R&D leaders, academ

Primary Methodology: Qualitative, conceptual with longitudinal case study

Primary Contribution Type: Methodological framework and process model

General Summary of the Paper

The paper develops and illustrates the "Table-Tennis Research" approach — a participatory inquiry frame

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is defined as knowledge that both advances scientific understanding and directly in

> "Actionable knowledge was defined as new knowledge that advances our scientific body of knowledge

> "In the context of generating knowledge for action, it is vital that many perspectives are used… and that

What Makes Something Actionable

- Relevance to "red and hot" issues (strategic importance, timeliness, perceived as critical by both academ

- Iterative testing and refinement of intermediate theories through actual experiments

- Boundary-spanning integration of perspectives, domains (action/reflection), and phases (design, data, v

- Close alignment with organizational decision-making and strategic discourse

- Mutual ownership of research questions, process, and interpretation

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** Table-Tennis Research

- **Methods/Levers:** Iterative jam sessions, intermediate theories, real-time experimentation, boundary-

- **Operational Steps / Workflow:** Identify red/hot issues → form mixed teams → conduct jam sessions

- **Data & Measures:** Qualitative data from organizational settings, observations, experimental outcome

- **Implementation Context:** Multi-project, multi-year collaboration at Ericsson involving engineers, man

> "Research in real-time and on red and hot issues… provides opportunities for validating actionability in

> "The jam sessions… act as the enabling context within which actionable knowledge creation occurs." (p

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clarity in research focus, intermediate theories, and communication of findings is

- **CR (Contextual Relevance):** Yes — must be tied to organizationally strategic "red and hot" issues.

- **FE (Feasibility):** Yes — actionable theories must be testable within organizational constraints.

- **TI (Timeliness):** Yes — focus on issues that are immediately relevant and urgent.

- **EX (Explainability):** Yes — intermediate theories serve as shared explanatory frameworks between

- **GA (Goal Alignment):** Yes — mutual goals of scientific contribution and practical improvement.

- **Other Dimensions Named by Authors:** Boundary-spanning integration, iterative adaptability, mutual

Theoretical or Conceptual Foundations

- Knowledge-based view of the firm (Grant, 1998; Nonaka & Takeuchi, 1995)

- Action research and participatory inquiry traditions (Lewin, 1946; Argyris & Schön, 1974; Reason, 1995)

- Habermas' three cognitive interests (technical, practical, emancipatory)

Indicators or Metrics for Actionability

- Degree to which research produces both scientific publications and local theories for action

- Uptake of intermediate theories in organizational practices

- Sustained learning systems post-project

Barriers and Enablers to Actionability

- **Barriers:** Loss of red/hot focus, turnover of key decision-makers, role ambiguity, imbalance between

- **Enablers:** Mutual trust, joint ownership, iterative validation, strategic relevance, boundary-spanning p

Relation to Existing Literature

Builds on and integrates multiple participatory research streams (action science, clinical field research, a

Summary

Adler and Shani's chapter advances "Table-Tennis Research" as a participatory methodology optimized f

Scores

- **Overall Relevance Score:** 95 — Explicit definition of actionable knowledge, comprehensive set of en

- **Operationalization Score:** 90 — Detailed process model with concrete steps, but context-specific to I

Supporting Quotes from the Paper

- "Actionable knowledge was defined as new knowledge that advances our scientific body of knowledge a

- "Research in real-time and on red and hot issues… provides opportunities for validating actionability in k

- "The jam sessions… act as the enabling context within which actionable knowledge creation occurs." (p

- "By integrating practitioners and different academic disciplines to address an organizational issue, the m

Actionability References to Other Papers

- Argyris & Schön (1974) — Action science

- Nonaka & Takeuchi (1995) — Knowledge creation theory

- Reason (1995) — Participative inquiry paradigm

- Habermas (1981) — Cognitive interests framework

- Gibbons et al. (1994) — Transdisciplinarity

Paper Summary

<!--META_START-->

Title: Implementing evidence-based assertions of clinical actionability in the context of secondary findings

Authors: Christine M. Pak, Marian J. Gilmore, Joanna E. Bulkley, Pranesh Chakraborty, Orit Dagan-Rose

DOI: https://doi.org/10.1016/j.gim.2024.101164

Year: 2024

Publication Type: Journal

Discipline/Domain: Genomic Medicine / Clinical Genetics

Subdomain/Topic: Clinical actionability, secondary genomic findings, evidence-based frameworks

Eligibility: Eligible

Overall Relevance Score: 98

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with pragmatic evaluation

Study Context: Development and implementation of an assertion rubric for clinical actionability in seconda

Geographic/Institutional Context: Primarily U.S.-based with contributions from Canada

Target Users/Stakeholders: Clinical laboratories, geneticists, policy makers, genomic medicine implemen

Primary Contribution Type: Framework/methodology for actionability assessment and assertion

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Implementing evidence-based assertions of clinical actionability in the context of secondary findi

Authors: Christine M. Pak et al.

DOI: https://doi.org/10.1016/j.gim.2024.101164

Year: 2024

Publication Type: Journal

Discipline/Domain: Genomic Medicine / Clinical Genetics

Subdomain/Topic: Clinical actionability, secondary genomic findings, evidence-based frameworks

Contextual Background: The paper addresses the gap in standardized, evidence-based assessment o

Geographic/Institutional Context: Primarily U.S.-based research institutions and clinical genetics organ

Target Users/Stakeholders: Clinical laboratories, geneticists, health policy makers, genomic medicine

Primary Methodology: Conceptual framework development with iterative refinement and pragmatic ev

Primary Contribution Type: Framework/methodology for actionability assessment and assertion.

General Summary of the Paper

This article presents the ClinGen AWG's development of an evidence-based "assertion rubric" to generat

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors define clinical actionability as the potential for an intervention, informed by genetic findings, t

> "Clinical actionability in this context includes interventions that could be implemented to mitigate or prev

> "The assertion process allows the AWG to capture… effectiveness of medical interventions… penetran

---

What Makes Something Actionable

- Severity of health outcome

- Likelihood (penetrance) of outcome

- Effectiveness of intervention in preventing/mitigating outcome

- Nature/burden of intervention

- Strength and quality of supporting evidence

- Contextual adoption in clinical practice

- Ethical or feasibility constraints on gathering more evidence

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ClinGen Actionability Assertion Rubric

- **Methods/Levers:** 4-domain SQM scoring → preliminary assertion → expert discussion → consensus

- **Operational Steps / Workflow:**

  1. Score outcome–intervention pairs in four domains (0–3 each).

  2. Identify highest-scoring O/I pair for each gene–condition pair.

  3. Generate preliminary assertion using score thresholds.

  4. Discuss in AWG meetings; consider additional predefined factors.

  5. Document rationale for final assertion.

- **Data & Measures:** Evidence from systematic reviews, meta-analyses, clinical guidelines; penetrance

- **Implementation Context:** Applied to both adult and pediatric gene–condition pairs across 350+ cases

> "The total score is the sum of the four domain scores… used to generate the preliminary assertion of ac

> "The assertion level can be changed based on… poor-quality evidence… interventions widely used… c

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear, structured scoring and definition of levels.

- **CR (Contextual Relevance):** Yes — Context-specific scoring (adult/pediatric frameworks).

- **FE (Feasibility):** Yes — Consideration of real-world clinical adoption and feasibility of interventions.

- **TI (Timeliness):** Partial — Timeliness implied via secondary finding reporting priorities.

- **EX (Explainability):** Yes — Rationale documented for each assertion.

- **GA (Goal Alignment):** Yes — Focus on preventing/mitigating health outcomes aligned with patient he

- **Other Dimensions Named by Authors:** Burden of intervention, ethical considerations for evidence co

---

Theoretical or Conceptual Foundations

- Builds on ACMG recommendations for secondary finding reporting.

- Extends the existing ClinGen semi-quantitative metric framework.

- Incorporates evidence hierarchies (systematic review, meta-analysis, guidelines).

Indicators or Metrics for Actionability

- Total domain score (0–12) for highest-scoring O/I pair

- Effectiveness score thresholds

- Tier 1 evidence for "definitive" designation

Barriers and Enablers to Actionability

- **Barriers:** Limited/poor-quality evidence; rare/pediatric conditions with limited trial feasibility.

- **Enablers:** Established clinical use; strong guidelines; high-penetrance variants.

Relation to Existing Literature

Positions the rubric as a standardization advance over prior ad hoc practices in secondary finding reporti

---

Summary

The paper describes the creation and implementation of the ClinGen Actionability Assertion Rubric, a sta

---

Scores

- **Overall Relevance Score:** 98 — Offers explicit definition, detailed dimensions, and a fully developed

- **Operationalization Score:** 95 — Provides clear step-by-step process, criteria, and integration into pra

---

Supporting Quotes from the Paper

- "Clinical actionability in this context includes interventions that could be implemented to mitigate or prev

- "The total score is the sum of the four domain scores… used to generate the preliminary assertion of ac

- "The assertion level can be changed based on… interventions widely used… high-quality evidence not l

- "The assertion process allows the AWG to capture… effectiveness of medical interventions… penetranc

---

Actionability References to Other Papers

- ACMG SF v2.0, v3.0, v3.1 policy statements

- Hunter et al. (2016, 2018, 2022) on clinical actionability assessment protocols

- Saelaert et al. (2019) on professional perspectives in reporting secondary findings

Paper Summary

<!--META_START-->

Title: Identifying actionable strategies: using Consolidated Framework for Implementation Research (CFII

Authors: Helen Lam, Michael Quinn, Toni Cipriano-Steffens, Manasi Jayaprakash, Emily Koebnick, Forne

DOI: https://doi.org/10.1186/s43058-021-00150-9

Year: 2021

Publication Type: Journal

Discipline/Domain: Implementation Science / Public Health

Subdomain/Topic: Colorectal cancer screening, evidence-based intervention implementation

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit, operational focus)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes (CFIR)

Operationalization Present: Yes

Primary Methodology: Qualitative

Study Context: Federally Qualified Health Centers (FQHCs) implementing 3 EBIs for CRC screening

Geographic/Institutional Context: Large urban FQHC in Chicago, Illinois, USA

Target Users/Stakeholders: Primary care providers, integrated care specialists (CRC stewards), administ...

Primary Contribution Type: Empirical study with implementation strategy recommendations

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Identifying actionable strategies: using CFIR-informed interviews to evaluate the implementation of a mul...

Authors:

Helen Lam, Michael Quinn, Toni Cipriano-Steffens, Manasi Jayaprakash, Emily Koebnick, Fornessa Ran...

DOI:

https://doi.org/10.1186/s43058-021-00150-9

Year:

2021

Publication Type:

Journal

Discipline/Domain:

Implementation Science / Public Health

Subdomain/Topic:

Colorectal cancer screening, evidence-based intervention (EBI) implementation

Contextual Background:

The study examines how three EBIs—EHR provider reminders, quarterly provider assessment/feedback,

Geographic/Institutional Context:

Large urban FQHC in Chicago, Illinois, USA

Target Users/Stakeholders:

Primary care providers, CRC stewards (integrated care specialists), administrators, implementation team

Primary Methodology:

Qualitative (semi-structured CFIR-guided interviews, template analysis)

Primary Contribution Type:

Empirical study + operational recommendations

General Summary of the Paper

The paper uses the Consolidated Framework for Implementation Research (CFIR) to analyze the implem

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is understood implicitly as the ability to **translate findings about barriers/facilitators into con

> "By identifying the contextual determinants, we can then determine implementation strategies to facilita

> "The ultimate goal… was to identify possible implementation strategies… to promote CRC screening…

What Makes Something Actionable

- Based on clearly identified barriers/facilitators from stakeholders

- Integrates with existing workflows to minimize disruption

- Distributes responsibility (team-based rather than provider-centric)

- Supported by clear goals and performance feedback

- Supported by culturally and linguistically appropriate resources

- Tied to measurable indicators (e.g., screening rates, completion rates)

- Supported by leadership engagement and organizational incentives

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** CFIR-guided post-implementation formative evaluation

- **Methods/Levers:** Qualitative interviews; barrier/facilitator mapping; context-specific strategy design

- **Operational Steps / Workflow:**

  - Conduct CFIR-based stakeholder interviews

  - Code responses into CFIR constructs

- Identify contextual barriers/facilitators

  - Develop targeted strategies (e.g., morning huddles, standing orders, dashboards)

- **Data & Measures:** EHR-based screening rates, provider order rates, completion rates, qualitative fee

- **Implementation Context:** Large urban FQHC with diverse patient populations and resource constrair

> "We will tackle the two barriers related to the EHR provider reminder… using a teamwork-based approa

> "Goals direct attention and action… Specific and challenging goals can lead to better task performance

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Strategies emphasize clarity in communication, goals, and feedback reports.

  > "Include the target CRC screening rates in the quarterly… report." (p. 12)

- **CR (Contextual Relevance):** Yes — Strategies tailored to FQHC realities (diverse patients, resource

- **FE (Feasibility):** Yes — Solutions integrate into workflow (e.g., huddles, MA screening updates).

- **TI (Timeliness):** No explicit link to timeliness as a requirement.

- **EX (Explainability):** Partial — Strategies are explained, but not framed in terms of "explainability."

- **GA (Goal Alignment):** Yes — Emphasis on setting clear organizational and clinic-level goals.

- **Other Dimensions Named by Authors:** Team-based care; cultural/linguistic appropriateness.

Theoretical or Conceptual Foundations

- Consolidated Framework for Implementation Research (CFIR)

- Goal-setting theory (Locke, Latham)

Indicators or Metrics for Actionability

- CRC screening order and completion rates

- Provider- and clinic-level performance comparisons

- Achievement of target goals in quarterly feedback

Barriers and Enablers to Actionability

- **Barriers:** EHR reminder fatigue; unreliable data; cultural/linguistic challenges; lack of goals; poor cor

- **Enablers:** HRSA reporting incentives; peer pressure; quarterly feedback reports; leadership engager

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Relation to Existing Literature

Positions CFIR as a pragmatic framework for evaluating and improving EBI implementation in resource-c

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Summary

This study operationalizes "actionability" as turning contextual analysis of implementation barriers and fac

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Scores

- **Overall Relevance Score:** 85 — Strong implicit conceptualization of actionability with concrete featur

- **Operationalization Score:** 90 — Detailed, context-specific strategies directly linked to identified barrie

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Supporting Quotes from the Paper

- "By identifying the contextual determinants, we can then determine implementation strategies to facilitat

- "Use teamwork approach and share the burden… Conduct morning huddles… Implement standing orde

- "Include the target CRC screening rates in the quarterly… report… Disseminate… to all members of the

- "Identify and collect culturally and linguistically specific CRC education material." (p. 12)

Actionability References to Other Papers

- CFIR framework: Damschroder et al. (2009)

- Goal-setting theory: Locke et al. (1981), Lunenburg (2011)

- Implementation strategies literature: Proctor et al. (2013), Keith et al. (2017)

Paper Summary

<!--META_START-->

Title: Human Resources-Based Organizational Data Mining (HRODM): Themes, Trends, Focus, Future

Authors: Hila Chalutz-Ben Gal

DOI: 10.1007/978-3-031-24628-9_36

Year: 2023

Publication Type: Book Chapter

Discipline/Domain: Human Resource Management, Data Science

Subdomain/Topic: Human Resources Analytics, Organizational Data Mining, ROI-based Analysis

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit via "actionable knowledge" definition in ODM/HRODM co

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes (e.g., interpretable actionable insights in recruitment model)

Contains Framework/Model: Yes (ROI-based approach, LAMP framework)

Operationalization Present: Yes (ROI-based HRODM process, tool-based implementation examples)

Primary Methodology: Systematic Literature Review and Synthesis (with conceptual and empirical analys

Study Context: Organizational decision-making in HR using data mining and analytics, ROI lens

Geographic/Institutional Context: Global, with shift of research focus from Europe to North America

Target Users/Stakeholders: HR managers, organizational decision-makers, data scientists, researchers

Primary Contribution Type: Theoretical framework, synthesis, practical implementation guidance

CL: Yes – clarity/understandability explicitly linked to actionable insight via "meaningful managerial insigh

CR: Yes – contextual relevance linked to ROI-based adoption decisions

FE: Yes – feasibility linked to adoption justification and ROI-driven prioritization

TI: Yes – timeliness implicit in proactive vs. reactive HRODM application

EX: Yes – explainability emphasized in interpretable recruitment decision model

GA: Yes – goal alignment via strategic management tool framing

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Human Resources-Based Organizational Data Mining (HRODM): Themes, Trends, Focus, Future

Authors:

Hila Chalutz-Ben Gal

DOI:

10.1007/978-3-031-24628-9_36

Year:

2023

Publication Type:

Book Chapter

Discipline/Domain:

Human Resource Management, Data Science

Subdomain/Topic:

Human Resources Analytics, Organizational Data Mining, ROI-based Analysis

Contextual Background:

The chapter explores the use of data mining and analytics in human resources (HRODM), situating it with

Geographic/Institutional Context:

Global; review shows an increasing North American research dominance post-2011.

Target Users/Stakeholders:

HR professionals, executives, data scientists, management scholars, organizational strategists.

Primary Methodology:

Systematic literature review, conceptual synthesis, and ROI-based framework application.

Primary Contribution Type:

Theoretical framework and applied guidance for HRODM adoption and implementation.

General Summary of the Paper

This chapter reviews and synthesizes the literature on Human Resources-Based Organizational Data Min

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the transformation of HR data into "valuable and actionable knowledge" to impro

> "ODM is defined as leveraging… tools… to transform data into valuable and actionable knowledge to ga

> HRODM aims "to provide an organization with insights for effectively managing employees… to achieve

---

What Makes Something Actionable

- Insights must be relevant to organizational strategy (goal alignment).

- They must be derived from structured analytics (LAMP components).

- ROI must be demonstrable to justify adoption.

- Outputs must be interpretable and implementable by practitioners.

- Contextual fit between analytics tools and organizational challenges.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ROI-based approach, LAMP framework (Logic, Analytics, Measuren

- **Methods/Levers:** Systematic literature review; classification of studies; mapping ROI levels to resear

- **Operational Steps / Workflow:** Identify HR challenge → select analytics tools → conduct analysis →

- **Data & Measures:** HR metrics, organizational KPIs, turnover data, satisfaction scores, recruitment su

- **Implementation Context:** Strategic HRM, talent management, workforce planning, recruitment, reten

> "The ROI-based approach… provides a robust tool to compare and contrast different dilemmas and ass

> "Extraction of interpretable and actionable insights" in recruitment decisions (p. 859).

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL:** Yes — "meaningful managerial insights" and "clear connection between analytics investment an

- **CR:** Yes — contextual fit between analytics approach and organizational challenge (p. 848).

- **FE:** Yes — ROI as a feasibility test for adoption (p. 834, 847).

- **TI:** Yes — proactive vs. reactive application influences timeliness (p. 847).

- **EX:** Yes — interpretable recruitment models explicitly mentioned (p. 859).

- **GA:** Yes — strategic management tool framing and KPI alignment (p. 842).

- **Other Dimensions Named by Authors:** Evidence-based approach, process efficiency.

Theoretical or Conceptual Foundations

- LAMP framework (Boudreau & Ramstad, 2006).

- Contextual approach in organizational research (Johns, 2006, 2018).

- Strategic HRM and ROI literature.

Indicators or Metrics for Actionability

- ROI percentage/ratio.

- Turnover rates and causes.

- Recruitment success probability.

- Training ROI.

- KPI performance changes post-implementation.

Barriers and Enablers to Actionability

- **Barriers:** Limited empirical evidence; lack of structured adoption methods; reactive data use; low RO

- **Enablers:** ROI-based decision framework; integration of LAMP; predictive analytics tools; alignment

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Relation to Existing Literature

Builds on HR analytics, organizational data mining, and ROI literature; integrates managerial and technic

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Summary

The chapter positions HRODM as a high-impact approach for transforming HR data into actionable organ

---

Scores

- **Overall Relevance Score:** 92 — Clear implicit definition of actionability, strong linkage to dimensions

- **Operationalization Score:** 95 — Detailed step-by-step operationalization with ROI metrics, applied to

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Supporting Quotes from the Paper

- "ODM is defined as… transforming data into valuable and actionable knowledge to gain a strategic com

- "To provide an organization with insights for effectively managing employees… to achieve business goa

- "The ROI-based approach… provides a robust tool to compare and contrast different dilemmas and ass

- "Extraction of interpretable and actionable insights" (p. 859).

Actionability References to Other Papers

- Boudreau & Ramstad (2006) – LAMP framework.

- Rasmussen & Ulrich (2015) – Adoption challenges and ROI focus.

- Levenson (2005, 2015) – Strategic HR analytics for goal alignment.

- Pessach et al. (2020) – Interpretable recruitment decision-making tool.

Paper Summary

<!--META_START-->

Title: How Clinicians Conceptualize "Actionability" in Genomic Screening

Authors: Kellie Owens, Pamela Sankar, Dina M. Asfaha

DOI: https://doi.org/10.3390/jpm13020290

Year: 2023

Publication Type: Journal Article

Discipline/Domain: Genomic Medicine / Medical Ethics

Subdomain/Topic: Actionability in population genomic screening

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 75

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: No

Operationalization Present: Yes

Primary Methodology: Qualitative

Study Context: Population genomic screening in primary care

Geographic/Institutional Context: United States; multiple health systems

Target Users/Stakeholders: Primary care providers, clinical geneticists, genetic counselors, genomic prog

Primary Contribution Type: Empirical qualitative analysis

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

How Clinicians Conceptualize "Actionability" in Genomic Screening

Authors:

Kellie Owens, Pamela Sankar, Dina M. Asfaha

DOI:

https://doi.org/10.3390/jpm13020290

Year:

2023

Publication Type:

Journal Article

Discipline/Domain:

Genomic Medicine / Medical Ethics

Subdomain/Topic:

Actionability in population genomic screening

Contextual Background:

The paper explores how clinicians define, assess, and operationalize "actionability" in the context of geno

Geographic/Institutional Context:

United States; multiple health systems with varying resources and genomic screening programs.

Target Users/Stakeholders:

Primary care providers, clinical geneticists, genetic counselors, public health genomics program manage

Primary Methodology:

Qualitative interviews (n=35) with purposive and snowball sampling.

Primary Contribution Type:

Empirical qualitative analysis.

General Summary of the Paper

This qualitative study investigates how clinicians—primary care providers, clinical geneticists, and genetic

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Definitions range from narrow ("pathogenic change with known treatment or surveillance saving lives") to

> "Actionable would have to be a truly pathogenic change, for which there is a known treatment or surveil

> "I think of [actionability] really broadly: anything that has the potential, either now or in the future, to mod

---

What Makes Something Actionable

- Strong evidence of pathogenicity and penetrance

- Efficacy, burden, and availability of interventions

- Severity of potential disease

- Potential for life modification, clinical trial enrollment, or psychosocial benefit

- Alignment with patient's values and personal utility

- Institutional capacity to act on the result

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** No formal named framework; draws on ACMG, CDC Tier One, and

- **Methods/Levers:** Variant classification (ClinVar, ClinGen), professional guidelines, institutional polic

- **Operational Steps / Workflow:** Evidence assessment (now vs. later), determination of available interv

- **Data & Measures:** Variant pathogenicity, penetrance, disease severity, trial data, population-level sc

- **Implementation Context:** Varies by health system—resource-rich systems expand scope; resource-li

> "Because we're a safety net hospital… we would return results on the CDC Tier 1 conditions… probabl

> "We don't want to leave patients hanging, because… reality happens before the ideal does." — Genetic

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clarity of variant classification and intervention pathways emphasized.

- **CR (Contextual Relevance):** Yes — tailored to institutional resources and patient population.

- **FE (Feasibility):** Yes — dependent on institutional capacity and follow-up infrastructure.

- **TI (Timeliness):** Partial — tension between acting now vs. waiting for more evidence.

- **EX (Explainability):** Partial — some emphasis on transparency of evidence and interpretation.

- **GA (Goal Alignment):** Yes — decisions reflect health system priorities and patient benefit.

- **Other Dimensions:** Personal utility, psychosocial impact, marketability (for some institutions).

Theoretical or Conceptual Foundations

- ACMG actionability guidelines and secondary findings lists

- CDC Tier One genomic conditions

- Concepts of clinical validity, clinical utility, and personal utility

- Precision medicine vs. evidence-based medicine paradigms

Indicators or Metrics for Actionability

- Evidence level for pathogenicity/penetrance

- Strength of intervention evidence (RCTs for PCPs; mechanistic plausibility for geneticists)

- Severity of disease outcome

- Institutional capacity metrics (follow-up care rates)

Barriers and Enablers to Actionability

- **Barriers:** Lack of consensus on evidence standards; insufficient infrastructure; provider genetics trair

- **Enablers:** Established guidelines (ACMG, CDC Tier One); institutional investment; belief in patient b

---

Relation to Existing Literature

Builds on prior patient-centered studies of actionability by focusing on clinician perspectives; confirms tha…

Summary

Owens et al. (2023) provide a qualitative investigation into how clinicians conceptualize "actionability" in g…

Scores

- **Overall Relevance Score:** 90 — Strong explicit and implicit definitions, systematic features, and clini…
- **Operationalization Score:** 75 — Clear description of decision-making processes and contextual facto…

Supporting Quotes from the Paper

- "[My definition of] actionable would have to be a truly pathogenic change… that impacts a lifetime of me…
- "Anything that has the potential, either now or in the future, to modify either life choices or medical treatr…
- "We don't want to leave patients hanging… reality happens before the ideal does." (p. 6)
- "Because we're a safety net hospital… we would return results on the CDC Tier 1 conditions." (p. 10)

Actionability References to Other Papers

- Berg et al. (2016) — semiquantitative metric for evaluating clinical actionability
- ACMG SF v3.1 (Miller et al., 2022)
- CDC Tier One Genomics Applications
- Lázaro-Muñoz et al. (2017) — subjective judgments in selecting medically actionable genes
- Kohler et al. (2017) — personal utility in genomic testing

Paper Summary

<!--META_START-->

Title: Genomically matched therapy in refractory colorectal cancer according to ESMO Scale for Clinical A…

Authors: Núria Mulet Margalef, Carmen Castillo, Miguel Mosteiro, Xavier Pérez, Susana Aguilar, Fiorella …

DOI: 10.1002/1878-0261.13444

Year: 2023

Publication Type: Journal Article

Discipline/Domain: Oncology

Subdomain/Topic: Precision oncology; colorectal cancer; genomic profiling; clinical actionability

Eligibility: Eligible

Overall Relevance Score: 78

Operationalization Score: 72

Contains Definition of Actionability: Yes (via ESCAT framework)

Contains Systematic Features/Dimensions: Yes (ESCAT levels I–IV)

Contains Explainability: No

Contains Interpretability: Partial (linked to molecular classification)

Contains Framework/Model: Yes (ESCAT classification)

Operationalization Present: Yes

Primary Methodology: Quantitative (retrospective cohort study)

Study Context: Expanded genomic profiling (EGP) for refractory metastatic colorectal cancer (mCRC) pat

Geographic/Institutional Context: Catalan Institute of Oncology and Vall d'Hebron Institute of Oncology, S

Target Users/Stakeholders: Oncologists, molecular tumor boards, clinical trial designers, precision oncol

Primary Contribution Type: Empirical results and application of ESCAT in clinical setting

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Genomically matched therapy in refractory colorectal cancer according to ESMO Scale for Clinical Action

Authors:

Núria Mulet Margalef et al.

DOI:

10.1002/1878-0261.13444

Year:

2023

Publication Type:

Journal Article

Discipline/Domain:

Oncology

Subdomain/Topic:

Precision oncology; colorectal cancer; genomic profiling; clinical actionability

Contextual Background:

The study assesses the feasibility and clinical utility of expanded genomic profiling (EGP) in refractory me

Geographic/Institutional Context:

Catalan Institute of Oncology and Vall d'Hebron Institute of Oncology, Spain.

Target Users/Stakeholders:

Oncologists, molecular tumor boards, clinical trial coordinators, policymakers in precision oncology.

Primary Methodology:

Quantitative – retrospective cohort analysis.

Primary Contribution Type:

Empirical evidence applying ESCAT to real-world mCRC genomic profiling.

General Summary of the Paper

This paper reports on a cohort of 187 heavily pretreated mCRC patients enrolled in an expanded genomi

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is conceptualized through the ESCAT framework, which ranks genomic alterations based on

> "The clinical value according to ESMO Scale for Clinical Actionability of Molecular Targets (ESCAT) cla

> "ESCAT I… validated in clinical trials… ESCAT IV… preclinical data" (Table 1, p. 2)

What Makes Something Actionable

- Validation in prospective clinical trials (ESCAT I)

- Evidence of response in phase I/II or retrospective studies (ESCAT II)

- Validated in other malignancies (ESCAT III)

- Supported only by preclinical data (ESCAT IV)

- Molecular relevance to drug targeting

- Potential inclusion in biomarker-guided clinical trials

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ESCAT (ESMO Scale for Clinical Actionability of Molecular Targets)

- **Methods/Levers:** Classification of genomic alterations; NGS profiling; molecular tumor boards; clinica

- **Operational Steps / Workflow:** Patient selection → FFPE tumor sample → NGS mutation, CNA, fusic

- **Data & Measures:** Prevalence of ESCAT I–IV alterations; trial inclusion rates

- **Implementation Context:** Precision oncology in a comprehensive cancer center

> "EGP programmes in patients with advanced CRC are feasible and identify a subset of patients with po

> "Final inclusion rate in biomarker-guided clinical trials was 2.7%" (p. 2)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — classification provides a clear, evidence-ranked hierarchy of targets.

- **CR (Contextual Relevance):** Yes — alterations are linked to mCRC therapeutic decisions.

- **FE (Feasibility):** Yes — NGS profiling is feasible in reference centers with adequate tumor tissue.

- **TI (Timeliness):** No explicit link.

- **EX (Explainability):** No explicit link.

- **GA (Goal Alignment):** Partial — aim to align profiling with targeted therapy inclusion.

- **Other Dimensions Named by Authors:** Evidence tier, molecular target druggability.

Theoretical or Conceptual Foundations

- ESCAT framework (Mateo et al., 2018) for ranking targets.

- ESMO guidelines on mCRC management and molecular profiling.

Indicators or Metrics for Actionability

- ESCAT category prevalence per patient cohort.

- Percentage inclusion in biomarker-guided trials.

- Mutation prevalence by sidedness and RAS status.

Barriers and Enablers to Actionability

- **Barriers:** Low prevalence of high-tier alterations; trial slot unavailability; sample insufficiency; absenc

- **Enablers:** Centralized high-quality NGS analysis; multidisciplinary molecular boards; established clin

---

Relation to Existing Literature

Aligns with prior reports on low prevalence of high-evidence druggable alterations in mCRC and low trial

---

Summary

The study applies the ESCAT framework to a real-world cohort of refractory mCRC patients undergoing e

---

Scores

- **Overall Relevance Score:** 78 — Strong explicit definition via ESCAT and systematic features, though

- **Operationalization Score:** 72 — Clear application of ESCAT in workflow and measurable outputs, bu

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Supporting Quotes from the Paper

- "The clinical value according to ESMO Scale for Clinical Actionability of molecular Targets (ESCAT) clas

- "EGP programmes in patients with advanced CRC are feasible and identify a subset of patients with pot

- "Final inclusion rate in biomarker-guided clinical trials was 2.7%" (p. 2)

- "Reducing tissue and economical costs… reshaping NGS panels periodically… implementing liquid biop

---

Actionability References to Other Papers

- Mateo J. et al., 2018 — Original ESCAT framework definition.

- Mosele F. et al., 2020 — ESMO NGS recommendations.

- ESMO Clinical Practice Guidelines for mCRC (Cervantes et al., 2023).

Paper Summary

<!--META_START-->

Title: Generic Project Definitions for Improvement of Health Care Delivery: A Case-Based Approach

Authors: Gerard C. Niemeijer, Ronald J. M. M. Does, Jeroen de Mast, Albert Trip, Jaap van den Heuvel

DOI: 10.1097/QMH.0b013e318213e75c

Year: 2011

Publication Type: Journal

Discipline/Domain: Health Care Management / Quality Improvement

Subdomain/Topic: Lean Six Sigma; Process Improvement; Case-Based Reasoning; Health Care Delivery

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit through "actionable knowledge" framing)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (CTQ flowdown + operational definitions; 9 generic templates)

Operationalization Present: Yes

Primary Methodology: Retrospective case-based analysis (Qualitative with quantitative metrics)

Study Context: 271 Lean Six Sigma projects in hospitals (general, teaching, academic) in the Netherlands

Geographic/Institutional Context: Netherlands, Belgium; University Medical Center Groningen, Erasmus N

Target Users/Stakeholders: Hospital managers, project leaders, health care professionals (including nurs

Primary Contribution Type: Case-based templates for defining improvement projects in healthcare deliver

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Generic Project Definitions for Improvement of Health Care Delivery: A Case-Based Approach

Authors:

Gerard C. Niemeijer, Ronald J. M. M. Does, Jeroen de Mast, Albert Trip, Jaap van den Heuvel

DOI:

10.1097/QMH.0b013e318213e75c

Year:

2011

Publication Type:

Journal

Discipline/Domain:

Health Care Management / Quality Improvement

Subdomain/Topic:

Lean Six Sigma; Process Improvement; Case-Based Reasoning; Health Care Delivery Optimization

Contextual Background:

The paper addresses improvement of health care delivery via process optimization, using a large-scale re

Geographic/Institutional Context:

Hospitals in the Netherlands and Belgium (general, teaching, academic hospitals).

Target Users/Stakeholders:

Hospital managers, project leaders, quality improvement teams, nurses, doctors, administrators.

Primary Methodology:

Retrospective qualitative analysis with quantitative operational metrics.

Primary Contribution Type:

Nine generic project definition templates for process improvement.

General Summary of the Paper

This study analyzes 271 Lean Six Sigma process improvement projects from hospitals in the Netherlands

---

Eligibility

Eligible for inclusion: **Yes**

The paper explicitly frames its goal as producing "actionable knowledge" for defining and operationalizing

---

How Actionability is Understood

Actionability is framed as the ability to define improvement projects in a way that enables efficient selectio

> "The purpose of this article is to create actionable knowledge, making the definition of process improve

> "These templates function as exemplars for future process improvement projects, making the selection,

---

What Makes Something Actionable

- Clear linkage between project objectives and organizational strategy

- Explicit operational definitions through CTQ flowdown

- Use of measurable indicators

- Mid-level generality (removing excessive context-specificity)

- Reusability of template structures

- Direct connection to performance dimensions (cost, safety, satisfaction, throughput)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Lean Six Sigma methodology; Case-Based Reasoning (CBR)

- **Methods/Levers:** CTQ flowdown; standard measurement plans; operational definitions; nine generic

- **Operational Steps / Workflow:** Define → Measure → Analyze → Improve → Control (DMAIC); extrac

- **Data & Measures:** Critical-to-Quality (CTQ) indicators linked to metrics such as LOS, resource utiliza

- **Implementation Context:** Hospitals in NL and BE, across multiple departments.

> "The CTQ flowdown results in a measurement plan, which operationalizes a project's objectives." (p. 15

> "We identified 9 generic project definition templates… proposed to serve as exemplars." (p. 155)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Templates and CTQ flowdown explicitly define objectives and metrics.

- **CR (Contextual Relevance):** Yes — Tied to hospital strategy and operational context.

- **FE (Feasibility):** Yes — Focus on measurable and achievable improvements.

- **TI (Timeliness):** Partial — Addresses throughput and waiting time in some templates.

- **EX (Explainability):** Partial — CTQ flowdowns show logical rationale but limited emphasis on interpre

- **GA (Goal Alignment):** Yes — Projects aligned with strategic focal points.

- **Other Dimensions Named by Authors:** Reusability; mid-level generality; evidence-based problem sel

---

Theoretical or Conceptual Foundations

- Lean Six Sigma DMAIC methodology

- Case-Based Reasoning (CBR) from AI

- CTQ flowdown as conceptual linking model

Indicators or Metrics for Actionability

- LOS (Length of Stay)

- Bed occupation rates

- Number of unnecessary units used

- Percentage of missing/unavailable equipment

- Error rates in registration/invoicing

- Resource utilization rates

- Complication/infection rates

Barriers and Enablers to Actionability

- **Barriers:** Context differences across hospitals; risk of uncritical application of templates; local knowle

- **Enablers:** Structured CTQ flowdown; clear linkage to strategy; reusable templates; measurable indic

---

Relation to Existing Literature

Positions contribution as a complement to rule-based Lean Six Sigma methods, adding case-based, mid-

---

Summary

Niemeijer et al. (2011) present a case-based reasoning approach to defining healthcare improvement pro

---

Scores

- **Overall Relevance Score:** 90 — Strong conceptual and practical integration of actionability through e

- **Operationalization Score:** 95 — Highly detailed operational process (DMAIC, CTQ flowdown, metrics

---

Supporting Quotes from the Paper

- "The purpose of this article is to create actionable knowledge, making the definition of process improver

- "These templates function as exemplars for future process improvement projects, making the selection,

- "The CTQ flowdown results in a measurement plan, which operationalizes a project's objectives." (p. 15

- "We identified 9 generic project definition templates… proposed to serve as exemplars." (p. 155)

Actionability References to Other Papers

- De Mast J, Does RJMM, De Koning H. *Lean Six Sigma for Service and Healthcare* (2006)

- Slade S. *Case-based reasoning: a research paradigm* (1991)

- Aamodt A, Plaza E. *Case-based reasoning: foundational issues* (1994)

- De Koning H, De Mast J. *The CTQ flowdown as a conceptual model of project objectives* (2007)

Paper Summary

<!--META_START-->

Title: Big data and technology assessment: research topic or competitor?

Authors: Gernot Rieder, Judith Simon

DOI: https://doi.org/10.1080/23299460.2017.1360718

Year: 2017

Publication Type: Journal Article

Discipline/Domain: Science, Technology, and Society (STS) / Responsible Innovation

Subdomain/Topic: Big Data governance; Technology Assessment (TA); Responsible Research and Innov

Eligibility: Eligible

Overall Relevance Score: 87

Operationalization Score: 75

Contains Definition of Actionability: Yes (implicit, as provision of actionable knowledge in TA and Big Data

Contains Systematic Features/Dimensions: Yes (multiple features tied to actionability such as timeliness,

Contains Explainability: Yes

Contains Interpretability: Partial (discussed via TA's reflexive practices and Big Data's opacity)

Contains Framework/Model: No formal named model, but structured comparative framework TA vs Big D

Operationalization Present: Yes (discussion of methods, practices, and integration possibilities for achiev

Primary Methodology: Conceptual / Review

Study Context: Comparative analysis of TA and Big Data analytics as socio-technical practices

Geographic/Institutional Context: Europe-focused with international references (EU policy, US OTA, globa

Target Users/Stakeholders: Policymakers, TA practitioners, data scientists, civil society, industry stakeho

Primary Contribution Type: Conceptual comparative analysis and recommendations

CL: Yes

CR: Yes

FE: Partial

TI: Yes

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Big data and technology assessment: research topic or competitor?

Authors:

Gernot Rieder, Judith Simon

DOI:

https://doi.org/10.1080/23299460.2017.1360718

Year:

2017

Publication Type:

Journal Article

Discipline/Domain:

Science, Technology, and Society (STS) / Responsible Innovation

Subdomain/Topic:

Big Data governance; Technology Assessment (TA); Responsible Research and Innovation (RRI)

Contextual Background:

The paper examines Big Data not only as a socio-technical phenomenon of interest to TA but also as a p

Geographic/Institutional Context:

Primarily European TA landscape, with references to US (OTA), OECD, and global Big Data policy initiati

Target Users/Stakeholders:

Policy makers, TA practitioners, data scientists, industry actors, civil society organizations.

Primary Methodology:

Conceptual / Review

Primary Contribution Type:

Comparative conceptual framework and normative recommendations.

General Summary of the Paper

The article explores the dual relationship between Big Data and Technology Assessment (TA): as a rese

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the provision of **reliable, relevant, and usable knowledge** to inform political d

> "Providing actionable knowledge and advice for democratic decision-making in cases where the stakes

> "Big Data's key promise… the provision of actionable, future-oriented knowledge" (p. 235)

What Makes Something Actionable

- Timely delivery of knowledge in decision-relevant windows.

- Contextual relevance to stakeholders' needs and policy environments.

- Reflexivity in anticipating future trajectories and their desirability.

- Inclusivity and deliberation to capture diverse perspectives.

- Ability to translate complex socio-technical dynamics into decision guidance.

- Feasibility and implementability of recommendations.

- Transparency/explainability to support trust and legitimacy.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Not a named model, but comparative TA vs Big Data operational mo

- **Methods/Levers:** Multi-, inter-, and transdisciplinary research; participatory foresight; scenario exerci

- **Operational Steps / Workflow:** Problem scoping, multidisciplinary synthesis, participatory engagemen

- **Data & Measures:** Combination of qualitative deliberation outputs, stakeholder inputs, and computat

- **Implementation Context:** Governance of emerging technologies, particularly Big Data, under RRI prin

> "Participatory engagement can be considered a vital element for a more 'anticipatory' and 'reflexive' go

> "Big Data technologies estimate probable future trajectories… rendering the future knowable and its ou

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – actionable advice must be clear and comprehensible to decision-makers.

  > "Providing independent, high-quality knowledge about techno-scientific developments…" (p. 240)

- **CR (Contextual Relevance):** Yes – relevance to stakeholder needs is central in TA and challenged b

- **FE (Feasibility):** Partial – implied in TA's role of offering viable options, but less explicitly tied to feasi

- **TI (Timeliness):** Yes – timely advice is critical in high-stakes contexts; Big Data's real-time capabilitie

- **EX (Explainability):** Yes – TA's transparency vs Big Data's opacity (algorithmic black boxes) discuss

- **GA (Goal Alignment):** Partial – alignment with societal goals is implicit in RRI framing.

- **Other Dimensions Named by Authors:** Inclusivity, reflexivity, sustainability, public trust.

Theoretical or Conceptual Foundations

- Responsible Research and Innovation (RRI) framework.

- Anticipatory governance (Guston 2014).

- Technology futures (Grunwald 2012).

- Post-normal science (Funtowicz & Ravetz 1993).

Indicators or Metrics for Actionability

No formal quantitative indicators; emphasis on qualitative criteria such as inclusivity, reflexivity, contextua

Barriers and Enablers to Actionability

- **Barriers:** Big Data opacity; overreliance on algorithmic objectivity; displacement of deliberative proce

- **Enablers:** Integration of computational analytics into TA; multidisciplinary collaboration; genuine part

Relation to Existing Literature

Positions Big Data as a socio-technical phenomenon with both epistemic and political implications, extend

Summary

This paper provides a conceptual comparison of TA and Big Data as providers of actionable, future-orien

Scores

- **Overall Relevance Score:** 87 – Strong conceptualization of actionability (explicitly named, linked to T

- **Operationalization Score:** 75 – Detailed discussion of methods and integration pathways, though no

Supporting Quotes from the Paper

- "Providing actionable knowledge and advice for democratic decision-making…" (p. 236)

- "Big Data's key promise… the provision of actionable, future-oriented knowledge" (p. 235)

- "Participatory engagement… vital element for more 'anticipatory' and 'reflexive' governance…" (p. 237)

- "Big Data technologies… rendering the future knowable and its outcome optimizable" (p. 239)

Actionability References to Other Papers

- Funtowicz & Ravetz (1993) – post-normal science.

- Guston (2014) – anticipatory governance.

- Grunwald (2012) – technology futures.

- Abelson et al. (2003) – public deliberation design.

Paper Summary

Geographic/Institutional Context: Bilbao City Council, Bilbao Ekintza (city development agency), Basque

Target Users/Stakeholders: Policymakers, entrepreneurs, researchers, quadruple helix actors

Primary Contribution Type: Conceptual framework with operationalization

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Facilitation of Entrepreneurial Discovery Processes by Policymakers: An Actionable Definition of

Authors: Miren Estensoro, Miren Larrea

DOI: https://doi.org/10.1007/s13132-022-00906-1

Year: 2023

Publication Type: Journal

Discipline/Domain: Regional Development / Innovation Policy

Subdomain/Topic: Smart Specialisation Strategies (S3/S4), Entrepreneurial Discovery Processes (ED

Contextual Background: Focuses on how policymakers can operationally facilitate EDPs within S3/S4

Geographic/Institutional Context: Bilbao City Council and Bilbao Ekintza, Basque Country, Spain.

Target Users/Stakeholders: Policymakers, entrepreneurs, quadruple helix actors, researchers.

Primary Methodology: Action Research

Primary Contribution Type: Actionable conceptual framework.

General Summary of the Paper

The paper develops and tests an actionable framework for the roles of policymakers in facilitating Entrepr

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the ability for policymakers' roles in EDPs to be **directly implementable** in pr

> "Our contribution is oriented… not exclusively in the theoretical… but also in how they can address its c

> "We connect… the roles with the dilemmas, efforts, tensions, needs, power issues, challenges, risks…

What Makes Something Actionable

- Roles are **linked to concrete actions**, decisions, and facilitation techniques.

- Grounded in **real-world dilemmas** and capacity gaps policymakers face.

- Context-specific learning integrated into process design.

- Inclusion of **both substance knowledge** (technical field) and **process knowledge** (trust, shared vis

- Built-in **monitoring and systematisation** for ongoing improvement.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Six Roles of Facilitative Policymakers in EDPs.

- **Methods/Levers:** Action research co-generation; facilitation techniques; collaborative governance; st

- **Operational Steps / Workflow:**

  1. Choose field to explore

  2. Learn about the field

  3. Engage stakeholders

  4. Attract outside knowledge

  5. Develop shared vision

  6. Monitor, evaluate, systematise

- **Data & Measures:** Process indicators, documentation of lessons learned, stakeholder engagement r

- **Implementation Context:** Bilbao's Futurable pilot EDP on wearable technologies.

> "Participants considered that the first step… was to have a clear definition of their roles…" (p. 1332)

> "Monitoring systems should include process indicators… and systematisation of experiences…" (p. 133

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear role definitions and functions.

- **CR (Contextual Relevance):** Yes — tailored to Bilbao's specific EDP context.

- **FE (Feasibility):** Yes — tested in practice with policymakers.

- **TI (Timeliness):** Partial — emphasis on continuous adaptation but less on strict time-bound delivery.

- **EX (Explainability):** Partial — roles explained, but mechanisms sometimes implicit.

- **GA (Goal Alignment):** Yes — aligned with S3/S4 innovation and collaborative governance goals.

- **Other Dimensions Named by Authors:** Trust-building, conflict management, integration of external kr

Theoretical or Conceptual Foundations

- Smart Specialisation and EDP literature (Foray et al., 2012; Lepore & Spigarelli, 2018)

- Facilitation theory (Costamagna & Larrea, 2018)

- Collaborative governance (Ansell & Gash, 2008)

- Action research methodology.

Indicators or Metrics for Actionability

- Process indicators (number of workshops, participant diversity)

- Evidence of stakeholder collaboration

- Recorded lessons learned and systematisation outputs.

Barriers and Enablers to Actionability

- **Barriers:** Lack of policymaker facilitation skills; limited knowledge of technical domains; power-shari

- **Enablers:** Embedded capability-building; action research support; proactive stakeholder engagemen

Relation to Existing Literature

Positions itself as filling the gap between conceptual EDP role descriptions and practical operationalisatic

Summary

This paper operationalises the facilitation role of policymakers in Entrepreneurial Discovery Processes wi

Scores

- **Overall Relevance Score:** 92 — Strong conceptual clarity on actionability, fully integrated with opera

- **Operationalization Score:** 95 — Detailed, field-tested workflow with concrete, replicable steps and cl

Supporting Quotes from the Paper

- "We connect… the roles with the dilemmas, efforts, tensions, needs… which increase their actionability.

- "Participants considered that the first step… was to have a clear definition of their roles…" (p. 1332)

- "Monitoring systems should include process indicators… and systematisation of experiences…" (p. 133

- "The knowledge… has a more actionable nature than the theoretical concepts…" (p. 1338)

Actionability References to Other Papers

- Foray et al. (2012); Lepore & Spigarelli (2018); Costamagna & Larrea (2018); Ansell & Gash (2008); Pe

Paper Summary

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicit, tied to usefulness of explanations for simulation refinem

Contains Systematic Features/Dimensions: Yes (implicit through explanation properties such as specificit

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (aggregation mechanism for explanations)

Operationalization Present: Yes

Primary Methodology: Conceptual + Simulation-based demonstration

Study Context: Traffic simulation with cognitive BDI agents

Geographic/Institutional Context: TU Clausthal, Germany; Victoria University of Wellington, New Zealand

Target Users/Stakeholders: Simulation developers, researchers, possibly decision-makers using simulati

Primary Contribution Type: Methodological framework and proof-of-concept

CL: Yes

CR: Yes

FE: Partial

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Explaining Aggregate Behaviour in Cognitive Agent Simulations Using Explanation

Authors:

Tobias Ahlbrecht, Michael Winikoff

DOI:

https://doi.org/10.1007/978-3-030-30391-4_8

Year:

2019

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence, Multi-Agent Systems

Subdomain/Topic:

Cognitive agents, Explainable AI, Agent-based simulation

Contextual Background:

The paper is situated in the context of developing and refining cognitive agent-based simulations, where

Geographic/Institutional Context:

TU Clausthal (Germany) and Victoria University of Wellington (New Zealand)

Target Users/Stakeholders:

Simulation developers, AI researchers, decision analysts relying on simulation outcomes

Primary Methodology:

Conceptual development with simulation-based illustration (traffic scenario)

Primary Contribution Type:

A method for aggregating individual agent explanations to interpret collective behaviour in simulations

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General Summary of the Paper

This paper presents a method for obtaining actionable understanding of aggregate behaviour in cognitive

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper implicitly defines actionability as the capacity of aggregated explanations to support simulation

> "...obtain useful (and actionable) insight into the behaviour of agent-based simulation..." (p. 129)

> "...this link would become less used. This hypothesis was therefore tested by re-running the simulation.

What Makes Something Actionable

- Specific to the scenario and time frame (not just generic dynamics)

- Links aggregate behaviour to identifiable causal factors

- Supports hypothesis testing via simulation modification

- Enables detection of unintended or unrealistic behaviours

- Relates factors directly to agent decision logic and environment conditions

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Aggregated Explanation Mechanism

- **Methods/Levers:** Logging explanatory factors in agent code; aggregating factors across relevant age

- **Operational Steps / Workflow:**

  1. Pose a query about aggregate behaviour

  2. Identify relevant agents

  3. Generate individual explanations using BDI-based mechanism

  4. Aggregate factors and count frequencies

  5. Filter and interpret most common factors

  6. Optionally run counterfactual simulations to test hypotheses

- **Data & Measures:** Counts of explanatory factor occurrences per agent for a given query

- **Implementation Context:** Applied to a simplified traffic simulation with road network, bridges, and rou

> "A straightforward way to aggregate explanations is to count the occurrences of all explanatory factors

> "...we might modify c (or the parameters) and re-run the simulation to check..." (p. 138)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Explanations are explicitly linked to decision logic, making cause understandabl

  > "...preferred the road from 1 to 2 over the road from 1 to 3 because there was traffic..." (p. 137)

- **CR (Contextual Relevance):** Yes — Explanations are scenario- and query-specific.

- **FE (Feasibility):** Partial — Hypotheses can be tested via simulation reruns.

- **TI (Timeliness):** Partial — Insights are generated in sync with simulation analysis.

- **EX (Explainability):** Yes — Mechanism based on BDI folk psychology concepts.

- **GA (Goal Alignment):** Partial — Explanations align with agents' stated goals (e.g., reach destination)

- **Other Dimensions Named by Authors:** Testability, specificity, frequency-based relevance.

Theoretical or Conceptual Foundations

- BDI model of cognitive agents

- Folk psychology explanation concepts (Malle, 2004)

- Explanation frameworks in AI (Winikoff et al., 2018)

Indicators or Metrics for Actionability

- Frequency of explanatory factors across relevant agents

- Presence of causal, scenario-specific factors in top-ranked list

- Change in observed behaviour after modifying implicated conditions

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Barriers and Enablers to Actionability

- **Barriers:** Noise from less relevant factors; difficulty in filtering relevant factors; unrealistic agent logic

- **Enablers:** Structured logging of decision rationale; aggregation process; human-in-the-loop query ref

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Relation to Existing Literature

Builds on work explaining single-agent behaviour (e.g., Winikoff et al., 2018) and extends to independent

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Summary

The authors propose a method to explain aggregate behaviour in cognitive agent-based simulations by a

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Scores

- **Overall Relevance Score:** 87 — Strong implicit definition of actionability tied to explanation usefulnes

- **Operationalization Score:** 85 — Detailed step-by-step process with implemented case study; robust

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Supporting Quotes from the Paper

- "...obtain useful (and actionable) insight into the behaviour of agent-based simulation..." (p. 129)

- "A straightforward way to aggregate explanations is to count the occurrences of all explanatory factors...

- "...preferred the road from 1 to 2 over the road from 1 to 3 because there was traffic..." (p. 137)

- "This hypothesis was therefore tested by re-running the simulation..." (p. 140)

Actionability References to Other Papers

- Malle, B.F. (2004) — Folk psychology framework for explanation

- Winikoff et al. (2018) — Single-agent explanation mechanism

- Harbers et al. (2010) — Early proposal for explaining collective behaviour

Paper Summary

<!--META_START-->

Title: Evidential Reasoning Approach for Predicting Popularity of Instagram Posts

Authors: L. Rivadeneira, I. Loor

DOI: 10.1109/ACCESS.2024.3510637

Year: 2024

<!--META_END-->

Title:

Evidential Reasoning Approach for Predicting Popularity of Instagram Posts

Authors:

L. Rivadeneira, I. Loor

DOI:

10.1109/ACCESS.2024.3510637

Year:

2024

Publication Type:

Journal

Discipline/Domain:

Computer Science / Social Media Analytics

Subdomain/Topic:

Predictive modelling of social media engagement using evidential reasoning

Contextual Background:

The paper evaluates the MAKER (Maximum likelihood evidential reasoning) approach for predicting Insta

Geographic/Institutional Context:

United States (Harvard University) and United Kingdom (University of Oxford).

Target Users/Stakeholders:

Social media managers, marketing teams, academic communication officers, influencers, and analytics re

Primary Methodology:

Quantitative — predictive modelling with machine learning algorithms (MAKER, DT, SVM, KNN).

Primary Contribution Type:

Methodological framework and empirical validation.

General Summary of the Paper

The study applies the MAKER algorithm, grounded in evidential reasoning, to predict the popularity of Ins

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Implicitly defined as the capacity of model outputs to guide content strategy decisions through transparen

> "MAKER's interpretability means that it provides actionable insights… help users make informed decisi

> "While this study focuses on proposing a model for prediction purposes, it is essential to translate these

What Makes Something Actionable

- Ability to identify specific post attributes correlated with higher popularity.

- Transparency in reasoning (weights, reliabilities, evidence interdependencies).

- Interpretability enabling justification of model outputs.

- Context-specific feature patterns rather than one-size-fits-all rules.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** MAKER (Maximum likelihood evidential reasoning).

- **Methods/Levers:** Integration of textual and visual post features into interpretable evidential reasoning

- **Operational Steps / Workflow:** Data collection → Preprocessing → Feature extraction (textual/visual)

- **Data & Measures:** Median likes threshold, emoji/hashtag/mention counts, sentiment, season, image

- **Implementation Context:** Official university Instagram accounts.

> "This transparency yields an interpretable model… examining the relationship between output and inpu

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — outputs are interpretable and grounded in transparent parameter assignment.

- **CR (Contextual Relevance):** Yes — feature influence patterns are institution-specific.

- **FE (Feasibility):** Partial — focuses on achievable content adjustments but omits resource constraints

- **TI (Timeliness):** No explicit link.

- **EX (Explainability):** Yes — full traceability of decision process.

- **GA (Goal Alignment):** Partial — aligns model with engagement improvement goals but not broader c

- **Other Dimensions Named by Authors:** Transparency, interpretability, data completeness handling.

Theoretical or Conceptual Foundations

- Evidential reasoning (ER) rule, based on Dempster-Shafer theory.

- Transparency and interpretability in AI (Rudin, 2019).

- Multimodal content engagement theory from prior social media analytics research.

Indicators or Metrics for Actionability

- Precision, recall, F1-score, AUC, RMSE (used to assess predictive reliability).

- Likelihood scores for evidence patterns.

Barriers and Enablers to Actionability

- **Barriers:** API restrictions limiting automated data collection; exclusion of non-picture post formats; lin

- **Enablers:** MAKER's robustness to incomplete data; integration of multimodal features; transparent n

Relation to Existing Literature

Extends prior predictive models for Instagram by addressing interpretability and transparency gaps. Unlik

Summary

The paper demonstrates how MAKER—a maximum likelihood evidential reasoning approach—can delive

Scores

- **Overall Relevance Score:** 78 — Strong implicit definition of actionability and systematic feature linka

- **Operationalization Score:** 85 — Clear step-by-step operational process tied directly to achieving acti

Supporting Quotes from the Paper

- "MAKER's interpretability means that it provides actionable insights… help users make informed decisio

- "Transparency yields an interpretable model… examining the relationship between output and input vari

- "It is essential to translate these findings into actionable strategies for decision-makers…" (p. 13)

- "Harvard's popular posts typically show positive or neutral sentiment… Oxford's popular posts… use mo

Actionability References to Other Papers

- Rudin, C. (2019) on interpretable models vs. black-box AI.

- Yang & Xu (2017) on inferential modelling with data in evidential reasoning.

- Aramendia-Muneta et al. (2021) on key image attributes for engagement.

Paper Summary

<!--META_START-->

Title: Enhancing Student Digital Skills: Adopting an Ecosystemic School Analytics Approach

Authors: Stylianos Sergis, Demetrios G. Sampson, Michail Giannakos

DOI: 10.1109/ICALT.2017.87

Year: 2017

Publication Type: Conference

Discipline/Domain: Educational Technology / Learning Analytics

Subdomain/Topic: School Analytics, Digital Skills, Educational Decision-Making

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (implicit and explicit in decision-making framing)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Quantitative (fsQCA), Conceptual-empirical

Study Context: K-12 schools, cross-European dataset

Geographic/Institutional Context: Europe (2995 schools; EU Commission study)

Target Users/Stakeholders: School leaders, policymakers, educators

Primary Contribution Type: Methodological and empirical model for deriving actionable school improveme

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Enhancing Student Digital Skills: Adopting an Ecosystemic School Analytics Approach

Authors:

Stylianos Sergis, Demetrios G. Sampson, Michail Giannakos

DOI:

10.1109/ICALT.2017.87

Year:

2017

Publication Type:

Conference

Discipline/Domain:

Educational Technology / Learning Analytics

Subdomain/Topic:

School Analytics, Digital Skills, Educational Decision-Making

Contextual Background:

Focuses on enabling K-12 school leaders to use *School Analytics*—a layered, ecosystemic data framew

Geographic/Institutional Context:

European cross-national dataset from an EU Commission survey.

Target Users/Stakeholders:

School leaders, educational policymakers, teacher professional development coordinators.

Primary Methodology:

Quantitative (fsQCA), supported by conceptual framework building.

Primary Contribution Type:

Development and validation of a School Analytics ecosystemic factor model + demonstration of fsQCA fo

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General Summary of the Paper

The paper introduces a School Analytics approach integrating an ecosystemic factor model with fuzzy-se

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is conceptualized as *the translation of school ecosystem data into targeted, evidence-base

> "[…] translate these analyses to specific remedying actions for targeted improvement" (p. 1)

> "[…] inform leaders on the specific school areas to improve to meet their goal" (p. 2)

What Makes Something Actionable

- Derived from **holistic, multi-layered data** spanning micro, meso, and macro school levels.

- **Configurable causality**: recognition that multiple different factor combinations can lead to the same o

- **Alignment with desired goals** (here: improving digital skills).

- Clear identification of **specific factor configurations** present/absent that produce the target outcome.

- Context-sensitive applicability—school-specific diagnosis.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** School Analytics Ecosystemic Factor Model + fsQCA-based decisio

- **Methods/Levers:** Collect data across school layers; calibrate factors into fuzzy sets; run fsQCA to ide

- **Operational Steps / Workflow:**

  1. Define factor model (macro, meso, micro).

  2. Collect and validate data (survey-based, Likert-scale).

  3. Calibrate into fuzzy sets.

  4. Run fsQCA to extract configurations linked to high digital skills.

  5. Interpret results for leadership decision-making.

- **Data & Measures:** 4-point Likert survey items; principal attitudes, teacher practices, equipment, cultu

- **Implementation Context:** EU schools, ICT integration and digital skills development.

> "[…] outline which configurations of the factors… can explain high levels of students' digital skills, and t

> "[…] eight distinct configurations… lead to high students' digital skills" (p. 4)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – model clearly identifies factor relationships and configurations.

  > "[…] outline… specific school areas to improve" (p. 2)

- **CR (Contextual Relevance):** Yes – configurations are context-specific to school ecosystem profiles.

- **FE (Feasibility):** Partial – feasibility is implied through practical applicability of identified configuration

- **TI (Timeliness):** No explicit reference.

- **EX (Explainability):** Yes – causal configurations and underlying factors are transparent.

- **GA (Goal Alignment):** Yes – directly tied to improving student digital skills.

Other Dimensions Named by Authors: Coverage and consistency metrics to assess robustness.

Theoretical or Conceptual Foundations

- School Analytics conceptual framework (Sergis & Sampson, 2016).

- Extensive Digital Competence (EDC) model.

- ICT Competence Profiling framework.

- Configurational theory via fsQCA (Ragin, 2000, 2008).

Indicators or Metrics for Actionability

- fsQCA coverage (analogous to R^2).

- fsQCA consistency (adequacy of causal configuration).

- Reliability & validity measures (Cronbach's alpha, AVE).

Barriers and Enablers to Actionability

- **Barriers:** Lack of integrated data systems; absence of certain enabling factors (e.g., ICT equipment,

- **Enablers:** Strong leadership attitudes; positive teacher attitudes; supportive culture; sufficient ICT inf

---

Relation to Existing Literature

Positions itself as moving beyond descriptive ICT adoption studies to **prescriptive, configuration-based

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Summary

This paper offers a robust, empirically validated method for converting multi-level school data into actiona

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Scores

- **Overall Relevance Score:** 85 – Strong implicit definition of actionability tied to targeted decision-mak

- **Operationalization Score:** 80 – Provides a detailed process and tool (fsQCA) to derive actionable ins

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Supporting Quotes from the Paper

- "[…] translate these analyses to specific remedying actions for targeted improvement" (p. 1)

- "[…] outline which configurations… can explain high levels of students' digital skills" (p. 2)

- "The fsQCA analysis revealed 8 distinct configurations… which can lead to high students' digital skills" (

- "[…] inform leaders on the specific school areas to improve to meet their goal" (p. 2)

Actionability References to Other Papers

- Sergis & Sampson (2016) – School Analytics framework.

- Aesaert et al. (2015) – EDC model.

- Ragin (2000, 2008) – fsQCA methodology.

- Pappas et al. (2016, 2015) – fsQCA applications in other domains.

Paper Summary

<!--META_START-->

Title: Enhancing Enterprise Decisions through Organizational Data Mining

Authors: Hamid R. Nemati, Christopher D. Barko

DOI: 10.1080/08874417.2002.11647049

Year: 2002

Publication Type: Journal

Discipline/Domain: Information Systems / Data Mining

Subdomain/Topic: Organizational Data Mining (ODM), Decision Support, CRM

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: No

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Conceptual framing + industry survey)

Study Context: Industry adoption of Organizational Data Mining across sectors

Geographic/Institutional Context: USA; University of North Carolina at Greensboro

Target Users/Stakeholders: Executives, decision-makers, analysts, CRM managers

Primary Contribution Type: Conceptual elaboration + empirical industry survey

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Enhancing Enterprise Decisions through Organizational Data Mining

Authors: Hamid R. Nemati, Christopher D. Barko

DOI: 10.1080/08874417.2002.11647049

Year: 2002

Publication Type: Journal

Discipline/Domain: Information Systems / Data Mining

Subdomain/Topic: Organizational Data Mining (ODM), Decision Support, CRM

Contextual Background: Focuses on how ODM transforms raw data into actionable knowledge to imp

Geographic/Institutional Context: USA; UNC Greensboro

Target Users/Stakeholders: Executives, analysts, CRM specialists, decision-makers in customer-cent

Primary Methodology: Mixed methods (conceptual explanation + survey of 106 industry practitioners)

Primary Contribution Type: Conceptual framing of ODM + empirical industry findings

General Summary of the Paper

This paper defines Organizational Data Mining (ODM) as the strategic use of data mining tools to transfo

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is understood as the transformation of data into "valuable actionable knowledge" that directly

> "Organizational Data Mining (ODM) is defined as leveraging data mining (DM) tools and technologies t

> "ODM… enhances an organization's ability to identify, analyze, and implement an optimal decision." (p.

What Makes Something Actionable

- Timeliness and relevance of information

- Value to decision-making (strategic advantage)

- Contextual fit to organizational goals and environment

- Clarity and interpretability for decision-makers

- Feasibility of implementation (supported by resources, technology, and processes)

- Derived from integrated sense-making, knowledge-making, and decision-making processes

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Organizational Data Mining (ODM) methodology (integrating sense-

- **Methods/Levers:** CRM systems, customer intelligence tools, OLAP, market-basket analysis, clusteri

- **Operational Steps / Workflow:** Data acquisition → data integration (internal + external) → analytical

- **Data & Measures:** Customer profiles, transaction data, demographic data, web clickstreams, financia

- **Implementation Context:** Cross-industry; especially banking, e-commerce, retail, healthcare

> "Sense-making… Knowledge-making… Decision-making… are integrated in a cascade of information s

> "The most critical factors… are garnering the sponsorship of an executive… and preparing the data for

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Information must be interpretable for decision-makers.

- **CR (Contextual Relevance):** Yes — Insights must be relevant to organizational environment and goa

- **FE (Feasibility):** Yes — Requires appropriate infrastructure and resources.

- **TI (Timeliness):** Partial — Mentioned as critical for competitive advantage but not fully elaborated.

- **EX (Explainability):** Partial — Techniques like decision trees aid interpretability; ANN less so.

- **GA (Goal Alignment):** Yes — Must support strategic competitive advantage.

- **Other Dimensions Named by Authors:** Integration with organizational knowledge management proce

Theoretical or Conceptual Foundations

- Choo's *Knowing Organization* model (sense-making, knowledge-making, decision-making)

- Knowledge management literature

- Decision support system theory

Indicators or Metrics for Actionability

- ROI via cost/benefit analysis

- Customer retention rates

- Profitability improvements

- Market share changes

- Project outcome vs. expectations

Barriers and Enablers to Actionability

- **Barriers:** Underutilization of external data, low data warehouse integration, insufficient knowledge inf

- **Enablers:** Executive sponsorship, quality data preparation, CRM integration, multiple ODM techniqu

Relation to Existing Literature

The paper builds on knowledge management theory and prior data mining studies but shifts emphasis to

Summary

Nemati and Barko (2002) conceptualize ODM as the deliberate application of data mining within a knowle

Scores

- **Overall Relevance Score:** 85 — Strong explicit definition of actionability, multiple systematically linke

- **Operationalization Score:** 80 — Clear process and tools described; lacks fully formalized framework

Supporting Quotes from the Paper

- "ODM… enhancing the decision-making process by transforming data into valuable actionable knowledg

- "Sense-making… Knowledge-making… Decision-making… integrated… to the selection and implement

- "The most critical factors… are garnering the sponsorship of an executive… and preparing the data for

- "Underutilization of… external data… presents an opportunity to improve the quality, consistency, and re

Actionability References to Other Papers

- Choo, C.W. *The Knowing Organization*

- Groth, R. *Data Mining: A Hands-on Approach for Business Professionals*

- Banasiewicz, A.D. (2000) "Keeping Your Best Customers Through Brand Loyalty"

Paper Summary

<!--META_START-->

Title: Efficient Action Extraction with Many-to-Many Relationship between Actions and Features

Authors: Jianfeng Du, Yong Hu, Charles X. Ling, Ming Fan, Mei Liu

DOI: N/A

Year: 2011

Publication Type: Conference

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Actionable Knowledge Discovery, Cost-Minimal Action Set Extraction

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental

Study Context: Software project risk management

Geographic/Institutional Context: China, Canada, USA

Target Users/Stakeholders: Decision-makers in business/risk management

Primary Contribution Type: Methodological innovation for efficient extraction of actionable knowledge

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: No

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Efficient Action Extraction with Many-to-Many Relationship between Actions and Features

Authors:

Jianfeng Du, Yong Hu, Charles X. Ling, Ming Fan, Mei Liu

DOI:

N/A

Year:

2011

Publication Type:

Conference

Discipline/Domain:

Computer Science / Artificial Intelligence

Subdomain/Topic:

Actionable Knowledge Discovery, Cost-Minimal Action Set Extraction

Contextual Background:

The paper addresses the gap in actionable knowledge discovery methods that typically assume a one-to-

Geographic/Institutional Context:

China, Canada, USA (authors' affiliations)

Target Users/Stakeholders:

Business decision-makers, software risk managers, data mining practitioners

Primary Methodology:

Conceptual framework with algorithmic design and experimental evaluation

Primary Contribution Type:

Methodological approach for efficiently extracting cost-minimal, actionable strategies from classifiers (spe

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General Summary of the Paper

This paper proposes a method for extracting actionable knowledge—specifically, cost-minimal action sets

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is understood as the capacity to identify and apply a set of actions that transforms an instand

> "Actions… render a state of an instance into a preferred state, where a state is represented by feature v

> "A preferred action set… is a set of actions that render the state of the instance into a preferred state…

What Makes Something Actionable

- Ability to transform a current state into a preferred state according to a classifier

- Consideration of execution cost (minimization)

- Accommodation of many-to-many action-feature relationships

- Contextual applicability to real-world problems (e.g., risk mitigation)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Cost-minimal action set extraction via Linear Pseudo-Boolean Optim

- **Methods/Levers:** Encode classifier and action execution as rules; transform into SAT and pseudo-Bo

- **Operational Steps / Workflow:**

  1. Encode classification and action execution rules

  2. Formulate as a Linear Pseudo-Boolean Optimization problem

  3. Use pseudo-Boolean solvers to find minimal-cost action set

- **Data & Measures:** Costs associated with each action; preferred class output by classifier

- **Implementation Context:** Demonstrated with random forest in software project risk management

> "…propose an efficient method to extract a cost-minimal action set from a classifier… based on… SAT

> "…reduction… to an extended SAT problem, called Linear Pseudo-Boolean Optimization problem…" (p

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Actions and states must be explicitly representable via features and rules

- **CR (Contextual Relevance):** Yes — Problem framed in real-world decision contexts like risk manage

- **FE (Feasibility):** Yes — Feasibility framed in terms of execution cost minimization

- **TI (Timeliness):** No — Not explicitly discussed

- **EX (Explainability):** No — No emphasis on model or action explainability

- **GA (Goal Alignment):** Yes — Goal defined as reaching a preferred classification outcome at minimal

- **Other Dimensions Named by Authors:** Scalability, efficiency

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Theoretical or Conceptual Foundations

- Domain-driven actionable knowledge discovery (Cao et al., 2007)

- Action extraction from decision trees (Yang et al., 2007)

- Random forest classification (Breiman, 2001)

- Pseudo-Boolean optimization (Manquinho & Roussel, 2006)

Indicators or Metrics for Actionability

- Minimal total execution cost of actions

- Achievement of preferred classification outcome

Barriers and Enablers to Actionability

- **Barriers:**

  - Inefficiency of generate-and-test methods with large action sets

  - Complexity of many-to-many action-feature relationships

- **Enablers:**

  - Encoding into SAT/optimization frameworks

  - Use of pseudo-Boolean solvers for scalability

Relation to Existing Literature

Extends prior actionable knowledge discovery research by removing the one-to-one restriction between a

---

Summary

The paper introduces a method for efficiently extracting cost-minimal action sets from classifiers when ac

---

Scores

- **Overall Relevance Score:** 82 — Strong implicit definition and identification of key features (cost mini

- **Operationalization Score:** 90 — Highly detailed and computationally implementable method with exp

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Supporting Quotes from the Paper

- "Actions… render a state of an instance into a preferred state…" (p. 1)

- "A preferred action set… is a set of actions that render the state… into a preferred state…" (p. 1)

- "…propose an efficient method to extract a cost-minimal action set from a classifier…" (p. 2)

- "…reduction… to an extended SAT problem, called Linear Pseudo-Boolean Optimization problem…" (p.

Actionability References to Other Papers

- Cao et al., 2007 — Domain-driven actionable knowledge discovery

- Yang et al., 2007 — Action extraction from decision trees

- Breiman, 2001 — Random forests

- Manquinho & Roussel, 2006 — Pseudo-Boolean solvers

Paper Summary

<!--META_START-->

Title: Efficacy of molecularly targeted agents given in the randomised trial SHIVA01 according to the ESM

Authors: A. Moreira, J. Masliah-Planchon, C. Callens, S. Vacher, C. Lecerf, M. Frelaut, E. Borcoman, N. T

DOI: https://doi.org/10.1016/j.ejca.2019.09.001

Year: 2019

Publication Type: Journal

Discipline/Domain: Oncology / Precision Medicine

Subdomain/Topic: Clinical actionability, molecularly targeted agents, ESCAT scale, SHIVA01 trial

Eligibility: Eligible

Overall Relevance Score: 75

Operationalization Score: 70

Contains Definition of Actionability: Yes (explicit via ESCAT framework)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (ESCAT)

Operationalization Present: Yes

Primary Methodology: Quantitative (retrospective analysis of trial data)

Study Context: Retrospective classification of molecular alterations from SHIVA01 trial according to ESC/

Geographic/Institutional Context: Institut Curie, France

Target Users/Stakeholders: Clinical oncologists, precision medicine researchers, trial designers

Primary Contribution Type: Empirical evaluation of actionability framework (ESCAT) applied to existing tri

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Efficacy of molecularly targeted agents given in the randomised trial SHIVA01 according to the ESMO Sc

Authors:

A. Moreira et al.

DOI:

https://doi.org/10.1016/j.ejca.2019.09.001

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Oncology / Precision Medicine

Subdomain/Topic:

Clinical actionability, molecularly targeted agents, ESCAT scale, SHIVA01 trial

Contextual Background:

The paper re-evaluates the SHIVA01 precision medicine trial by applying the European Society for Medic

Geographic/Institutional Context:

Institut Curie, France

Target Users/Stakeholders:

Oncologists, trial designers, policy-makers in precision oncology

Primary Methodology:

Quantitative retrospective analysis

Primary Contribution Type:

Empirical reassessment of trial outcomes through an actionability framework

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General Summary of the Paper

The SHIVA01 trial compared molecularly targeted agents (MTAs) selected by a treatment algorithm base

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is explicitly framed through ESCAT as the degree of clinical evidence supporting the use of a

> "ESCAT… defined criteria to prioritise molecular alterations (MAs) to select anticancer drugs." (p. 202)

> "We… classified [MAs] according to the ESCAT by assessing the level of evidence in the literature." (p.

What Makes Something Actionable

- Supported by clinical trial evidence in the same tumour type (higher ESCAT tier)

- Type of alteration must match that shown to confer benefit (mutation vs amplification)

- Evidence from other tumour types (lower tier) less predictive

- Preclinical or in silico evidence can guide classification when clinical data is lacking

- Drug-target affinity and specificity influence actionability beyond ESCAT tier

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ESMO Scale for Clinical Actionability of molecular Targets (ESCAT)

- **Methods/Levers:** Literature review for evidence of benefit of MA-targeted MTA

- **Operational Steps / Workflow:** Identify MA → Search same-cancer evidence → If absent, search cro

- **Data & Measures:** PFS, OS, ESCAT tier classification, patient demographics

- **Implementation Context:** Retrospective re-analysis of SHIVA01 patient data

> "For each MA, we… searched for clinical trials… in the same tumour type… then… other tumour types.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — ESCAT tiers are explicitly defined and applied

- **CR (Contextual Relevance):** Yes — Same vs other tumour type evidence distinguishes tiers

- **FE (Feasibility):** Yes — Relates to whether drugs are usable in context based on evidence strength

- **TI (Timeliness):** No — Not addressed directly

- **EX (Explainability):** Partial — ESCAT rationale is given, but biological mechanisms less discussed

- **GA (Goal Alignment):** Partial — Implicit alignment with precision oncology goals

- **Other Dimensions Named by Authors:** Type of alteration specificity, drug-target affinity

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Theoretical or Conceptual Foundations

- ESCAT framework (Mateo et al., 2018)

- Prior actionability scales (OncoKB, AMP/ASCO/CAP guidelines)

Indicators or Metrics for Actionability

- ESCAT tier assignment (I–V)

- Clinical endpoints: PFS, OS stratified by tier

Barriers and Enablers to Actionability

- **Barriers:** Low ESCAT tier prevalence, misclassification of alteration type, lack of tumour-type-specific

- **Enablers:** In vitro/in vivo functional validation, drug specificity, comprehensive molecular profiling

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Relation to Existing Literature

Positions ESCAT as the latest in a series of actionability frameworks and demonstrates its application to

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Summary

This paper retrospectively applies the ESCAT actionability framework to the SHIVA01 trial, showing that

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Scores

- **Overall Relevance Score:** 75 — Strong conceptual clarity through ESCAT, explicit linkage of feature
- **Operationalization Score:** 70 — Detailed process for applying ESCAT tiers; however, not a prospect

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Supporting Quotes from the Paper

- "[ESCAT] defined criteria to prioritise molecular alterations (MAs) to select anticancer drugs." (p. 202)
- "Most MAs… were shown to improve outcomes in other tumour types (tier IIIA). Worst outcome… in tier
- "For each MA, we… searched for clinical trials… in the same tumour type… other tumour types… precli
- "This highlights the crucial importance of the type of alteration beyond the gene and/or signalling pathwa

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Actionability References to Other Papers

- Mateo J et al., 2018 — ESCAT
- Chakravarty D et al., 2017 — OncoKB
- Li MM et al., 2017 — AMP/ASCO/CAP guidelines
- Meric-Bernstam F et al., 2015 — Decision support framework

Paper Summary

<!--META_START-->

Title: Dissecting Generalizability and Actionability of Disease-Associated Genes From 20 Worldwide Ethn

Authors: Emile R. Chimusa, Shatha Alosaimi, Christian D. Bope

DOI: 10.3389/fgene.2022.835713

Year: 2022

Publication Type: Journal Article

Discipline/Domain: Genetics / Genomic Medicine

Subdomain/Topic: Clinical actionability of disease-associated genes, population genomics, genetic divers

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 85

Contains Definition of Actionability: Yes (explicit and comparative definitions)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (comparative genomic analysis framework)

Operationalization Present: Yes

Primary Methodology: Quantitative (Population genetics analysis using WGS/WES data)

Study Context: Genetic diversity and actionability of disease-associated genes across 20 ethnolinguistic

Geographic/Institutional Context: Global, with emphasis on African populations (Bantu, Khoesan) and con

Target Users/Stakeholders: Genomic researchers, clinical geneticists, public health practitioners, policy n

Primary Contribution Type: Empirical study with conceptual framing

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Dissecting Generalizability and Actionability of Disease-Associated Genes From 20 Worldwide Ethnolingu

Authors:

Emile R. Chimusa, Shatha Alosaimi, Christian D. Bope

DOI:

10.3389/fgene.2022.835713

Year:

2022

Publication Type:

Journal Article

Discipline/Domain:

Genetics / Genomic Medicine

Subdomain/Topic:

Clinical actionability of disease-associated genes, population genomics, genetic diversity

Contextual Background:

The study evaluates whether "actionable" genes identified by the American College of Medical Genetics a

Geographic/Institutional Context:

Global genomic datasets, particularly African Genome Variation Project and 1000 Genomes Project; stro

Target Users/Stakeholders:

Genomic researchers, clinical geneticists, healthcare policymakers, precision medicine initiatives

Primary Methodology:

Quantitative population genomics analysis using large-scale whole-exome/whole-genome sequencing

Primary Contribution Type:

Empirical genomic analysis with conceptual framing on actionability and generalizability

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General Summary of the Paper

The paper investigates the distribution and clinical actionability of disease-associated genetic variants ac

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed through multiple authoritative definitions:

- ClinGen: clinically prescribed interventions effective for prevention, reduced clinical burden, delayed ons

- 100,000 Genomes Project: variants that, if identified pre-symptomatically, can significantly prevent or m

- Also operationally tied to classification processes involving ethical approval, annotation databases, path

> "Actionability as clinically prescribed interventions to a genetic disorder that is effective for prevention, l

> "…variants that can significantly prevent (or result in illness…if identified before symptoms become app

---

What Makes Something Actionable

- Clinically preventable or mitigable before symptom onset

- Severity and clinical significance of condition

- Established interventions exist with proven benefit

- Variant classification supported by evidence and ethical review

- Population-specific allele frequency and pathogenicity evidence

- Functional impact predictions from multiple annotation tools

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Comparative population genomics actionability assessment

- **Methods/Levers:** Joint variant calling across global ethnolinguistic groups; functional annotation via A

- **Operational Steps / Workflow:**

  1. Identify disease-associated and ACMG actionable genes from curated databases (GWAS Catalog, D

  2. Extract relevant SNPs from WGS/WES datasets

  3. Perform quality control, phasing, and haplotype inference

  4. Analyze genetic structure (PCA), pathogenicity proportions, derived allele frequencies, MAF distributi

  5. Compare patterns across 20 ethnolinguistic groups

- **Data & Measures:** SNP counts, proportion pathogenic, derived allele proportion, heterozygosity met

- **Implementation Context:** Global, cross-population genomic comparatives

> "…combine many annotation pipelines during filtering and prioritization of mutations…" (p. 2)

> "…proportion of pathogenic variants within ACG-specific genes from ethnolinguistic cultural groups…" (

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear variant classification processes are necessary (p. 2)

- **CR (Contextual Relevance):** Yes — population-specific allele frequency and disease relevance critic

- **FE (Feasibility):** Yes — intervention must be possible and effective (p. 2)

- **TI (Timeliness):** Partial — early/pre-symptomatic detection mentioned but not deeply operationalize

- **EX (Explainability):** Yes — reliance on multiple annotation tools and known pathogenicity databases

- **GA (Goal Alignment):** Yes — alignment with improved global healthcare equity and personalized me

- **Other Dimensions Named by Authors:** Transferability/generalizability, genetic diversity, pathogenicity

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Theoretical or Conceptual Foundations

- ClinGen actionability framework

- 100,000 Genomes Project protocol

- ACMG actionable gene list standards

- Population genomics concepts of genetic diversity, derived allele frequencies, linkage disequilibrium

---

Indicators or Metrics for Actionability

- Proportion of pathogenic variants per gene in a population
- Minor allele frequency (MAF) distributions
- Proportion of derived alleles
- Gene-specificity of SNP frequency
- Observed vs. expected heterozygosity

Barriers and Enablers to Actionability

- **Barriers:**
  - Limited transferability of ACMG actionable gene lists to African populations
  - Knowledge bias in existing variant databases toward non-African populations
  - Variation in derived allele distributions affecting predictive validity
- **Enablers:**
  - High-quality population-specific genomic data
  - Multi-tool annotation consensus
  - Cross-population comparative frameworks

Relation to Existing Literature

Builds on prior work highlighting disparities in actionable variant frequencies between European and Afric

---

Summary

The study critically assesses the global generalizability of ACMG's actionable gene list and known diseas

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Scores

- **Overall Relevance Score:** 90 — strong explicit and implicit conceptual framing, comparative definitio
- **Operationalization Score:** 85 — detailed methodology linking genetic metrics to actionability, though

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Supporting Quotes from the Paper

- "Actionability as clinically prescribed interventions… effective for prevention, lowered clinical burden…"
- "…classification of variants to be clinically actionable… can only emerge during the process of seeking
- "…high genetic diversity in the present actionable and known disease-associated genes… suggesting th
- "…combine many annotation pipelines during filtering and prioritization…" (p. 2)

- "…proportion of pathogenic variants within ACG-specific genes…" (p. 4)

Actionability References to Other Papers

- Hunter et al., 2016 — ClinGen actionability assessment protocol

- Bope et al., 2019 — in silico mutation prediction challenges in African genomes

- Dorschner et al., 2016; Amendola et al., 2015 — disparities in actionable variants between populations

- ACMG-73 actionable genes list

Paper Summary

<!--META_START-->

Title: Development of the Patient Education Materials Assessment Tool (PEMAT): A new measure of und

Authors: Sarah J. Shoemaker, Michael S. Wolf, Cindy Brach

DOI: 10.1016/j.pec.2014.05.027

Year: 2014

Publication Type: Journal

Discipline/Domain: Health Communication / Health Literacy

Subdomain/Topic: Patient education materials evaluation

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Instrument development and validation (Mixed Methods)

Study Context: Development of an assessment tool for evaluating understandability and actionability of p

Geographic/Institutional Context: USA (multi-institutional, including Abt Associates, Northwestern Univers

Target Users/Stakeholders: Health professionals, patient educators, lay users, policymakers

Primary Contribution Type: Measurement instrument (PEMAT)

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: No

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Development of the Patient Education Materials Assessment Tool (PEMAT): A new measure of understa

Authors:

Sarah J. Shoemaker, Michael S. Wolf, Cindy Brach

DOI:

10.1016/j.pec.2014.05.027

Year:

2014

Publication Type:

Journal

Discipline/Domain:

Health Communication / Health Literacy

Subdomain/Topic:

Patient education materials evaluation

Contextual Background:

The study responds to the U.S. National Action Plan to Improve Health Literacy, which calls for health an

Geographic/Institutional Context:

USA; collaboration among Abt Associates, Northwestern University, and AHRQ

Target Users/Stakeholders:

Health professionals, patient educators, clinicians, medical librarians, lay assessors, policymakers

Primary Methodology:

Instrument development and validation (Mixed Methods — expert panel review, reliability testing, consum

Primary Contribution Type:

Measurement instrument (PEMAT)

General Summary of the Paper

This paper presents the development and validation of the Patient Education Materials Assessment Tool

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the extent to which patient education materials enable consumers "to identify w

> "Patient education materials are actionable when consumers … can identify what they can do based on

---

What Makes Something Actionable

- Clearly identifies at least one specific action the user can take.

- Addresses the user directly when describing actions.

- Breaks down actions into manageable, explicit steps.

- Provides tangible tools (e.g., checklists, planners).

- Offers simple calculation instructions where relevant.

- Explains how to use visual or data elements to take action.

- Uses visual aids to facilitate acting on instructions.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Patient Education Materials Assessment Tool (PEMAT)

- **Methods/Levers:** Expert panel review, iterative reliability testing, untrained rater usability, consumer

- **Operational Steps / Workflow:**

  1. Rate each material against defined PEMAT items (scales for understandability and actionability).

  2. Calculate percentage score per scale (excluding N/A items).

  3. Compare against a threshold (≥70% considered actionable).

- **Data & Measures:** Inter-rater reliability (kappa, Gwet's AC1), Cronbach's alpha, consumer comprehe

- **Implementation Context:** Designed for use by both professionals and laypersons without training, ap

> "The material clearly identifies at least one action the user can take." (p. 398)

> "The material breaks down any action into manageable, explicit steps." (p. 398)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — common language, active voice, visual cues.

- **CR (Contextual Relevance):** Yes — aligns instructions with user needs and capacities.

- **FE (Feasibility):** Yes — explicit steps, tangible tools, manageable instructions.

- **TI (Timeliness):** No explicit link.

- **EX (Explainability):** Partial — explains use of visuals and data for action.

- **GA (Goal Alignment):** No explicit link.

- **Other Dimensions Named by Authors:** Use of visual aids to facilitate action.

Theoretical or Conceptual Foundations

- U.S. National Action Plan to Improve Health Literacy (accuracy, accessibility, actionability).

- Health literacy frameworks recognizing both individual skills and systemic demands.

- Prior patient education material suitability and comprehension assessment tools.

Indicators or Metrics for Actionability

- PEMAT actionability score (0–100 scale).

- Threshold of ≥70% considered actionable (provisional, not empirically fixed).

Barriers and Enablers to Actionability

- **Barriers:** Use of jargon/medical terms without definition; lack of captions for visuals; complex instruct

- **Enablers:** Clear visual aids with captions; direct user address; provision of tools and checklists; brea

---

Relation to Existing Literature

The PEMAT addresses gaps in prior instruments by:

1. Measuring actionability explicitly.

2. Validating with untrained raters and consumers.

3. Applying to both print and audiovisual materials.

4. Demonstrating psychometric robustness (internal and external consistency).

Summary

Shoemaker et al. (2014) advance the field of health literacy by developing the PEMAT, the first rigorously

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Scores

- **Overall Relevance Score:** 95 — Clear, explicit definition of actionability, robust conceptual framing, c

- **Operationalization Score:** 90 — Detailed operational steps, scoring system, and validated use cases

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Supporting Quotes from the Paper

- "Patient education materials are actionable when consumers … can identify what they can do based on

- "The material clearly identifies at least one action the user can take." (p. 398)

- "The material breaks down any action into manageable, explicit steps." (p. 398)

- "The material provides a tangible tool (e.g., menu planners, checklists) whenever it could help the user t

---

Actionability References to Other Papers

- U.S. Department of Health and Human Services. National Action Plan to Improve Health Literacy (2010

- Kaphingst et al. (2012) — Health Literacy INDEX.

- CDC Clear Communication Index (2013).

Paper Summary

<!--META_START-->

Title: Development of actionable quality indicators and an action implementation toolbox for appropriate a

Authors: Marlot C. Kallen, Marie-Jose Roos-Blom, Dave A. Dongelmans, Jeroen A. Schouten, Wouter T.

DOI: https://doi.org/10.1371/journal.pone.0207991

Year: 2018

Publication Type: Journal Article

Discipline/Domain: Medical Informatics / Intensive Care Medicine

Subdomain/Topic: Antibiotic stewardship, quality indicators, ICU performance improvement

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes (modified-RAND Delphi, Flottorp et al. checklist)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (systematic literature review + expert consensus + framework-base

Study Context: Adult ICU antibiotic use quality measurement and improvement

Geographic/Institutional Context: Netherlands, multicenter ICU context

Target Users/Stakeholders: ICU clinicians, microbiologists, pharmacists, stewardship teams, policy make

Primary Contribution Type: Development of actionable quality indicators + implementation toolbox

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Development of actionable quality indicators and an action implementation toolbox for appropriate antibio

Authors:

Marlot C. Kallen, Marie-Jose Roos-Blom, Dave A. Dongelmans, Jeroen A. Schouten, Wouter T. Gude, Ev

DOI:

https://doi.org/10.1371/journal.pone.0207991

Year:

2018

Publication Type:

Journal Article

Discipline/Domain:

Medical Informatics / Intensive Care Medicine

Subdomain/Topic:

Antibiotic stewardship, ICU quality improvement, actionable indicators

Contextual Background:

The paper addresses the challenge of inappropriate antibiotic use in intensive care units (ICUs), a driver

Geographic/Institutional Context:

Netherlands, involving 15 Dutch ICU experts across university and non-university hospitals.

Target Users/Stakeholders:

ICU physicians, clinical microbiologists, pharmacists, infection control teams, policy makers.

Primary Methodology:

Mixed Methods — modified-RAND Delphi consensus with systematic literature review, guideline extractio

Primary Contribution Type:

Framework and tool development (quality indicators + action implementation toolbox).

General Summary of the Paper

This study develops a set of four actionable quality indicators (QIs) and one quantity metric to guide and i

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is explicitly defined as an indicator offering **clear direction to improve performance in daily p

> "Actionability, meaning that the indicator offers clear direction to improve performance in daily practice,

> "Indicators with a median score… on actionability were defined as potentially suitable" (p. 3)

What Makes Something Actionable

- Relevance to patient outcomes or healthcare efficiency.

- Clear direction for quality improvement.

- Feasibility of data collection (preferably from routine EHR/PDMS data).

- Defined target values (100% for process indicators).

- Specificity to ICU context where possible.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Modified-RAND Delphi procedure; Flottorp et al. checklist for barrier

- **Methods/Levers:** Expert consensus, literature & guideline synthesis, barrier identification, strategy m

- **Operational Steps / Workflow:**

  1. Identify potential indicators (expert input + literature + guidelines).

  2. Online rating for relevance & actionability.

  3. Face-to-face consensus refining and feasibility assessment.

  4. Develop detailed indicator definitions, numerators, denominators, and targets.

  5. Build toolbox: map barriers to strategies using checklist.

- **Data & Measures:** EHR/PDMS-derived metrics, process & structure measures, DOT for benchmarki

- **Implementation Context:** Dutch ICU registry (NICE) integration for feedback dashboards.

> "Targets for indicator 1, 2 and 3 were set at 100%, which is a theoretical optimum…" (p. 7)

> "…toolbox displays the suggested improvement strategies associated with the selected barriers." (p. 9)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — indicators have explicit operational definitions and targets.

- **CR (Contextual Relevance):** Yes — ICU-specific, clinically grounded.

- **FE (Feasibility):** Yes — prioritization of electronically extractable data.

- **TI (Timeliness):** Partial — targets set for frequency (e.g., biannual meetings) but less emphasis on ra

- **EX (Explainability):** Partial — rationale provided but no deep interpretability framework.

- **GA (Goal Alignment):** Yes — aligned with stewardship goals and resistance reduction.

- **Other Dimensions:** Reliability (implicitly required), Benchmarking value (explicit for quantity metric).

Theoretical or Conceptual Foundations

- OECD and AHRQ criteria for good quality indicators.

- Flottorp et al. framework for determinants of practice.

- Tailored intervention literature (Wensing et al.).

Indicators or Metrics for Actionability

- **Indicators:**

  1. Blood cultures before empirical therapy (100%).

  2. Therapeutic drug monitoring within 48h for vancomycin/aminoglycosides (100%).

  3. Surveillance cultures if SDD/SOD applied (100%).

  4. Biannual ICU-microbiology meetings on resistance (≥2/year).

- **Quantity Metric:** DOT per 100 patient-days or admissions (no fixed target).

Barriers and Enablers to Actionability

- **Barriers:** Inadequate local guidelines, insufficient familiarity with protocols, poor ICU team communic

- **Enablers:** Standardized protocols, interdisciplinary meetings, educational materials, EHR integration

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Relation to Existing Literature

The study builds on ICU quality measurement literature but distinguishes itself by **explicitly integrating a

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Summary

This study delivers a rigorously developed, ICU-specific set of four actionable quality indicators and one b

---

Scores

- **Overall Relevance Score:** 92 — Strong explicit definition of actionability, clear criteria, ICU-specific c

- **Operationalization Score:** 95 — Detailed process, measurable targets, integrated barrier-strategy to

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Supporting Quotes from the Paper

- "Actionability, meaning that the indicator offers clear direction to improve performance in daily practice…

- "Targets for indicator 1, 2 and 3 were set at 100%…" (p. 7)

- "…toolbox displays the suggested improvement strategies associated with the selected barriers." (p. 9)

Actionability References to Other Papers

- Flottorp SA et al., 2013 — Determinants of practice checklist.

- OECD, 2006; AHRQ, 2011 — Criteria for quality indicators.

- Wensing M et al., 2011; 2010 — Tailored implementation for chronic diseases and overcoming barriers.

- van den Bosch CM et al., 2014; 2016 — Antibiotic treatment indicators.

Paper Summary

<!--META_START-->

Title: Development of Actionable Insights for Regulating Students' Collaborative Writing of Scientific Texts

Authors: Christian Hoffmann, Nadine Mandran, Cédric d'Ham, Sébastien Rebaudo, Mohamed Anis Hadd

DOI: https://doi.org/10.1007/978-3-031-16290-9_47

Year: 2022

Publication Type: Conference Paper

Discipline/Domain: Learning Analytics / Educational Technology

Subdomain/Topic: Collaborative Writing, Teacher Dashboards, Educational Collaboration Analytics

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Contains Definition of Actionability: Yes (via Jørnø & Gynther, 2018 and Martinez-Maldonado et al., 2021

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes

Contains Framework/Model: Yes (Mapping "From Clicks to Constructs")

Operationalization Present: Yes

Primary Methodology: Design-Based Research (Iterative User-Centered Design)

Study Context: Web-based science learning environment (LabNbook) for collaborative writing of scientific

Geographic/Institutional Context: Univ. Grenoble Alpes (France), IMT Atlantique (France)

Target Users/Stakeholders: Teachers in secondary and higher education

Primary Contribution Type: Indicators and visualizations for actionable insights in collaborative writing

CL: Yes

CR: Yes

FE: No

TI: No

EX: Partial

GA: No

Reason if Not Eligible: N/A

<!--META_END-->

Title: Development of Actionable Insights for Regulating Students' Collaborative Writing of Scientific T

Authors: Christian Hoffmann, Nadine Mandran, Cédric d'Ham, Sébastien Rebaudo, Mohamed Anis H

DOI: https://doi.org/10.1007/978-3-031-16290-9_47

Year: 2022

Publication Type: Conference Paper

Discipline/Domain: Learning Analytics / Educational Technology

Subdomain/Topic: Collaborative Writing, Teacher Dashboards, Educational Collaboration Analytics

Contextual Background: The study focuses on supporting teachers in monitoring and regulating stude

Geographic/Institutional Context: Univ. Grenoble Alpes, CNRS, LIG, France; IMT Atlantique, LABSTIC

Target Users/Stakeholders: Teachers (secondary and higher education) using OLEs for science educ

Primary Methodology: Design-Based Research (iterative, user-centered design with interviews, focus

Primary Contribution Type: Development of computational indicators and visualizations for CW action

General Summary of the Paper

The paper develops a set of computationally calculable indicators and visualizations to provide teachers v

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable insights are defined (via Jørnø & Gynther, 2018) as "data that allows a corrective procedure, o

> "The challenge for designers of LADs is to provide teachers with actionable group insights defined… as

> "They emphasize the role of a clear 'mapping from low-level data to higher-order constructs…'" (p. 535)

What Makes Something Actionable

- Clear mapping from trace data to meaningful educational constructs

- Relevance to teacher goals (e.g., assessing collaboration strategies)

- Understandable by the intended user (teacher)

- Presented in a way that supports immediate pedagogical decisions

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Mapping "From Clicks to Constructs"

- **Methods/Levers:** Use of educational sub-constructs (symmetry in action, territorial functioning) deriv

- **Operational Steps / Workflow:**

  1. Collect authorship, timestamp, and version data

  2. Calculate indicators (turn taking, writing time, contribution scores, cowriting score)

  3. Visualize indicators in teacher-friendly timelines and panels

  4. Teachers interpret in context to diagnose collaboration strategy

- **Data & Measures:** Words added (difflib), editor changes, sentence-level overlap detection

- **Implementation Context:** LabNbook platform in science education

> "Our analytics are based on… symmetry in action and territorial functioning… translated… into computa

> "Visualization… allows a teacher to get a wealth of information about how the report was co-constructe

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Simplicity and clear indicator definitions stressed (p. 540)

- **CR (Contextual Relevance):** Yes — Indicators tied directly to collaborative writing processes (p. 535

- **FE (Feasibility):** No explicit link

- **TI (Timeliness):** No explicit link

- **EX (Explainability):** Partial — Mapping framework provides interpretability, but some computational s

- **GA (Goal Alignment):** No explicit link

- **Other Dimensions Named by Authors:** Complementarity of indicators, avoidance of aggregation

Theoretical or Conceptual Foundations

- Jørnø & Gynther's definition of actionable insights

- Martinez-Maldonado et al.'s collaboration analytics model (five-step mapping)

- CSCW constructs: symmetry in action (Dillenbourg, 1999), territorial functioning (Larsen-Ledet & Korsga

Indicators or Metrics for Actionability

- Turn taking (number of editor changes)

- Writing time (active editing time in 30s windows)

- Contribution scores (words added)

- Cowriting score (percentage of sentences modified by multiple authors)

Barriers and Enablers to Actionability

- **Barriers:** Over-aggregation of indicators, complex visualizations reducing interpretability

- **Enablers:** Iterative teacher feedback, complementary indicators, simple visualizations, on-demand d

Relation to Existing Literature

Builds on CSCW collaborative writing strategy distinctions (summative vs integrative), extends Martinez-M

Summary

The authors present a design-based research approach to developing actionable insights for regulating s

Scores

- **Overall Relevance Score:** 82 — Strong conceptual link to actionability, with clear definitions and dim

- **Operationalization Score:** 90 — Comprehensive explanation of how to calculate, visualize, and interp

Supporting Quotes from the Paper

- "[Actionable insights]… 'data that allows a corrective procedure, or feedback loop…'" (p. 535)

- "They emphasize the role of a clear 'mapping from low-level data to higher-order constructs…'" (p. 535)

- "Our analytics are based on… symmetry in action and territorial functioning…" (p. 537)

- "Visualization… allows a teacher to get a wealth of information about how the report was co-constructed

Actionability References to Other Papers

- Jørnø & Gynther (2018) — Definition of actionable insights

- Martinez-Maldonado et al. (2021) — Collaboration analytics model

- Dillenbourg (1999) — Symmetry in action

- Larsen-Ledet & Korsgaard (2019) — Territorial functioning in collaborative writing

Paper Summary

Year: 2021

Publication Type: Journal

Discipline/Domain: Public Health / Health Communication

Subdomain/Topic: COVID-19 dashboards, performance intelligence, public reporting

Eligibility: Eligible

Overall Relevance Score: 87

Operationalization Score: 78

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Descriptive assessment + expert appraisal)

Study Context: Dutch COVID-19 government dashboard development and adaptation over pandemic pha

Geographic/Institutional Context: Netherlands / Ministry of Health, Welfare and Sport

Target Users/Stakeholders: Policymakers, general public, public health experts

Primary Contribution Type: Empirical case study with conceptual framing

CL: Yes

CR: Yes

FE: Partial

TI: Yes

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Development and Actionability of the Dutch COVID-19 Dashboard: Descriptive Assessment and Expert A

Authors:

Véronique L. L. C. Bos, Tessa Jansen, Niek S. Klazinga, Dionne S. Kringos

DOI:

10.2196/31161

Year:

2021

Publication Type:

Journal

Discipline/Domain:

Public Health / Health Communication

Subdomain/Topic:

COVID-19 dashboards, performance intelligence, public reporting

Contextual Background:

Examines the development of the Dutch government's COVID-19 dashboard from June 2020 to January

Geographic/Institutional Context:

Netherlands / Ministry of Health, Welfare and Sport

Target Users/Stakeholders:

Policymakers, general public, public health experts

Primary Methodology:

Mixed Methods (Descriptive assessment + expert appraisal)

Primary Contribution Type:

Empirical case study with conceptual framing

General Summary of the Paper

This study investigates the evolution of the Dutch COVID-19 dashboard, assessing its actionability throug

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the potential of a dashboard to inform decision-making by being:

- **Fit for purpose**: meeting a specific information need.

- **Fit for use**: delivering the right information to the right audience at the right time, in an understandabl

> "Information can be actionable only if it is fit for purpose and fit for use." (p. 2)

> "Actionability refers to a dashboard's potential to inform decision making by way of providing informatio

---

What Makes Something Actionable

- Knowing the audience and their needs

- Managing type, volume, and flow of information

- Clear data sources and methods

- Linking time trends to policy

- Providing data "close to home"

- Disaggregation into relevant subgroups

- Storytelling and visual cues

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Seven common features of highly actionable dashboards (Ivankovi█

- **Methods/Levers:** Descriptive monitoring, actionability scoring, reflection meetings with dashboard de

- **Operational Steps / Workflow:** Iterative adaptation, feedback integration, thematic navigation, indicat

- **Data & Measures:** Epidemiological indicators, health system metrics, behavioral surveys, sewage te

- **Implementation Context:** Netherlands, government-led pandemic monitoring tool

> "The dashboard has been designed for… high-frequency (daily) updates…" (p. 7)

> "Transparency of data was maximized by making it largely available as open source." (p. 7)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Efforts to explain indicators; news-like items for public understanding.

- **CR (Contextual Relevance):** Yes — Geographic and thematic tailoring, audience shift to public.

- **FE (Feasibility):** Partial — Constraints due to data access, privacy, and resources.

- **TI (Timeliness):** Yes — Daily updates, responsive to pandemic phases.

- **EX (Explainability):** Yes — Narratives and visual cues to aid interpretation.

- **GA (Goal Alignment):** Partial — Aligned with public health monitoring goals, but not fully integrated v

- **Other Dimensions Named by Authors:** Transparency, granularity, equity focus (through subgroup da

---

Theoretical or Conceptual Foundations

- Lasswell's Model of Communication (1948)

- Performance intelligence in health

- WHO pandemic monitoring framework (public health, health system, behavioral, socioeconomic)

Indicators or Metrics for Actionability

- Availability of disaggregation

- Indicator variety (epidemiological, health system, socioeconomic)

- Navigation and usability features

- Timeliness of updates

Barriers and Enablers to Actionability

- **Barriers:**

  - Limited access to neighborhood-level data

  - Privacy constraints on granular data

  - Lack of integrated socioeconomic and ethnicity data

- **Enablers:**

  - Open-source data

  - Political commitment to transparency

  - Ongoing public understanding research

Relation to Existing Literature

Builds on Ivankovi■ et al. (2021) framework for actionable COVID-19 dashboards, adapting it to the Dutc

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Summary

The Dutch COVID-19 dashboard transitioned from a policy-focused monitoring tool to a public-facing com

---

Scores

- **Overall Relevance Score:** 87 — Strong conceptual clarity, clear criteria, and framework application t

- **Operationalization Score:** 78 — Provides a structured approach to achieving actionability with practi

---

Supporting Quotes from the Paper

- "Actionability refers to a dashboard's potential to inform decision making by way of providing informatior

- "Seven common features… knowing the audience… managing the type, volume… linking time trends to

- "Transparency of data was maximized by making it largely available as open source." (p. 7)

- "Two of the four key components advised by WHO… were still missing: indicators of available capacity.

Actionability References to Other Papers

- Ivankovi■ et al. (2021) – Features Constituting Actionable COVID-19 Dashboards

- Barbazza et al. (2021) – Actionability of healthcare performance indicators

- WHO (2020) – Pandemic transition monitoring framework

Paper Summary

<!--META_START-->

Title: Design of Information and Warfare Analytics using MapReduce and Machine Learning

Authors: Pallaw Kumar Mishra

DOI: n/a

Year: 2017

Publication Type: Conference Paper

Discipline/Domain: Defense Informatics / Military Data Science

Subdomain/Topic: Warfare analytics, big data, actionable intelligence, MapReduce, social network analys

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 88

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + System Design

Study Context: Development of an integrated information and warfare analytics system for military decisio

Geographic/Institutional Context: India / Defence Research and Development Organisation (DRDO)

Target Users/Stakeholders: Military decision-makers, defense analysts, cyber security teams, intelligence

Primary Contribution Type: Conceptual framework and system design proposal

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

Title:

Design of Information and Warfare Analytics using MapReduce and Machine Learning

Authors:

Pallaw Kumar Mishra

DOI:

n/a

Year:

2017

Publication Type:

Conference Paper

Discipline/Domain:

Defense Informatics / Military Data Science

Subdomain/Topic:

Warfare analytics, big data, actionable intelligence, MapReduce, social network analysis

Contextual Background:

The paper addresses the growing need for real-time, data-driven decision support in modern warfare, lev

Geographic/Institutional Context:

India / Defence Research and Development Organisation (DRDO)

Target Users/Stakeholders:

Military decision-makers, defense analysts, cyber security teams, intelligence agencies

Primary Methodology:

Conceptual + System Design

Primary Contribution Type:

Conceptual framework and system design proposal

General Summary of the Paper

The paper proposes a comprehensive "Information and Warfare Analytics System" to provide meaningful

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper frames actionability as the ability of the system to provide **real-time, contextual, and predictiv

> "Real time quantitative measure of warfare scenario is an essential input to top decision maker for unde

> "...provide meaningful and real-time actionable insight." (Abstract)

What Makes Something Actionable

- Integration of multi-source, heterogeneous data (battlefield, cyber, social)

- Use of predictive models and metrics tailored to warfare contexts

- Contextualization of raw data into threat posture, vulnerabilities, and operational readiness

- Real-time processing and alerting to anticipate events

- Feasibility through scalable, distributed computing infrastructure

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Information and Warfare Analytics System

- **Methods/Levers:** Big data processing via Spark MapReduce; MLlib for scalable machine learning; in

- **Operational Steps / Workflow:**

  1. Data generation & collection from multiple military, cyber, and open sources

  2. Preprocessing via ETL and Big Data Toolbox

  3. Distributed processing & analytics via Spark

  4. Application of statistical, ML, and SNA algorithms

  5. Computation of warfare metrics

  6. Visualization and decision support output

- **Data & Measures:** GIS, battlefield exercises, simulations, MASINT, HUMINT, OSINT; conventional v

- **Implementation Context:** Military decision support in both active conflict and peacetime intelligence r

> "...integration of Data Mining, Social Network Analysis, statistical and analytics techniques..." (Section I

> "...develop comprehensive set of warfare metrics." (Abstract)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Outputs must be interpretable to top decision makers.

- **CR (Contextual Relevance):** Yes — Contextualization of multi-domain data into decision-ready insigh

- **FE (Feasibility):** Yes — Emphasis on scalable, commodity-hardware-based cluster solutions.

- **TI (Timeliness):** Partial — Near real-time capability mentioned but not exhaustively defined.

- **EX (Explainability):** Partial — Models' logic partially described; domain-specific metrics aid interpreta

- **GA (Goal Alignment):** Yes — Explicit aim to support military strategic and tactical objectives.

- **Other Dimensions Named by Authors:** Predictive ability, resilience to data quality issues, multi-doma

---

Theoretical or Conceptual Foundations

- Network Centric Warfare (NCW)

- Information Age Combat Models

- Graph Theory for SNA

- Lanchester and Adaptive Dynamic Models for combat

- CVSS vulnerability metrics for cyber warfare

Indicators or Metrics for Actionability

- Conventional warfare: OLI, WEI, Lanchester, Adaptive Dynamic, Situational Force Strength

- Cyber warfare: Base, Temporal, Environmental metrics; probability of attack; system vulnerability; threa

- Social network: Centrality, Density, Diameter, Prestige, Sentiment, Topic Value, Scale Shift

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Barriers and Enablers to Actionability

- **Barriers:** Data heterogeneity, incomplete/missing data, sensor inaccuracies, cross-vendor incompati

- **Enablers:** Distributed computing (Spark MapReduce), data preprocessing toolkit, integration of ML/S

Relation to Existing Literature

The paper builds on practical military analytics cases (e.g., NATO's use of Twitter for intelligence, electro

---

Summary

The paper conceptualizes a comprehensive architecture for military decision support that operationalizes

---

Scores

- **Overall Relevance Score:** 90 — Strong, integrated conceptualization of actionability, with explicit link

- **Operationalization Score:** 88 — Detailed framework and workflow; some aspects (timeliness, explair

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Supporting Quotes from the Paper

- "...provide meaningful and real-time actionable insight." (Abstract)

- "Real time quantitative measure of warfare scenario is an essential input to top decision maker..." (Abstr

- "...develop comprehensive set of warfare metrics." (Abstract)

- "...integration of Data Mining, Social Network Analysis, statistical and analytics techniques..." (Section II

Actionability References to Other Papers

- NATO social media intelligence collection (Ackerman, 2011)

- CVSS vulnerability scoring (First.org, 2015)

- Social Network Analysis theory (McCulloh et al., 2013)

- Lanchester and Adaptive Dynamic Models (Jaiswal, 1997)

Paper Summary

<!--META_START-->

Title: Defining and Conceptualizing Actionable Insight: A Conceptual Framework for Decision-centric Ana

Authors: Shiang-Yen Tan, Taizan Chan

DOI: n/a

Year: 2015

Publication Type: Conference Paper

Discipline/Domain: Information Systems

Subdomain/Topic: Data Analytics, Decision Support, Problem Solving

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (HIVE framework)

Operationalization Present: Yes

Primary Methodology: Conceptual/Theoretical Development

Study Context: Decision-centric data analytics

Geographic/Institutional Context: Queensland University of Technology, Australia

Target Users/Stakeholders: Data analysts, decision makers, system designers

Primary Contribution Type: Conceptual framework and definition

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Defining and Conceptualizing Actionable Insight: A Conceptual Framework for Decision-centric Analytics

Authors:

Shiang-Yen Tan, Taizan Chan

DOI:

n/a

Year:

2015

Publication Type:

Conference Paper

Discipline/Domain:

Information Systems

Subdomain/Topic:

Data Analytics, Decision Support, Problem Solving

Contextual Background:

The paper addresses the lack of a systematic, theory-driven definition of "actionable insight" in data analy

Geographic/Institutional Context:

Queensland University of Technology, Australia

Target Users/Stakeholders:

Data analysts, decision makers, system designers

Primary Methodology:

Conceptual/Theoretical Development

Primary Contribution Type:

Conceptual framework and definition

General Summary of the Paper

This paper proposes a theory-driven, multi-component definition of actionable insight for decision-centric

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable insight is defined as:

> "A cohesive set of understandings about the problem situation based on prognostic insights derived fro

It is conceptualized as reasoning artefacts gained through the analytics process, contextualized, internali

What Makes Something Actionable

- Derived from integrating analytic, synergic, and prognostic insights.

- Contextualized to the user's objectives, constraints, and domain.

- Involves internalization of results into mental models.

- Supports confident, informed decision making for problem solving.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** HIVE Framework

- **Methods/Levers:** Hierarchical insight layering, integration of analytic results with soft evidence, situat

- **Operational Steps / Workflow:**

  1. Derive **analytic insights** from data queries/analysis.

  2. Synthesize into **synergic insight** via chains of arguments and situation models.

  3. Generate hypotheses and predict future states for **prognostic insight**.

- **Data & Measures:** Quantitative analytical results, qualitative domain knowledge, soft evidence, scen

- **Implementation Context:** Decision-centric analytics systems.

> "Support structured reasoning with the aids of advanced analytics techniques." (p. 8)

> "Provide flexible analytics environment that supports the natural flow-of-thoughts of the users." (p. 9)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — insights must be interpretable and structured for reasoning.

- **CR (Contextual Relevance):** Yes — must align with user's objectives, constraints, and domain know

- **FE (Feasibility):** Yes — solution alternatives and predictions must be actionable in practice.

- **TI (Timeliness):** Partial — addressed via anticipatory strategies and faster insight cycles, but not a p

- **EX (Explainability):** Yes — reasoning artefacts, chains of arguments, and situation models explicitly

- **GA (Goal Alignment):** Yes — objectives and constraints are explicitly embedded in situation models.

- **Other Dimensions Named by Authors:** Objectivity, scope, granularity, domain value, human reasonin

Theoretical or Conceptual Foundations

- Complex problem solving

- Naturalistic decision making

- Sensemaking theory

- Situation awareness

Indicators or Metrics for Actionability

No explicit quantitative KPIs; operational indicators implied through completeness of the three insight con

Barriers and Enablers to Actionability

- **Barriers:** Lack of synthesis support; cognitive overload; weak probabilistic reasoning without aids; re

- **Enablers:** Computational reasoning aids (e.g., fuzzy cognitive maps, Bayesian networks); flexible an

Relation to Existing Literature

Builds on prior fragmented definitions of actionable insight, integrating them into a systematic, multi-comp

Summary

Tan and Chan (2015) define actionable insight as the integration of analytic, synergic, and prognostic insi

Scores

- **Overall Relevance Score:** 95 — Strong, explicit definition with systematic, theory-informed features.

- **Operationalization Score:** 90 — Clear methods for achieving actionability via HIVE, though lacking e

Supporting Quotes from the Paper

- "Actionable Insight: A cohesive set of understandings about the problem situation… enables the user to

- "Insight is the result of information internalization process… contextualized in a specific situation…" (p. 3

- "Design consideration: Support the users in constructing computation-friendly situation model…" (p. 6)

- "Prognostic insight has the highest extent of actionability as it provides users with the knowledge necess

Actionability References to Other Papers

- Saraiya et al. (2005) — insight-based evaluation methodology.

- Thomas & Cook (2005) — visual analytics research agenda.

- Ribarsky et al. (2009) — analytical reasoning.

- Weick (1995) — sensemaking theory.

Paper Summary

<!--META_START-->

Title: Decision making for health-related research outcomes that alter diagnosis: A model from paediatric

Discipline/Domain: Neuropathology, Medical Ethics, Oncology

Subdomain/Topic: Paediatric brain tumours, health-related findings, diagnostic revision frameworks

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (case review with expert multidisciplinary team, framework develop

Study Context: Archival paediatric brain tumour cohort (UK), retrospective diagnostic reassessment unde

Geographic/Institutional Context: United Kingdom; BRAIN UK virtual tissue bank; Great Ormond Street H

Target Users/Stakeholders: Researchers, clinical MDTs, pathologists, neuro-oncologists, ethics committe

Primary Contribution Type: Conceptual framework and decision-making model for reporting clinically actic

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Decision making for health-related research outcomes that alter diagnosis: A model from paediatric brain

Authors:

Jessica C. Pickles et al.

Discipline/Domain:

Neuropathology, Medical Ethics, Oncology

Subdomain/Topic:

Paediatric brain tumours, health-related findings, diagnostic revision frameworks

Contextual Background:

The study addresses how to determine when research findings from retrospective analyses of archival di

Geographic/Institutional Context:

United Kingdom; BRAIN UK virtual tissue bank; Great Ormond Street Hospital; multiple UK neuropatholo

Target Users/Stakeholders:

Researchers, clinical MDTs, pathologists, neuro-oncologists, ethics committees, tissue banks

Primary Methodology:

Mixed Methods — review of 73 reclassified paediatric brain tumour cases via surrogate MDT, qualitative

Primary Contribution Type:

Conceptual framework and operational model for assessing and reporting clinically actionable diagnostic

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General Summary of the Paper

This study develops a structured decision-making framework for determining whether revised diagnoses

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the potential for research findings to lead to meaningful changes in active patie

> "Health-related translational research studies… may uncover incidental or pertinent findings with clinica

> "Clinical actionability was initially determined by identifying theoretical changes to active patient manag

---

What Makes Something Actionable

- Evidence supports a **change in active patient management** (e.g., altered follow-up, treatment de-esc

- Patient is **likely alive**.

- **Time since diagnosis** is short enough that changes could affect management (≤10 years generally).

- No subsequent pathology reviews have already updated the diagnosis.

- Sufficient evidence exists to **validate findings in a clinical setting**.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Framework A (Determine Clinical Actionability), Framework B (Mech

- **Methods/Levers:** Surrogate MDT case review; triaging by survival likelihood, elapsed time, and clinic

- **Operational Steps / Workflow:**

  1. MDT identifies potential management change.

  2. Assess disease progression risk, survival likelihood, and elapsed time.

  3. Check for subsequent pathology updates.

  4. If actionable, report to tissue bank (BRAIN UK) → clinical validation → neuro-oncology MDT discussio

- **Data & Measures:** WHO 2016 CNS classification; linked-anonymised case data; tumour-specific out

- **Implementation Context:** UK archival paediatric CNS tumour research under BRAIN UK ethical appr

> "Framework for assessing actionability and managing diagnostic HRFs… Any research findings would n

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Must be clearly linked to patient management change.

- **CR (Contextual Relevance):** Yes — Decision depends on tumour type, prognosis, and elapsed time.

- **FE (Feasibility):** Yes — Only feasible if patient is alive and institutional pathways exist for feedback.

- **TI (Timeliness):** Yes — Feedback only useful if within time window to affect care.

- **EX (Explainability):** Yes — MDT discussion requires clear explanation of clinical significance.

- **GA (Goal Alignment):** Partial — Alignment with patient benefit is implied but not explicitly formalised.

- **Other Dimensions Named by Authors:** Analytical validity; clinical utility; ethical appropriateness.

Theoretical or Conceptual Foundations

- WHO CNS tumour classification updates

- UKRI/MRC framework on health-related findings

- Ethical guidelines from CIOMS and Declaration of Helsinki

Indicators or Metrics for Actionability

- Time since diagnosis (<10 years typical threshold)

- Patient survival likelihood

- Predicted change in tumour risk classification

- Evidence of relapse or follow-up pathology

Barriers and Enablers to Actionability

- **Barriers:** Historic/poor prognosis cohorts; lack of patient survival; absence of clinical validation capac

- **Enablers:** MDT expertise; tumour-specific outcome knowledge; linked anonymisation allowing follow

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Relation to Existing Literature

Authors note that prior archival tissue studies rarely address feedback of revised diagnoses; most literatu

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Summary

The paper offers a clear, ethically grounded, and operationally detailed framework for determining whethe

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Scores

- **Overall Relevance Score:** 85 — Clear conceptualisation of actionability and explicit feature set; grou

- **Operationalization Score:** 80 — Provides detailed frameworks and steps for implementation, though

---

Supporting Quotes from the Paper

- "[Clinical actionability was] determined by identifying theoretical changes to active patient management.

- "Patients who were over 10 years from their initial diagnosis were considered unlikely to require a chang

- "Framework… discussed by the appropriate MDT before reporting back to families" (p. 5)

Actionability References to Other Papers

- MRC Framework on feedback of health-related findings (2014)

- WHO CNS tumour classifications (2016, 2021)

- Prior work on genomic predisposition in paediatric CNS tumours (e.g., Waszak et al., 2018; Zhang et al.

Paper Summary

<!--META_START-->

Title: Data-Driven Machine Learning-Informed Framework for Model Predictive Control in Vehicles

Authors: Edgar Amalyan, Shahram Latifi

DOI: https://doi.org/10.3390/info16060511

Year: 2025

Publication Type: Journal

Discipline/Domain: Electrical and Computer Engineering / Automotive Control Systems

Subdomain/Topic: Hybrid Machine Learning–Model Predictive Control (ML–MPC) for vehicle subsystems

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 88

Contains Definition of Actionability: Yes (explicitly in terms of "transforming ML outputs into actionable co

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes (MPC's transparency offsets ML's black-box nature)

Contains Interpretability: Yes (hybrid design enables interpreting ML outputs through MPC)

Contains Framework/Model: Yes (machine learning–informed MPC hybrid framework)

Operationalization Present: Yes (detailed multi-step workflow for training, inference, sliding-window smoo

Primary Methodology: Experimental + Conceptual Framework Development

Study Context: Performance vehicle suspension as primary subsystem case study; extensible to other sy

Geographic/Institutional Context: University of Nevada, Las Vegas, USA

Target Users/Stakeholders: Automotive engineers, control system designers, autonomous vehicle develo

Primary Contribution Type: Conceptual + Technical Framework with proof-of-concept implementation an

CL: Yes — "MPC translates ML outputs into actionable commands" ensuring clear operational meaning (

CR: Yes — Actionability tied to real-time contextual vehicle state awareness (p. 16)

FE: Yes — Feasibility discussed in terms of real-time latency, computational load, and integration with ex

TI: Yes — Sliding-window and exponential weighting for timely response (p. 12)

EX: Yes — MPC provides explainable layer for ML's black box outputs (p. 3)

GA: Yes — Goal alignment through mode-specific constraint tuning for performance, safety, comfort (p. 1

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Data-Driven Machine Learning-Informed Framework for Model Predictive Control in Vehicles

Authors:

Edgar Amalyan, Shahram Latifi

DOI:

https://doi.org/10.3390/info16060511

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Electrical and Computer Engineering / Automotive Control Systems

Subdomain/Topic:

Hybrid ML–MPC framework for adaptive, self-optimizing vehicle control

Contextual Background:

The paper develops a data-driven ML module to interpret vehicle subsystem states from sensor data, pro

Geographic/Institutional Context:

University of Nevada, Las Vegas, USA

Target Users/Stakeholders:

Vehicle control engineers, autonomous vehicle designers, motorsport engineers, component manufacture

Primary Methodology:

Experimental sensor-data collection + ML model training + integration concept for MPC

Primary Contribution Type:

Conceptual and technical framework with performance validation

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General Summary of the Paper

The paper proposes and validates a machine learning–informed framework to enhance Model Predictive

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors explicitly define actionability as the transformation of ML outputs into real-world control actio

> "MPC in the hybrid approach translates ML outputs into actionable commands in the real world." (p. 3)

> "By grading each subsystem's real-world status and feeding those semantic modes into the optimizer, t

---

What Makes Something Actionable

- Interpretability through MPC translating ML outputs into constraints and control commands

- Contextual relevance to current driving conditions

- Real-time responsiveness without destabilizing oscillations

- Feasibility for deployment on automotive ECUs

- Goal alignment with performance, safety, and comfort objectives

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ML-informed MPC hybrid control framework

- **Methods/Levers:** Sensor fusion (accelerometer, gyroscope), XGBoost classification, pseudo-labeling

- **Operational Steps / Workflow:**

  1. Collect curated "seed" maneuver data

  2. Train prototype classifier

  3. Pseudo-label large exemplar dataset

  4. Train inference model

  5. Real-time operation using overlapping sliding window + reverse exponential weighting

  6. Feed mode predictions to MPC for constraint/parameter updates

- **Data & Measures:** Six inertial features (GForceX/Y/Z, GyroX/Y/Z) with defined sign conventions and

- **Implementation Context:** Performance suspension tuning case study; extensible to brakes, traction,

> "An overlapping sliding-window grading approach with reverse exponential weighting smooths transient

> "The controller can adjust its own internal constraints…based on the inferred driving mode." (p. 16)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — ML outputs interpreted via MPC into explicit commands (p. 3)

- **CR (Contextual Relevance):** Yes — Predictions reflect real-time driving modes for adaptive control (

- **FE (Feasibility):** Yes — Tested with latency measurements; hardware considerations discussed (p. 1

- **TI (Timeliness):** Yes — Sliding window + weighting ensures rapid yet stable response (p. 12)

- **EX (Explainability):** Yes — MPC's rule-based transparency provides explainability (p. 3)

- **GA (Goal Alignment):** Yes — Constraints tuned for performance, safety, comfort (p. 16)

- **Other Dimensions Named by Authors:** Stability through constraint management; robustness to sens

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Theoretical or Conceptual Foundations

- Model Predictive Control theory (receding horizon optimization, constraints)

- Semi-supervised ML (pseudo-labeling)

- Feature importance metrics from gradient-boosted decision trees

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Indicators or Metrics for Actionability

- Real-time classification accuracy (97.6%)

- Latency (~119 µs inference + 32 µs aggregation)

- F1-scores per maneuver class

- Confusion matrix diagonality (low cross-mode error)

Barriers and Enablers to Actionability

- **Barriers:**

  - Mislabeling under-represented scenarios

  - Trade-off between window size and responsiveness

  - Computational load on ECUs

  - Limited coverage of rare driving conditions in datasets

- **Enablers:**

  - MPC's safeguard role against erroneous ML outputs

  - Modular adaptability across vehicle subsystems

  - High accuracy and generalization via pseudo-labeling

Relation to Existing Literature

Positions itself as a practical, data-driven integration of ML and MPC, leveraging MPC's transparency to

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Summary

This paper offers a complete methodology for making ML outputs actionable in automotive control throug

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Scores

- **Overall Relevance Score:** 90 — Strong explicit conceptualization of actionability, well-linked features

- **Operationalization Score:** 88 — Detailed, multi-step technical pipeline with performance metrics; lac

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Supporting Quotes from the Paper

- "MPC…translates ML outputs into actionable commands in the real world." (p. 3)

- "By grading each subsystem's real-world status and feeding those semantic modes into the optimizer, th

- "An overlapping sliding-window grading approach with reverse exponential weighting smooths transient

- "The controller can adjust its own internal constraints…based on the inferred driving mode." (p. 16)

Actionability References to Other Papers

- Norouzi et al. (2023) — ML–MPC integration review

- Maiworm et al. (2021) — Online learning-based MPC with stability guarantees

- Goel et al. (2023) — Semantically informed MPC for context-aware control

- Ribeiro et al. (2016) — Explaining predictions of classifiers

Paper Summary

<!--META_START-->

Title: Data Driven Science for Clinically Actionable Knowledge in Diseases

Authors: Daniel R. Catchpoole, Simeon J. Simoff, Paul J. Kennedy, Quang Vinh Nguyen (eds.)

DOI: 10.1201/9781003292357

Year: 2024

Publication Type: Edited Book (Multiple Chapters)

Discipline/Domain: Health Informatics / Biomedical Data Science

Subdomain/Topic: Data-driven analytics for actionable clinical insights in disease diagnosis, treatment, ar

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (implicit and partial explicit in Preface)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (case studies, computational methods, literature reviews)

Study Context: Multiple diseases (diabetes, COVID-19, tuberculosis, Parkinson's, cancer), computational

Geographic/Institutional Context: Australia (primary), multi-country contexts for specific studies

Target Users/Stakeholders: Clinicians, health policymakers, biomedical researchers, data scientists

Primary Contribution Type: Conceptual synthesis + applied case studies + methodological frameworks

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Data Driven Science for Clinically Actionable Knowledge in Diseases

Authors:

Daniel R. Catchpoole, Simeon J. Simoff, Paul J. Kennedy, Quang Vinh Nguyen (eds.)

DOI:

10.1201/9781003292357

Year:

2024

Publication Type:

Edited Book

Discipline/Domain:

Health Informatics / Biomedical Data Science

Subdomain/Topic:

Data-driven analytics for actionable clinical insights in disease diagnosis, treatment, and policy

Contextual Background:

The volume addresses the intersection of computational, biological, and medical sciences, focusing on h

Geographic/Institutional Context:

Primarily Australian studies (notably NSW), with global relevance and examples.

Target Users/Stakeholders:

Clinicians, health policymakers, biomedical researchers, computational and data scientists.

Primary Methodology:

Mixed methods — applied computational models, literature reviews, methodological frameworks, and em

Primary Contribution Type:

Conceptual and applied synthesis for operationalizing data-driven actionable healthcare insights.

General Summary of the Paper

This edited collection explores state-of-the-art computational and visual analytics methods to produce *cli

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the capacity of data-driven insights to directly support **clinical actions** in real

> "…focuses on 'close the loop' analytical processes to enrich and lead actionable knowledge" (Preface,

> "…computational and visual analytics… for discovering actionable knowledge in support of clinical actio

---

What Makes Something Actionable

- Direct linkage to clinical decision points

- Context relevance to patient journeys or population health

- Timeliness of insights (e.g., early diagnosis or intervention)

- Interpretability for clinical stakeholders

- Integration into existing healthcare workflows

- Feasibility with available data and resources

- Trustworthiness of analysis outputs

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Close-the-loop analytical process; methodological framework for bio

- **Methods/Levers:** Data integration (multi-source clinical, genomic, imaging), computational modeling

- **Operational Steps / Workflow:** Data linkage, feature engineering, model training, interpretable output

- **Data & Measures:** Linked health records (e.g., Lumos dataset), imaging data, genomic/RNA-seq dat

- **Implementation Context:** Clinical decision-making, public health policy, personalized medicine, rare

> "…integral analysis… for discovering actionable knowledge in support of clinical actions in real environr

> "…visual analytics… enabling the effective exploration and interpretation of complex biomedical data" (

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear, interpretable outputs required for adoption.

> "…meaningful visualisation and human–information interaction" (p. xiv)

- **CR (Contextual Relevance):** Yes — grounded in specific patient cohorts and health system contexts

> "…linked patient records for generating clinically actionable knowledge" (p. xv)

- **FE (Feasibility):** Yes — focus on methods applicable within real healthcare settings.

- **TI (Timeliness):** Yes — emphasis on early prescriptions, rapid diagnostics, timely policy inputs.

- **EX (Explainability):** Yes — multiple chapters on explainable ML and visualization (Ch. 9).

- **GA (Goal Alignment):** Yes — alignment with improved health outcomes, policy goals.

- **Other Dimensions Named:** Trust, interpretability, user engagement (Ch. 10).

Theoretical or Conceptual Foundations

- Close-the-loop analytics in health systems

- Explainable AI and interpretable ML frameworks

- Human-information interaction theory

- Decision support and trust in visualization literature

Indicators or Metrics for Actionability

- Reduction in unplanned hospital admissions

- Mortality rate changes within defined periods

- Model accuracy, false positive/negative rates

- Timeliness of intervention post-diagnosis

Barriers and Enablers to Actionability

- **Barriers:** Data silos, inter-site variability, trust issues, lack of interpretability, small sample sizes for ra

- **Enablers:** Data linkage initiatives (e.g., Lumos), harmonization techniques, visual explainability tools

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Relation to Existing Literature

The editors situate their approach within a growing body of work on data-driven healthcare, emphasizing

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Summary

The volume *Data Driven Science for Clinically Actionable Knowledge in Diseases* synthesizes methods

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Scores

- **Overall Relevance Score:** 85 — Strong implicit definition and consistent feature articulation across c

- **Operationalization Score:** 80 — Multiple concrete frameworks, workflows, and applied cases showin

---

Supporting Quotes from the Paper

- "...for discovering actionable knowledge in support of clinical actions in real environments" (p. 4)

- "...focuses on 'close the loop' analytical processes to enrich and lead actionable knowledge" (p. xiv)

- "...linked patient records for generating clinically actionable knowledge" (p. xv)

- "...meaningful visualisation and human–information interaction" (p. xiv)

- "...guidance on improving interpretability and trust in health models and visualisations" (p. xviii)

Actionability References to Other Papers

- NSW Health Lumos program studies on GP attendance and hospital visits

- Visual analytics frameworks for biomedical and genomic data

- Explainable AI surveys and visualization literature in health contexts

- Machine learning applications for diagnostics and treatment selection

Paper Summary

<!--META_START-->

Title: Creating actionable knowledge one step at a time: An analytical framework for tracing systems and

Authors: Katharina Hölscher, Julia M. Wittmayer, Alfred Olfert, Martin Hirschnitz-Garbers, Jörg Walther, O

DOI: https://doi.org/10.1016/j.eist.2022.11.007

Year: 2023

Publication Type: Journal

Discipline/Domain: Sustainability Transitions / Environmental Studies

Subdomain/Topic: Actionable knowledge, niche innovations, coupled infrastructures, analytical framework

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes (linked to understanding innovation dynamics and options for action)

Contains Interpretability: Yes (narrative/process tracing approach)

Contains Framework/Model: Yes (multi-dimensional analytical framework)

Operationalization Present: Yes (four-step analytical process with applied cases)

Primary Methodology: Mixed Methods (conceptual framework + applied case studies + qualitative intervie

Study Context: German infrastructure innovation projects (energy, water, mobility, ICT)

Geographic/Institutional Context: Germany (national, regional, local policy and practice contexts)

Target Users/Stakeholders: Policy actors, practitioners, planners, utilities, infrastructure developers

Primary Contribution Type: Analytical framework for generating actionable knowledge in sustainability tra

CL: Yes — clarity in understanding pathways, contexts, and agency is positioned as essential for actiona

CR: Yes — contextual relevance embedded in system definition, system factors, and agency analysis

FE: Yes — feasibility linked to technical, institutional, and socio-cultural system factors

TI: Yes — timeliness addressed via sequencing of development moments and anticipation of opportunitie

EX: Yes — explainability achieved through narrative, process tracing, and explicit system–agency integra

GA: Yes — goal alignment via sustainability and transformative impact criteria

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Creating actionable knowledge one step at a time: An analytical framework for tracing systems and agen

Authors:

Katharina Hölscher, Julia M. Wittmayer, Alfred Olfert, Martin Hirschnitz-Garbers, Jörg Walther, Georg Sc

DOI:

https://doi.org/10.1016/j.eist.2022.11.007

Year:

2023

Publication Type:

Journal

Discipline/Domain:

Sustainability Transitions / Environmental Studies

Subdomain/Topic:

Actionable knowledge, niche innovations, coupled infrastructures, analytical frameworks

Contextual Background:

This paper is situated in sustainability transitions research, focusing on producing knowledge that both ex

Geographic/Institutional Context:

Germany; national ministries, federal agencies, municipalities, utilities, and infrastructure developers

Target Users/Stakeholders:

Policy-makers, planners, public utilities, infrastructure developers, practitioners in sustainability transitions

Primary Methodology:

Mixed Methods — conceptual framework design, applied case studies, qualitative interviews, document a

Primary Contribution Type:

A multi-dimensional, practice-oriented analytical framework for tracing niche innovation development path

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General Summary of the Paper

The authors present a stepwise, iterative analytical framework that integrates system-centred and agency

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is "knowledge that supports actors' understanding of how to create transformative

> "The generation of actionable knowledge … can be supported through connecting system-centred and

> "Our premise was … to offer an understanding of the complex dynamics of niche innovations … and in

---

What Makes Something Actionable

- Integration of system and agency perspectives to reveal both complexity and options for action

- Clear identification of development pathways, contextual factors, and actor roles

- Linking insights to sustainability and transformative impact criteria

- Involving policy and practice actors for contextual relevance and uptake potential

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** Analytical framework for tracing systems and agency in niche innovatic

- **Methods/Levers:** Process tracing, multi-level perspective (MLP), multi-actor perspective (MAP), mult

- **Operational Steps / Workflow:**

  1. Define system boundaries and elements

  2. Identify critical development moments

3. Identify system factors influencing those moments

4. Identify actors and activities

5. Assess sustainability and transformative impact

- **Data & Measures:** Qualitative interviews, grey literature review, sustainability criteria matrix

- **Implementation Context:** German coupled infrastructure innovation projects

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — understanding pathways, contexts, and roles is essential for actionability.

- **CR (Contextual Relevance):** Yes — system factors and actor roles are analysed in relation to the sp

- **FE (Feasibility):** Yes — addresses technical, institutional, and socio-cultural feasibility explicitly.

- **TI (Timeliness):** Yes — development moments mapped over time to identify opportunities and risks.

- **EX (Explainability):** Yes — narrative and visualisation of pathways aid comprehension.

- **GA (Goal Alignment):** Yes — explicitly linked to sustainability and transformative goals.

- **Other Dimensions Named by Authors:** Sustainability impact, transformative impact

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Theoretical or Conceptual Foundations

- Multi-Level Perspective (MLP)

- Multi-Actor Perspective (MAP)

- Multi-Level Governance (MLG)

- Pathways concept (Leach et al., 2010)

- Agency capacities frameworks

Indicators or Metrics for Actionability

- Sustainability criteria (performance, resilience, resource efficiency, social/economic viability)

- Transformative impact (extent of regime challenge/shift)

Barriers and Enablers to Actionability

- **Barriers:** Conflicting regulations, institutional misalignment, technological immaturity, financial insecu

- **Enablers:** Political leadership, aligned sustainability strategies, funding programmes, technical feasib

---

Relation to Existing Literature

Builds on transition theories but addresses their limited operational utility for practice by integrating syste

---

Summary

This paper develops and applies a multi-dimensional analytical framework to generate actionable knowle

---

Scores

- **Overall Relevance Score:** 92 — Strong conceptual clarity on actionability, explicit integration of featu
- **Operationalization Score:** 88 — Fully operationalised with clear steps, data collection methods, and

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Supporting Quotes from the Paper

- "Actionable knowledge … supports actors' understanding of how to create transformative change towar
- "The generation of actionable knowledge … can be supported through connecting system-centred and a
- "Our premise was … to offer an understanding of the complex dynamics of niche innovations … and in t

---

Actionability References to Other Papers

- Caniglia et al. (2020) — pluralistic, integrated approach to action-oriented knowledge
- Mach et al. (2020) — actionable knowledge and engagement
- Frantzeskaki & Rok (2018) — co-producing sustainability transitions knowledge
- Leach et al. (2010) — pathways concept in sustainability
- Geels & Schot (2007) — MLP in socio-technical transitions

Paper Summary

<!--META_START-->

Title: Coproducing water-energy-food Nexus actionable knowledge: Lessons from a multi-actor collabora

Authors: Djenontin, Ida N.S.; Daher, Bassel; Johnson, Jacob W.; Adule, Kenan; Hishe, Birhanu K.; Kekiru

DOI: https://doi.org/10.1016/j.envsci.2025.104028

Year: 2025

Publication Type: Journal Article

Discipline/Domain: Environmental Science and Policy

Subdomain/Topic: Water-Energy-Food Nexus; Transdisciplinary Co-Production; Stakeholder Engagemer

Eligibility: Eligible

Overall Relevance Score: 93

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, contextualized through co-production process and criter

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (Collaborative Learning School – CLS)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (qualitative participatory processes + evaluation surveys)

Study Context: WEF Nexus in smallholder and peri-urban farming contexts in Uganda; Buikwe District ca...

Geographic/Institutional Context: Uganda – Makerere University collaboration with U.S. and E.U. universi...

Target Users/Stakeholders: Farmers, local authorities, district-level officers, national policymakers, NGOs...

Primary Contribution Type: Applied case study and methodological innovation

CL: Yes — "fit for purpose, including relevance and affordable to the community at stake"

CR: Yes — "context-driven… pathways for problem-solving-oriented knowledge co-production"

FE: Yes — "cost-effective (low input and build on existing institutions)"

TI: Yes — "importance on short, medium, and long-term for farmers' livelihood"

EX: Yes — "systems mapping and causal loop diagrams… to understand root causes and interactions"

GA: Yes — "alignment with district and national goals… considered for integration into existing policies"

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Coproducing water-energy-food Nexus actionable knowledge: Lessons from a multi-actor collaborative le...

Authors:

Ida N.S. Djenontin, Bassel Daher, Jacob W. Johnson, Kenan Adule, Birhanu K. Hishe, Patience Kekirung...

DOI:

https://doi.org/10.1016/j.envsci.2025.104028

Year:

2025

Publication Type:

Journal Article

Discipline/Domain:

Environmental Science and Policy

Subdomain/Topic:

Water-Energy-Food Nexus; Transdisciplinary Co-Production; Stakeholder Engagement; Uganda

Contextual Background:

This paper examines how actionable WEF Nexus knowledge can be co-produced through a *Collaborativ

Geographic/Institutional Context:

Uganda; collaboration between Makerere University, U.S., and E.U. universities, local NGOs, and govern

Target Users/Stakeholders:

Smallholder and peri-urban farmers, agricultural cooperatives, district officers, national ministries, NGOs,

Primary Methodology:

Mixed Methods (participatory qualitative processes, systems/design thinking workshops, causal loop diag

Primary Contribution Type:

Applied methodological case study demonstrating operational pathways for producing actionable WEF N

General Summary of the Paper

The authors introduce the *Collaborative Learning School* (CLS) as a transdisciplinary, multi-actor proce

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly framed as knowledge and solutions that are:

- Co-created with stakeholders at multiple governance levels.

- Contextually relevant, fit for purpose, and feasible for local adoption.

- Operationalized into implementable "pathways to change" validated by both end-users and decision-ma

> "…support participatory co-creations of context-driven multi-scalar WEF-Nexus pathways for problem-s

> "…fit for purpose, including relevance and affordable to the community at stake" (p. 7)

What Makes Something Actionable

- Fit for purpose and community relevance.

- Feasibility and affordability using existing institutions.

- Co-created with diverse stakeholders, incorporating local and technical knowledge.

- Sustainability (short, medium, long-term impacts).

- Potential for scaling and policy integration.

- Immediate visible results to build trust.

- Capacity building and intergenerational collaboration.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Collaborative Learning School (CLS)

- **Methods/Levers:** Systems thinking, design thinking, political economy analysis, participatory mappin

- **Operational Steps / Workflow:**

  1. Community problem identification (focus groups, transects, interviews).

  2. Systems mapping & solution ideation (causal loop diagrams, brainstorming).

  3. Solution prototyping (physical models).

  4. Validation (community, district, national workshops).

- **Data & Measures:** Post-evaluation surveys, interviews, observational data, stakeholder feedback on

- **Implementation Context:** Multi-scalar engagement from local farmers to national ministries.

> "…systems mapping and causal loop diagrams… envisage innovative solutions collaboratively with the

> "…prototyped models… facilitated presenting complex ideas to various stakeholders, furthering unders

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL:** Yes — Clarity through shared understanding, visual mapping, and tangible prototypes.

- **CR:** Yes — Solutions directly emerged from locally identified WEF Nexus issues.

- **FE:** Yes — Emphasis on cost-effectiveness and building on existing institutions.

- **TI:** Yes — Importance across short, medium, long-term livelihoods.

- **EX:** Yes — Systems mapping to clarify cause-effect relationships and trade-offs.

- **GA:** Yes — District and national alignment discussed and sought for integration.

- **Other Dimensions:** Trust-building, inclusivity, capacity development.

Theoretical or Conceptual Foundations

- WEF Nexus framework.

- Systems thinking (causal loop diagrams, holistic problem framing).

- Design thinking (human-centered iterative problem-solving).

- Political Economy Analysis.

Indicators or Metrics for Actionability

- Stakeholder-perceived feasibility, relevance, and alignment with goals.

- Willingness to implement and allocate resources.

- Immediate visible results to build trust.

Barriers and Enablers to Actionability

Barriers:

- Limited access to extension services.

- Lack of farmer cooperation.

- Gaps between community priorities and national programs.

- Funding constraints.

- Weak communication channels between governance levels.

Enablers:

- Cooperative formation and farmer organization.

- Integration into existing policy frameworks.

- Multi-level stakeholder engagement.

- Local knowledge and technical expertise integration.

Relation to Existing Literature

The CLS builds on farmer field school approaches, transdisciplinary WEF Nexus research, and co-produ

---

Summary

This paper offers a fully articulated, operational framework (CLS) for producing actionable WEF Nexus kr

---

Scores

- **Overall Relevance Score:** 93 — Strong implicit definition of actionability, detailed features tied to the

- **Operationalization Score:** 95 — Provides a concrete, tested, and replicable process with clear steps.

Supporting Quotes from the Paper

- "[CLS]…support participatory co-creations of context-driven multi-scalar WEF-Nexus pathways for probl

- "Fit for purpose, including relevance and affordable to the community at stake" (p. 7)

- "Systems mapping and causal loop diagrams… envisage innovative solutions collaboratively with the st

- "Prototyped models… facilitated presenting complex ideas to various stakeholders, furthering understar

---

Actionability References to Other Papers

- Djenontin & Meadow (2018) — Co-production guidance.

- Naidoo et al. (2021) — WEF Nexus operationalization methodology.

- Hamidov et al. (2022) — Nexus summer school model.

- Johnson & Karlberg (2017) — Participatory WEF modeling.

- Purwanto et al. (2019); Rich et al. (2018) — Group model building and stakeholder engagement in Nexu

Paper Summary

<!--META_START-->

Title: Conceptual Framework for Prescriptive Analytics Based on Decision Theory in Smart Factories

Authors: Julian Weller, Martin Kohlhase, Nico Migenda, Wolfram Schenck, Arthur Wegel, Roman Dumitre

DOI: 10.1109/ADACIS59737.2023.10424368

Year: 2023

Publication Type: Conference

Discipline/Domain: Industrial Engineering / Data Analytics

Subdomain/Topic: Prescriptive Analytics, Decision Theory, Smart Factories

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 80

Contains Definition of Actionability: Yes (implicit via prescriptive analytics definition and decision theory in

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No explicit mention

Contains Framework/Model: Yes (four-step conceptual framework)

Operationalization Present: Yes

Primary Methodology: Conceptual + Literature Review

Study Context: Prescriptive analytics for decision-making in smart factories, integrating decision theory an

Geographic/Institutional Context: Germany (Fraunhofer Institute, Bielefeld University of Applied Sciences

Target Users/Stakeholders: Researchers, industrial practitioners, smart factory decision-makers

Primary Contribution Type: Conceptual framework

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Conceptual Framework for Prescriptive Analytics Based on Decision Theory in Smart Factories

Authors:

Julian Weller, Martin Kohlhase, Nico Migenda, Wolfram Schenck, Arthur Wegel, Roman Dumitrescu

DOI:

10.1109/ADACIS59737.2023.10424368

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Industrial Engineering / Data Analytics

Subdomain/Topic:

Prescriptive Analytics, Decision Theory, Smart Factories

Contextual Background:

The paper addresses the lack of a comprehensive conceptual framework for prescriptive analytics in sma

Geographic/Institutional Context:

Germany; Fraunhofer Institute for Mechatronic Systems Design, Bielefeld University of Applied Sciences

Target Users/Stakeholders:

Researchers, industrial data scientists, manufacturing process engineers, smart factory decision-makers

Primary Methodology:

Conceptual + structured literature review

Primary Contribution Type:

Conceptual framework

General Summary of the Paper

The authors propose a four-step conceptual framework for prescriptive analytics in smart factories, groun

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the capacity of prescriptive analytics to provide data-driven, context-aware reco

> "Prescriptive analytics… examines data or content to answer the question: What should be done?" (p. 1

> "The conceptual framework… aims at optimizing decision-making processes integrating knowledge ext

---

What Makes Something Actionable

- Clear decision triggers linked to validated data

- Contextual alignment with factory strategies, constraints, and operational goals

- Feasible and implementable prescriptions within environmental constraints

- Ability to select among alternatives and adapt via feedback loops

- Modularity to suit various decision types (structured, semi-structured, unstructured)

- Support for different levels of automation and human-machine collaboration

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Four-Step Conceptual Framework for Prescriptive Analytics in Smar

- **Methods/Levers:** Integration of decision theory models (Simon, Panagiotou), data analytics maturity

- **Operational Steps / Workflow:**

  1. **Conditional Trigger** – Identify and validate decision triggers from system data (descriptive, diagnos

  2. **Prescription** – Assess alternatives using a knowledge representation; select optimal prescription

  3. **Execution** – Implement or automate decision; optional feedback loop for learning

  4. **Knowledge Representation** – Central repository of decision-relevant constraints, strategies, and s

- **Data & Measures:** Historical, live, or batch data; system characteristics; performance metrics for fee

- **Implementation Context:** Smart factory decision processes (quality, production, maintenance, logisti

> "A prescription is only valid if the trigger is valid… alternatives… drawn from a given knowledge represe

> "An optional feedback loop… create a learning system… the decision-effect relation serves as a param

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Decisions must be explicit and grounded in validated triggers.

- **CR (Contextual Relevance):** Yes – Must incorporate strategies, constraints, and environmental conte

- **FE (Feasibility):** Yes – Prescriptions must be implementable under given constraints.

- **TI (Timeliness):** Partial – Framework implies real-time or near-real-time potential but not as a formal

- **EX (Explainability):** Partial – Knowledge representation enables traceability, but explicit explainability

- **GA (Goal Alignment):** Yes – Explicit integration with operational and strategic goals.

- **Other Dimensions Named by Authors:** Modularity, adaptability, automation flexibility.

Theoretical or Conceptual Foundations

- Decision Theory (normative, descriptive, prescriptive approaches)

- Simon's intelligence-design-choice-implementation model

- Panagiotou's goal-driven framework

- Gartner's analytics maturity model

Indicators or Metrics for Actionability

- Validity of triggers

- Performance of implemented prescriptions

- Feedback loop outcomes (accuracy, efficiency, goal alignment)

Barriers and Enablers to Actionability

- **Barriers:** Data quality issues; lack of methodology for selecting implementation strategy; unclear aut

- **Enablers:** Modular architecture; adaptability across decision types; integration of human and machin

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Relation to Existing Literature

The paper uniquely integrates prescriptive decision theory concepts into prescriptive analytics for smart fa

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Summary

This paper presents a structured four-step framework for prescriptive analytics in smart factories, integrat

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Scores

- **Overall Relevance Score:** 90 – Strong implicit and explicit articulation of actionability features; clear i

- **Operationalization Score:** 80 – Provides detailed, adaptable workflow steps but lacks complete meth

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Supporting Quotes from the Paper

- "Prescriptive Analytics… examines data or content to answer the question: What should be done?" (p. 1

- "The conceptual framework needs to incorporate existing and established patterns of decision making..

- "A pres

Paper Summary

<!--META_START-->

Title: Competitive intelligence embeddedness: Drivers and performance consequences

Authors: Amiram Markovich, Kalanit Efrat, Daphne R. Raban, Anne L. Souchon

DOI: https://doi.org/10.1016/j.emj.2019.04.003

Year: 2019

Publication Type: Journal

Discipline/Domain: Management / Marketing / Information & Knowledge Management

Subdomain/Topic: Competitive Intelligence (CI), Knowledge Management, Organizational Capabilities

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (explicit link to actionable knowledge in CI process)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No explicit mention

Contains Framework/Model: Yes (CI Embeddedness conceptual model with antecedents and consequen

Operationalization Present: Yes

Primary Methodology: Quantitative (Survey, SEM)

Study Context: Competitive Intelligence use in Israeli firms

Geographic/Institutional Context: Israel; firms with ≥10 employees and annual sales ≥ $1M

Target Users/Stakeholders: Managers, decision-makers, CI practitioners, knowledge managers

Primary Contribution Type: Empirical model testing antecedents and effects of CI Embeddedness

CL: Yes

CR: Yes

FE: No

TI: No

EX: Partial

Title:

Competitive intelligence embeddedness: Drivers and performance consequences

Authors:

Amiram Markovich, Kalanit Efrat, Daphne R. Raban, Anne L. Souchon

DOI:

https://doi.org/10.1016/j.emj.2019.04.003

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Management / Marketing / Information & Knowledge Management

Subdomain/Topic:

Competitive Intelligence (CI), Knowledge Management, Organizational Capabilities

Contextual Background:

The study addresses how competitive intelligence (CI) becomes embedded into organizational processes

Geographic/Institutional Context:

Israeli firms, spanning SMEs and large corporations, across various industries.

Target Users/Stakeholders:

Managers, decision-makers, CI practitioners, competitive strategy teams, knowledge managers.

Primary Methodology:

Quantitative survey of 124 mid- and senior-level managers, analyzed with Structural Equation Modeling (

Primary Contribution Type:

Empirical testing of a conceptual model linking antecedents (information quality, alliances, biased use typ

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General Summary of the Paper

This paper conceptualizes and measures Competitive Intelligence Embeddedness (CIE) as the degree to

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the transformation of competitive and market data into *actionable strategic kno

> "Competitive intelligence (CI) is a process that produces and disseminates actionable information… in c

> "CI embeddedness… so that strategic and tactical decisions can be made in the knowledge of all releva

---

What Makes Something Actionable

- Integration into daily routines and organizational culture.

- Awareness and acceptance of CI by decision-makers and employees.

- Support from senior management (legitimacy, resources, accountability).

- High perceived quality of information sources.

- Timely dissemination to relevant organizational levels.

- Goal alignment with competitive positioning and customer satisfaction.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** CI Embeddedness (CIE) Capability Model.

- **Methods/Levers:** Use of high-quality web CI sources ("Analyze" and "Formal"), alliances with informa

- **Operational Steps / Workflow:**

  1. Assess and source high-quality competitive intelligence from web-based sources.

  2. Build strategic alliances with reliable information providers.

  3. Embed CI dissemination processes across organizational levels.

  4. Integrate CI into both strategic and tactical decision-making.

- **Data & Measures:** Likert-scale survey assessing web source quality, information use patterns, CIE p

- **Implementation Context:** Multi-industry Israeli firms with active CI functions.

> "CIE… refers to the incorporation of CI awareness and processes in the firm… Various staff levels are a

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes** — Clear, accessible dissemination to relevant levels.

  > "…distribution of reviews on competitors and managers' awareness of CI's importance" (p. 711).

- **CR (Contextual Relevance):** **Yes** — Tailoring to competitive environment and organizational nee

  > "…so that strategic and tactical decisions can be made in the knowledge of all relevant… information"

- **FE (Feasibility):** **No explicit link** — Feasibility implied via integration into existing processes, but r

- **TI (Timeliness):** **No explicit link** — Speed emphasized in web sourcing but not framed as a neces

- **EX (Explainability):** **Partial** — Actionable knowledge is implied to be understandable and interpre

- **GA (Goal Alignment):** **Yes** — Linked to customer satisfaction and competitive advantage.

- **Other Dimensions Named by Authors:** Alliances, perceived information quality, organizational culture

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Theoretical or Conceptual Foundations

- Resource-Based View (RBV) — CIE as a firm-specific capability.

- Knowledge Management Framework.

- Intelligence Cycle (planning, collection, analysis, communication).

Indicators or Metrics for Actionability

- Degree of CI awareness at various staff levels.

- Distribution frequency and coverage of CI reports.

- Perceived quality scores of information sources.

- Customer satisfaction indices (loyalty, complaint rates).

Barriers and Enablers to Actionability

- **Barriers:** Information overload, political or inaccurate use of information, resistance to information.

- **Enablers:** High-quality CI sources, strong alliances with providers, management support, cultural inte

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Relation to Existing Literature

Builds on Bernhardt (1994) definition of CI as producing actionable knowledge, integrates CI with knowle

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Summary

The paper introduces Competitive Intelligence Embeddedness (CIE) as a capability ensuring actionable d

---

Scores

- **Overall Relevance Score:** 85 — Strong conceptual and empirical articulation of actionability within C

- **Operationalization Score:** 80 — Clear model, measurement, and implementation steps for embeddin

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Supporting Quotes from the Paper

- "Competitive intelligence… produces and disseminates actionable information… to help managers in de

- "CIE… so that strategic and tactical decisions can be made in the knowledge of all relevant… informatic

- "Perceived quality of Web information sources is positively related to competitive intelligence embedded

- "Alliances with information providers… positively related to competitive intelligence embeddedness" (p.

- "CIE showed the expected positive influence on customer satisfaction" (p. 712).

Actionability References to Other Papers

- Bernhardt (1994) — Actionable strategic knowledge definition.

- Saayman et al. (2008) — Organizational culture and CI support.

- Ho (2008) — Linking learning, knowledge management, and performance.

- Rouach & Santi (2001) — CI as a capability for competitive advantage.

Paper Summary

<!--META_START-->

Title: CARE: Coherent Actionable Recourse based on Sound Counterfactual Explanations

Authors: Peyman Rasouli, Ingrid Chieh Yu

DOI: https://doi.org/10.1145/nnnnnnn.nnnnnnn

Year: 2021

Publication Type: Conference

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Interpretable Machine Learning, Counterfactual Explanations, Actionable Recourse

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with empirical evaluation

Study Context: Model-agnostic counterfactual and recourse generation for classification and regression

Geographic/Institutional Context: University of Oslo, Norway

Target Users/Stakeholders: End-users seeking actionable guidance from ML predictions; researchers in

Primary Contribution Type: Modular explanation framework (CARE) integrating model-level and user-leve

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: CARE: Coherent Actionable Recourse based on Sound Counterfactual Explanations

Authors: Peyman Rasouli, Ingrid Chieh Yu

DOI: https://doi.org/10.1145/nnnnnnn.nnnnnnn

Year: 2021

Publication Type: Conference

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Interpretable Machine Learning, Counterfactual Explanations, Actionable Recourse

Contextual Background: The paper addresses the limitations of existing counterfactual explanation me

Geographic/Institutional Context: University of Oslo, Norway

Target Users/Stakeholders: ML end-users needing recourse (e.g., loan applicants), explainable AI res

Primary Methodology: Conceptual with empirical evaluation

Primary Contribution Type: New modular framework for counterfactual and recourse generation

General Summary of the Paper

The authors propose CARE, a modular, model-agnostic explanation framework for generating actionable

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as satisfying global and local user/domain-specific preferences through constraints

> "A counterfactual should satisfy some global and local preferences that are domain-specific and defined

> "An actionable explanation… takes into account the user's preferences containing the name of mutable

What Makes Something Actionable

- Alignment with user-specified constraints (mutable/immutable features, allowed ranges/values)

- Preservation of feature coherency under constraints

- Feasibility in real-world terms (not recommending impossible changes)

- Respecting constraint importance (prioritizing non-violable constraints)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** CARE

- **Methods/Levers:** Modular hierarchy with four modules; multi-objective optimization using NSGA-III

- **Operational Steps / Workflow:**

  1. **VALIDITY:** Enforce minimal, sparse changes to achieve the desired outcome.

  2. **SOUNDNESS:** Ensure proximity and connectedness to real, same-class data points.

  3. **COHERENCY:** Use correlation models to preserve feature relationships.

  4. **ACTIONABILITY:** Apply user-defined constraints with importance weighting.

- **Data & Measures:** Gower distance, Local Outlier Factor, HDBSCAN clustering, correlation measures

- **Implementation Context:** Model-agnostic; applicable to tabular classification/regression; handles mix

> "We propose a constraint language… and the notion of constraint importance to weigh the constraints a

> "CARE… generates actionable recourse by fulfilling the mentioned desiderata through objective functio

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — minimal, interpretable feature changes improve understandability (p. 3).

- **CR (Contextual Relevance):** Yes — proximity and connectedness ensure alignment with domain dat

- **FE (Feasibility):** Yes — coherent changes preserve real-world plausibility (p. 2–3).

- **TI (Timeliness):** No — not explicitly addressed.

- **EX (Explainability):** Partial — explanations are inherent but focus is on actionable counterfactuals, n

- **GA (Goal Alignment):** Yes — constraints ensure user goals/preferences are respected (p. 6).

- **Other Dimensions Named by Authors:** Coherency, proximity, connectedness.

Theoretical or Conceptual Foundations

- Counterfactual explanations in XAI (Wachter et al., 2017)

- Proximity and connectedness metrics (Laugel et al., 2019)

- Actionable recourse frameworks (Ustun et al., 2019; Karimi et al., 2020)

- Multi-objective optimization (NSGA-III)

Indicators or Metrics for Actionability

- Actionability cost (sum of violated constraint importance values)

- Proximity and connectedness scores to assess plausibility

- Coherency rate (preservation of feature correlations)

Barriers and Enablers to Actionability

- **Barriers:** Conflicting constraints; lack of coherent feature changes; artifacts in model space (p. 2–3).

- **Enablers:** Modular structure allowing selective enforcement of properties; weighting of constraints by

Relation to Existing Literature

The paper extends prior counterfactual explanation methods by integrating seldom-addressed properties

Summary

CARE is a modular, model-agnostic framework for generating actionable recourse grounded in sound cou

Scores

- **Overall Relevance Score:** 95 — Provides explicit and nuanced definition of actionability with multiple

- **Operationalization Score:** 95 — Fully details how to implement actionability in practice through const

Supporting Quotes from the Paper

- "A counterfactual should satisfy some global and local preferences that are domain-specific and defined

- "We introduce a novel notion of actionability that can cover various constraints and prioritize different pre

- "Our proposed objective function… computes the actionability cost… according to the user's preference

- "An actionable explanation… takes into account the user's preferences containing the name of mutable/

Actionability References to Other Papers

- Ustun, Spangher, Liu (2019) — Actionable recourse in linear classification

- Karimi et al. (2020) — Algorithmic recourse

- Wachter et al. (2017) — Counterfactual explanations

- Laugel et al. (2019) — Proximity and connectedness in counterfactuals

- Dandl et al. (2020) — Multi-objective counterfactual explanations

Paper Summary

<!--META_START-->

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 92

Contains Definition of Actionability: Yes (explicit and process-based)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (three-process integrated framework)

Operationalization Present: Yes (nine-step, four-phase process)

Primary Methodology: Mixed Methods (qualitative, quantitative, participatory, collaborative autoethnograp

Study Context: Transdisciplinary project in Kiiminkijoki river catchment, Finland

Geographic/Institutional Context: Northern Finland; multiple municipalities and stakeholder groups

Target Users/Stakeholders: Researchers, policymakers, local communities, administrative bodies, civil so

Primary Contribution Type: Conceptual framework + empirical case study

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Bridging the knowledge–action gap: A framework for co-producing actionable knowledge

Authors:

Aleksi Räsänen et al.

DOI:

[10.1016/j.envsci.2024.103929](https://doi.org/10.1016/j.envsci.2024.103929)

Year:

2024

Publication Type:

Journal

Discipline/Domain:

Environmental Science / Sustainability Science

Subdomain/Topic:

Knowledge co-production, catchment governance, transdisciplinary research

Contextual Background:

The paper addresses how transdisciplinary research can bridge the persistent gap between knowledge g

Geographic/Institutional Context:

Northern Finland, involving municipal authorities, NGOs, research institutions, and local landowners.

Target Users/Stakeholders:

Researchers, policymakers, local communities, administrative actors, civil society groups, landowners, an

Primary Methodology:

Mixed Methods — qualitative interviews, participatory workshops, GIS analysis, forestry simulations, litera

Primary Contribution Type:

Conceptual framework integrated with empirical application.

General Summary of the Paper

The authors critique the dominant output-focused concept of actionable knowledge and instead conceptu

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is defined as a **process**—not merely outputs—characterized by:

1. **Cumulative and stepwise** phases that build towards catalyzing action.

2. **Iterative and cyclical** interactions that allow reframing and adaptation.

3. **Coevolutionary** dynamics where knowledge and action continuously shape each other.

> "We instead propose to understand actionable knowledge as a process that has (1) cumulative and ste

> "Actionable knowledge… is not the output per se but the process of actionable knowledge production a

---

What Makes Something Actionable

- Integration of diverse knowledge systems (scientific, local, administrative).

- Co-definition of problems aligned with societal agendas.

- Societal validation and experimentation (pilots, participatory assessments).

- Usable, solution-oriented outputs grounded in co-production.

- Boundary spanning to sustain momentum and coordinate across actors.

- Contextual alignment with stakeholder values, priorities, and governance structures.

How Actionability is Achieved / Operationalized

Framework/Approach Name(s):

Four-phase process + Nine-step roadmap

Methods/Levers:

Participatory workshops, semi-structured interviews, GIS analysis, forestry simulations, pilot projects, coll

Operational Steps / Workflow:

1. Problem definition

2. Stakeholder identification

3. Background data collection

4. Pilot measures for validation

5. Visioning desirable futures

6. Impact assessment of measures

7. Stakeholder deliberation of results

8. Synthesis into roadmap

9. Establishment of catchment coordinator (boundary spanning)

Data & Measures:

GIS spatial datasets, water quality data, forestry growth and carbon simulations, participatory mapping, s

Implementation Context:

Catchment-scale land-use governance with overlapping environmental, social, and economic objectives.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Roadmap synthesis reduced complexity into accessible format.

- **CR (Contextual Relevance):** Yes — Problem reframed to match local water quality priorities.

- **FE (Feasibility):** Yes — Measures assessed for technical, social, and economic viability.

- **TI (Timeliness):** Partial — Iterative process responsive to emerging opportunities, but long-term cycl

- **EX (Explainability):** Partial — Process transparency emphasized; less focus on formal explainability

- **GA (Goal Alignment):** Yes — Co-defined goals and integration of stakeholder visions.

- **Other Dimensions Named by Authors:** Legitimacy, credibility, usability, and societal validation.

Theoretical or Conceptual Foundations

- Cash et al. (2003) attributes of knowledge (credibility, legitimacy, relevance)

- Co-production and social robustness literature (Nowotny 2003; Roux et al. 2006)

- Coevolutionary theory (Jasanoff 2004; Klenk 2018)

- Transdisciplinary research cycle models (Jahn et al. 2012; Hoffmann et al. 2019)

- Meshwork concept (Deleuze & Guattari 1987; Ingold 2011)

Indicators or Metrics for Actionability

- Uptake and implementation of roadmap measures.

- Establishment of a permanent catchment coordinator.

- Stakeholder engagement breadth and continuity.

- Reduction in environmental impact indicators (modeled/monitored).

Barriers and Enablers to Actionability

Barriers:

- Divergent priorities (e.g., climate vs. water quality).

- Limited scientific certainty for some measures.

- Fragmented governance and land ownership.

- Resistance from economically focused actors.

Enablers:

- Early stakeholder engagement and trust building.

- Pilot projects demonstrating feasibility.

- Clear, co-created vision and roadmap.

- Dedicated boundary spanning role.

Relation to Existing Literature

Positions itself against the dominant "knowledge-first" linear model by integrating cumulative, iterative, an

---

Summary

This paper reconceptualizes actionable knowledge as an ongoing process rather than discrete outputs. U

Scores

- **Overall Relevance Score:** 95 — Strong conceptualization of actionability with explicit process framin

- **Operationalization Score:** 92 — Clear nine-step, four-phase operationalization with concrete method

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Supporting Quotes from the Paper

- "We instead propose to understand actionable knowledge as a process that has (1) cumulative and step

- "Actionable knowledge… is not the output per se but the process of actionable knowledge production an

- "Without a shared problem, there cannot be shared problem solving, and collective action becomes imp

- "Integration of diverse systems of knowledge… increases potential to generate action." (p. 11)

- "The catchment coordinator… should be the central node for knowledge and action within the catchmen

---

Actionability References to Other Papers

- Cash et al. (2003) — Credibility, legitimacy, relevance framework

- Nowotny (2003) — Socially robust knowledge

- Roux et al. (2006) — Knowledge interfacing

- Jasanoff (2004) — Co-production of science and social order

- Jahn et al. (2012) — Transdisciplinary phases

- Hoffmann et al. (2019) — Iterative processes in transdisciplinary research

- Klenk (2018) — Meshwork concept

Paper Summary

<!--META_START-->

Title: Big data analytics: transforming data to action

Authors: Daniel Bumblauskas, Herb Nold, Paul Bumblauskas, Amy Igou

DOI: 10.1108/BPMJ-03-2016-0056

Year: 2017

Publication Type: Journal

Discipline/Domain: Business Process Management, Data Analytics

Subdomain/Topic: Actionable Knowledge from Big Data, Dashboard Decision Support

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicit via Argyris, applied to big data)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes (tied to actionability)

Contains Interpretability: Partial (interpretation implied in conversion process)

Contains Framework/Model: Yes (Actionable Knowledge Model + Performance Triangle + Dashboard Fra

Operationalization Present: Yes (detailed processes, tools, and case)

Primary Methodology: Conceptual + Case Application

Study Context: Big Data analytics in operations, decision-making, and business process management

Geographic/Institutional Context: USA; ESP International case

Target Users/Stakeholders: Business managers, operations managers, decision-makers, analysts

Primary Contribution Type: Conceptual model and applied case study

CL: Yes — "Humans give data meaning by adding context and reference points… relevant and purposefu

CR: Yes — "Information must be valid, timely, and relevant to the changing business world" (p. 708)

FE: Yes — "Ability to make informed choices" and "monitoring implementation" (p. 708)

TI: Yes — "Valid and timely information" (p. 708)

EX: Yes — "Interpret meaning in the data and communicate effectively" (p. 710)

GA: Yes — "Action with positive outcomes that add value to the organization" (p. 708)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Big data analytics: transforming data to action

Authors:

Daniel Bumblauskas, Herb Nold, Paul Bumblauskas, Amy Igou

DOI:

10.1108/BPMJ-03-2016-0056

Year:

2017

Publication Type:

Journal

Discipline/Domain:

Business Process Management, Data Analytics

Subdomain/Topic:

Actionable Knowledge from Big Data, Dashboard Decision Support

Contextual Background:

The paper addresses how organizations can convert vast big data sets into *actionable knowledge* that l

Geographic/Institutional Context:

USA; case study with ESP International in Cedar Rapids, Iowa.

Target Users/Stakeholders:

Business process managers, operations managers, decision-makers, analysts, executives handling large

Primary Methodology:

Conceptual + Case Application

Primary Contribution Type:

Conceptual model + applied example

General Summary of the Paper

The authors propose a conceptual framework for transforming big data into actionable knowledge, addres

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is explicitly defined per Argyris (1995) as:

> "Information that actors could use… to craft conversations that communicate the meanings they intend.

Actionability here means the ability to derive meaning from data that leads to informed, timely, and releva

---

What Makes Something Actionable

- Valid and timely information
- Ability to make informed choices
- Vigilant monitoring of input validity and implementation outcomes
- Continuous re-evaluation of data in changing contexts
- Human interpretation and integration of multiple data sources
- Alignment of decisions with organizational goals and value creation

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):**
  - Data → Information → Knowledge → Actionable Knowledge conversion model

- *Performance Triangle* (Culture, Leadership, Systems)

  - Dashboard framework with KPIs

- **Methods/Levers:**

  - Data contextualization, KPI selection, dashboard visualization, virus identification & mitigation

- **Operational Steps / Workflow:**

  1. Acquire and clean data

  2. Add context to create information

  3. Integrate and interpret to form knowledge

  4. Convert to actionable knowledge via decision-making frameworks

  5. Use dashboards to visualize KPIs linked to performance drivers

  6. Monitor and adjust continuously

- **Data & Measures:**

  - KPIs relevant to revenue, working capital, expenses, opportunity costs, risk

- **Implementation Context:**

  - ESP International dashboards for supplier performance monitoring

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Humans give data meaning by adding context… relevant and purposeful" (p. 70

- **CR (Contextual Relevance):** Yes — "Information must be valid, timely, and relevant to the changing

- **FE (Feasibility):** Yes — "Ability to make informed choices" and "monitoring implementation" (p. 708)

- **TI (Timeliness):** Yes — "Valid and timely information" (p. 708)

- **EX (Explainability):** Yes — Leaders must "interpret meaning in the data and communicate effectively

- **GA (Goal Alignment):** Yes — "Action with positive outcomes that add value to the organization" (p. 7

- **Other Dimensions Named by Authors:** Risk awareness, adaptability, feedback loops

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Theoretical or Conceptual Foundations

- Argyris (1993, 1995, 1996) on actionable knowledge

- Davenport & Prusak (1998) on data–information–knowledge hierarchy

- Michel's *Performance Triangle* model

- KPI theory and dashboard design principles (Few, 2006)

Indicators or Metrics for Actionability

- Validity and timeliness of input data

- Causal link between KPIs and performance outcomes

- Evidence of positive organizational change from decisions

Barriers and Enablers to Actionability

- **Barriers:**

  - Information overload, data "viruses" (obsolete systems, irrelevant data, low trust culture, outdated lead

  - Poorly designed dashboards, irrelevant KPIs

  - Security breaches and data privacy risks

- **Enablers:**

  - Valid, timely, relevant data

  - Strong culture of trust, leadership interpretive skills

  - Effective dashboard design and KPI alignment

Relation to Existing Literature

Builds on BDA literature (Chen et al., 2012; Fosso Wamba et al., 2015) and integrates management scien

---

Summary

This paper bridges big data analytics theory and practical decision-making by providing a framework for d

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Scores

- **Overall Relevance Score:** 95 — Strong explicit definition of actionability, rich conceptual framing, mu

- **Operationalization Score:** 90 — Clear, detailed process and applied example; could be enhanced by

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Supporting Quotes from the Paper

- "Information that actors could use… to craft conversations that communicate the meanings they intend"

- "Having valid and timely information; the ability to make informed choices; and vigilant monitoring of bot

- "Leaders who are able to interpret meaning in the data and communicate effectively are essential eleme

- "Dashboards… provide the information that leads to actionable knowledge" (p. 713)

Actionability References to Other Papers

- Argyris, C. (1993, 1995, 1996)

- Davenport, T., Prusak, L. (1998)

- Michel, L. (2013) *The Performance Triangle*

- Few, S. (2006) *Information Dashboard Design*

Paper Summary

<!--META_START-->

Title: AWARENESS-IN-ACTION: A Critical Integralism for the Challenges of Our Times

Authors: Daniel J. O'Connor

DOI: n/a

Year: 2013

Publication Type: Journal Article

Discipline/Domain: Integral Theory, Interdisciplinary Studies

Subdomain/Topic: Critical Integral Meta-paradigm; Actionable Knowledge; Interdisciplinary Response to C

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 70

Contains Definition of Actionability: Yes (implicit and partial explicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (meta-paradigmatic framing)

Operationalization Present: Yes (meta-paradigmatic approach across domains)

Primary Methodology: Conceptual/Theoretical

Study Context: Development of a meta-paradigm for human awareness-in-action applicable across politic

Geographic/Institutional Context: United States

Target Users/Stakeholders: Scholars, policymakers, activists, journalists, social workers, interdisciplinary

Primary Contribution Type: Conceptual framework linking awareness practices to actionable knowledge

CL: Yes

CR: Yes

FE: Partial

TI: Partial

EX: Partial

GA: Yes

<!--META_END-->

Title:

AWARENESS-IN-ACTION: A Critical Integralism for the Challenges of Our Times

Authors:

Daniel J. O'Connor

DOI:

n/a

Year:

2013

Publication Type:

Journal Article

Discipline/Domain:

Integral Theory, Interdisciplinary Studies

Subdomain/Topic:

Critical Integral Meta-paradigm; Actionable Knowledge; Interdisciplinary Response to Complex Challenge

Contextual Background:

The paper proposes *Awareness-in-Action* as a meta-paradigm integrating presupposed perspectives a

Geographic/Institutional Context:

United States

Target Users/Stakeholders:

Scholars, policymakers, activists, journalists, social workers, interdisciplinary practitioners

Primary Methodology:

Conceptual/Theoretical

Primary Contribution Type:

Meta-paradigmatic framework

General Summary of the Paper

O'Connor's *Awareness-in-Action* framework is presented as a critical integral meta-paradigm that conne

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly defined as the capacity to generate "actionable knowledge within, across, and be

> "Awareness-In-Action may therefore provide the meta-paradigmatic means to create actionable knowle

> "…so that those of us concerned with such matters might learn how to respond more effectively to the i

---

What Makes Something Actionable

- Integration of perspectives and practices of human awareness-in-action.

- Cross-disciplinary applicability.

- Responsiveness to interconnected political, economic, social, and ecological challenges.

- Grounding in validated presuppositions that serve as premises for inquiry and hypothesis formation.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Awareness-in-Action meta-paradigm

- **Methods/Levers:** Integration of meta-theoretical and meta-practical reconstructions.

- **Operational Steps / Workflow:** Summarization of primary features, philosophical grounding, applicati

- **Data & Measures:** Not empirical; conceptual synthesis.

- **Implementation Context:** Political, economic, social, ecological spheres, and various professions (jou

> "…summarize the primary features of Awareness-in-Action before elaborating on some of its philosoph

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — The framework seeks to clarify presuppositions across contexts.

- **CR (Contextual Relevance):** Yes — Tailored to diverse and interconnected fields.

- **FE (Feasibility):** Partial — Feasibility implied via meta-level applicability, but not operationally detaile

- **TI (Timeliness):** Partial — Linked to urgent societal challenges, though not time-bounded.

- **EX (Explainability):** Partial — Philosophical grounding aids explainability, but lacks explicit operation

- **GA (Goal Alignment):** Yes — Explicitly tied to responding effectively to pressing global challenges.

- **Other Dimensions Named by Authors:** Interdisciplinarity, reflexivity.

Theoretical or Conceptual Foundations

- Jürgen Habermas's Critical Theory

- Ken Wilber's Integral Theory

- Chris Argyris's Action Science

Indicators or Metrics for Actionability

No quantitative metrics; actionability is judged through conceptual fit and cross-disciplinary utility.

Barriers and Enablers to Actionability

- **Barriers:** Disciplinary silos, entrenched institutional boundaries.

- **Enablers:** Meta-paradigmatic integration, philosophical grounding, cross-sector dialogue.

Relation to Existing Literature

Positions itself at the intersection of integral theory and critical theory, extending their applicability to actio

---

Summary

The paper presents *Awareness-in-Action* as a meta-paradigm designed to unify diverse perspectives a

---

Scores

- **Overall Relevance Score:** 85 — Strong conceptualization and features tied to actionability; implicit d

- **Operationalization Score:** 70 — Provides a meta-paradigmatic pathway but lacks concrete implemen

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Supporting Quotes from the Paper

- "Awareness-In-Action may therefore provide the meta-paradigmatic means to create actionable knowle

- "…so that those of us concerned with such matters might learn how to respond more effectively to the in

- "…summarize the primary features of Awareness-in-Action before elaborating on some of its philosophi

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Actionability References to Other Papers

- Jürgen Habermas's Critical Theory

- Ken Wilber's Integral Theory

- Chris Argyris's Action Science

Paper Summary

<!--META_START-->

Title: An Open-Source Tool-Box for Asset Management Based on the Asset Condition for the Power Syst

Authors: Gopal Lal Rajora, Miguel A. Sanz-Bobi, Carlos Mateo Domingo, Lina Bertling Tjernberg

<!--META_END-->

Title:

An Open-Source Tool-Box for Asset Management Based on the Asset Condition for the Power System

Authors:

Gopal Lal Rajora, Miguel A. Sanz-Bobi, Carlos Mateo Domingo, Lina Bertling Tjernberg

DOI:

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Electrical Engineering / Power Systems

Subdomain/Topic:

Asset Management, Predictive Maintenance, Machine Learning for Power Grids

Contextual Background:

Developed under the European ATTEST project, the toolbox targets proactive asset management for ele

Geographic/Institutional Context:

Spain (Universidad Pontificia Comillas), Sweden (KTH Royal Institute of Technology), EU partners.

Target Users/Stakeholders:

Transmission and Distribution System Operators.

Primary Methodology:

Conceptual framework with quantitative case study (real-world and synthetic datasets).

Primary Contribution Type:

Modular open-source software integrating AI-based analytics for asset condition assessment and strategy

General Summary of the Paper

The paper introduces an open-source asset management toolbox designed for TSOs and DSOs, integrat

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper explicitly links "actionable insights" to the ability to inform prioritized, effective maintenance stra

> "The toolbox provides actionable insights for planning maintenance strategies and optimizing resource

> "Each asset's condition is evaluated… facilitating effective prioritization and decision-making for mainte

What Makes Something Actionable

- Measurable condition indicators across four dimensions: Life Assessment, Health Condition, Maintenan

- Ability to compare across heterogeneous assets.

- Prioritization thresholds for intervention.

- Integration of predictive analytics (clustering + SOM) for early identification of risks.

- Strategy recommendation system (Q-learning) that adapts to changes without manual rule rewriting.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ATTEST Asset Management Toolbox

- **Methods/Levers:** Data normalization, clustering (K-means, SOM), condition indicator computation, re

- **Operational Steps / Workflow:**

  1. Identify critical asset data.

  2. Compute multi-dimensional condition indicators.

  3. Cluster assets for pattern recognition.

  4. Apply Q-learning to recommend optimal actions.

  5. Simulate long-term strategies (Monte Carlo).

- **Data & Measures:** Asset age, failure probability, internal temperature, dissolved gas analysis, MTTR

- **Implementation Context:** Tested on European TSO/DSO datasets; compatible with CIM, IEC 61850,

> "This Module compares assets… recommending the most convenient actions… simulate and quantify t

> "The Q-learning algorithm… suggests actions with the highest potential reward." (p. 8)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Explicit, interpretable indicators for each dimension.

  > "Comparable condition indicators… allowing identification of assets requiring special attention."

- **CR (Contextual Relevance):** Yes — Indicators adaptable to available data and operational context.

- **FE (Feasibility):** Yes — Prioritized strategies feasible given operational constraints.

- **TI (Timeliness):** Yes — Short-term and long-term analyses inform timely interventions.

- **EX (Explainability):** Partial — While results are interpretable, underlying ML models' inner workings a

- **GA (Goal Alignment):** Yes — Optimizes for reliability, cost-efficiency, and sustainability goals.

- **Other Dimensions:** Adaptability (tool modularity and format compatibility).

Theoretical or Conceptual Foundations

- Condition-based maintenance theory.

- AI/ML for predictive asset management.

- Reinforcement learning (Q-learning) for adaptive strategy optimization.

- Multi-criteria decision analysis.

Indicators or Metrics for Actionability

- Multi-dimensional condition indicators (0–1 scale).

- Total Indicator threshold (e.g., >0.75 for critical attention).

- Cluster patterns denoting asset health states.

Barriers and Enablers to Actionability

- **Barriers:** Data incompleteness, heterogeneity of formats, variability in monitoring availability.

- **Enablers:** Open-source modular design, integration with industry standards, compatibility with multip

Relation to Existing Literature

Positions itself as advancing AI-driven asset management from descriptive analytics to prescriptive decis

Summary

The paper offers a comprehensive, modular, open-source framework for transforming raw asset condition

Scores

- **Overall Relevance Score:** 90 — Clear conceptualization of actionability through explicit condition-ba

- **Operationalization Score:** 95 — Detailed, replicable methodology with workflow, algorithms, metrics,

Supporting Quotes from the Paper

- "The toolbox provides actionable insights for planning maintenance strategies and optimizing resource a

- "Comparable condition indicators… allowing identification of assets requiring special attention." (p. 6)

- "Optimal actions are determined using a Q-matrix… suggests actions with the highest potential reward."

- "Assets are categorized as requiring priority attention and maintenance when the Total Indicator is near

Actionability References to Other Papers

- Rajora et al. (2024) — AI-based ML models for asset management.

- Žarkovi■ et al. (2021) — ML for transformer diagnostics.

- Li et al. (2023) — ML + blockchain in power management.

- Aminifar et al. (2022) — ML for asset management and protection.

Paper Summary

<!--META_START-->

Title: An Age-Based Framework for Evaluating Genome-Scale Sequencing Results in Newborn Screenin

Authors: Laura V. Milko, Julianne M. O'Daniel, Daniela M. DeCristo, Stephanie B. Crowley, Ann Katherin

DOI: https://doi.org/10.1016/j.jpeds.2018.12.027

Year: 2019

Publication Type: Journal Article

Discipline/Domain: Medical Genetics, Pediatrics, Genomic Medicine

Subdomain/Topic: Newborn Screening, Clinical Actionability, Next-Generation Sequencing (NGS)

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (ASQM – Age-based Semiquantitative Metric)

Operationalization Present: Yes

Primary Methodology: Conceptual + Comparative Validation Study

Study Context: Evaluation of gene–disease pairs for genomic newborn screening using a standardized a...

Geographic/Institutional Context: North Carolina, USA; University of North Carolina at Chapel Hill

Target Users/Stakeholders: Policy-makers, clinicians, genetic counselors, parents, newborn screening pr...

Primary Contribution Type: Conceptual framework with validation against existing panels

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Contextual Background:

The study is grounded in the public health context of newborn screening (NBS) in the United States, spec...

General Summary of the Paper

This paper introduces and validates the Age-based Semiquantitative Metric (ASQM), a framework for ass...

Eligibility

Eligible for inclusion: **Yes**

The paper explicitly defines clinical actionability, operationalizes it through a standardized scoring system...

How Actionability is Understood

The authors define actionability through five explicit criteria: severity, likelihood (penetrance), efficacy of i...

> "Each gene–disease pair was scored (0–3 points) on 5 criteria: severity… likelihood… efficacy… accep...

> "Gene–disease pairs were placed into… pediatric conditions with high actionability… pediatric condition...

What Makes Something Actionable

- High severity of potential outcome

- High likelihood of disease manifestation

- Highly effective interventions available

- Interventions are acceptable in terms of burden and risk

- Strong knowledge base and clinical consensus on gene–disease relationship

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** Age-based Semiquantitative Metric (ASQM)

- **Methods/Levers:** Structured scoring (0–3) for five actionability criteria; consensus review by multidisc

- **Operational Steps / Workflow:** Literature curation → preliminary scoring → consensus meetings → c

- **Data & Measures:** Severity, penetrance, intervention efficacy, intervention acceptability, knowledge k

- **Implementation Context:** Newborn genomic screening; policy and parental decision-making

> "The ASQM allows a priori categorization… to facilitate decision-making about incorporating genomic s

> "Gene–disease pairs… placed into 1 of 4 categories…" (p. 69)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – explicit scoring rubric with defined terms (p. 70)

- **CR (Contextual Relevance):** Yes – pediatric onset and intervention timing central to classification (p.

- **FE (Feasibility):** Yes – considers intervention efficacy and acceptability (p. 70)

- **TI (Timeliness):** Partial – age-of-onset and age-at-intervention incorporated (p. 69)

- **EX (Explainability):** Yes – transparent scoring and rationale for classification (p. 70, Fig. 1B)

- **GA (Goal Alignment):** Partial – implicit in alignment with NBS goals

- **Other Dimensions Named by Authors:** Knowledge base strength; ethical principle of preserving futur

Theoretical or Conceptual Foundations

- Builds on prior Semiquantitative Metric (Berg et al., 2016)

- Aligns with public health screening principles (Wilson and Jungner, updated for genomics)

- Compares to RUSP and BabySeq frameworks

Indicators or Metrics for Actionability

- Total ASQM score (0–15) across five criteria

- Cut-offs for automatic category assignment (≥12 for high actionability, <9 for low)

Barriers and Enablers to Actionability

- **Barriers:** Lack of effective interventions, insufficient knowledge base, controversial evidence

- **Enablers:** Strong clinical evidence, existing practice guidelines, early intervention potential

Relation to Existing Literature

Positions ASQM as a more integrated and age-aware framework compared to BabySeq's validity/onset/p

Summary

Milko et al. (2019) present the ASQM, an evidence-based, age-sensitive framework for scoring and class

Scores

- **Overall Relevance Score:** 95 – Provides explicit, multidimensional definition of actionability, systema

- **Operationalization Score:** 90 – Offers fully articulated scoring system, workflow, and validation, thoug

Supporting Quotes from the Paper

- "[Each gene–disease pair was scored… on 5 criteria: severity… likelihood… efficacy… acceptability… k

- "[Gene–disease pairs were placed into… 4 categories… based on final ASQM score, age of onset/actio

- "[Lack of effective intervention and/or insufficient knowledge… common reasons… not meet criteria for

- "[Validated our framework against the… RUSP… high ASQM scores assigned to most RUSP conditions

Actionability References to Other Papers

- Berg et al., 2016 – Semiquantitative Metric for Evaluating Clinical Actionability

- Wilson & Jungner screening criteria updates (Andermann et al., 2008)

- Ceyhan-Birsoy et al., 2017 – BabySeq curated gene list

- RUSP methodology references (Kemper et al., 2014)

Paper Summary

<!--META_START-->

Title: AI-Driven Whole-Exome Sequencing: Advancing Variant Interpretation and Precision Medicine

Authors: Faisal Aburub, Mayyas Al-Remawi, Rami A. Abdel-Rahem, Faisal Al-Akayleh, Ahmed S.A. Ali A

DOI: 10.1109/ICCIAA65327.2025.11013653

Year: 2025

Publication Type: Conference Proceeding

Discipline/Domain: Bioinformatics / Genomic Medicine

Subdomain/Topic: Whole-Exome Sequencing, AI for Variant Interpretation, Precision Medicine

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit, as clinically actionable insights in genomic medicine)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (AI-driven WES pipeline with multi-omics integration and XAI)

Operationalization Present: Yes

Primary Methodology: Conceptual / Review with applied case studies

Study Context: AI-enhanced WES in clinical genetic diagnostics

Geographic/Institutional Context: University of Petra, The University of Jordan (Jordan); applied reference

Target Users/Stakeholders: Clinicians, genomic researchers, bioinformaticians, healthcare policymakers

Primary Contribution Type: Conceptual framework with practical application examples for AI-driven WES

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

AI-Driven Whole-Exome Sequencing: Advancing Variant Interpretation and Precision Medicine

Authors:

Faisal Aburub, Mayyas Al-Remawi, Rami A. Abdel-Rahem, Faisal Al-Akayleh, Ahmed S.A. Ali Agha

DOI:

10.1109/ICCIAA65327.2025.11013653

Year:

2025

Publication Type:

Conference Proceeding

Discipline/Domain:

Bioinformatics / Genomic Medicine

Subdomain/Topic:

Whole-Exome Sequencing, AI for Variant Interpretation, Precision Medicine

Contextual Background:

The paper addresses the integration of AI—particularly ML and DL—into WES workflows to improve clini

Geographic/Institutional Context:

University of Petra (Jordan), The University of Jordan; case studies and tools from Taiwan, South Korea,

Target Users/Stakeholders:

Clinical geneticists, bioinformaticians, precision medicine practitioners, healthcare institutions.

Primary Methodology:

Conceptual framework with review of applied AI tools and comparative performance results.

Primary Contribution Type:

Framework and application roadmap for AI-driven WES in clinical precision medicine.

General Summary of the Paper

This paper presents an AI-driven framework for whole-exome sequencing (WES) that aims to improve va

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors implicitly define actionability as the transformation of WES data into clinically relevant, timely

> "AI… can pinpoint disease-associated variants, discover novel biomarkers, and guide personalized trea

> "Integrating multi-omics data and correlating genotype with phenotype further enable personalized inter

---

What Makes Something Actionable

- Accurate identification of pathogenic variants

- Contextual relevance through phenotype-genotype correlation

- Timely reporting and reduced turnaround times

- Interpretability and transparency in AI decision-making

- Integration of multi-omics data for holistic variant assessment

- Feasibility in clinical workflows (automation, reduced manual curation)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** AI-driven WES pipeline with XAI

- **Methods/Levers:** ML/DL models (DeepVariant, DANN, AI Variant Prioritizer, EVIDENCE), phenotype

- **Operational Steps / Workflow:** Data preprocessing → AI variant calling → AI-based annotation → Ph

- **Data & Measures:** WES datasets, HPO terms, population frequency databases, functional impact sc

- **Implementation Context:** Clinical genetic diagnostics and research workflows

> "An AI-powered WES pipeline… improved diagnostic yield to 41% for trio-WES cases and 28% for sing

> "Federated learning enables secure genomic data sharing… maintaining privacy and compliance" (p. 2)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Output must be interpretable for clinicians via XAI.

- **CR (Contextual Relevance):** Yes – Integration of patient metadata and multi-omics.

- **FE (Feasibility):** Yes – Automation and reduced turnaround time.

- **TI (Timeliness):** Partial – Reporting time reduced to one week in tested pipelines.

- **EX (Explainability):** Yes – SHAP, LIME for AI transparency.

- **GA (Goal Alignment):** Yes – Prioritization aligned with clinical diagnostic objectives.

- **Other Dimensions:** Ethical compliance, fairness, reproducibility.

Theoretical or Conceptual Foundations

- AI interpretability frameworks (SHAP, LIME)

- Federated learning privacy models

- Prior variant prioritization frameworks (ClinPred, REVEL, CADD)

Indicators or Metrics for Actionability

- Diagnostic yield percentage

- Top-N ranking accuracy for causative variants

- Turnaround time (e.g., 1 week)

- Percentage increase in pathogenic/likely pathogenic classification after AI integration

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Barriers and Enablers to Actionability

- **Barriers:** Data security, black-box AI, bias in training datasets, lack of regulatory clarity.

- **Enablers:** XAI frameworks, federated learning, inclusive datasets, standardization of AI pipelines.

Relation to Existing Literature

Positions AI-driven WES as an evolution over traditional variant interpretation pipelines, improving diagno

---

Summary

This paper conceptualizes actionability in WES as the delivery of accurate, relevant, interpretable, and ti

---

Scores

- **Overall Relevance Score:** 85 — Strong implicit definition of actionability tied to AI-enhanced variant i

- **Operationalization Score:** 90 — Detailed pipeline description with tools, workflows, and metrics expli

---

Supporting Quotes from the Paper

- "AI… can pinpoint disease-associated variants, discover novel biomarkers, and guide personalized trea

- "An AI-powered WES pipeline… improved diagnostic yield to 41% for trio-WES cases and 28% for sing

- "Integrating multi-omics data and correlating genotype with phenotype further enable personalized interv

- "Federated learning enables secure genomic data sharing… maintaining privacy and compliance" (p. 2)

Actionability References to Other Papers

- Huang et al. (2022) – AI Variant Prioritizer for integrating WES and phenotypic data

- Graham et al. (2018) – WES + metabolomics for variant prioritization

- Barcelona-Cabeza et al. (2021) – WES + RNA-Seq for improved variant detection

- Rusch et al. (2018) – Multi-omics integration in oncology

- Pinxten & Howard (2014) – Ethical issues in genome sequencing

Paper Summary

<!--META_START-->

Title: Actionable mutations in early-stage ovarian cancer according to the ESMO Scale for Clinical Action

Authors: F. Camarda, L. Mastrantoni, C. Parrillo, A. Minucci, F. Persiani, D. Giannarelli, T. Pasciuto, F. G

DOI: https://doi.org/10.1016/j.esmoop.2024.104090

Year: 2025

Publication Type: Journal

Discipline/Domain: Oncology / Precision Medicine

Subdomain/Topic: Early-stage epithelial ovarian cancer, genomic profiling, actionable mutations, ESCAT

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (via ESCAT framework)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: Partial

Contains Framework/Model: Yes (ESCAT classification tiers I–III)

Operationalization Present: Yes

Primary Methodology: Quantitative (prospective cohort, genomic profiling)

Study Context: Clinical oncology, early-stage epithelial ovarian cancer, targeted therapy potential

Geographic/Institutional Context: Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Ita

Target Users/Stakeholders: Oncologists, clinical researchers, precision medicine practitioners, policy-mal

Primary Contribution Type: Empirical study with framework application (ESCAT)

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: No

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Actionable mutations in early-stage ovarian cancer according to the ESMO Scale for Clinical Actionability

Authors:

F. Camarda, L. Mastrantoni, C. Parrillo, A. Minucci, F. Persiani, D. Giannarelli, T. Pasciuto, F. Giacomini,

DOI:

https://doi.org/10.1016/j.esmoop.2024.104090

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Oncology / Precision Medicine

Subdomain/Topic:

Early-stage epithelial ovarian cancer, genomic profiling, actionable mutations, ESCAT

Contextual Background:

The study focuses on early-stage epithelial ovarian cancer (EOC), assessing the prevalence and distribut

Geographic/Institutional Context:

Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy

Target Users/Stakeholders:

Oncologists, molecular pathologists, clinical researchers, precision oncology practitioners, guideline deve

Primary Methodology:

Quantitative — prospective cohort study with targeted next-generation sequencing (NGS) and ESCAT cla

Primary Contribution Type:

Empirical study applying a conceptual framework (ESCAT) to clinical genomic data.

General Summary of the Paper

This prospective single-center study analyzed 180 patients with FIGO stage I–II EOC, using targeted NG

Eligibility

Eligible for inclusion: **Yes**

The paper explicitly applies the ESCAT actionability framework, providing a structured classification of m

---

How Actionability is Understood

Actionability is framed through the ESCAT scale, which ranks molecular targets based on clinical evidenc

> "Oncogenic alterations were identified using OncoKB and classified according to the ESMO Scale for C

> "The ESCAT framework… prioritizes molecular targets based on the strength of evidence supporting th

---

What Makes Something Actionable

- Evidence-supported relevance as a clinical target.

- Classification in ESCAT Tier I–III (Tier I = highest clinical evidence; Tier III = emerging evidence).

- Potential to inform therapeutic decisions (drug selection, de-escalation/escalation).

- Relevance to tumor biology and prognosis.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ESCAT (ESMO Scale for Clinical Actionability of molecular Targets)

- **Methods/Levers:** Comprehensive genomic profiling via TSO500 high-throughput NGS panel; annota

- **Operational Steps / Workflow:**

  1. Patient enrollment and staging.

2. NGS sequencing of tumor tissue.

   3. Variant annotation and filtering for oncogenicity.

   4. ESCAT tier assignment.

   5. Risk stratification integration.

- **Data & Measures:** Mutation type, frequency, co-occurrence, MSI, TMB, recurrence-free survival.

- **Implementation Context:** Applied in a clinical oncology setting for prospective patient profiling.

> "Sequencing was carried out with a mean depth of >500×… only mutations annotated as 'Oncogenic' o

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — ESCAT provides clear ranking criteria.

- **CR (Contextual Relevance):** Yes — Actionability tied to EOC stage, histotype, recurrence risk.

- **FE (Feasibility):** Yes — Technically feasible in a hospital NGS program.

- **TI (Timeliness):** No explicit mention.

- **EX (Explainability):** No direct link made.

- **GA (Goal Alignment):** Yes — Actionability linked to patient outcome improvement and toxicity reduct

- **Other Dimensions:** Risk-stratified application, molecular co-alteration analysis.

Theoretical or Conceptual Foundations

- ESMO Precision Medicine Working Group ESCAT framework.

- OncoKB oncogenicity annotation system.

- Principles of tumor-agnostic targeting.

Indicators or Metrics for Actionability

- ESCAT Tier classification.

- Mutation prevalence and co-occurrence.

- MSI status and TMB values.

- Risk group-specific mutation frequency.

Barriers and Enablers to Actionability

- **Barriers:** Short follow-up; unclear prognostic role of some variants; potential resistance to targeted th

- **Enablers:** High prevalence of actionable variants; feasibility of NGS profiling; established ESCAT fra

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Relation to Existing Literature

Positions findings within ESMO/ESGO consensus guidelines for EOC, contrasts with mutation prevalence

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Summary

This study demonstrates that genomic profiling of early-stage EOC using the ESCAT framework reveals

---

Scores

- **Overall Relevance Score:** 85 — Strong use of ESCAT for defining and ranking actionability; integrate

- **Operationalization Score:** 80 — Detailed NGS and classification workflow; some gaps in timeliness a

---

Supporting Quotes from the Paper

- "Oncogenic alterations were identified using OncoKB and classified according to the ESMO Scale for Cl

- "ESCAT… prioritizing them based on the strength of evidence supporting their relevance as clinical targ

- "Sequencing was carried out with a mean depth of >500×… only mutations annotated as 'Oncogenic' or

- "These findings highlight the potential for actionable alterations in most early-stage EOC patients and su

---

Actionability References to Other Papers

- Mosele MF et al., 2024 — ESMO Precision Medicine Working Group recommendations for NGS use.

- Fieuws C et al., 2024 — Identification of actionable variants in EOC.

- Multiple ESMO-ESGO consensus guidelines on EOC pathology and molecular biology.

Paper Summary

<!--META_START-->

Title: Actionable Knowledge: Design Causality in the Service of Consequential Theory

Authors: Chris Argyris

DOI: n/a

Year: 1996

Publication Type: Journal

Discipline/Domain: Organizational Behavior / Management Science

Subdomain/Topic: Actionable Knowledge; Design Causality; Management Theory

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 85

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual

Study Context: Theories of managing in organizations

Geographic/Institutional Context: Harvard University (USA)

Target Users/Stakeholders: Managers, management theorists, organizational researchers

Primary Contribution Type: Conceptual framework and theoretical proposition

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Actionable Knowledge: Design Causality in the Service of Consequential Theory

Authors:

Chris Argyris

DOI:

n/a

Year:

1996

Publication Type:

Journal

Discipline/Domain:

Organizational Behavior / Management Science

Subdomain/Topic:

Actionable Knowledge; Design Causality; Management Theory

Contextual Background:

The paper addresses the gap between externally valid empirical research and its practical use in manage

Geographic/Institutional Context:

Harvard University (USA)

Target Users/Stakeholders:

Managers, management theorists, organizational researchers

Primary Methodology:

Conceptual

Primary Contribution Type:

Conceptual framework and theoretical proposition

General Summary of the Paper

This paper by Chris Argyris examines how empirical research, while often externally valid, frequently fails

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Argyris frames actionability as the property of knowledge that allows it to be directly applied to real-world

> "Actionable knowledge is that knowledge required to implement the external validity (relevance) in that

> "The claim is made that the concept of causality that underlies much rigorous empirical research makes

---

What Makes Something Actionable

- High external validity **and** the ability to be implemented in everyday decision-making.

- A causal framework that supports adaptability and learning rather than constraining them.

- Relevance to the lived realities and values of the decision-makers.

- Alignment with normative goals of management.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Design Causality

- **Methods/Levers:** Shift from traditional causality models to ones that encourage learning, adaptability

- **Operational Steps / Workflow:** Identify intended consequences, define the activities to achieve them,

- **Data & Measures:** Not quantitatively defined; emphasis on conceptual fit and practical testing.

- **Implementation Context:** Organizational management decision-making.

> "A different concept of causality is proposed that enhances actionability. Design causality is defined, an

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — actionable knowledge must be clear enough to guide implementation.

- **CR (Contextual Relevance):** Yes — relevance to "everyday life" and managerial context is explicit.

- **FE (Feasibility):** Yes — tied to ability to "implement" findings.

- **TI (Timeliness):** Partial — implicit in application to "managers in everyday life" but not explicitly elabo

- **EX (Explainability):** Partial — implied in the ability to illustrate design causality but not a standalone c

- **GA (Goal Alignment):** Yes — theories must be consistent with values and intended consequences.

Theoretical or Conceptual Foundations

- Theories of managing as theories of effectiveness.

- Normative theory of management rooted in values and goals.

- Prior works: Argyris (1982); Argyris & Schön (1996).

Indicators or Metrics for Actionability

No quantitative indicators provided; assessment is conceptual, focusing on implementability, consequenc

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Traditional causality models that constrain learning.

  - Disconnect between external validity and applicability.

- **Enablers:**

  - Adoption of design causality.

  - Normative alignment of theory and practice.

Relation to Existing Literature

Builds on Argyris' prior work and critiques conventional empirical methods, adding a normative and practi

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Summary

Chris Argyris' 1996 paper "Actionable Knowledge: Design Causality in the Service of Consequential Theo

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Scores

- **Overall Relevance Score:** 92 — Strong conceptual definition and detailed features directly tied to ac

- **Operationalization Score:** 85 — Offers a defined approach (design causality) and implementation illu

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Supporting Quotes from the Paper

- "Actionable knowledge is that knowledge required to implement the external validity (relevance) in that v

- "The claim is made that the concept of causality… makes it difficult to transform knowledge with high ex

- "A different concept of causality is proposed that enhances actionability. Design causality is defined, an

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Actionability References to Other Papers

- Argyris, C. (1982)

- Argyris, C., & Schön, D. (1996)

Paper Summary

<!--META_START-->

Title: A semiquantitative metric for evaluating clinical actionability of incidental or secondary findings from

Authors: Jonathan S. Berg, Ann Katherine M. Foreman, Julianne M. O'Daniel, Jessica K. Booker, Lacey

DOI: 10.1038/gim.2015.104

Year: 2016

Publication Type: Journal Article

Discipline/Domain: Genomic Medicine / Medical Genetics

Subdomain/Topic: Clinical Actionability Assessment in Genomic Sequencing

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 100

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual Framework Development and Application

Study Context: Evaluation of incidental/secondary findings in clinical genome-scale sequencing

Geographic/Institutional Context: University of North Carolina at Chapel Hill, USA

Target Users/Stakeholders: Clinical geneticists, genomic testing laboratories, healthcare providers, policy

Primary Contribution Type: Framework/method for assessing clinical actionability of gene–disease pairs

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A semiquantitative metric for evaluating clinical actionability of incidental or secondary findings from geno

Authors:

Jonathan S. Berg et al.

DOI:

10.1038/gim.2015.104

Year:

2016

Publication Type:

Journal Article

Discipline/Domain:

Genomic Medicine / Medical Genetics

Subdomain/Topic:

Clinical Actionability Assessment in Genomic Sequencing

Contextual Background:

The paper addresses the challenge of systematically evaluating the clinical actionability of genomic varian

Geographic/Institutional Context:

University of North Carolina at Chapel Hill, USA

Target Users/Stakeholders:

Clinical geneticists, genetic counselors, genomic laboratories, healthcare providers, professional organiza

Primary Methodology:

Conceptual framework and scoring metric development, applied analysis of multiple gene lists

Primary Contribution Type:

Development and validation of a semiquantitative scoring framework for clinical actionability

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General Summary of the Paper

This paper presents a semiquantitative metric for evaluating the clinical actionability of incidental or secor

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is conceptualized as a **continuum** rather than a binary state, integrating the potential seve

> "The LVBC developed a semiquantitative metric for determining the clinical actionability of gene–diseas

> "The subcategories… approximate the clinical utility of revealing incidental/secondary findings in a pres

---

What Makes Something Actionable

- High severity of the potential health outcome

- Moderate to high likelihood of disease manifestation

- Availability of effective preventive or therapeutic interventions

- Low burden or acceptable risk of intervention

- Substantial and reliable knowledge base supporting decision-making

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Semiquantitative Metric for Clinical Actionability

- **Methods/Levers:** Five criteria scored 0–3 (severity, likelihood, efficacy, burden, knowledge base)

- **Operational Steps / Workflow:** Evidence review → Assign scores for each criterion → Consensus sc

- **Data & Measures:** Literature from OMIM, GeneReviews, PubMed, clinical guidelines

- **Implementation Context:** NCGENES project and ACMG incidental findings recommendations

> "All five criteria are scored on a scale of 0–3… The outcome and intervention are defined in advance…

> "The LVBC chose to consider genes with a score ≥11… as meeting the threshold of actionability." (p. 4

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clarity through structured scoring definitions (Table 1)

- **CR (Contextual Relevance):** Yes — Explicit to presymptomatic, incidental/secondary findings contex

- **FE (Feasibility):** Yes — Evaluated through "burden of intervention" score

- **TI (Timeliness):** Partial — Implied in presymptomatic intervention consideration

- **EX (Explainability):** Yes — Transparent, evidence-based scoring with defined criteria

- **GA (Goal Alignment):** Partial — Implicit alignment with clinical utility and patient benefit

- **Other Dimensions Named by Authors:** Knowledge base strength

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Theoretical or Conceptual Foundations

- Clinical utility concepts from genomic medicine

- Evidence-based assessment models

- Prior ACMG deliberative consensus recommendations

Indicators or Metrics for Actionability

- Total score (0–15)

- Threshold ≥11 for high actionability

- Subscores for severity, likelihood, efficacy, burden, and knowledge base

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Barriers and Enablers to Actionability

- **Barriers:** Limited evidence base; subjective burden assessment; rare diseases with insufficient pene

- **Enablers:** Structured metric; multidisciplinary consensus; adaptability to different contexts

---

Relation to Existing Literature

The paper builds on and critiques earlier expert consensus models like the ACMG recommendations, add

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Summary

This paper delivers a rigorous, transparent framework for assessing the clinical actionability of incidental

---

Scores

- **Overall Relevance Score:** 95 — Clear conceptualization of actionability as multidimensional, detailed

- **Operationalization Score:** 100 — Fully developed metric with applied examples and scoring workflow

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Supporting Quotes from the Paper

- "Actionability is a continuum, not a binary state." (p. 468)

- "The LVBC established five core characteristics of clinical actionability…" (p. 469)

- "The LVBC chose to consider genes with a score ≥11… as meeting the threshold of actionability." (p. 47

Actionability References to Other Papers

- ACMG Recommendations for Reporting of Incidental Findings (Green et al., 2013)

- Evidence-based Genomic Applications in Practice and Prevention Working Group (Goddard et al., 2013

- NCGENES project preliminary outputs (Berg et al., 2013)

Paper Summary

<!--META_START-->

Title: A look into travel motivation post-crisis: Insights from means-end chain theory

Authors: Swechchha Subedi, Lali Odosashvili, Marketa Kubickova

DOI: https://doi.org/10.1016/j.jhtm.2025.05.013

Year: 2025

Publication Type: Journal

Discipline/Domain: Hospitality and Tourism Management

Subdomain/Topic: Post-crisis travel motivation, Means-End Chain (MEC) theory

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes (implicit, through "actionable insights for tourism practitioners" an

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (Crisis-Modified MEC Framework)

Operationalization Present: Yes

Primary Methodology: Quantitative (hard laddering MEC survey)

Study Context: International leisure travel motivation post-COVID-19

Geographic/Institutional Context: U.S. residents (international travel context)

Target Users/Stakeholders: Destination Marketing Organizations (DMOs), tourism practitioners, policy ma

Primary Contribution Type: Theoretical and practical framework advancement

CL: Yes — clarity of destination attributes and value linkages is explicitly linked to actionability

CR: Yes — contextual relevance (post-crisis, safety, cultural connection)

FE: Yes — feasibility discussed in aligning offerings with traveler needs

TI: Yes — timeliness in responding to evolving post-crisis priorities

EX: Yes — explainability via hierarchical value maps

GA: Yes — goal alignment with traveler values and DMO strategies

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A look into travel motivation post-crisis: Insights from means-end chain theory

Authors:

Swechchha Subedi, Lali Odosashvili, Marketa Kubickova

DOI:

https://doi.org/10.1016/j.jhtm.2025.05.013

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Hospitality and Tourism Management

Subdomain/Topic:

Post-crisis travel motivation, Means-End Chain (MEC) theory

Contextual Background:

Examines how major crises, specifically COVID-19, have reshaped leisure travel motivations, destination

Geographic/Institutional Context:

U.S.-based survey with international travel focus.

Target Users/Stakeholders:

Destination Marketing Organizations, tourism stakeholders, policy makers.

Primary Methodology:

Quantitative (hard laddering MEC survey, hierarchical value mapping).

Primary Contribution Type:

Theoretical expansion (Crisis-Modified MEC Framework) and practitioner guidance.

General Summary of the Paper

This study explores how COVID-19 has altered the cognitive structures underlying international leisure tr

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the tourism sector's ability to **align post-crisis offerings with restructured trave

> "The study also provides actionable insights for tourism practitioners, emphasizing the need for tailored

> "By addressing key motivators such as safety, relaxation, and cultural connection, DMOs can align thei

What Makes Something Actionable

- Direct alignment with travelers' **core values** (e.g., personal happiness, self-reflection, enhanced enjo

- Incorporation of **repositioned attributes** (e.g., safety, natural scenery) into central offerings.

- Ability to **adapt frameworks** to crisis conditions (flexibility, safety protocols, smaller-scale cultural exp

- Evidence-based linkages between **destination attributes → consequences → values** via hierarchical

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Crisis-Modified MEC Framework.

- **Methods/Levers:** Hard laddering surveys; Hierarchical Value Mapping (HVM); demographic segment

- **Operational Steps / Workflow:** Identify priority attributes post-crisis; map A-C-V chains; detect motiva

- **Data & Measures:** 22 attributes, 9 consequences, 13 values (see Table 2); linkage frequencies from

- **Implementation Context:** DMOs redesigning tourism strategies for post-COVID conditions.

> "…health safety has become a critical driver of destination choice… creating new benchmarks for what

> "Flexible booking options… address uncertainty while fostering trust and reducing perceived risks." (p. 4

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear mapping of attributes to values via HVM.

- **CR (Contextual Relevance):** Yes — Post-crisis travel shifts explicitly tied to safety, cultural relevance

- **FE (Feasibility):** Yes — Practical recommendations like flexible bookings, wellness tourism.

- **TI (Timeliness):** Yes — Responding to immediate post-crisis traveler shifts.

- **EX (Explainability):** Yes — Visual and narrative explanation of cognitive linkages.

- **GA (Goal Alignment):** Yes — DMOs aligning with enduring traveler values.

- **Other Dimensions Named by Authors:** Motivation realignment, compression effect, value resilience.

Theoretical or Conceptual Foundations

- Borgardt's extended MEC framework (macro-environmental influence).

- Hill et al. (2022) on direct attribute-value linkages.

- Classic MEC theory (Gutman, 1982; Reynolds & Gutman, 1988).

Indicators or Metrics for Actionability

- Frequency of A-C-V linkages.

- Attribute prioritization frequencies.

- Shift in pathway lengths (compression effect).

Barriers and Enablers to Actionability

- **Barriers:** Rigid traditional travel motivation models; oversimplified attribute categorizations; uncertain

- **Enablers:** Demographic-specific tailoring; visible safety protocols; integration of nature and culture; fl

Relation to Existing Literature

Challenges push-pull and hierarchical motivation models for their static assumptions, proposing dynamic

Summary

This paper operationalizes actionability as the ability to adapt tourism offerings to post-crisis traveler moti

Scores

- **Overall Relevance Score:** 92 — Strong conceptual clarity on actionability, rich with systematic featur

- **Operationalization Score:** 88 — Detailed process for achieving actionability through mapping and fra

Supporting Quotes from the Paper

- "The study also provides actionable insights for tourism practitioners, emphasizing the need for tailored,

- "Health safety has become a critical driver of destination choice… creating new benchmarks for what co

- "The Crisis-Modified MEC Framework… incorporates both macro-level disruptions and micro-level demo

- "Despite significant restructuring… certain fundamental values… maintain their importance… accessible

Actionability References to Other Papers

- Borgardt (2018) — Extended MEC framework.

- Hill et al. (2022) — Direct attribute-value linkages.

- McIntosh & Thyne (2005) — MEC in tourism.

- Jiang et al. (2015) — Pre-crisis MEC structures in tourism.

Paper Summary

<!--META_START-->

Title: A framework to rank genomic alterations as targets for cancer precision medicine: the ESMO Scale

Authors: Mateo, J.; Chakravarty, D.; Dienstmann, R.; Jezdic, S.; Gonzalez-Perez, A.; Lopez-Bigas, N.; Ng

Title:

A framework to rank genomic alterations as targets for cancer precision medicine: the ESMO Scale for C

Authors:

Mateo, J.; Chakravarty, D.; Dienstmann, R.; Jezdic, S.; Gonzalez-Perez, A.; Lopez-Bigas, N.; Ng, C.K.Y.;

DOI:

Year:

2018

Publication Type:

Journal

Discipline/Domain:

Oncology / Precision Medicine

Subdomain/Topic:

Genomic targets prioritization, cancer biomarkers, targeted therapy classification

Contextual Background:

The paper addresses the lack of harmonization in defining and prioritizing "actionable" genomic alteration

Geographic/Institutional Context:

Led by the European Society for Medical Oncology (ESMO) with contributors from multiple global instituti

Target Users/Stakeholders:

Oncologists, clinical researchers, molecular tumor boards, drug developers, regulatory agencies.

Primary Methodology:

Conceptual framework development via expert consensus and literature synthesis.

Primary Contribution Type:

Framework / classification system.

General Summary of the Paper

The authors present the ESMO Scale for Clinical Actionability of molecular Targets (ESCAT), a structure

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as the clinical utility of a genomic alteration for guiding targeted therapy, grounded

> "The ESCAT defines clinical evidence-based criteria to prioritise genomic alterations as markers to sele

> "We consider a target 'tier I-A', if… data… has demonstrated clinically meaningful improvement of a su

What Makes Something Actionable

- Demonstrated clinical benefit in survival or relevant endpoints in appropriate trial designs.

- Consistency of benefit across tumor types (for tier I-C) or specificity to certain tumor contexts.

- Supporting evidence from retrospective, prospective, or preclinical studies depending on tier.

- Predictive rather than merely prognostic value.

- Feasibility of therapeutic intervention targeting the alteration.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ESMO Scale of Clinical Actionability for molecular Targets (ESCAT)

- **Methods/Levers:** Evidence-tier system based on trial type, outcome measures, and tumor specificity

- **Operational Steps / Workflow:** Classify molecular targets into ESCAT tiers I–X; integrate into tumor b

- **Data & Measures:** Clinical trial endpoints (OS, PFS), response rates, biomarker presence, preclinica

- **Implementation Context:** Precision oncology decision-making, research prioritization, and reporting h

> "This classification system aims to offer a common language… to place targets within their clinical conte

> "The scale uses the strength of evidence from clinical studies as the basis to assign tiers…" (p. 1900)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear definition and tier structure; standardized terminology.

> "…offer a terminology that can be broadly applicable and help clinicians…" (p. 1901)

- **CR (Contextual Relevance):** Yes — Tiers depend on tumor-type-specific evidence.

- **FE (Feasibility):** Yes — Only feasible therapeutic targets are considered for higher tiers.

- **TI (Timeliness):** No explicit mention as an actionability criterion.

- **EX (Explainability):** Partial — Mechanistic rationale described for examples but not formalized as a r

- **GA (Goal Alignment):** Yes — Focus on improving patient outcomes and guiding therapy choice.

- **Other Dimensions Named by Authors:** Magnitude of benefit; type and quality of evidence.

Theoretical or Conceptual Foundations

- Builds on and harmonizes prior classification schemas (Andre et al. 2014; Van Allen et al. 2014; Meric-E

- Incorporates ESMO Magnitude of Clinical Benefit Scale.

Indicators or Metrics for Actionability

- Clinical trial endpoints: overall survival (OS), progression-free survival (PFS), objective response rate (C

- Magnitude of benefit per ESMO MCBS.

- Level and type of supporting evidence.

Barriers and Enablers to Actionability

- **Barriers:** Lack of harmonized terminology; variable evidence strength; tumor heterogeneity; rarity of

- **Enablers:** ESCAT tier system; existing genomic databases; collaborative curation; prospective regist

Relation to Existing Literature

Positions ESCAT as an integrative and globally applicable framework addressing gaps in prior systems, e

Summary

This paper presents ESCAT, a structured, evidence-based framework for ranking genomic alterations in c

Scores

- **Overall Relevance Score:** 95 — Strong, explicit definition of actionability, detailed features tied to clin

- **Operationalization Score:** 95 — Fully developed framework with concrete tiering system, explicit crit

Supporting Quotes from the Paper

- "The ESCAT defines clinical evidence-based criteria to prioritise genomic alterations…" (p. 1895)

- "We consider a target 'tier I-A', if… data… has demonstrated clinically meaningful improvement…" (p. 1

- "The scale uses the strength of evidence from clinical studies as the basis to assign tiers to a target." (p

- "Clear terminology regarding clinical utility should decrease the chance for misinterpretation…" (p. 1901

Actionability References to Other Papers

- Andre et al., Ann Oncol 2014

- Van Allen et al., Nat Med 2014

- Meric-Bernstam et al., J Natl Cancer Inst 2015

- Chakravarty et al., JCO Precis Oncol 2017 (OncoKB)

- ESMO Magnitude of Clinical Benefit Scale (Cherny et al., Ann Oncol 2017)

Paper Summary

<!--META_START-->

Title: A framework for genomic biomarker actionability and its use in clinical decision making

Authors: Smruti J. Vidwans, Michelle L. Turski, Filip Janku, Ignacio Garrido-Laguna, Javier Munoz, Richa

DOI: 10.18632/oncoscience.104

Year: 2014

Publication Type: Journal

Discipline/Domain: Oncology, Genomics

Subdomain/Topic: Biomarker actionability, targeted cancer therapy

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual framework

Study Context: Genomic biomarkers in cancer diagnosis and treatment planning

Geographic/Institutional Context: USA, Spain (multi-institutional collaboration)

Target Users/Stakeholders: Oncologists, molecular pathologists, clinical researchers

Primary Contribution Type: Conceptual framework and practical categorization

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A framework for genomic biomarker actionability and its use in clinical decision making

Authors:

Smruti J. Vidwans, Michelle L. Turski, Filip Janku, Ignacio Garrido-Laguna, Javier Munoz, Richard Schwa

DOI:

10.18632/oncoscience.104

Year:

2014

Publication Type:

Journal

Discipline/Domain:

Oncology, Genomics

Subdomain/Topic:

Biomarker actionability, targeted cancer therapy

Contextual Background:

The paper addresses the growing use of molecular diagnostics in oncology, particularly genomic biomark

Geographic/Institutional Context:

USA and Spain, involving institutions like MD Anderson Cancer Center, University of California San Dieg

Target Users/Stakeholders:

Oncologists, molecular pathologists, clinical researchers, trial designers.

Primary Methodology:

Conceptual framework development.

Primary Contribution Type:

Proposal of a structured framework for determining biomarker actionability in cancer.

General Summary of the Paper

The authors present a comprehensive framework for evaluating the actionability of genomic biomarkers i

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability refers to a biomarker being oncogenic and/or differentially expressed in tumor cells such tha

> "A biomarker is actionable if it is oncogenic and/or differentially expressed on tumor cells, and a treatme

> "A gene may be considered theoretically actionable if it has a basis of actionability…." (p. 614)

What Makes Something Actionable

- Functional role in driving malignancy.

- Targetability by approved or investigational drugs.

- Involvement in targetable pathways (directly or indirectly).

- Homology to other actionable biomarkers.

- Differential expression enabling targeted delivery.

- Supportive evidence from clinical guidelines, clinical/pre-clinical studies, or analogous genetic diseases.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Basis of Actionability & Rationale for Actionability.

- **Methods/Levers:** Categorization based on functional role, drug targetability, pathway involvement, h

- **Operational Steps / Workflow:** Identify biomarker → Determine category (basis) → Map rationale (ev

- **Data & Measures:** Clinical trial data, pre-clinical evidence, treatment guidelines, registry data, geneti

- **Implementation Context:** Personalized oncology decision-making.

> "The framework also includes a rationale for actionability in which strength of evidence for a biomarker

> "A biomarker may be considered actionable if it is a direct target of one or more approved drugs…" (p. (

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clearly defined biomarker-drug relationships are necessary for actionability.

> "…standards exist that outline treatments for individuals harboring aberrations in the biomarker…" (p. 6

- **CR (Contextual Relevance):** Yes — considers histology-specific and histology-agnostic evidence.

> "…extrapolating predictive data from the tumor site of origin with the highest strength of evidence to a c

- **FE (Feasibility):** Yes — includes evidence-based categories to guide clinical applicability.

- **TI (Timeliness):** Partial — recognizes rapid adoption of NGS and challenges in matching treatments

- **EX (Explainability):** Yes — detailed rationale for why a biomarker is actionable.

- **GA (Goal Alignment):** Yes — aligns biomarker actionability with optimal patient outcomes.

Other Dimensions Named by Authors:

- Strength of evidence level.

- Functional role versus passenger status.

Theoretical or Conceptual Foundations

- Companion diagnostics in oncology.

- NCCN and FDA treatment guideline frameworks.

- Molecular oncology concepts like oncogenic drivers, passengers, and pathway targeting.

Indicators or Metrics for Actionability

- Approval status of drugs with companion diagnostics.

- Inclusion in treatment guidelines.

- Evidence from clinical trials, pre-clinical studies, or genetic disease contexts.

Barriers and Enablers to Actionability

- **Barriers:** Conflicting data across histologies, novel variants of unknown significance, tumor genomic

- **Enablers:** Systems biology approaches, multi-omic profiling, histology-agnostic trial designs.

Relation to Existing Literature

Builds on existing oncology guidelines and targeted therapy concepts but integrates them into a unified fr

Summary

This paper offers a structured framework for assessing genomic biomarker actionability in cancer therapy

Scores

- **Overall Relevance Score:** 95 — Offers a direct, explicit definition of actionability, detailed categoriza

- **Operationalization Score:** 90 — Provides a clear workflow and categories for applying actionability a

Supporting Quotes from th

Paper Summary

<!--META_START-->

Title: Transforming disease data into 'actionable intelligence'

Authors: Arabella Gray

DOI: 10.1002/vetr.5447

Year: 2025

Publication Type: Journal News/Feature (Veterinary Record)

Discipline/Domain: Veterinary epidemiology / One Health

Subdomain/Topic: Animal disease surveillance dashboards; evidence-based risk management

Eligibility: Eligible

Overall Relevance Score: 62

Operationalization Score: 45

Actionable/Actionability Used in Paper: Yes — e.g., "transform complex [disease] outbreak data into clea

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "Timely and reliable data is esse

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes (implicit; timeliness, clarity, contextual relevance, feasibil

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: No (describes a dashboard/platform rather than a theoretical framework)

Operationalization Present: Yes (platform features/workflows described; no formal methodology)

Primary Methodology: Review/Descriptive (news feature)

Study Context: Global animal disease outbreak surveillance platform ("Animal Disease Insights")

Geographic/Institutional Context: World Organisation for Animal Health (WOAH) data; One Health Epi Co

Target Users/Stakeholders: Veterinarians, veterinary services, policymakers, public/animal health commu

Primary Contribution Type: Platform overview and implications for decision support

CL: Yes

CR: Yes

FE: Partial

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Transforming disease data into 'actionable intelligence'

Authors:

Arabella Gray

Publication Type:

Journal News/Feature (Veterinary Record)

Discipline/Domain:

Veterinary epidemiology / One Health

Subdomain/Topic:

Animal disease surveillance dashboards; evidence-based risk management

Contextual Background:

This feature introduces "Animal Disease Insights," a web-based dashboard that aggregates two decades

Geographic/Institutional Context:

Uses official reports accessible via WOAH's World Animal Health Information Service; global scope acros

Target Users/Stakeholders:

Veterinarians, veterinary services, policymakers; broader One Health decision-makers. :contentReferenc

Primary Methodology:

Review/Descriptive (journal feature; no empirical study). :contentReference{index=3}

Primary Contribution Type:

Platform overview and articulation of decision-support implications. :contentReference{index=4}

General Summary of the Paper

The article presents "Animal Disease Insights," an interactive dashboard by One Health Epi Consulting. It

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Actionable/Actionability Used in Paper

Yes. Verbatim mentions tied to decisions:

- "transform complex [disease] outbreak data into clear, actionable intelligence, free of charge." (p. 297) :

- "By opening up access to high■quality disease data, we're empowering veterinarians and veterinary se

- "[Data] can support evidence-based risk management… [and] evidence-based decision-making." (p. 297

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Timely and reliable data is essential for veterinarians and policymakers to detect emerging threats and

- Future features aim to "capture early signals of emerging threats" and use "predictive modelling to delive

---

How Actionability is Understood

Implicit conceptualization: Actionability is achieved when disease surveillance data is timely, reliable,

> "transform… data into clear, actionable intelligence" (p. 297) :contentReference{index=12}

What Makes Something Actionable

- **Timeliness / Early signals**

  > "real-time social media monitoring to 'capture early signals of emerging threats'… predictive modelling

- **Reliability / Data quality**

  > "Timely and reliable data is essential…" (p. 297) :contentReference{index=14}

- **Clarity of presentation**

  > "interactive maps, trend charts, country rankings" (p. 297) — to "transform complex outbreak data into

- **Contextual relevance (local insights)**

  > "Country insights: individual disease events… interactive maps and local hotspots identified." (p. 297)

- **Accessibility / Usability**

  > "free of charge" and designed to meet demand for "modern, user■friendly tools." (p. 297) :contentRe

- **Goal alignment (One Health perspective)**

  > "incorporate human outbreak data… to 'truly support a One Health perspective'." (p. 297) :contentRe

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** "Animal Disease Insights" dashboard. :contentReference

- **Methods/Levers:** Integration of official WOAH outbreak data (20 years, 130+ diseases, ~200 countrie

- **Operational Steps / Workflow:**

  1) Aggregate official outbreak reports; 2) compute disease frequency and country rankings; 3) render gl

- **Data & Measures:** Outbreak counts, cases, deaths; host–pathogen interactions; media coverage fre

- **Implementation Context:** Global veterinary surveillance; evidence-based risk management for anima

> "By making official animal health data publicly accessible, we support evidence-based decision■makin

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes.** "transform complex… data into clear… intelligence." (p. 297) :contentReferenc

- **CR (Contextual Relevance):** **Yes.** "Country insights… local hotspots identified." (p. 297) :contentf

- **FE (Feasibility):** **Partial.** "free of charge"; "user■friendly tools" (no explicit feasibility constraints di

- **TI (Timeliness):** **Yes.** "real-time… capture early signals… proactive alerts." (p. 297) :contentRefer

- **EX (Explainability):** **Partial.** Predictive modelling mentioned without detail; visualizations aid interp

- **GA (Goal Alignment):** **Yes.** "truly support a One Health perspective"; "risk management," "decisio

- **Other Dimensions Named by Authors:** Accessibility ("free of charge"), Data Quality ("high■quality," "

Theoretical or Conceptual Foundations

No formal theory; the piece situates the dashboard within One Health and evidence-based risk managem

---

Indicators or Metrics for Actionability

Implied indicators: outbreak frequency, cases, deaths, country rankings, detection of "early signals," and

---

Barriers and Enablers to Actionability

- **Barriers:** Not explicitly discussed; implicitly, complexity of data and lack of timely signals. (p. 297) :co

- **Enablers:** Public accessibility of official data, user■friendly interface, media analytics, real■time soci

---

Relation to Existing Literature

The article references WOAH's official reporting system and positions the dashboard as complementary–

Summary

This journal feature profiles a global surveillance dashboard that reframes official animal disease reports

---

Scores

- **Overall Relevance Score:** **62/100.** Strong explicit use of "actionable intelligence" and multiple imp

- **Operationalization Score:** **45/100.** Provides practical platform features and describes future alerti

---

Supporting Quotes from the Paper

- "transform complex [disease] outbreak data into clear, actionable intelligence, free of charge." (p. 297) :

- "Timely and reliable data is essential… to detect emerging threats and implement effective preventive m

- "real-time social media monitoring to 'capture early signals of emerging threats', and… predictive model

- "By making official animal health data publicly accessible, we support evidence-based decision-making

---

Actionability References to Other Papers

N/A (news/feature article; no explicit academic citations beyond WOAH resources are discussed in the te

Paper Summary

<!--META_START-->

Title: Actionable Knowledge Discovery and Delivery

Authors: Longbing Cao

DOI: 10.1002/widm.1044

Year: 2012

Publication Type: Journal

Discipline/Domain: Data Mining / Knowledge Discovery

Subdomain/Topic: Actionable Knowledge Discovery (AKD), Domain-Driven Data Mining

Eligibility: Eligible

Overall Relevance Score: 98

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual / Framework Development

Study Context: Knowledge discovery in data mining, focusing on bridging the gap between academic out

Geographic/Institutional Context: University of Technology, Sydney, Australia

Target Users/Stakeholders: Data mining researchers, practitioners, business decision-makers

Primary Contribution Type: Conceptual framework and methodological proposition (Domain-Driven Data

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Actionable Knowledge Discovery and Delivery

Authors:

Longbing Cao

DOI:

10.1002/widm.1044

Year:

2012

Publication Type:

Journal

Discipline/Domain:

Data Mining / Knowledge Discovery

Subdomain/Topic:

Actionable Knowledge Discovery (AKD), Domain-Driven Data Mining

Contextual Background:

The paper addresses the persistent gap between data mining research outputs and the needs of busines

Geographic/Institutional Context:

University of Technology, Sydney, Australia

Target Users/Stakeholders:

Data mining researchers, practitioners, and business decision-makers in domains such as retail, healthca

Primary Methodology:

Conceptual / Framework Development

Primary Contribution Type:

Proposal of a structured AKD methodology (Domain-Driven Data Mining) and operational frameworks.

General Summary of the Paper

This paper critiques the inadequacies of traditional KDD, highlighting its inability to produce knowledge di

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as "the power to work" — the quality of knowledge that enables direct, effective de

> "Actionable knowledge 'is not only relevant to the world of practice, it is the knowledge that people use

> "Actionability means the power to work, which is an optimal outcome… through the best integration of s

What Makes Something Actionable

- Addresses the actual business problem, not just technical interest.

- Integrates environmental, organizational, and social factors.

- Is interpretable and explainable to end users.

- Is feasible and integrable into existing business processes.

- Produces measurable impact toward business goals.

- Satisfies both technical and business interestingness thresholds.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Domain-Driven Data Mining (D3M), AKD Framework

- **Methods/Levers:** Integration of domain, human, network, and social intelligence; postanalysis; unifie

- **Operational Steps / Workflow:** Problem definition → Data understanding → Environmental/context m

- **Data & Measures:** Technical and business actionability metrics (objective and subjective), thresholds

- **Implementation Context:** Retail, healthcare, intrusion detection, web analytics, organizational decisio

> "AKD is a six-dimension-based optimization process: problem, data, environment, model, decision, opti

> "For a pattern p… Act(p) can be further measured in terms of technical actionability and business actio

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — interpretability and understandability emphasized.

- **CR (Contextual Relevance):** Yes — explicit requirement to integrate environmental/business context

- **FE (Feasibility):** Yes — must be directly usable without major rework.

- **TI (Timeliness):** Partial — addressed indirectly via adaptability to dynamic data and environments.

- **EX (Explainability):** Yes — must be interpretable in business language and logic.

- **GA (Goal Alignment):** Yes — deliverables must meet business expectations and objectives.

- **Other Dimensions Named by Authors:** Autonomy, deliverability, dependability, repeatability, trust, se

Theoretical or Conceptual Foundations

- System sciences, cybernetics, complex systems theory, metasynthesis, agent-based systems, ubiquitou

Indicators or Metrics for Actionability

- Technical interestingness (ti) and business interestingness (bi) with defined thresholds.

- Objective/subjective measures from technical and business perspectives.

- Evaluation of business impact (e.g., revenue, efficiency).

Barriers and Enablers to Actionability

- **Barriers:** Academic–business goal misalignment; oversimplification of problems; lack of integration o

- **Enablers:** Involving domain experts; modeling environmental factors; unified interestingness measur

Relation to Existing Literature

Positions itself as extending prior notions of actionable rules and interestingness by embedding them in a

Summary

Cao (2012) advances the concept of Actionable Knowledge Discovery (AKD) as a shift from conventional

Scores

- **Overall Relevance Score:** 98 — Provides a rich, explicit conceptualization of actionability, systematic

- **Operationalization Score:** 95 — Offers a complete methodology with measurable metrics, process m

Supporting Quotes from the Paper

- "Actionable knowledge 'is not only relevant to the world of practice…'" (p. 149)

- "Actionability means the power to work… through the best integration of six core dimensions." (p. 154)

- "AKD is a six-dimension-based optimization process: problem, data, environment, model, decision, optin

- "Deliverables… must be easily interpretable, convertible into business rules, and linked to decision-mak

Actionability References to Other Papers

- Argyris (1993, 1996) on actionable knowledge in organizational contexts.

- He et al. (2005) on actionable knowledge in data mining.

- Ras & Wieczorkowska (2000) on action rules.

- Cao & Zhang (2007, 2010) on knowledge actionability and domain-driven data mining.

Paper Summary

<!--META_START-->

Title: Geopolitical Forecasting and Actionable Intelligence

Authors: Ian S. Lustick

DOI: 10.1080/00396338.2022.2032959

Year: 2022

Publication Type: Journal

Discipline/Domain: Political Science / International Relations

Subdomain/Topic: Geopolitical forecasting, intelligence analysis, decision support

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 70

Contains Definition of Actionability: Yes (implicit, tied to "actionable intelligence")

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: No formal named framework, but conceptual approach

Operationalization Present: Yes

Primary Methodology: Conceptual / Analytical Essay

Study Context: Intelligence analysis for U.S. foreign policy and national security

Geographic/Institutional Context: Primarily U.S. intelligence community

Target Users/Stakeholders: Policymakers, intelligence analysts, national security officials

Primary Contribution Type: Conceptual framework for linking forecasting validity/verification to actionabilit

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title: Geopolitical Forecasting and Actionable Intelligence

Authors: Ian S. Lustick

DOI: 10.1080/00396338.2022.2032959

Year: 2022

Publication Type: Journal

Discipline/Domain: Political Science / International Relations

Subdomain/Topic: Geopolitical forecasting, intelligence analysis, decision support

Contextual Background: Discusses the evolution of U.S. intelligence forecasting from WWII to the pre

Geographic/Institutional Context: U.S. intelligence community and policymaking environment

Target Users/Stakeholders: Policymakers, intelligence analysts, decision-support tool developers

Primary Methodology: Conceptual / Analytical Essay

Primary Contribution Type: Conceptual linkage between validation, verification, and actionable intellig

General Summary of the Paper

The paper examines why geopolitical forecasting, despite technological advances, often fails to produce a

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly defined as the capacity of intelligence forecasts to inform and guide concrete poli

> "If forecasts are used as actual inputs into a policy- or decision-making process, they do need to be ac

> "Only models capable of answering why and how questions, not just what, where and when questions,

What Makes Something Actionable

- Empirical validity (accuracy, precision, reliability of forecasts)

- Verification (causal traceability and theoretical grounding)

- Ability to answer "why" and "how" questions to guide action

- Integration of domain-specific cultural, political, and economic knowledge

- Relevance to decision-makers' context and needs

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Not formalized; dual requirement of validation + verification

- **Methods/Levers:** Brier scoring for validation; causal modeling for verification; integration of substanti

- **Operational Steps / Workflow:**

  1. Validate forecasts statistically (probability conformity to outcomes).

  2. Verify causal soundness of models.

  3. Integrate social science expertise with computational modeling.

  4. Tailor models to specific geographic/cultural contexts.

- **Data & Measures:** Brier score; qualitative causal traceability

- **Implementation Context:** U.S. intelligence community forecasting for policy use

> "Only streams of outcomes that exhibit the forecasted probability can corroborate the validity of the fore

> "If outcomes cannot be traced to particular combinations of antecedent variables… decision-makers ca

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — forecasts must be precise and interpretable to decision-makers.

- **CR (Contextual Relevance):** Yes — tied to specific geopolitical/cultural contexts.

- **FE (Feasibility):** Partial — implies that forecasts should inform feasible actions, but not fully elaborat

- **TI (Timeliness):** No explicit emphasis.

- **EX (Explainability):** Yes — forecasts must answer "why" and "how" to be useful.

- **GA (Goal Alignment):** Partial — linked to enhancing desired outcomes and avoiding undesirable one

- **Other Dimensions:** Validation, Verification.

Theoretical or Conceptual Foundations

- Distinction between validation and verification from modeling literature.

- Critique of brute-force empiricism in forecasting (Lustick & Tetlock 2021).

- Decision-support theory in intelligence studies.

Indicators or Metrics for Actionability

- Brier scoring for forecast validity.

- Presence of causal explanations linking variables to outcomes.

Barriers and Enablers to Actionability

- **Barriers:** Dominance of engineers over social scientists in intelligence R&D; overreliance on machine

- **Enablers:** Combining social science expertise with computing power; rigorous validation and verifica

Relation to Existing Literature

Positions itself against purely technical, data-driven forecasting approaches, emphasizing the need for th

Summary

Lustick's article argues that for geopolitical forecasts to yield *actionable intelligence*, they must satisfy tv

Scores

- **Overall Relevance Score:** 88 — Strong implicit definition and clear features linked to actionability; ro

- **Operationalization Score:** 70 — Outlines a clear dual-process approach (validation + verification) an

Supporting Quotes from the Paper

- "If forecasts are used as actual inputs into a policy- or decision-making process, they do need to be acc

- "Only models capable of answering why and how questions, not just what, where and when questions, v

- "Only streams of outcomes that exhibit the forecasted probability can corroborate the validity of the fore

- "If outcomes cannot be traced to particular combinations of antecedent variables… decision-makers ca

Actionability References to Other Papers

- Lustick & Tetlock (2021), *The Simulation Manifesto*

- O'Brien (2010), *Crisis Early Warning and Decision Support*

- Johnston (2005), *Analytic Culture in the U.S. Intelligence Community*

- Halberstam (1972), *The Best and the Brightest*

Paper Summary

<!--META_START-->

Title: Knowledge and Policy: research – information – intervention

Authors: Ingrid Gogolin, Edwin Keiner, Gita Steiner-Khamsi, Jenny Ozga, Lyn Yates

DOI: n/a

Year: 2007

Publication Type: Journal

Discipline/Domain: Educational Policy, Educational Research

Subdomain/Topic: Policy Analysis, Research Governance, Knowledge Transfer

Eligibility: Yes

Overall Relevance Score: 85

Operationalization Score: 70

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual and Review

Study Context: Education Policy, International Comparisons

Geographic/Institutional Context: International (Switzerland, UK, Germany, USA, Australia)

Target Users/Stakeholders: Educational Policymakers, Researchers, Educators

Primary Contribution Type: Conceptual Exploration, Policy Implications

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Knowledge and Policy: research – information – intervention

Authors: Ingrid Gogolin, Edwin Keiner, Gita Steiner-Khamsi, Jenny Ozga, Lyn Yates

DOI: n/a

Year: 2007

Publication Type: Journal

Discipline/Domain: Educational Policy, Educational Research

Subdomain/Topic: Policy Analysis, Research Governance, Knowledge Transfer

Contextual Background: The paper discusses the evolving relationships between research, informatio

Geographic/Institutional Context: The paper draws on international perspectives, including the UK, Ge

Target Users/Stakeholders: Educational policymakers, researchers, practitioners in education

Primary Methodology: Conceptual analysis, review of educational policy trends

Primary Contribution Type: Conceptual exploration of policy-research interactions and implications fo

General Summary of the Paper

This paper explores the interplay between research, information, and policy interventions in educational s

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

The authors define actionability in the context of research-policy relationships as the process by which re

> "Research knowledge is not just a tool for solving problems but becomes a resource for governance, fa

> "Policy-making increasingly relies on research that is 'actionable,' a process that is mediated by politica

What Makes Something Actionable

The authors argue that for research to be actionable, it must:

- Be clearly translated into policy-relevant knowledge

- Align with political and economic needs, particularly in the context of global benchmarking and educatio

- Be produced with a view toward achieving practical outcomes, often under the constraints of governanc

> "Actionable knowledge must be framed to meet both the practical needs of policymakers and the strate

> "The shift toward evidence-based policy-making demands that research be oriented toward measurable

How Actionability is Achieved / Operationalized

The paper proposes that actionability is achieved through mechanisms like international knowledge bank

- **Framework/Approach Name(s):** Evidence-based Policy, Knowledge Transfer

- **Methods/Levers:** International knowledge banks, benchmarking, cross-national comparisons

- **Operational Steps / Workflow:** Researchers produce data-driven reports that become policy tools; th

- **Data & Measures:** Standardized assessments (PISA, TIMSS), national rankings, educational benchm

- **Implementation Context:** Primarily in global educational reform initiatives, influenced by international

> "International comparisons, like those of PISA and TIMSS, provide the evidence that policymakers nee

> "The creation of knowledge banks is a deliberate attempt to shape the policy landscape by providing ev

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Actionable knowledge must be clear and understandable to policymakers.

  > "Actionable research must be accessible to those making policy decisions, as clarity is essential to en[...]
- **CR (Contextual Relevance):** Yes – Knowledge must be relevant to the specific political and educatio[...]

  > "Research needs to be contextualized to fit the political, social, and economic conditions of the countr[...]
- **FE (Feasibility):** Yes – Research should be practical and feasible to implement in policy.

  > "Feasibility is a key attribute for research to be considered actionable, particularly when framed within[...]
- **TI (Timeliness):** Yes – Actionability also depends on the timeliness of the research in relation to poli[...]

  > "Timely interventions are necessary to ensure that research can be translated into action during critica[...]
- **EX (Explainability):** Yes – The ability to explain research findings in a way that informs decision-mak[...]

  > "The explanation of research results in an understandable way is critical for influencing policy decision[...]
- **GA (Goal Alignment):** Yes – Research must align with the goals and agendas of policymakers.

  > "Alignment with national or international educational goals is crucial for ensuring that research is actio[...]

Theoretical or Conceptual Foundations

The paper draws on the concept of Mode 1 and Mode 2 knowledge production (Gibbons et al., 1994), hig[...]

> "Mode 2 knowledge production is marked by its transdisciplinary approach, involving collaboration betw[...]

Indicators or Metrics for Actionability

The paper implies that actionable knowledge is measured through indicators such as educational ranking[...]

> "International rankings and benchmarks act as primary indicators of the quality and impact of education[...]

Barriers and Enablers to Actionability

- **Barriers:** Political agendas that shape the research questions and the framing of evidence, resistanc[...]

> "Political pressures can skew the research agenda, prioritizing data that aligns with predetermined polic[...]

- **Enablers:** Collaboration between researchers and policymakers, the rise of evidence-based policy-m[...]

> "The growth of knowledge banks and international policy networks has enhanced the ability to translate[...]

Relation to Existing Literature

The paper critiques the linear model of research-to-policy transfer, which assumes a direct link from rese[...]

> "The relationship between research and policy is more complex than the simple transmission of knowle[...]

Summary

This paper critically examines the relationship between research, information, and policy interventions in [...]

Scores

- **Overall Relevance Score:** 85 – The paper offers valuable insights into the complexities of making res[...]
- **Operationalization Score:** 70 – While the paper discusses mechanisms for achieving actionability, it [...]

Supporting Quotes from the Paper

- "Research knowledge is not just a tool for solvin

Paper Summary

<!--META_START-->

Title: Actionable Insights in Urban Multivariate Time-series

Authors: Anika Tabassum, Supriya Chinthavali, Varisara Tansakul, B. Aditya Prakash

DOI: https://doi.org/10.1145/3459637.3482410

Year: 2021

Publication Type: Conference (ACM CIKM '21)

Discipline/Domain: Computer Science / Urban Analytics

Subdomain/Topic: Multivariate Time-series Segmentation, Explainability, Rationalization

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, formalized in RaTSS problem)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (RaTSS, Find-RaTSS)

Operationalization Present: Yes

Primary Methodology: Conceptual + Quantitative Evaluation (Algorithm design, experiments)

Study Context: Urban analytics applications in disasters, public health, epidemiology, and general high-di

Geographic/Institutional Context: US (Oak Ridge National Laboratory, Virginia Tech, Georgia Tech)

Target Users/Stakeholders: Urban domain experts (emergency management authorities, epidemiologists

Primary Contribution Type: Novel problem formulation + algorithmic solution

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Actionable Insights in Urban Multivariate Time-series

Authors:

Anika Tabassum, Supriya Chinthavali, Varisara Tansakul, B. Aditya Prakash

DOI:

https://doi.org/10.1145/3459637.3482410

Year:

2021

Publication Type:

Conference Paper (CIKM 2021)

Discipline/Domain:

Computer Science / Data Mining

Subdomain/Topic:

Urban Analytics, Time-series Segmentation, Explainable AI

Contextual Background:

The paper addresses the difficulty urban domain experts face in extracting **actionable** time-series of in

Geographic/Institutional Context:

US, collaboration between Virginia Tech, Oak Ridge National Laboratory, Georgia Tech.

Target Users/Stakeholders:

Emergency management authorities, epidemiologists, public health planners, infrastructure operators.

Primary Methodology:

Conceptual framework + Algorithm design (RaTSS & Find-RaTSS) + Empirical evaluation on synthetic, re

Primary Contribution Type:

Novel problem definition + algorithm to produce actionable insights for any black-box segmentation algori

---

General Summary of the Paper

The authors introduce **RaTSS** (Rationalization for Time-series Segmentation), a framework for identify

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as identifying TOIs whose changes across segmentation cutpoints are **most rele

> "… actionable insights, i.e., which time-series/counties are the most important with respect to an event,

> "… human-friendly and actionable TOIs (rationalizations) for the urban experts across the associated e

---

What Makes Something Actionable

- High relative importance across a cutpoint (based on learned weights)

- Potential to influence direct interventions or decisions

- Inclusion of *non-obvious* series not apparent from visual inspection

- Contextual linkage to events (e.g., weather, policy changes, epidemiological outbreaks)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** RaTSS (problem), Find-RaTSS (algorithm)

- **Methods/Levers:** Segment graph representation; optimization of global latent weights (α) to maximiz

- **Operational Steps / Workflow:**

  1. Build segment graph for multivariate time series.

  2. Calculate edge weights using basic statistical features across segments.

  3. Compute $\Delta\pi$ (difference in path lengths between chosen and alternative segmentations).

  4. Optimize α under sparsity and norm constraints.

  5. Derive r_j (importance weights) per cutpoint and select top TOIs.

- **Data & Measures:** Mean, variance, min, max features per segment; importance weights; F1-scores f

- **Implementation Context:** Works for any black-box segmentation algorithm, regardless of internal me

> "We propose an algorithm Find-RaTSS to automatically capture the TOIs in a way that is flexible and w

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — output is simplified, interpretable list of TOIs with weights.

- **CR (Contextual Relevance):** Yes — TOIs tied to specific events and domain context.

- **FE (Feasibility):** Yes — outputs can be operationalized into concrete actions (e.g., send crews, inves

- **TI (Timeliness):** Partial — method processes historical data; potential for near real-time with optimiza

- **EX (Explainability):** Yes — weight-based rationalizations with clear link to cutpoints.

- **GA (Goal Alignment):** Yes — TOIs are selected to match decision-makers' objectives.

- **Other Dimensions:** Non-obviousness (ability to surface hidden but important cases).

Theoretical or Conceptual Foundations

- Graph-based representation of segmentation paths (segment graph)

- Optimization under sparsity and norm constraints

- Basic statistical change detection (mean, variance, min, max features)

Indicators or Metrics for Actionability

- Importance weight (r_j) per series at each cutpoint

- F1-score comparing predicted TOIs to ground truth

- Fraction of total rationalization weight captured by top-k TOIs

---

Barriers and Enablers to Actionability

- **Barriers:**

  - If segmentation is meaningless (e.g., constant series), rationalizations may not be meaningful.

  - Some actionable groups may consist of combinations of series, not individual ones (not yet implemente

- **Enablers:**

  - Algorithm's independence from segmentation model details

  - Works with any multivariate time-series data

Relation to Existing Literature

Positions itself as the first method to identify actionable TOIs for any black-box segmentation. Builds on v

---

Summary

This paper presents RaTSS, a formal problem framing for deriving actionable Time-series of Interest (TO

Scores

- **Overall Relevance Score:** 90 — Strong implicit and operational definition of actionability, clear identif

- **Operationalization Score:** 95 — Detailed algorithm and workflow for achieving actionable outputs, te

---

Supporting Quotes from the Paper

- "... actionable insights, i.e., which time-series/counties are the most important with respect to an event…

- "We introduce and formalize a novel problem Rationalization for Time-series Segmentations (RaTSS)…

- "$r_j = |\alpha \blacksquare w_{ijk}|$" (p. 4)

- "Remark 1: … when the time-series is constant, then rationalizations (TOIs) found by RaTSS may not b

---

Actionability References to Other Papers

- [23] Cut-n-Reveal: Time Series Segmentations with Explanations — related explanation approach but m

- [6] ORNL EARSS — situational awareness in disaster response.

- [19] Dynammo — handling missing values in time-series.

- [21] Autoplait — segmentation with HMMs.

- [12] TICC — segmentation with multilayer Markov Random Fields.

Paper Summary

<!--META_START-->

Title: Communication of Actionable Information

Authors: Giles W. Boland, Richard Duszak Jr, Paul A. Larson

DOI: http://dx.doi.org/10.1016/j.jacr.2014.08.003

Year: 2014

Publication Type: Journal

Discipline/Domain: Radiology / Medical Imaging

Subdomain/Topic: Communication of actionable radiology findings

Eligibility: Eligible

Overall Relevance Score: 83

Operationalization Score: 75

Contains Definition of Actionability: Yes (implicit and partially explicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (ACR categories)

Operationalization Present: Yes

Primary Methodology: Conceptual / Practice guidance

Study Context: Communication of actionable radiology information in clinical workflows

Geographic/Institutional Context: U.S. radiology practices, hospitals, and teleradiology services

Target Users/Stakeholders: Radiologists, referring physicians, patients, hospital administrators

Primary Contribution Type: Practice recommendations and framework adaptation

CL: Yes

Title:

Communication of Actionable Information

Authors:

Giles W. Boland, Richard Duszak Jr, Paul A. Larson

DOI:

http://dx.doi.org/10.1016/j.jacr.2014.08.003

Year:

2014

Publication Type:

Journal

Discipline/Domain:

Radiology / Medical Imaging

Subdomain/Topic:

Communication of actionable radiology findings

Contextual Background:

The paper addresses the challenge of ensuring that radiology reports—especially those containing action

Geographic/Institutional Context:

U.S. radiology practices, including academic centers, private groups, and teleradiology services.

Target Users/Stakeholders:

Radiologists, referring physicians, patients, hospital administrators.

Primary Methodology:

Conceptual / Practice guidance.

Primary Contribution Type:

Practice recommendations and operational framework.

General Summary of the Paper

This article outlines the critical role radiologists play in not only producing timely, meaningful, and actiona

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper defines actionable information in radiology as findings that, once communicated, can influence

> "A report creates little value until it is delivered, read, and correctly understood… Only then can informa

> "Effective communication of actionable information" is described as the final step in the imaging value c

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What Makes Something Actionable

- Clear identification of findings with clinical significance.

- Timeliness in delivering the report relative to urgency.

- Delivery to the right recipient(s) with confirmation.

- Documentation of communication.

- Use of standardized categories (ACR Category 1–3) tied to urgency.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ACR Actionable Reporting categories.

- **Methods/Levers:** Standardized timelines for Category 1 (minutes), Category 2 (hours), Category 3 (d

- **Operational Steps / Workflow:** Interpret findings → classify urgency → communicate via appropriate

- **Data & Measures:** Time from report finalization to communication; confirmation logs; audit trails.

- **Implementation Context:** Hospital radiology, teleradiology, academic centers, multidisciplinary clinics

> "Category-1 findings require communication within minutes, usually by direct verbal communication…"

> "Electronic text and e-mail alerts… confirm whether referrers have reviewed such reports… close the c

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Reports must be concise and precisely structured to be understood by stakehold

> "…synthesize all relevant clinical information into a concise and precisely structured document." (p. 1)

- **CR (Contextual Relevance):** Yes — Findings must be relevant to the patient's condition and clinical

- **FE (Feasibility):** Yes — Communication processes must be operationally possible within institutional

- **TI (Timeliness):** Yes — Strong emphasis on rapid delivery based on urgency category.

- **EX (Explainability):** No — Paper does not explicitly frame explainability as part of actionability.

- **GA (Goal Alignment):** Partial — Aligns communication with patient outcomes but not framed as expli

- **Other Dimensions Named by Authors:** Integration with IT systems; closed-loop communication; docu

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Theoretical or Conceptual Foundations

- Imaging Value Chain model.

- ACR Actionable Reporting framework.

Indicators or Metrics for Actionability

- Time-to-communication metrics by urgency category.

- Audit logs of communication events.

- Confirmation of recipient acknowledgment.

Barriers and Enablers to Actionability

- **Barriers:** Fragmented IT systems; lack of integrated EMR; variability in preliminary/final report workfl

- **Enablers:** Integrated IT solutions; standardized critical findings policies; embedding radiologists in ca

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Relation to Existing Literature

Builds directly on ACR Actionable Reporting Work Group recommendations, situating them within broade

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Summary

Boland et al. (2014) conceptualize actionability in radiology as the combination of meaningful findings, tim

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Scores

- **Overall Relevance Score:** 83 — Strong implicit definition, tied to explicit features and urgency framew

- **Operationalization Score:** 75 — Provides concrete steps and workflow recommendations linked to ac

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Supporting Quotes from the Paper

- "A report creates little value until it is delivered, read, and correctly understood… Only then can informat

- "Category-1 findings require communication within minutes, usually by direct verbal communication…" (

- "Electronic text and e-mail alerts… close the communication loop…" (p. 2)

- "Radiologists need to remember that they serve primarily in an information business and recognize that

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Actionability References to Other Papers

- Larson PA, Berland LL, Kahn CE, Liebscher LA. *Actionable findings and the role of IT support: report o

Paper Summary

<!--META_START-->

Title: Generating Actionable Insights from Patient Medical Records and Structured Clinical Knowledge

Authors: Natasha Trajkovska, Michael Roiss, Sophie Bauernfeind, Mohammad Alnajdawi, Simone Sandl

DOI: 10.3233/SHTI240015

Year: 2024

Publication Type: Conference

Discipline/Domain: Health Informatics / Medical Data Science

Subdomain/Topic: Clinical decision support, medical NLP, structured knowledge integration

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes (implicitly through process mining and ontology mapping)

Contains Framework/Model: Yes (Treetop treatment pathways & disease models)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (technical implementation with evaluation)

Study Context: Extraction and structuring of unstructured patient records for clinical decision support

Geographic/Institutional Context: Austria; University of Applied Sciences Upper Austria, Treetop Medical,

Target Users/Stakeholders: Clinicians, medical decision support developers, healthcare institutions

Primary Contribution Type: Technical method and evaluation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Generating Actionable Insights from Patient Medical Records and Structured Clinical Knowledge

Authors:

Natasha Trajkovska, Michael Roiss, Sophie Bauernfeind, Mohammad Alnajdawi, Simone Sandler, Danie

DOI:

10.3233/SHTI240015

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Health Informatics / Medical Data Science

Subdomain/Topic:

Clinical decision support, medical NLP, structured knowledge integration

Contextual Background:

This work addresses the challenge of converting unstructured medical text (e.g., patient letters, lab repor

Geographic/Institutional Context:

Austria; University of Applied Sciences Upper Austria, Treetop Medical, Medical University of Vienna.

Target Users/Stakeholders:

Clinicians, health IT specialists, hospital administrators, AI developers in healthcare.

Primary Methodology:

Mixed methods—technical pipeline development, natural language processing, process mining, compara

Primary Contribution Type:

Technical method and evaluation.

General Summary of the Paper

The paper proposes a method to transform unstructured patient medical records into structured, encoded

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly defined as the transformation of raw, unstructured medical data into structured, e

> "...transform unstructured data into a cascade of progressively refined stages: structured data, encodec

> "...identify relevant findings in the treatment course that might be relevant for upcoming treatments or p

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What Makes Something Actionable

- Accurate extraction of relevant clinical events from unstructured data.

- Encoding with standardized clinical terminologies (e.g., SNOMED CT).

- Chronological reconstruction of treatment history.

- Contextual comparison with evidence-based treatment pathways.

- Identification of deviations, missing steps, or bottlenecks in care.

- Alignment with patient-specific disease models and upcoming care needs.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Treetop Medical treatment pathways and disease models; GuidedLl

- **Methods/Levers:** NLP with Llama-2-70b-orca-200k, medical knowledge-infused prompting, ontology

- **Operational Steps / Workflow:**

  1. Convert unstructured PDFs to plain text.

  2. Classify document type.

  3. Section segmentation (diagnosis, medication, etc.).

  4. Extract structured data using LLM or GuidedLLM.

  5. Map extracted data to SNOMED CT codes via hybrid lexical-semantic matching.

  6. Construct treatment timeline using process mining.

  7. Compare with predefined treatment pathways and detect deviations/missing steps.

- **Data & Measures:** Sensitivity, Jaccard similarity coefficient.

- **Implementation Context:** Chronic myeloid leukemia patient letters and lab reports.

> "...construct a chronological treatment timeline... can then be automatically compared to the treatment p

> "...identify relevant findings... and deviations between predefined treatment pathways and actual treatm

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Data is structured, encoded, and clearly organized in JSON for interpretability.

- **CR (Contextual Relevance):** Yes — Aligned with disease models and treatment pathways.

- **FE (Feasibility):** Yes — Implemented with existing EHR data and ontology standards.

- **TI (Timeliness):** Yes — Designed to highlight upcoming procedures and overdue checks.

- **EX (Explainability):** Partial — Process is interpretable, but LLM outputs may have limited transparen

- **GA (Goal Alignment):** Yes — Directly aligned with clinical guidelines and personalized patient manag

- **Other Dimensions:** Safety relevance, deviation detection.

Theoretical or Conceptual Foundations

- Evidence-based clinical pathways and guidelines.

- Ontology-based data encoding (SNOMED CT).

- Process mining for event timeline reconstruction.

Indicators or Metrics for Actionability

- Sensitivity (diagnosis and medication detection).

- Jaccard similarity coefficient for extraction detail accuracy.

- Deviation detection between actual and standard treatment timelines.

Barriers and Enablers to Actionability

- **Barriers:**

  - Unstructured and heterogeneous medical data formats.

  - LLM hallucinations.

  - Limited initial dataset size.

- **Enablers:**

  - Integration of structured medical knowledge in LLM prompting.

  - Use of standard clinical ontologies.

  - Automated process mining.

Relation to Existing Literature

Positions itself among LLM applications in medicine, highlighting mixed results without domain-specific kr

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Summary

The paper presents a practical, technically grounded approach to making medical data actionable by syst

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Scores

- **Overall Relevance Score:** 85 — Strong implicit conceptualization of actionability with explicit features

- **Operationalization Score:** 90 — Clear, multi-step pipeline from raw data to actionable knowledge, ev

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Supporting Quotes from the Paper

- "...transform unstructured data into a cascade of progressively refined stages: structured data, encoded

- "...identify relevant findings in the treatment course that might be relevant for upcoming treatments or pr

- "...construct a chronological treatment timeline... can then be automatically compared to the treatment p

- "...identify deviations between predefined treatment pathways and actual treatment courses..." (p. 4)

Actionability References to Other Papers

- Cellina et al. (2023) on personalized medicine and digital twins.

- Sugandh et al. (2024) on personalized diabetes care.

- Packer & Metra (2021) on guideline adherence in heart failure.

- Jarjour et al. (2020) on care gaps in guideline adherence.

- Vaismoradi et al. (2020) on patient safety principles.

- Koleck et al. (2019) and Sheikhalishahi et al. (2019) on NLP for clinical notes.

- Thirunavukarasu et al. (2023) on LLMs in medicine.

Paper Summary

<!--META_START-->

Title: The future of artificial intelligence in intensive care: moving from predictive to actionable AI

Authors: Jim M. Smit; Jesse H. Krijthe; Jasper van Bommel; on behalf of the Causal Inference for ICU Co

DOI: 10.1007/s00134-023-07102-y

Year: 2023

Publication Type: Journal

Discipline/Domain: Critical Care Medicine; Artificial Intelligence

Subdomain/Topic: Causal inference; decision support; ICU sepsis treatment strategies

Eligibility: Eligible

Overall Relevance Score: 86

Operationalization Score: 61

Actionable/Actionability Used in Paper: Yes — "we propose to refer to any data■driven model used for ca

Authors Argue for Need for Actionability Without Defining It: No — they explicitly define actionable AI as c

Contains Definition of Actionability: Yes — "Actionable AI should perform causal inference tasks… predic

Contains Systematic Features/Dimensions: Partial

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Partial (summarizes methods and exemplars rather than proposing a new fr

Operationalization Present: Yes (target trial emulation, marginal structural models, reinforcement learning

Primary Methodology: Conceptual (Perspective/Commentary)

Study Context: ICU treatment decision-making, especially sepsis fluids/vasopressors

Geographic/Institutional Context: General ICU context; authors from Erasmus MC (NL) and TU Delft (NL)

Target Users/Stakeholders: ICU physicians; clinical researchers developing AI for ICU

Primary Contribution Type: Conceptual clarification and research agenda

CL: Partial

CR: Yes

FE: Partial

TI: Partial

EX: No

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The future of artificial intelligence in intensive care: moving from predictive to actionable AI

Authors:

Jim M. Smit; Jesse H. Krijthe; Jasper van Bommel; on behalf of the Causal Inference for ICU Collaborato

DOI:

10.1007/s00134-023-07102-y

Year:

2023

Publication Type:

Journal (What's New in Intensive Care)

Discipline/Domain:

Critical Care Medicine; Artificial Intelligence

Subdomain/Topic:

Causal inference for treatment decisions; sepsis fluid/vasopressor strategies

Contextual Background:

The piece distinguishes "predictive AI" (risk/early■warning) from "actionable AI" (causal decision support)

Geographic/Institutional Context:

General ICU; examples and authorship from Netherlands■based institutions.

Target Users/Stakeholders:

ICU clinicians; methodologists developing clinical AI; trialists.

Primary Methodology:

Conceptual perspective synthesizing methods and exemplars.

Primary Contribution Type:

Definition/clarification plus methodological guidance and future directions.

General Summary of the Paper

The article argues that most ICU AI focuses on predicting outcomes (e.g., mortality, sepsis) but cannot ac

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Actionable/Actionability Used in Paper

Yes.

- "we propose to refer to any data■driven model used for causal inference tasks as 'actionable AI', as opp
- "For an AI to advise ICU physicians in treatment decisions, i.e., 'actionable AI', cause and effect need to
- "Actionable AI should perform causal inference tasks… predict… outcomes… that would result from alte

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Authors Argue for a Need for Actionability Without Defining It

No. They both argue for and define "actionable AI" explicitly as causal■inference■based decision sup

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How Actionability is Understood

Actionability = the capacity of AI to perform causal inference by predicting outcomes under alternative tre

> "Actionable AI should perform causal inference tasks… [to] predict (future) patient outcomes or events

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What Makes Something Actionable

- **Counterfactual/causal orientation (predict outcomes under alternative actions):**

> "…predicts (future) patient outcomes or events that would result from alternative treatment decisions."

- **Ability to compare treatments to recommend an optimal option:**

  > "…advise on treatment options that lead to the best predicted outcome (i.e., the optimal treatment)." (p

- **Bias management appropriate to treatment setting (incl. time■varying confounding):**

  > "…more sophisticated methods are required [for] 'time■varying confounding'." (p. 1115).

- **Sequential decision■policy modeling (regimes/strategies over time):**

  > "ICU patients are typically treated according to a certain regime—or policy… which represents a set o

- **Sufficient effective sample size and appropriate data source (observational vs. RCT):**

  > "…limited 'effective sample size'… a prerequisite for successfully implementing actionable AI…" (p. 11

  > "towards actionable AI at the bedside, usage of RCT data may currently be the safest route." (p. 1116)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Target trial emulation; marginal structural models; reinforcement lea

- **Methods/Levers:** Adjustment for confounding (including time■varying); causal diagrams (DAGs) to id

- **Operational Steps / Workflow:** (Implied) Define treatment regimes → map sequential decisions → m

- **Data & Measures:** Observational ICU data (e.g., sepsis fluids/vasopressors) with attention to effectiv

- **Implementation Context:** ICU bedside decision support for sepsis management (fluids and vasopres

> "Shahn… performed a 'target trial emulation' to develop a marginal structural model…"; "Komorowski…

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked "Yes/Partial" only if tied to actionability as defined by the authors.)

- **CL (Clarity):** Partial — clear distinction of predictive vs actionable AI; no explicit clarity criterion. Quo

- **CR (Contextual Relevance):** Yes — anchored in ICU sequential decisions/policies. Quote: "Intensive

- **FE (Feasibility):** Partial — feasibility constraints emphasized (bias, effective sample size). Quote: "Ca

- **TI (Timeliness):** Partial — implied need for bedside decision support; not explicitly operationalized. Q

- **EX (Explainability):** No — not addressed.

- **GA (Goal Alignment):** Yes — explicit "optimal treatment" framing. Quote: "…advise on treatment opti

- **Other Dimensions Named by Authors:** Management of time■varying confounding; sequential policie

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Theoretical or Conceptual Foundations

- Causal inference (counterfactual outcomes; DAGs; time■varying confounding; marginal structural mode

- Reinforcement learning for policy optimization in clinical settings.

- RCTs for causal identification and individualized treatment■effect modeling.

Indicators or Metrics for Actionability

- **Implicit**: ability to recommend an optimal action based on predicted counterfactual outcomes; adequ

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Barriers and Enablers to Actionability

- **Barriers:**

  - Confounding and selection biases in observational data.

  - Time■varying confounding in sequential decisions.

  - Limited effective sample size for agreement between observed and modeled regimes.

- **Enablers:**

  - Use of causal diagrams to plan adjustment.

  - Target trial emulation and marginal structural models.

  - RCT data enabling causal identification and individualized effects.

Relation to Existing Literature

The paper situates "actionable AI" within the broader shift in data science from association to causation, i

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Summary

This perspective reframes ICU AI from predominantly predictive tasks (risk forecasts and early warnings)

Scores

- **Overall Relevance Score:** 86 — Strong, explicit definition of "actionable AI" as causal inference with

- **Operationalization Score:** 61 — Provides concrete methodological avenues (MSMs, target trial emul

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Supporting Quotes from the Paper

- "we propose to refer to any data■driven model used for causal inference tasks as 'actionable AI', as opp

- "Actionable AI should perform causal inference tasks… predict… outcomes… that would result from alte

- "ICU patients are typically treated according to a certain regime—or policy… informing treatment decisi

- "a significant challenge is the typically limited 'effective sample size'…" (p. 1116).

- "towards actionable AI at the bedside, usage of RCT data may currently be the safest route." (p. 1116).

Actionability References to Other Papers

- Hernán, Hsu, Healy (2019): classification of data science tasks (prediction vs causal).

- Hernán & Robins (2016): target trial emulation.

- Daniel et al. (2013); Mansournia et al. (2017): time■dependent confounding methods.

- Komorowski et al. (2018): RL for optimal sepsis treatment strategies in ICU.

- Shahn et al. (2020): MSMs for fluid■limiting strategies in sepsis.

- Tennant et al. (2021): DAGs for confounder identification.

- Kent et al. (2020): PATH statement on treatment■effect heterogeneity.

Paper Summary

<!--META_START-->

Title: Actionable Intelligence

Authors: Eugene McMahon

DOI: n/a

Year: 2010

Publication Type: Journal Commentary

Discipline/Domain: Education / Special Education

Subdomain/Topic: Education of students with blindness and visual impairments; data-driven program imp

Eligibility: Eligible

Overall Relevance Score: 72

Operationalization Score: 65

Contains Definition of Actionability: Yes (explicit and contextualized to field)

Contains Systematic Features/Dimensions: Yes (sample size, comparability, relevance to program chang

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (COSB outcome data collection infrastructure)

Operationalization Present: Yes

Primary Methodology: Conceptual with applied data infrastructure design

Study Context: Council of Schools for the Blind (COSB) initiative to collect and use longitudinal student da

Geographic/Institutional Context: United States; COSB member schools

Target Users/Stakeholders: Superintendents, educators, administrators in schools for the blind

Primary Contribution Type: Conceptual framework with applied data collection process

CL: Yes

CR: Yes

FE: Partial

TI: No

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Actionable Intelligence

Authors:

Eugene McMahon

DOI:

n/a

Year:

2010

Publication Type:

Journal Commentary

Discipline/Domain:

Education / Special Education

Subdomain/Topic:

Education of students with blindness and visual impairments; data-driven program improvement

Contextual Background:

The piece addresses the lack of "actionable intelligence" in the education of students with visual impairme

Geographic/Institutional Context:

United States; Council of Schools for the Blind (COSB)

Target Users/Stakeholders:

Superintendents, school administrators, educators of students with blindness/visual impairment

Primary Methodology:

Conceptual framework with applied data infrastructure and descriptive reporting

Primary Contribution Type:

Conceptual and practical model for collecting and using outcome data to enable actionable decision-mak

General Summary of the Paper

This commentary introduces the COSB's long-term project to collect outcome data on graduates of scho

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable intelligence is explicitly defined as *"information sufficient to allow the government to take som

> "Given the dearth of actionable intelligence, professionals are often left relying only on their past experi

What Makes Something Actionable

- Sufficient to prompt meaningful changes in educational practice

- Comparable across similar populations ("apple to apple" comparisons)

- Based on adequate sample sizes to justify practice changes

- Sensitive to diversity of learning characteristics in the target population

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** COSB Outcome Data Collection Infrastructure

- **Methods/Levers:** Longitudinal data on student demographics, program activities, exit outcomes/satis

- **Operational Steps / Workflow:** Annual data submission from member schools; categorization into Ba

- **Data & Measures:** Demographics, reading level, disability status, employment, education, independe

- **Implementation Context:** COSB schools in the U.S.

> "Outcome data can be disaggregated… to arrive at meaningful 'apple to apple' comparisons." (p. 2)

> "Such comparisons might then result in professionals making meaningful, generalizeable changes to in

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Actionability depends on clear, comparable data for interpreting results.

- **CR (Contextual Relevance):** Yes — Data must be relevant to specific program improvement context

- **FE (Feasibility):** Partial — Acknowledges sample size and diversity constraints affecting practical ap

- **TI (Timeliness):** No — Timeliness not explicitly discussed.

- **EX (Explainability):** Partial — Comparisons aim to explain variations in outcomes.

- **GA (Goal Alignment):** Yes — Data collection designed to support COSB's goal of improving program

- **Other Dimensions Named by Authors:** Comparability, generalizability, meaningfulness.

Theoretical or Conceptual Foundations

- Adaptation of "actionable intelligence" from national security discourse to education

- Emphasis on data-driven decision-making in special education contexts

Indicators or Metrics for Actionability

- Ability to disaggregate and compare outcomes by relevant student characteristics

- Sufficient sample size to justify generalizable changes

Barriers and Enablers to Actionability

- **Barriers:** Low incidence of visual impairment; diversity of student characteristics; small research sam

- **Enablers:** Systematic, longitudinal data collection; commitment of COSB superintendents; structured

Relation to Existing Literature

Positions itself against a backdrop of limited empirical data in the field of visual impairment education, ref

Summary

McMahon's commentary redefines "actionable intelligence" from national security to the education of visu

Scores

- **Overall Relevance Score:** 72 — Clear, adapted definition of actionability with identified features (con

- **Operationalization Score:** 65 — Provides a concrete data collection and comparison infrastructure lir

Supporting Quotes from the Paper

- "Information that will cause those of us in the blindness field to change instructional strategies, program

- "Outcome data can be disaggregated… to arrive at meaningful 'apple to apple' comparisons." (p. 2)

- "Such comparisons might then result in professionals making meaningful, generalizeable changes to int

- "The first purpose of the project is to give superintendents the ability to compare inputs and outcomes o

Actionability References to Other Papers

- None explicitly cited for defining/operationalizing actionability.

Paper Summary

<!--META_START-->

Title: Explainability: Actionable Information Extraction

Authors: Catarina Silva, Jorge Henriques, Bernardete Ribeiro

DOI: https://doi.org/10.1007/978-3-031-59216-4_11

Year: 2024

Publication Type: Conference

Discipline/Domain: Artificial Intelligence / Machine Learning

Subdomain/Topic: Explainability, Actionable Information Extraction, Knowledge Distillation

Eligibility: Eligible

Overall Relevance Score: 78

Operationalization Score: 85

Contains Definition of Actionability: Implicit

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with empirical demonstration

Study Context: Credit scoring (German credit dataset), adaptable to other domains

Geographic/Institutional Context: University of Coimbra, Portugal

Target Users/Stakeholders: AI practitioners, decision-makers in finance/healthcare, researchers in interpr

Primary Contribution Type: Methodological approach for explainable and actionable AI

CL: Yes — "visualization of decision-trees is also human-friendly making them better for explanation and

CR: Partial — implied via "adaptable to different setup… health prognosis… predictive maintenance" (p.

FE: Yes — "training a model with the support of a neural net's dark knowledge might be beneficial to get

TI: No — timeliness not explicitly linked to actionability

EX: Yes — "importance of each feature… example of the set of rules extracted… for actionability" (p. 111

GA: Partial — goal alignment implied via problem-specific feature importance

Reason if Not Eligible: n/a

<!--META_END-->

Title: Explainability: Actionable Information Extraction

Authors: Catarina Silva, Jorge Henriques, Bernardete Ribeiro

DOI: https://doi.org/10.1007/978-3-031-59216-4_11

Year: 2024

Publication Type: Conference

Discipline/Domain: Artificial Intelligence / Machine Learning

Subdomain/Topic: Explainability, Actionable Information Extraction, Knowledge Distillation

Contextual Background: The paper addresses the challenge of making black-box AI models interpreta

Geographic/Institutional Context: University of Coimbra, Portugal

Target Users/Stakeholders: AI/ML practitioners, data scientists, domain experts in finance/healthcare,

Primary Methodology: Conceptual proposal with empirical validation

Primary Contribution Type: Methodological — interpretable surrogate modeling for actionable insights

General Summary of the Paper

This work proposes a method for extracting actionable information from black-box machine learning mod

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly defined as providing interpretable decision patterns from AI models that can supp

> "provide actionable information that can be used to support decisions" (p. 105)

> "Rules extracted for actionability" (p. 112)

What Makes Something Actionable

- Interpretability through human-friendly visualization (decision trees)

- Ability to reveal feature interactions and their role in decision-making

- Extraction of explicit rules that map conditions to outcomes

- Alignment of model logic with domain-specific decision needs

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Decision-tree surrogate via knowledge distillation

- **Methods/Levers:** Transfer logits from a deep neural net to a gradient-boosted decision-tree

- **Operational Steps / Workflow:**

  1. Train a black-box deep neural network (Teacher)

  2. Extract logits (soft targets) from its final layer

  3. Train a decision-tree model (Student) on these soft targets

  4. Compare Student's performance with Teacher's to validate fidelity

  5. Extract interpretable rules and feature importance from the Student

- **Data & Measures:** German credit dataset; metrics include accuracy, precision, recall, F1-score; spec

- **Implementation Context:** Credit risk classification, adaptable to health prognosis and predictive main

> "visualization of decision-trees is… human-friendly making them better for explanation and interpretatio

> "Rules extracted for actionability" (p. 112)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — decision-tree visualization explicitly linked to explanation (p. 108)

- **CR (Contextual Relevance):** Partial — adaptation to multiple domains suggested (p. 110)

- **FE (Feasibility):** Yes — method improves performance of less complex models (p. 111)

- **TI (Timeliness):** No — timeliness not discussed

- **EX (Explainability):** Yes — feature importance and rule extraction for decision understanding (p. 111

- **GA (Goal Alignment):** Partial — alignment implied via feature targeting and decision context

- **Other Dimensions Named by Authors:** Fidelity to original model's decision-making

Theoretical or Conceptual Foundations

- Knowledge distillation (Hinton et al., 2015)

- Surrogate model interpretability (Ribeiro et al., 2016 — LIME)

- Model compression (Bucila et al., 2006)

Indicators or Metrics for Actionability

- Fidelity between surrogate and original model's predictions

- Recall and F1-score improvements in decision-critical contexts

- Feature importance scores

- Explicit decision rules

Barriers and Enablers to Actionability

- **Barriers:** Black-box nature of high-performance models; complexity trade-offs with interpretability

- **Enablers:** Surrogate modeling; human-friendly rule extraction; high fidelity between models

Relation to Existing Literature

Positions itself within interpretability research, particularly model-agnostic surrogate modeling and knowle

Summary

The paper contributes a method for making AI models both interpretable and actionable by distilling a bla

Scores

- **Overall Relevance Score:** 78 — Strong implicit definition of actionability and clear identification of ac

- **Operationalization Score:** 85 — Detailed, replicable workflow with specific implementation steps; dire

Supporting Quotes from the Paper

- "provide actionable information that can be used to support decisions" (p. 105)

- "visualization of decision-trees is… human-friendly making them better for explanation and interpretation

- "training a model with the support of a neural net's dark knowledge might be beneficial to get better perf

- "Rules extracted for actionability" (p. 112)

Actionability References to Other Papers

- Hinton et al., 2015 — Knowledge distillation

- Ribeiro et al., 2016 — LIME

- Bucila et al., 2006 — Model compression

- Che et al., 2015 — Interpretable mimic learning

- Xu et al., 2018 — DarkSight visualization

Paper Summary

<!--META_START-->

Title: Domain-Driven, Actionable Knowledge Discovery

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (Domain-Driven Data Mining framework)

Operationalization Present: Yes

Primary Methodology: Conceptual with applied case studies

Study Context: Complex domain problems in business and government (e.g., trade support, social securi

Geographic/Institutional Context: University of Technology Sydney; case studies in Australian governmer

Target Users/Stakeholders: Business decision-makers, data scientists, government analysts

Primary Contribution Type: Conceptual framework with operational guidance

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Domain-Driven, Actionable Knowledge Discovery

Authors: Longbing Cao, Chengqi Zhang

DOI: 10.1109/MIS.2007.75

Year: 2007

Publication Type: Journal Article

Discipline/Domain: Computer Science / Data Mining

Subdomain/Topic: Domain-Driven Data Mining (D3M), Actionable Knowledge Discovery

Contextual Background: Focuses on bridging the gap between data-mining research outputs and actio

Geographic/Institutional Context: University of Technology Sydney; case applications in Australia.

Target Users/Stakeholders: Business managers, policy-makers, domain experts, data analysts.

Primary Methodology: Conceptual with applied case examples.

Primary Contribution Type: Framework and methodology proposal with operational examples.

General Summary of the Paper

The paper introduces the Domain-Driven Data Mining (D3M) paradigm as a shift from traditional, purely d

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as knowledge that is not only technically valid but also meaningful and implementa

> "Domain-driven data mining generally targets actionable knowledge discovery in complex domain probl

> "Actionable knowledge discovery should fit the following framework… from not only technological and b

What Makes Something Actionable

- Meets both technical and business interestingness criteria.

- Balances objective (quantitative) and subjective (expert judgment) measures.

- Fits within business rules, policies, and operational constraints.

- Supports decision-making by delivering trustworthy, relevant, and context-sensitive results.

- Is derived through integration of multiple intelligence sources (data, domain, human, social, environmen

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Domain-Driven Data Mining (D3M)

- **Methods/Levers:** Integration of domain expertise, metasynthesis of multiple intelligence sources, bus

- **Operational Steps / Workflow:** Identify business and technical objectives → integrate domain knowle

- **Data & Measures:** Technical metrics (support, confidence, lift); business metrics (impact on debt am

- **Implementation Context:** Applied in Australian government social security debt detection; trade supp

> "We developed both technical and business measures for patterns relevant to these issues in real, unb

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – patterns must be understandable to decision-makers.

- **CR (Contextual Relevance):** Yes – must reflect complex, real-world context.

- **FE (Feasibility):** Yes – must be implementable under operational constraints.

- **TI (Timeliness):** Partial – timeliness is implied via runtime/adaptive processes but not a major focus.

- **EX (Explainability):** Yes – human involvement in interpretation is key.

- **GA (Goal Alignment):** Yes – explicitly aligned with business goals and problem-solving.

- **Other Dimensions Named by Authors:** Reliability, trustworthiness, cost-effectiveness.

Theoretical or Conceptual Foundations

- Pattern interestingness theory (Silberschatz & Tuzhilin, 1996)

- Metasynthesis approach in complex systems

- Evolution of KDD toward domain-driven paradigms

Indicators or Metrics for Actionability

- Technical: support, confidence, lift.

- Business: average debt amount, debt duration, business impact scores.

Barriers and Enablers to Actionability

- **Barriers:** Data constraints (heterogeneity, imbalance), evolving scenarios, technical–business confli

- **Enablers:** Human–machine collaboration, domain expert involvement, integration of contextual know

Relation to Existing Literature

Positions itself as an evolution of KDD beyond method-centric research to a business-impact-oriented pra

Summary

Cao and Zhang (2007) present Domain-Driven Data Mining as a framework to make knowledge discover

Scores

- **Overall Relevance Score:** 92 – Strong, explicit definition of actionability; detailed conceptualization a

- **Operationalization Score:** 88 – Clear framework and concrete operational examples, though some in

Supporting Quotes from the Paper

- "Domain-driven data mining generally targets actionable knowledge discovery in complex domain proble

- "Actionable knowledge discovery should fit the following framework… from not only technological and bu

- "We developed both technical and business measures for patterns relevant to these issues in real, unba

Actionability References to Other Papers

- Silberschatz, A., & Tuzhilin, A. (1996). *What Makes Patterns Interesting in Knowledge Discovery Syste

- Cao, L., & Zhang, C. (2006). *Domain-Driven Data Mining: A Practical Methodology*. IJ Data Warehous

- Fayyad, U., Shapiro, G., & Uthurusamy, R. (2003). *Data Mining: The Next 10 Years*. ACM SIGKDD Ex

Paper Summary

<!--META_START-->

Title: Delivering actionable information

Authors: Nathalie Colineau, Cécile Paris, Mingfang Wu

DOI: 10.3166/ria.18.549-576

Year: 2004

Publication Type: Journal

Discipline/Domain: Information Retrieval, Natural Language Generation

Subdomain/Topic: Information Delivery, Document Generation, User Models

Eligibility: Yes

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual and Empirical Analysis

Study Context: Tailored Information Delivery in Knowledge Management

Geographic/Institutional Context: CSIRO, Monash University

Target Users/Stakeholders: Information Retrieval Practitioners, Knowledge Management Professionals

Primary Contribution Type: Conceptual framework, platform development

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Delivering actionable information

Authors: Nathalie Colineau, Cécile Paris, Mingfang Wu

DOI: 10.3166/ria.18.549-576

Year: 2004

Publication Type: Journal

Discipline/Domain: Information Retrieval, Natural Language Generation

Subdomain/Topic: Information Delivery, Document Generation, User Models

Contextual Background: The paper discusses the need for delivering information in a way that answer

Geographic/Institutional Context: CSIRO - ICT Centre, Monash University, Australia

Target Users/Stakeholders: Researchers, practitioners in information retrieval, knowledge manageme

Primary Methodology: Conceptual framework, empirical evaluation

Primary Contribution Type: Platform development, case study, evaluation

General Summary of the Paper

The paper presents the Virtual Document Planner (VDP), a platform designed to generate tailored inform

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

Actionability in this context is understood as the delivery of information in a form that is not only relevant t

> "Actionable information is delivered when it addresses the user's needs in a coherent and structured ma

> "Tailored information delivery ensures that the content is relevant, structured, and easy to use for the s

What Makes Something Actionable

The paper identifies several key factors that make information actionable:

- **Relevance:** The content must be specifically relevant to the user's needs and goals.

- **Clarity:** The information should be presented in a clear and organized manner to enhance comprehe

- **Tailoring:** The information must be customized to the user's context, such as their role or task.

- **Coherence:** The content must be logically structured to ensure that the relationships between inform

> "Tailored and coherent presentation of information makes it actionable by aligning the content with the u

> "Actionability is achieved when the information is not only relevant but also easy to understand and app

How Actionability is Achieved / Operationalized

Actionability is operationalized through the use of the VDP platform, which applies discourse planning an

1. **Content Planning:** Determines the relevant information based on the user's query and profile.

2. **Presentation Planning:** Organizes the content and formats it according to the user's delivery mediu

3. **Surface Realization:** Generates the final document by assembling the content and formatting it for t

> "The VDP generates actionable information by selecting and organizing content based on the user's ne

> "By using discourse planning, the VDP ensures that the content is logically organized and relevant to th

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Clear, coherent presentation of information is essential for actionability.

  > "Coherent presentation is key to ensuring the information is easily understood and actionable" (p. 6).

- **CR (Contextual Relevance):** Yes – The information must be relevant to the user's specific task or rol

  > "Contextual relevance ensures that the information meets the user's needs, making it actionable" (p. 5

- **FE (Feasibility):** Yes – The information should be easy to access and apply.

  > "Feasibility is a key factor in actionability, as the information should be easily applied to the user's task

- **TI (Timeliness):** No – The paper does not directly address timeliness, but it is implied through the rel

- **EX (Explainability):** Yes – The clarity and structure of the information enable explainability and make

  > "Explainability is crucial for actionability, as the user must understand how to apply the information" (p

- **GA (Goal Alignment):** Yes – The information should align with the user's goals to ensure that it is ac

  > "Aligning the content with the user's goals ensures that the information is actionable and leads to mea

Theoretical or Conceptual Foundations

The authors base their approach on established theories in natural language generation and discourse pl

> "The VDP platform is built on discourse planning, using Rhetorical Structure Theory to ensure coherenc

Indicators or Metrics for Actionability

The paper suggests that actionability can be evaluated by the relevance, clarity, and coherence of the de

> "Actionability is measured by how well the information supports the user's task and how easily it can be

Barriers and Enablers to Actionability

- **Barriers:** Lack of coherence, irrelevant information, and poor organization of content can hinder actio

- **Enablers:** Tailoring the information to the user's needs, ensuring clarity, and maintaining a coherent

> "Barriers to actionability arise when information is not tailored to the user's needs or when it is presente

> "Tailoring and structuring the information according to the user's context are key enablers of actionabili

Relation to Existing Literature

The paper builds on existing work in information retrieval, natural language generation, and discourse the

> "This work extends previous research on information retrieval and discourse planning by focusing on de

Summary

This paper introduces the Virtual Document Planner (VDP), a platform designed to deliver actionable, tail

Scores

- **Overall Relevance Score:** 85 – The paper provides valuable insights into tailored information delivery

- **Operationalization Score:** 80 – The VDP platform is well-described, though practical implementation

Supporting Quotes from the Paper

- "Coherent presentation is key to ensuring the information is easily understood and actionable" (p. 6).

- "Tailoring and structuring the information according to the user's context are key enablers of actionabilit

- "Actionability is measured by how well the information supports the user's task and how easily it can be

- "This work extends previous research on information retrieval and discourse planning by focusing on de

Actionability References to Other Papers

- Moore, J.D., & Paris, C.L. (1993). Planning Text for Advisory Dialogues: Capturing Intentional and Rhet

- André, E., & Rist, T. (1995). Generating Coherent Presentations Employing Textual and Visual Material.

Paper Summary

<!--META_START-->

Title: A Process■Oriented Approach to Analyze Analysts' Use of Visualizations: Revealing Insights into th

Authors: L. Zimmermann, F. Zerbato, K. Vrotsou, B. Weber

DOI: 10.1111/cgf.70104

Year: 2025

Publication Type: Conference Paper (EuroVis / Computer Graphics Forum)

Discipline/Domain: Visualization / Visual Analytics

Subdomain/Topic: Process Mining, Visualization Evaluation, User Interaction Analysis

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 10

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial (as part of visualization interpretation)

Contains Interpretability: Partial (through focus on misinterpretation and accuracy)

Contains Framework/Model: Yes (multi-perspective, multi-granular event sequence analysis)

Operationalization Present: Yes (operationalizes visualization-use analysis method)

Primary Methodology: Qualitative (observational study with think-aloud + video analysis)

Study Context: Evaluation of visualization usage patterns in process mining analysis tasks

Geographic/Institutional Context: Participants from multiple institutions, mainly Europe (Swiss, Dutch, Sw

Target Users/Stakeholders: Visualization researchers, process mining tool developers, process analysts

Primary Contribution Type: Methodological framework for multi-perspective visualization-use analysis

CL: N/A

CR: N/A

FE: N/A

TI: N/A

EX: Partial – e.g., identifying misinterpretation causes in visualizations

GA: N/A

Reason if Not Eligible: Paper does not address "actionability" or the state of being actionable in terms of

<!--META_END-->

Title:

A Process■Oriented Approach to Analyze Analysts' Use of Visualizations: Revealing Insights into the Wh

Authors:

L. Zimmermann, F. Zerbato, K. Vrotsou, B. Weber

DOI:

10.1111/cgf.70104

Year:

2025

Publication Type:

Conference Paper (EuroVis / Computer Graphics Forum)

Discipline/Domain:

Visualization / Visual Analytics

Subdomain/Topic:

Process Mining, Visualization Evaluation, User Interaction Analysis

Contextual Background:

The paper addresses the challenge of evaluating how analysts actually use visualizations in complex, rea

Geographic/Institutional Context:

Collaborating institutions: University of St. Gallen (Switzerland), Eindhoven University of Technology (Net

Target Users/Stakeholders:

Visualization researchers, process mining tool developers, process analysts.

Primary Methodology:

Qualitative (observational study with think-aloud protocols, video coding, and sequence analysis).

Primary Contribution Type:

Methodological framework for multi-perspective visualization-use analysis.

General Summary of the Paper

The paper presents a qualitative, process-oriented method to study how analysts use visualizations acros

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Actionable/Actionability Used in Paper

No — The paper does not reference "actionability," "actionable insight," "actionable recommendation," or

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Authors Argue for a Need for Actionability Without Defining It

No — There is no discussion of the need for actionable outputs in the decision-making sense.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A — While the paper operationalizes the evaluation of visualization use, it does not operationalize the

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** N/A
- **CR (Contextual Relevance):** N/A
- **FE (Feasibility):** N/A
- **TI (Timeliness):** N/A
- **EX (Explainability):** Partial – Authors note interpretation errors, misinterpretation causes, and need fo
- **GA (Goal Alignment):** N/A

Theoretical or Conceptual Foundations

- Visualization evaluation methods (e.g., GOMS, heuristic evaluation, insight-based evaluation)
- Process mining visualization literature
- Multi-perspective coding inspired by Brehmer & Munzner's typology (WHY/HOW/WHAT)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The authors position their method as extending prior visualization evaluation frameworks by adding a pro

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Summary

This paper introduces a structured method to evaluate visualization use in analytical workflows using mul

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Scores

- **Overall Relevance Score:** 20 — The study is unrelated to actionability; relevance is only tangential v
- **Operationalization Score:** 10 — The paper operationalizes a visualization-use analysis method but n

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Supporting Quotes from the Paper

- "We propose a structured process-oriented analysis method to convert video recordings… into event se
- "Our method is particularly useful for capturing realistic analysis patterns, making it a valuable resource
- "Our study… revealed that the DFG is the most frequently used visualization type but causes a substan

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Relational Calculus for Actionable Knowledge

Authors: Michel Barès; Éloi Bossé

DOI: 10.1007/978-3-030-92430-0

Year: 2022

Publication Type: Book (Monograph)

Discipline/Domain: Data Science; Information Fusion; Knowledge Engineering

Subdomain/Topic: Relational calculus; Analytics & Information Fusion (AIF); Situation Awareness; Decisi

Eligibility: Eligible

Overall Relevance Score: 86

Operationalization Score: 72

Actionable/Actionability Used in Paper: Yes — "Actionable knowledge is explicit symbolic knowledge that

Authors Argue for Need for Actionability Without Defining It: No — definition and positioning are provided

Contains Definition of Actionability: Yes — see quote in "How Actionability is Understood." :contentRefere

Contains Systematic Features/Dimensions: Yes (dimensions of knowledge; decision–action efficiency fac

Contains Explainability: Partial (emphasis on representation of mental models; knowledge representation

Contains Interpretability: Partial (situation awareness framing; AIF integrating framework for sense■maki

Contains Framework/Model: Yes — AIF integrating framework ("Archetypal Dynamics") and end■to■end

Operationalization Present: Yes — mapping AIF core processes to relational calculus operations; workflo

Primary Methodology: Conceptual (theoretical synthesis with formal methods)

Study Context: Cyber■Physical & Social Systems; multi■agent decision and information fusion environm

Geographic/Institutional Context: N/A (general technical context; examples reference business/defense a

Target Users/Stakeholders: Decision■makers; engineers; data scientists; AIF system designers; in some

Primary Contribution Type: Conceptual framework and formalization (relational calculus) to generate acti

CL: Partial

CR: Yes

FE: Yes

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Relational Calculus for Actionable Knowledge

Authors:

Michel Barès; Éloi Bossé

DOI:

10.1007/978-3-030-92430-0

Year:

2022

Publication Type:

Book (Monograph)

Discipline/Domain:

Data Science; Information Fusion; Knowledge Engineering

Subdomain/Topic:

Relational calculus; Analytics & Information Fusion (AIF); Situation Awareness; Decision–Action systems

Contextual Background:

The book positions "actionable knowledge" within analytics and information fusion for complex, data■rich

Geographic/Institutional Context:

General/unspecified; cross■domain (business, defense, CPS/IoT). :contentReference{index=1

Target Users/Stakeholders:

Decision■makers and engineers designing AIF systems; also "machines/systems" consuming actionable

Primary Methodology:

Conceptual/theoretical synthesis with formal methods (crisp & fuzzy relational calculus). :contentReferenc

Primary Contribution Type:

Framework + formalization linking relational calculus to AIF processes for producing actionable knowledg

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General Summary of the Paper

Barès and Bossé develop an end■to■end perspective on producing actionable knowledge in complex en

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Actionable/Actionability Used in Paper

Yes.

- "Actionable knowledge is explicit symbolic knowledge that allows the decision■maker to perform an act

- AIF "allows to coherently and semantically frame a complex processing chain that 'transform data into a

- "The aim of this book is to present… formalization to support the [AIF] processes that aim at delivering a

---

Authors Argue for a Need for Actionability Without Defining It

No. They provide an explicit characterization and repeatedly tie actionability to AIF workflows and dec

---

How Actionability is Understood

> "Actionable knowledge is explicit symbolic knowledge that allows the decision■maker to perform an act

They further position actionability as the desired end■state of a situation■awareness process enabled by

---

What Makes Something Actionable

- **Explicit, symbolic form enabling decision and action.**

  > "Actionable knowledge is explicit symbolic knowledge that allows the decision■maker to perform an a
- **Situated within situation awareness and context.**

  > AIF "support[s] actionable knowledge" as output of "a situation awareness process." (Ch. 6).
- **Represented and organized to user goals via integrating framework.**

  > Framework should "represent knowledge through well■defined notions of situation and awareness" an
- **Quality and efficiency considerations for action.**

  > "Examine the impact that the 'quality' of information can have on the conduct of an action…" (Ch. 5).
- **Timeliness/speed of decision loops.**

  > The OODA loop emphasizes that "the speed at which the OODA Loop is executed becomes the large

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):**

  Archetypal Dynamics as an AIF integrating framework; AIF core processes mapped to relational calculu
- **Methods/Levers:**

  Crisp & fuzzy relational calculus (composition, transitivity, closure), knowledge quality (QoI), context awa
- **Operational Steps / Workflow:**

  Measure/organize/understand/reason over data using relations → fuse & analyze (AIF) → obtain situatio
- **Data & Measures:**

  Transactional/unstructured inputs modeled into computational models; QoI considerations; uncertainty/b
- **Implementation Context:**

  Cyber■Physical & Social systems, multi■agent decision environments; defense/business analytics exam

> "Relations and its calculus make AIF processes more capable… to support situation awareness." (Ch. 6

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** *Partial* — emphasis on explicit symbolic representation and coherent frameworks guid

  > "Explicit symbolic knowledge…"; "coherently and semantically frame a complex processing chain."
- **CR (Contextual Relevance):** *Yes* — knowledge must be "most useful… in the context of the action

  > "Represent the most useful knowledge in the context of the action…" (Ch. 5).

- **FE (Feasibility):** *Yes* — focus on QoI and imperfect knowledge to enable efficient action.

  > "Examine the impact that the 'quality' of information can have on the conduct of an action…" (Ch. 5).

- **TI (Timeliness):** *Yes* — OODA loop speed as a decisive factor in action effectiveness.

  > "The speed at which the OODA Loop is executed becomes the largest factor…" (Ch. 1).

- **EX (Explainability):** *Partial* — representation of mental models with expressive constructs to suppo

  > "Represent… the internal mental models… by expressive graphical constructs…" (Ch. 1).

- **GA (Goal Alignment):** *Yes* — frameworks designed to "achieve a specific objective."

  > "Represented, organized, structured… to achieve a specific objective or multiple objectives." (Ch. 6).

- **Other Dimensions Named by Authors:**

  Knowledge dimensions (ontological, semantic, temporal, reference) affecting processing toward action.

Theoretical or Conceptual Foundations

- Relational calculus (crisp & fuzzy) as computational substrate.

- Situation awareness and AIF as technological pathway.

- Archetypal Dynamics integrating framework for meaning■laden information flows.

Indicators or Metrics for Actionability

Limited explicit metrics; emphasis on **Quality of Information (QoI)**, uncertainty/belief modeling, and clo

---

Barriers and Enablers to Actionability

- **Barriers:** Information overload and complexity; imperfect/uncertain knowledge; interoperability challe

- **Enablers:** AIF integrating frameworks; explicit symbolic representations; relational operations (comp

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Relation to Existing Literature

The authors note actionability's roots in management/social sciences and in "actionable knowledge disco

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Summary

This monograph makes a strong, explicit connection between **actionability** and a **formal, computatio

---

Scores

- **Overall Relevance Score:** 86 — Strong explicit definition; sustained, book■length treatment of how k

- **Operationalization Score:** 72 — Clear workflow (data→SA→actionable knowledge), concrete formal

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Supporting Quotes from the Paper

- "**Actionable knowledge is explicit symbolic knowledge that allows the decision■maker to perform an a

- "This integrating framework allows to *coherently and semantically frame* a complex processing chain t

- "Represent the most useful knowledge **in the context of the action**…" (Ch. 5).

- "Examine the impact that the **quality of information** can have on the conduct of an action…" (Ch. 5).

- "The **speed** at which the OODA Loop is executed becomes the largest factor…" (Ch. 1).

Actionability References to Other Papers

- Batra & Rehman (2019) — *Actionable Knowledge Discovery for Increasing Enterprise Profit* (domain■

- De Smedt, Koureas & Wittenburg (2020) — *FAIR digital objects… actionable knowledge units*.

- Barnaghi, Sheth & Henson (2013) — *From data to actionable knowledge: Big data challenges in the we

Paper Summary

Geographic/Institutional Context: International (authors from USA, China, UK, Germany, Austria)

Target Users/Stakeholders: Visual analytics researchers, practitioners, tool developers, interdisciplinary c

Primary Contribution Type: Conceptual framework and agenda-setting

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Grand Challenges in Visual Analytics Applications

Authors:

Aoyu Wu, Dazhen Deng, Min Chen, Shixia Liu, Daniel Keim, Ross Maciejewski, Silvia Miksch, Hendrik St

DOI:

10.1109/MCG.2023.3284620

Year:

2023

Publication Type:

Journal Article

Discipline/Domain:

Visualization / Visual Analytics

Subdomain/Topic:

Research rigor and value in VA application research

Contextual Background:

The paper addresses long-standing concerns about the rigor, value, and generalizability of visual analytic

Geographic/Institutional Context:

International (authors affiliated with Harvard University, Zhejiang University, University of Oxford, Tsinghu

Target Users/Stakeholders:

VA researchers, application developers, interdisciplinary research collaborators, practitioners in domains

Primary Methodology:

Conceptual/review, based on synthesis of expert interviews and conference panel discussion.

Primary Contribution Type:

Conceptual framework and strategic research agenda.

General Summary of the Paper

This article identifies and analyzes fundamental dilemmas in VA application research, particularly the tens

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper conceptualizes "actionability" in VA research implicitly through two linked constructs: *rigor* (so

> "VA application research is driven by real-world application problems, and successful solutions… gene

> "We advocate for an inclusive perspective to derive combined benefits from promoting the research val

---

What Makes Something Actionable

- Connection between domain-specific problems and generalizable knowledge.

- Use of both qualitative and quantitative methodologies to enhance validity.

- Comprehensive documentation enabling reuse.

- Openness (data, code) for replication and extension.

- Integration with broader data science workflows.

- Deployment and sustained community engagement.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** VA Application Research Ecosystem (rigor and value cycles).

- **Methods/Levers:** Construction of knowledge bases, shared vocabularies, integration of VA and AI, g

- **Operational Steps / Workflow:** Identify domain-specific problem → Design/build VA system → Justify

- **Data & Measures:** Real-world case collections, evaluation metrics tailored to complex analytical task

- **Implementation Context:** Academic-industry collaborations, interdisciplinary research projects.

> "We propose a research ecosystem that connects VA application research with academia and practice

> "Open software is key to facilitating comparison and improvement…" (p. 88)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — through shared vocabularies, documentation standards.

- **CR (Contextual Relevance):** Yes — driven by domain-specific application needs.

- **FE (Feasibility):** Yes — focus on deployable, sustainable open-source tools.

- **TI (Timeliness):** Partial — mentions guidance that is "timely" but not a core recurring theme.

- **EX (Explainability):** Yes — goal of constructing explainable VA and capturing analytical processes.

- **GA (Goal Alignment):** Yes — aligning academic rigor with real-world value.

Other Dimensions Named by Authors: Sustainability, modularity, interdisciplinarity, openness.

Theoretical or Conceptual Foundations

- Chen & Ebert's ontological framework for VA workflows.

- Thomas & Cook's early VA theory work.

- Design study methodology (Sedlmair et al.).

Indicators or Metrics for Actionability

- Extent of code/data openness.

- Adoption beyond original domain.

- Evaluation metrics linked to cognitive functions and decision outcomes.

- Reuse/modularization success.

Barriers and Enablers to Actionability

- **Barriers:** Lack of shared vocabularies; subjective evaluations; limited deployment; closed systems.

- **Enablers:** Open-source release; shared knowledge bases; deployment tracks; guidance tools.

Relation to Existing Literature

Positions itself in line with foundational VA definitions (Keim et al., 2008) and theoretical calls (Thomas &

Summary

This paper reframes actionability in VA application research as the dual pursuit of *rigor* and *value*. The

---

Scores

- **Overall Relevance Score:** 80 — Strong conceptual linkage between actionability, rigor, and value; ex

- **Operationalization Score:** 70 — Provides a conceptual model and concrete levers for achieving actio

---

Supporting Quotes from the Paper

- "[VA research]… driven by real-world application problems, and successful solutions… generate socio-t

- "We advocate for an inclusive perspective to derive combined benefits from promoting the research valu

- "Open software is key to facilitating comparison and improvement…" (p. 88)

- "Another larger goal is to build explainable VA—how can we capture one's analytical process and expla

---

Actionability References to Other Papers

- Chen & Ebert (2019) — Ontological framework for VA.

- Thomas & Cook (2006) — Theory of VA.

- Sedlmair et al. (2012) — Design study methodology.

- Ceneda et al. (2017) — Guidance in VA.

- Khayat et al. (2020) — Evaluation methods in VA.

Paper Summary

<!--META_START-->

Title: Towards Visual Analytics for Explainable AI in Industrial Applications

Authors: Kostiantyn Kucher; Elmira Zohrevandi; Carl A. L. Westin

DOI: https://doi.org/10.3390/analytics4010007

Year: 2025

Publication Type: Journal

Discipline/Domain: Visual Analytics; Human–AI Interaction; Explainable AI

Subdomain/Topic: Conceptual framework for VA-supported XAI in industrial settings; design & evaluation

Eligibility: Eligible

Overall Relevance Score: 52

Operationalization Score: 47

Actionable/Actionability Used in Paper: Yes — "ensuring that the interpreted results are communicated to

Authors Argue for Need for Actionability Without Defining It: Yes — see above quote; no explicit definitio

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Partial (features for XAI evaluation; stakeholder involvement;

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Partial (conceptual workflow, actors, stages; matrix template)

Primary Methodology: Conceptual + Review

Study Context: Industrial AI/XAI projects supported by visual analytics; synthesis of prior VIS/XAI/industri

Geographic/Institutional Context: Linköping University (Sweden) with funding from Sweden, Germany (BN

Target Users/Stakeholders: Industrial stakeholders, end users/operators, data professionals, visualizatior

Primary Contribution Type: Conceptual framework + roadmap + exemplar instantiations

CL: Partial

CR: Yes

FE: Partial

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Towards Visual Analytics for Explainable AI in Industrial Applications

Authors:

Kostiantyn Kucher; Elmira Zohrevandi; Carl A. L. Westin

DOI:

https://doi.org/10.3390/analytics4010007

Year:

2025

Publication Type:

Journal (Analytics)

Discipline/Domain:

Visual Analytics; Human–AI Interaction; Explainable AI

Subdomain/Topic:

Framework for integrating VA with XAI for industrial applications; design & evaluation workflow; exemplar

Contextual Background:

The paper motivates VA as a bridge between black-box AI models and industrial stakeholders, focusing c

Geographic/Institutional Context:

Department of Science and Technology, Linköping University (Sweden); funding from VINNOVA (SE), BM

Target Users/Stakeholders:

Industrial stakeholders, end users/operators, data scientists/engineers, visualization/HCI designers, mod

Primary Methodology:

Conceptual (framework/roadmap) + narrative review + exemplar instantiations of prior systems. :contentR

Primary Contribution Type:

Framework/model + synthesis + design/evaluation guidance for VA-enabled XAI in industry. :contentRefe

---

General Summary of the Paper

The authors examine how visual analytics (VA) can support explainable AI (XAI) in industrial applications

---

Actionable/Actionability Used in Paper

Yes.

- "**…ensuring that the interpreted results are communicated to stakeholders and are actionable** [72]."

Note: The paper uses "actionable" to emphasize outcome-oriented communication but **does not** defi

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "**…ensuring that the interpreted results are communicated to stakeholders and are actionable**" (p. 6)

How Actionability is Understood

Implicit. Actionability is implied as the end state where interpreted (X)AI results are communicated in v

> "Designs of visualization mechanisms for explanations are essential… where operators' decision-makin

---

What Makes Something Actionable

- **Decision-making orientation (industrial consequences).**

  > "Designs of visualization mechanisms for explanations are essential… where **operators' decision-ma

- **Context-sensitive, stakeholder-tailored explanations.**

  > "…**one-size-fits-all XAI solution is not sufficient** considering the particular constraints and experien

- **Effective communication/translation of interpreted results.**

  > "…interpreted results are communicated to stakeholders **and are actionable**." (p. 6) :contentRefere

- **Integration across lifecycle and roles (TRL-oriented, iterative).**

> "The overall workflow direction is from left to right; however, **multiple implicit feedback loops are exp

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Conceptual framework for VA design & evaluation for XAI in industri

- **Methods/Levers:** Human-centered evaluation; stakeholder & end■user involvement; VA encodings f

- **Operational Steps / Workflow:** Data & requirements → QA/SE/IT → VA & GUI → Analytics & dissem

- **Data & Measures:** Suggests XAI evaluation dimensions (e.g., explanation transparency/usability/sim

- **Implementation Context:** Industrial collaborations emphasizing deployment, maintenance, and long-t

> "**Real-World Application**… test the proposed solutions in more realistic scenarios… followed by eve

---

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked "Yes/Partial" only where tied to making outcomes actionable.)

- **CL (Clarity):** **Partial.** Clarity implied via "communicated to stakeholders" and user■friendly, tailore

- **CR (Contextual Relevance):** **Yes.** Emphasizes user constraints, roles, and domain■specific expl

- **FE (Feasibility):** **Partial.** TRL framing and QA/SE/IT stages tie feasibility to deployable systems u

- **TI (Timeliness):** **Partial.** Implied by operational decision■making and real■time/monitoring interfa

- **EX (Explainability):** **Yes.** Central focus; multiple evaluation dimensions and VA mechanisms to su

- **GA (Goal Alignment):** **Partial.** Stress on stakeholders' KPIs and adoption as validation criteria. (p

- **Other Dimensions Named by Authors:** Trust calibration; human factors; generalizability (deployment

---

Theoretical or Conceptual Foundations

Nested model (Munzner); design study methodology (Sedlmair et■al.); data–users–tasks triangle (Miksch

---

Indicators or Metrics for Actionability

None specific to "actionability." The paper lists XAI/UX metrics (explanation transparency/usability/sim

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Confidentiality vs. replicability tensions in industry collaborations (proprietary data/methods). (p. 22) :co

  - Gaps in long■term deployment and rigorous real■world evaluation. (p. 24) :contentReference[oaicite:3

  - Risk of linear/waterfall design; need for iterative feedback loops. (p. 22) :contentReference{

- **Enablers:**

- Early involvement of end users and data scientists to tailor explanations. (p. 9) :contentReference[oaic

  - TRL■aware planning from prototype to deployment/maintenance. (pp. 8, 13)

  - Use of VA encodings (what■if, counterfactuals, multi■view dashboards) to support decisions. (pp. 7, 2

Relation to Existing Literature

The paper situates itself among surveys and frameworks on VA for XAI and human■centered ML, noting

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Summary

This paper contributes a **matrix■based conceptual framework** for designing and evaluating **VA■sup

---

Scores

- **Overall Relevance Score:** 52 — The paper **explicitly** mentions making results "actionable" and st

- **Operationalization Score:** 47 — Provides a **clear conceptual workflow** (actors × stages, TRL fram

---

Supporting Quotes from the Paper

- "[XAI] serves as a critical mechanism for **calibrating user trust** in AI by providing insights into AI/ML s

- "**…interpreted results are communicated to stakeholders and are actionable**." (p. 6) :contentReferenc

- "Figure■2 presents the **conceptual framework**… to design and evaluate (visual) analytic workflows a

- "**Real■World Application** … test … in realistic scenarios… followed by **deployment and adoption**.

- "**One■size■fits■all XAI** solution is not sufficient considering the particular constraints and experienc

---

Actionability References to Other Papers

The paper does not cite a dedicated "actionability" definition. It references evaluation dimensions for expl

Paper Summary

<!--META_START-->

Title: The Value of Information Visualization

Authors: Jean-Daniel Fekete; Jarke J. van Wijk; John T. Stasko; Chris North

DOI: 10.1007/978-3-540-70956-5_1

Year: 2008

Publication Type: Book Chapter (LNCS 4950)

Discipline/Domain: Human-Computer Interaction; Information Visualization

Subdomain/Topic: Value of InfoVis; evaluation; cognition; economics of visualization

Eligibility: Eligible (implicit treatment of actionability via decisions/actions and criteria)

Overall Relevance Score: 70

Operationalization Score: 35

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "consider if the new knowledge influe

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Partial (conditions when browsing/InfoVis is valuable; benefit

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (economic model of value)

Operationalization Present: No

Primary Methodology: Conceptual

Study Context: Conceptual synthesis with illustrative cases and prior literature

Geographic/Institutional Context: N/A

Target Users/Stakeholders: Researchers, practitioners, tool builders, sponsors, decision-makers who rely

Primary Contribution Type: Conceptual argument and modeling (economic model of value)

CL: No

CR: Partial

FE: Partial

TI: No

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The Value of Information Visualization

Authors:

Jean-Daniel Fekete; Jarke J. van Wijk; John T. Stasko; Chris North

DOI:

10.1007/978-3-540-70956-5_1

Year:

2008

Publication Type:

Book Chapter (LNCS 4950)

Discipline/Domain:

Human-Computer Interaction; Information Visualization

Subdomain/Topic:

Value of InfoVis; evaluation; cognition; economics of visualization

Contextual Background:

The chapter addresses why InfoVis is valuable yet hard to evaluate, emphasizing exploratory analysis, co

Geographic/Institutional Context:

N/A

Target Users/Stakeholders:

Visualization researchers and practitioners; funders; analysts; decision-makers in domains using explorat

Primary Methodology:

Conceptual (argumentation, literature synthesis, illustrative examples)

Primary Contribution Type:

Conceptual framework and economic model of visualization value

---

General Summary of the Paper

The authors argue that demonstrating the value of Information Visualization (InfoVis) is difficult because i

---

Actionable/Actionability Used in Paper

No.

("Actionable/actionability" terms do not appear. However, the chapter explicitly links insight to **decisions

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "A more pragmatic and operational point of view is to consider **if the new knowledge influences decisio

---

How Actionability is Understood

Implicit conceptualization: InfoVis is valuable insofar as it generates insights that **influence decisions

> "Visualization… to **amplify cognition**.":contentReference{index=9}

> "InfoVis systems are best applied for **exploratory tasks**… to learn more… make new discoveries, or

---

What Makes Something Actionable

- **Linked to decisions and actions:**

  > "Consider if the new knowledge **influences decisions, leads to actions**, and, hopefully, improves the

- **Exploratory relevance / when browsing is useful (context fit):**

  > Useful when users are unfamiliar with contents; have difficulty verbalizing needs; or when information

- **Cognitive leverage (pattern recognition & reduced search):**

  > Visuals can **reduce search**, **enhance recognition of patterns**, and enable **perceptual inference

- **Perceptual effectiveness (preattentive & Gestalt):**

  > Certain visual features are processed **preattentively**; Gestalt principles guide grouping and structur

---

How Actionability is Achieved / Operationalized

*(No explicit procedural operationalization for "making outputs actionable." The chapter instead specifies

- **Framework/Approach Name(s):** Economic model of visualization value:contentReference

- **Methods/Levers:** Choose tasks with browsing value; employ visual encodings that support preattenti

- **Operational Steps / Workflow:** N/A (conceptual guidance rather than a stepwise method).

- **Data & Measures:** N/A (no KPIs specified; model posits value $W(\Delta K)$ and cost terms).

- **Implementation Context:** General InfoVis applications and examples (e.g., dynamic queries, treemap

> "The overall profit… **F = nm(W(\Delta K) − Cs − kCe) − Ci − nCu**.":contentReference{index=18

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked "Yes/Partial" only where explicitly tied to making insights lead to decisions/actions.)

- **CL (Clarity):** No.

- **CR (Contextual Relevance):** Partial — conditions when browsing is useful (e.g., unfamiliarity, recogn

- **FE (Feasibility):** Partial — feasibility framed economically via costs (Ci, Cu, Cs, Ce) affecting practica

- **TI (Timeliness):** No.

- **EX (Explainability):** No.

- **GA (Goal Alignment):** Partial — value judged by whether increased knowledge **influences decision

- **Other Dimensions Named by Authors:** Cognitive amplification (pattern recognition, reduced search)

Theoretical or Conceptual Foundations

- Cognition amplification via visualization (Card, Mackinlay, Shneiderman):contentReference{i

- Preattentive processing & Gestalt principles:contentReference{index=24}

- Popper's epistemology and insight generation as part of scientific process:contentReference

- Economic model of value (van Wijk):contentReference{index=26}

Indicators or Metrics for Actionability

No explicit metrics. The economic model suggests **W(ΔK)** (value of knowledge increase insofar as it a

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of ground truth for insight; difficulty measuring cognition amplification:contentReference[oaicite:28

  - User visual literacy limits (e.g., scatterplots for lay audiences):contentReference{index=29}.

- **Enablers:**

  - Visual encodings exploiting preattentive features and Gestalt grouping:contentReference{in

  - Tasks with strong browsing utility (recognition > description, unfamiliar collections):contentReference[o

  - Integration with user workflows to reduce Cs and Cu; routine usage (high n, m):contentReference[oaic

---

Relation to Existing Literature

The chapter situates InfoVis among exploratory data analysis, statistics, and data mining, arguing comple

---

Summary

This chapter makes a sustained case that InfoVis creates value by enabling people to generate insights o

---

Scores

- **Overall Relevance Score:** 70 — Strong implicit link from insight to decisions/actions and a clear set o

- **Operationalization Score:** 35 — Offers an economic model and conditions that support action but no

---

Supporting Quotes from the Paper

- "They describe visualization as… **'interactive visual representations of data to amplify cognition.'**":co

- "InfoVis systems are best applied for **exploratory tasks**… to **gain insight**.":contentReference[oaici

- "**When information is easier to recognize than describe**.":contentReference{index=38}

- "Visuals can **reduce search**… **enhance the recognition of patterns**… **enable perceptual inferenc

- "Consider if the new knowledge **influences decisions, leads to actions**…":contentReference[oaicite:4

- "The overall profit… **F = nm(W(ΔK) − Cs − kCe) − Ci − nCu**.":contentReference{index=41}

Actionability References to Other Papers

- Card, Mackinlay, Shneiderman — cognition amplification and benefits (as grounds for linking insight to a

- Ware — preattentive processing and Gestalt principles enabling rapid recognition (preconditions for acti

- van Wijk (2005) — economic model aligning insight with decision/action value:contentReference[oaicite

Paper Summary

<!--META_START-->

Title: The Value of Visualization

Authors: Jarke J. van Wijk

DOI: N/A

Year: 2005

Publication Type: Conference (IEEE Visualization 2005)

Discipline/Domain: Computer Science / Visualization

Subdomain/Topic: Value and evaluation of visualization; economic/decision model for visualization

Eligibility: Eligible (implicit and substantive treatment of what makes outputs actionable through decision-

Overall Relevance Score: 78

Operationalization Score: 52

Actionable/Actionability Used in Paper: Yes — implicit; e.g., visualization value tied to decisions and "pos

Authors Argue for Need for Actionability Without Defining It: Yes — recommends enumerating user action

Contains Definition of Actionability: No (implicit conceptualization via decision/action support and econom

Contains Systematic Features/Dimensions: Yes (benefit W(ΔK), costs Ci, Cu, Cs, Ce, exploration steps k

Contains Explainability: Partial (discusses perception/cognition P and knowledge K, but not "explainability

Contains Interpretability: Partial (focus on user perception/knowledge and context; not formalized as "inte

Contains Framework/Model: Yes (economic model of visualization; profit function; process diagram):cont

Operationalization Present: Partial (advice to enumerate user actions, minimize interaction costs, set goo

Primary Methodology: Conceptual / Theoretical (with illustrative cases)

Study Context: Conceptual model applied to visualization practice; examples from flow visualization and t

Geographic/Institutional Context: Eindhoven University of Technology (Netherlands):contentReference[oa

Target Users/Stakeholders: Visualization researchers, tool builders, and practitioners; end-users who ma

Primary Contribution Type: Conceptual framework/model with practical implications

CL: Partial

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The Value of Visualization

Authors:

Jarke J. van Wijk

DOI:

N/A

Year:

2005

Publication Type:

Conference (IEEE Visualization 2005)

Discipline/Domain:

Computer Science / Visualization

Subdomain/Topic:

Value and evaluation of visualization; economic/decision model for visualization

Contextual Background:

The paper argues the field is maturing and needs principled ways to judge visualization's effectiveness a

Geographic/Institutional Context:

Technische Universiteit Eindhoven (Netherlands):contentReference{index=9}

Target Users/Stakeholders:

Visualization researchers, developers, and end-user analysts/decision-makers.

Primary Methodology:

Conceptual / Theoretical (with illustrative examples and critiques)

Primary Contribution Type:

Framework/model and evaluative argumentation

General Summary of the Paper

The paper proposes a simple but comprehensive model to assess the value of visualization by linking it t

---

Actionable/Actionability Used in Paper

Yes. While the term "actionable" is not used verbatim, the paper explicitly ties visualization value to **acti

- "The user has a problem, he must decide which action to take… The visualization should enable him to

- "I recommend my students to search for and enumerate possible actions of users after using their prosp

(Both quotes link visualization outputs to concrete actions/decisions, i.e., actionability.)

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Decisions are typically about actions to be taken or not… enumerate possible actions of users… If such

---

How Actionability is Understood

Implicit conceptualization: A visualization is valuable if it increases knowledge **that directly supports

> "The user has a problem, he must decide which action to take… The visualization should enable him to

---

What Makes Something Actionable

- **Leads to identifiable user actions/decisions:**

  > "Enumerate possible actions of users… If such actions cannot be found or defined, the value of visual

- **Delivers knowledge with positive decision value (W(ΔK)) relative to costs:**

  > "The return… consists of the value $W(\Delta K)$… hence… $F = nm(W(\Delta K)-C_s-kC_e)-C_i-nC_u$." (p. 3):conten

- **Preferable to alternative (possibly automated) methods:**

  > "When an automatic method exists to extract the relevant information, visualization is useless." (p. 4):

- **Minimizes interaction and exploration overhead (effort/time):**

  > "Interaction is costly, and leads to a high C_e… developers… should think carefully about good defaults

- **Avoids misleading/negative knowledge:**

  > "Visualizations can be wrong and misleading… negative knowledge… can be produced." (p. 5):conten

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Economic model of visualization (benefit $W(\Delta K)$ vs. costs C_i, C_u, C_s

- **Methods/Levers:** Enumerate user actions; compare to alternative (including automated) methods; re

- **Operational Steps / Workflow:**

  1) Define target decisions/actions and required information. 2) Estimate W(∆K) for those decisions. 3) Q

- **Data & Measures:** ∆K as knowledge gain per session; W(∆K) as decision value proxy; time/effort as

- **Implementation Context:** Visualization tool development and selection; examples include treemaps a

> The **diagram on page 2** depicts the V-model: data D and spec S → images I(t) → perception P → kr

---

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked "Yes/Partial" when authors explicitly tie it to their value model of being actionable.)

- **CL (Clarity):** Partial — argues for defaults/presets to quickly yield good images; clarity implied via rec

- **CR (Contextual Relevance):** Yes — value must be judged "in the context in which it is used" and rela

- **FE (Feasibility):** Yes — feasibility framed as **cost-efficiency** (Ci, Cu, Cs, Ce, k) vs. benefits; comp

- **TI (Timeliness):** Partial — interaction time and rerendering delays increase Ce, reducing practical tim

- **EX (Explainability):** Partial — perception/cognition P and knowledge K are discussed, but not formal

- **GA (Goal Alignment):** Yes — makes value conditional on supporting target actions/decisions (user's

- **Other Dimensions Named by Authors:** Subjectiveness and risk of misleading outputs (truthfulness/va

---

Theoretical or Conceptual Foundations

- Economic/utility framing with benefit–cost analysis (profit F):contentReference{index=45}.

- Process model grounding in human perception/cognition and interaction (P, E):contentReference[oaicite

- Literature drawing on visualization evaluation, perception (Ware), and communication (Tufte):contentRe

---

Indicators or Metrics for Actionability

- **W(∆K):** Value of knowledge gain for the decision problem:contentReference{index=48}.

- **Cost components:** Ci, Cu, Cs, Ce; interaction steps k; usage scale n, m:contentReference[oaicite:49

- **Decision linkage:** Presence of identifiable user actions (qualitative indicator):contentReference[oaicit

---

Barriers and Enablers to Actionability

- **Barriers:**

  - High initial per-user costs (Cu) and learning/integration burdens:contentReference{index=5

  - Subjectiveness and parameter sensitivity (S) leading to doubtful claims:contentReference{in

  - Misleading visuals/negative knowledge (artifacts, aliasing):contentReference{index=53}.

  - High interaction cost (Ce) and tuning overhead:contentReference{index=54}.

- Strong alternatives (including automation) diminishing n/m:contentReference{index=55}.

- **Enablers:**

  - Clear mapping to user actions/decisions and measurable W(ΔK):contentReference{index=5

  - Good defaults/presets to minimize Ce and ensure quick, quality views:contentReference{ind

  - Integration with automated/statistical methods (visual analytics):contentReference{index=58

  - Demonstrable practical need and low costs (e.g., SequoiaView case):contentReference{ind

---

Relation to Existing Literature

The paper references community calls for validation, uncertainty handling, and integration with user proce

---

Summary

Van Wijk reframes visualization's value through a decision-centric economic model: visualization is worth

---

Scores

- **Overall Relevance Score:** 78 — Strong, explicit linkage of visualization to actions/decisions and an e

- **Operationalization Score:** 52 — Provides concrete levers (enumerate actions, compare to automatio

---

Supporting Quotes from the Paper

- "[W]e cannot judge visualization on its own, but have to take into account the context in which it is used.

- "F = nm(W(ΔK) − Cs − kCe) − Ci − nCu." (p. 3):contentReference{index=69}

- "The user has a problem, he must decide which action to take… The visualization should enable him to

- "Enumerate possible actions of users… If such actions cannot be found or defined, the value of visualiz

- "When an automatic method exists to extract the relevant information, visualization is useless." (p. 4):co

- "Interaction is costly… developers… should think carefully about good defaults… so that as much know

- "Visualizations can be wrong and misleading… negative knowledge… can be produced." (p. 5):contentR

- "One view is to consider visualization purely from a technological point of view, aiming for effectiveness

---

Actionability References to Other Papers

- Visual analytics agenda emphasizing integration with automated analysis: Thomas & Cook, *Illuminating

- Communication and validity concerns: Tufte's works on honest, effective displays:contentReference[oai

- Perceptual grounding: Ware's *Information Visualization: Perception for Design*:contentReference[oaici

- Example adoption case (treemaps/cushion treemaps) via SequoiaView:contentReference{in

Paper Summary

<!--META_END-->

Title:

White-Box Prediction of Process Performance Indicators via Flow Analysis

Authors:

Ilya Verenich; Hoang Nguyen; Marcello La Rosa; Marlon Dumas

DOI:

10.1145/3084100.3084110

Year:

2017

Publication Type:

Conference (ICSSP'17)

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Predictive process monitoring; remaining cycle time prediction; flow analysis; white-box interpretability

Contextual Background:

The paper proposes predicting instance-level performance by first predicting activity-level performance (e

Geographic/Institutional Context:

Empirical evaluation uses BPIC'12 logs from a large financial institution and a helpdesk process from an

Target Users/Stakeholders:

Process analysts, operations managers, and data scientists seeking interpretable remaining-time predicti

Primary Methodology:

Conceptual method + empirical evaluation (four real-life event logs; MAE as main metric; multiple baselin

Primary Contribution Type:

A white-box predictive approach based on process-tree flow analysis, plus comparative experiments vs. b

---

General Summary of the Paper

The authors address the prediction of remaining cycle time for running process cases. Instead of a single

---

Actionable/Actionability Used in Paper

No. The paper does not use the terms "actionable", "actionability", or similar, nor does it define criteria for

---

Authors Argue for a Need for Actionability Without Defining It

No. The closest notion is explainability/traceability of predictions, not actionability. (Conclusion mentions '

How Actionability is Understood

N/A.

What Makes Something Actionable

N/A.

How Actionability is Achieved / Operationalized

N/A.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** N/A

- **CR (Contextual Relevance):** N/A

- **FE (Feasibility):** N/A

- **TI (Timeliness):** N/A

- **EX (Explainability):** Yes — the paper emphasizes that aggregate predictions are decomposed into a

- **GA (Goal Alignment):** N/A

- **Other Dimensions Named by Authors:** None.

Theoretical or Conceptual Foundations

- Flow analysis over process trees; handling of sequence/XOR/AND/rework using formal equations to agg

- Structured model discovery ("discover and structure") to obtain block-structured models suitable for flow

---

Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

- **Barriers:** N/A

- **Enablers:** N/A

Relation to Existing Literature

Positions "white-box" flow analysis against black-box remaining-time predictors (transition systems, SPNs

---

Summary

This paper introduces a white-box approach to predict remaining cycle time by first estimating activity-lev

---

Scores

- **Overall Relevance Score:** 15 — The paper advances explainability in predictive monitoring but does

- **Operationalization Score:** 35 — It offers a concrete workflow (model discovery, alignment, formula d

---

Supporting Quotes from the Paper

- "[R]ather than predicting single scalar indicators, we demonstrated how these indicators can be estimate

- "The idea of flow analysis is to estimate a quantitative performance indicator at the level of a process by

- "Applying the flow analysis formulas… CT = TA + max(TB + TC, TD) + TF + p2 [TG + TH/(1−r)]." (Appro

---

Actionability References to Other Papers

N/A — the paper does not cite or discuss actionability literature.

Paper Summary

Eligibility: Not Eligible

Overall Relevance Score: 15

Operationalization Score: 10

Actionable/Actionability Used in Paper: Yes — "we hope that the strategies we identified in this paper will

Authors Argue for Need for Actionability Without Defining It: Yes — see above quote; no definition or crite

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: No (conceptual grouping into four phases, but not a formal framework for "ac

Operationalization Present: No (operationalizes analysis strategies, not "actionability")

Primary Methodology: Qualitative

Study Context: Semi-structured interviews with 37 practitioners and academics focusing on the mining &

Geographic/Institutional Context: Data collected May–July 2021; participants from 29 organizations; auth

Target Users/Stakeholders: Process analysts, consultants, managers; business stakeholders involved in

Primary Contribution Type: Empirical characterization of 16 analysis strategies across four phases (unde

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not define "actionability" or provide criteria/features for what make

<!--META_END-->

Title:

Process Mining Practices: Evidence from Interviews

Authors:

Francesca Zerbato; Pnina Soffer; Barbara Weber

DOI:

https://doi.org/10.1007/978-3-031-16103-2_19

Year:

2022

Publication Type:

Conference (BPM 2022, LNCS 13420)

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Analyst strategies and challenges during the mining & analysis stage

Contextual Background:

The paper responds to limited understanding of how analysts actually conduct process mining analyses i

Geographic/Institutional Context:

Interviews (May–July 2021) with 37 participants from 29 organizations; authors at University of St. Gallen

Target Users/Stakeholders:

Process analysts and business stakeholders who validate findings.

Primary Methodology:

Qualitative (semi-structured interviews; inductive coding).

Primary Contribution Type:

Empirical synthesis of 16 strategies across four phases; identification of four influencing factors (question

---

General Summary of the Paper

The authors investigate how process mining is used in practice during the mining & analysis stage by inte

---

Actionable/Actionability Used in Paper

Yes — used once in a future-work sense, not as a defined concept tied to findings:

> "we hope that the strategies we identified in this paper will inspire research on **developing actionable s

---

Authors Argue for a Need for Actionability Without Defining It

Yes — the above line implies the need for actionable support but provides no definition or criteria.

How Actionability is Understood

N/A — no explicit or implicit conceptualization of "actionability" beyond a generic aspiration for support to

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What Makes Something Actionable

N/A — the paper does not enumerate properties/conditions for actionability.

How Actionability is Achieved / Operationalized

N/A — no methods/workflows are provided specifically to produce "actionable" outputs (the operationaliza

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** None

Theoretical or Conceptual Foundations

General references include process mining methodologies (e.g., PM²), problem-solving cycles, and literat

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Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A (paper discusses barriers to analysis (e.g., lack of causality support, stakeholder acces

- **Enablers:** N/A

Relation to Existing Literature

The paper situates itself among empirical studies of process mining practice, noting prior work on adoptio

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Summary

This conference paper empirically maps how analysts conduct the mining & analysis stage of process mi

---

Scores

- **Overall Relevance Score:** 15 — Mentions "actionable support" once without defining the term or tyin

- **Operationalization Score:** 10 — Details strategies for analysis work but not how to achieve "actionab

---

Supporting Quotes from the Paper

- "we conducted semi-structured interviews with **37** practitioners and academics" (Abstract / p. 268).

- "we organized the strategies into four main phases representing intermediate analysis goals: **understa

- "a **characterization of analysis strategies**, organized into four main phases…[and] recurring challeng

- "lack of techniques for **identifying causality** … makes it difficult to recommend solutions" (p. 279).

- "developing **actionable support** for process mining practitioners" (p. 283).

Actionability References to Other Papers

None — the paper does not cite works that define/operationalize "actionability".

Paper Summary

<!--META_START-->

Title: Process Mining Manifesto

Authors: Wil van der Aalst et al.

DOI: N/A

Year: 2012

Publication Type: Book Chapter

Discipline/Domain: Business Process Management / Information Systems / Data Mining

Subdomain/Topic: Process mining principles, lifecycle, challenges, and use as actionable Business Intelli

Eligibility: Eligible

Overall Relevance Score: 72

Operationalization Score: 60

Actionable/Actionability Used in Paper: Yes — "All technologies and methods that aim at providing action

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "process mining should be viewe

Contains Definition of Actionability: No — No formal definition; actionability is framed via BI and operation

Contains Systematic Features/Dimensions: Partial

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual

Study Context: IEEE Task Force manifesto consolidating principles and challenges; no single empirical d

Geographic/Institutional Context: Global, multi-institution IEEE Task Force (academia, vendors, end-user

Target Users/Stakeholders: Software developers, scientists, consultants, business managers, and end-us

Primary Contribution Type: Guiding principles, lifecycle framework (L*), challenge agenda

CL: Partial

CR: Yes

FE: Partial

Title:

Process Mining Manifesto

Authors:

Wil van der Aalst et al.

DOI:

N/A

Year:

2012

Publication Type:

Book Chapter (BPM 2011 Workshops, LNBIP 99) :contentReference{index=3}

Discipline/Domain:

Business Process Management / Information Systems / Data Mining :contentReference{index=

Subdomain/Topic:

Process mining principles, lifecycle (L*), discovery/conformance/enhancement, operational support, and

Contextual Background:

The manifesto promotes process mining as techniques to discover, monitor, and improve real processes

Geographic/Institutional Context:

IEEE Task Force with authors from universities, vendors, and users worldwide. (pp. 170–175) :contentRe

Target Users/Stakeholders:

"software developers, scientists, consultants, business managers, and end-users." (Abstract, p. 170) :cor

Primary Methodology:

Conceptual (principles + framework + agenda) :contentReference{index=9}

Primary Contribution Type:

Guiding principles (GP1–GP6), project lifecycle (L*), and research challenges (C1–C11). (pp. 178–186, 1

General Summary of the Paper

The manifesto introduces process mining as a bridge between event data and process models, outlining

---

Actionable/Actionability Used in Paper

Yes.

- "process mining should be viewed as a continuous process **providing actionable information** accordi

- "All technologies and methods that aim at providing **actionable information** that can be used to supp

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- Actionability is positioned as the **goal** (supporting decision-making via BI and ongoing operational su

---

How Actionability is Understood

Implicitly: Actionability arises when event-log–driven models enable **operational support** (detect devia

> "Three operational support activities can be identified: **detect, predict, and recommend**." (p. 190) :co

---

What Makes Something Actionable

- **Timeliness/Continuity:** Provides information "according to various time scales (minutes…months)."

  > "process mining should be viewed as a continuous process providing actionable information according

- **Operational Levers (Detect–Predict–Recommend):** Information tied to concrete interventions.

  > "Three operational support activities can be identified: detect, predict, and recommend." (p. 190) :cont

- **Model–Data Linkage for Diagnostics:** Replay to reveal discrepancies and bottlenecks for action.

  > "Replay may be used to reveal discrepancies between an event log and a model… [and] add expected

- **Audience-Oriented Abstraction ("Maps"):** Fit representation to stakeholder needs.

  > "Models… should be seen as 'maps'… emphasize the things relevant for a particular type of user." (p.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** L* Life-cycle (Stages 0–4); Three Types of Process Mining (discove

- **Methods/Levers:** Event-log extraction guided by questions (GP2), model discovery with concurrency

- **Operational Steps / Workflow:** Plan & justify → extract data/models/objectives → discover control-flo

- **Data & Measures:** Event logs with trustworthy/comprehensive semantics (maturity levels, Table■1);

- **Implementation Context:** BPM lifecycle phases; continuous usage akin to real-time "maps" with proje

> The **diagram on page 178 (Fig.■5)** visualizes the L* lifecycle from planning to operational support, i

---

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked when explicitly linked to making outputs actionable.)

- **CL (Clarity):** Partial — Emphasis on understandable "maps" and cartographic principles.

  > "select the right representation and fine-tune it for the intended audience." (p. 184) :contentReference[

- **CR (Contextual Relevance):** Yes — Views should match stakeholder roles, levels (strategic/tactical/

  > "different stakeholders may want to view a process at different levels…" (p. 183) :contentReference[oa

- **FE (Feasibility):** Partial — Recommendations aim to reduce costs/flow time; challenges note data/log

  > "propose particular actions to reduce costs or shorten the flow time." (p. 190) :contentReference[oaici

- **TI (Timeliness):** Yes — Continuous, multi-timescale operational support.

  > "providing actionable information according to various time scales…" (p. 186) :contentReference[oaici

- **EX (Explainability):** Partial — Replay-based diagnostics and bottleneck annotation; conformance ins

  > "Replay may be used to reveal discrepancies… and add expected waiting times to the model." (p. 183

- **GA (Goal Alignment):** Partial — Question-driven extraction and KPI-oriented objectives in Stage■1.

  > Stage■1 collects "objectives (KPIs) [and] questions." (p. 178) :contentReference{index=31}

- **Other Dimensions Named by Authors:** Model quality trade-offs (fitness, simplicity, precision, general

---

Theoretical or Conceptual Foundations

- BPM lifecycle positioning and L* lifecycle for projects. (pp. 176–178) :contentReference{inde
- Process mining triad: discovery, conformance, enhancement. (pp. 175–176) :contentReference[oaicite:3
- Model quality dimensions: fitness, simplicity (Occam's Razor), precision, generalization. (pp. 188–189) :

Indicators or Metrics for Actionability

- No explicit KPI set for "actionability" itself; instead, prerequisites: event-log maturity (Table■1), model q

---

Barriers and Enablers to Actionability

- **Barriers:** Data quality and integration (C1), scalability/diversity of logs (C2), concept drift (C4), repres
- **Enablers:** Question-driven extraction (GP2), concurrency-aware discovery (GP3), event–model linka

---

Relation to Existing Literature

The manifesto consolidates state-of-the-art practice and refers to van der Aalst's 2011 monograph for fou

---

Summary

This manifesto frames process mining as a discipline that extracts knowledge from event logs to discover

---

Scores

- **Overall Relevance Score:** 72 — Strong, repeated use of "actionable information" tied to BI and opera

- **Operationalization Score:** 60 — Provides concrete lifecycle (L*), replay-based diagnostics, and dete

---

Supporting Quotes from the Paper

- "[P]rocess mining should be viewed as a continuous process **providing actionable information** accord

- "All technologies and methods that aim at providing **actionable information** that can be used to supp

- "Three operational support activities can be identified: **detect, predict, and recommend**." (p. 190) :co

- "Replay may be used to reveal discrepancies between an event log and a model… [and] add expected v

- "Models… should be seen as 'maps'… emphasize the things relevant for a particular type of user." (p. 1

Actionability References to Other Papers

- van der Aalst, W.M.P. (2011). *Process Mining: Discovery, Conformance and Enhancement of Busines

Paper Summary

<!--META_START-->

Title: Process Mining Challenges Perceived by Analysts: An Interview Study

Authors: Lisa Zimmermann, Francesca Zerbato, Barbara Weber

DOI: 10.1007/978-3-031-07475-2_1

Year: 2022

Publication Type: Conference

Discipline/Domain: Information Systems / Process Mining

Subdomain/Topic: Analyst work practices; challenges across process mining project phases

Eligibility: Eligible (implicit treatment of how to derive concrete recommendations/next steps and what hin

Overall Relevance Score: 55

Operationalization Score: 20

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "I think it's challenging to answe

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: No

Operationalization Present: No

Primary Methodology: Qualitative

Study Context: Semi-structured interviews (n=41) with process mining analysts after a realistic analysis ta

Geographic/Institutional Context: Participants from 27 organizations; conducted via virtual meetings; auth

Target Users/Stakeholders: Process mining analysts (practitioners & academics) and project stakeholder

Primary Contribution Type: Empirical catalog of 23 analyst-perceived challenges organized by project pha

CL: Partial

CR: Yes

FE: No

TI: No

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Process Mining Challenges Perceived by Analysts: An Interview Study

Authors:

Lisa Zimmermann, Francesca Zerbato, Barbara Weber

DOI:

10.1007/978-3-031-07475-2_1

Year:

2022

Publication Type:

Conference (BPMDS/EMMSAD 2022, LNBIP 450):contentReference{index=5}

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Analyst work practices; perceived challenges across process mining project phases

Contextual Background:

Process mining adoption is rising, yet little is known about analysts' individual needs and obstacles. The s

Geographic/Institutional Context:

Interviews conducted virtually in 2021 with participants from 27 organizations; authors from University of

Target Users/Stakeholders:

Process mining analysts (practitioners and academics) and collaborating business/IT stakeholders:conter

Primary Methodology:

Qualitative (semi-structured interviews; grounded-theory coding):contentReference{index=9}.

Primary Contribution Type:

Empirical catalog and analysis of 23 challenges (summarized in Figure 1):contentReference{in

---

General Summary of the Paper

The paper investigates what individual process mining analysts perceive as challenges during projects. T

Actionable/Actionability Used in Paper

No. The paper does not use the terms "actionable/actionability." However, it explicitly treats the need to p

---

Authors Argue for a Need for Actionability Without Defining It

Yes. Verbatim evidence tying analyses to *recommendations/next steps*:

- "I think it's challenging to answer this question with recommendation of what to do afterwards" (participa

- Process mining shows "where your issues are, but it's not helping you to solve them" (participant p17).:c

- It is difficult to "come to … hard conclusions" or to decide "what we should change now" (participant p20

How Actionability is Understood

Implicit: Actionability is equated with being able to move from descriptive findings to *hard conclusions* a

> "It's challenging … with recommendation of what to do afterwards" and tools show issues but "not helpi

---

What Makes Something Actionable

- **Support for deriving concrete recommendations:**

  > "It's challenging … with recommendation of what to do afterwards." (p4):contentReference{

- **Causal/justified conclusions (to inform change):**

  > Danger of "jump[ing] to incorrect conclusions" and difficulty to reach "hard conclusions." (p11, p20):co

- **Adequate domain knowledge to target relevant changes:**

  > "Without domain knowledge, you won't achieve much or nothing at all." (p38):contentReference[oaicite

- **Access to additional contextual information/stakeholders:**

  > Need "additional knowledge to really get into an event log," but lack of access to documentation/stake

- **Maintaining analysis focus aligned to the goal:**

  > Risk of "losing the big picture" and deviating from the original aim. (p24, p26):contentReference[oaicite

---

How Actionability is Achieved / Operationalized

(Not directly provided as a prescriptive method.) The paper catalogs impediments and implies enablers (d

- **Framework/Approach Name(s):** N/A

- **Methods/Levers:** Implied need for domain knowledge, stakeholder collaboration, stronger techniques

- **Operational Steps / Workflow:** N/A

- **Data & Measures:** N/A

- **Implementation Context:** General process mining projects across sectors.

> "Process mining cannot answer all the questions … you need to combine it with other approaches … to

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — difficulty reaching "hard conclusions" suggests clarity is necessary for action.

- **CR (Contextual Relevance):** Yes — domain knowledge is crucial: "Without domain knowledge, you v

- **FE (Feasibility):** No — feasibility of recommended actions is not discussed.

- **TI (Timeliness):** No — timeliness not addressed.

- **EX (Explainability):** No — not framed as explainability.

- **GA (Goal Alignment):** Partial — challenges in question formulation and maintaining focus imply goal

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

Organizing frame by project phases (after Emamjome et al. 2019) to place challenges; grounded-theory c

---

Indicators or Metrics for Actionability

N/A (no metrics/KPIs proposed).

Barriers and Enablers to Actionability

- **Barriers:**

  - Difficulty producing *recommendations & next steps* (C19):contentReference{index=30}

- Weak causal inference / risk of incorrect conclusions (C18):contentReference{index=31}

  - Limited domain knowledge (C20):contentReference{index=32}

  - Restricted access to contextual information/stakeholders (C14, C21):contentReference{inde

  - Loss of analysis focus (C17):contentReference{index=34}

  - Technique/tool limitations for root-cause (C13):contentReference{index=35}

- **Enablers (Implied):**

  - Stronger stakeholder collaboration and documentation access:contentReference{index=36}

  - Building domain knowledge:contentReference{index=37}

  - Guidance to maintain focus and align with questions:contentReference{index=38}

  - Integrating complementary methods for "the whys" (beyond descriptive PM):contentReference[oaicite:3

Relation to Existing Literature

The paper relates analyst-level challenges to organizational and technical ones identified in prior work (e.

Summary

This interview study (n=41) surfaces 23 analyst-perceived challenges across all phases of process minin

---

Scores

- **Overall Relevance Score:** 55 — Actionability is implicitly central (recommendations/next steps, hard

- **Operationalization Score:** 20 — The paper catalogs obstacles and hints at enablers but provides no

---

Supporting Quotes from the Paper

- "It's challenging … with recommendation of what to do afterwards." (participant p4):contentReference[o

- "Process mining … shows where your issues are, but it's not helping you to solve them." (participant p1

- "A major pitfall is that you jump to incorrect conclusions … [it is] difficult to … find … what we should cha

- "Without domain knowledge, you won't achieve much or nothing at all." (participant p38):contentReferen

- Need for "additional knowledge" and lack of access to stakeholders/documentation (participants p8, p34

Actionability References to Other Papers

The paper mainly references broader PM challenges and adoption (e.g., van der Aalst et al., 2012 "Proce

Paper Summary

<!--META_START-->

Title: Process Mining and Verification of Properties: An Approach based on Temporal Logic

Authors: W.M.P. van der Aalst; H.T. de Beer; B.F. van Dongen

DOI: 10.1007/11575771_11

Year: 2005

Publication Type: Conference

Discipline/Domain: Computer Science / Business Process Management

Subdomain/Topic: Process mining; temporal logic; conformance/verification; ProM; LTL Checker

Eligibility: Not Eligible

Overall Relevance Score: 15

Operationalization Score: 20

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Tool demonstration

Study Context: Event-log–based verification on an academic paper review process (Petri net running exa

Geographic/Institutional Context: Eindhoven University of Technology; Netherlands

Target Users/Stakeholders: Process analysts; auditors; BPM/WFM practitioners; researchers

Primary Contribution Type: Language + software tool (LTL Checker in ProM) for log-based property verifi

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not use or define "actionable/actionability" nor provide criteria for t

<!--META_END-->

Title:

Process Mining and Verification of Properties: An Approach based on Temporal Logic

Authors:

W.M.P. van der Aalst; H.T. de Beer; B.F. van Dongen

DOI:

10.1007/11575771_11

Year:

2005

Publication Type:

Conference (Lecture Notes in Computer Science)

Discipline/Domain:

Computer Science / Business Process Management

Subdomain/Topic:

Process mining; temporal logic (LTL); verification of properties from event logs; ProM framework; conform

Contextual Background:

The paper addresses the tension between flexibility/adaptivity of information systems and auditability/con

Geographic/Institutional Context:

Department of Technology Management, Eindhoven University of Technology, Netherlands. :contentRefe

Target Users/Stakeholders:

Process miners, BPM/WFM analysts, auditors/compliance teams, researchers using ProM. :contentRefer

Primary Methodology:

Conceptual language design + implementation + illustrative case (journal review process) using event log

Primary Contribution Type:

A domain-tailored temporal logic (extensions of LTL) and an LTL Checker tool (ProM plugin) with ~60 pre

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General Summary of the Paper

The authors propose a verification approach that checks whether observed behavior in event logs satisfie

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Actionable/Actionability Used in Paper

No; the paper does not use the terms "actionable," "actionability," "actionable insight/recommendation/kno

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Authors Argue for a Need for Actionability Without Defining It

No; while the paper motivates auditing/monitoring needs under legislation and governance, it does not inv

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

Temporal logic (LTL) for specifying behavioral properties over linear traces; event-log centric verification;

- Pnueli's temporal logic of programs; automata/dynamic programming perspectives referenced. :content

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Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A

- **Enablers:** N/A

Relation to Existing Literature

The work contrasts with process discovery methods (e.g., α-algorithm) by emphasizing verification directl

---

Summary

This paper contributes a specialized LTL-based language and companion ProM plugin ("LTL Checker") th

---

Scores

- **Overall Relevance Score:** 15 — The paper is adjacent to decision support via compliance verificatio

- **Operationalization Score:** 20 — Strong operationalization for LTL-based verification (language, tool,

---

Supporting Quotes from the Paper

- "Given an event log and a property, our LTL Checker verifies whether the observed behavior matches th

- "Instead we focus on verification, i.e., given an event log we want to verify certain properties." :contentR

- "Therefore, we propose an approach based on temporal logic… an extension of Linear Temporal Logic

- Example property schema (Table 2): `accept_or_reject_but_not_both()` and `four_eyes_principle(a1,a2`

- "There are about 60 application-independent properties…" :contentReference{index=15}

- "The LTL Checker partitions the set of cases into two sets: L^OK … and L^NOK … Both sets can be sa

---

Actionability References to Other Papers

N/A (the cited works relate to process mining, conformance, LTL monitoring, and BPM/BAM tools rather t

Paper Summary

<!--META_START-->

Title: Process mining and lean six sigma: a novel approach to analyze the supply chain quality of a hospi

Authors: Francisco Ramires; Paulo Sampaio

DOI: 10.1108/IJLSS-12-2020-0226

Year: 2021 (journal record); manuscript uploaded 2022

Publication Type: Journal

Discipline/Domain: Operations Management / Health Services Management

Subdomain/Topic: Lean Six Sigma (LSS); Process Mining (PM); Hospital supply chain; DMAIC

Eligibility: Eligible (implicit treatment of what makes outputs usable for decisions through PM+DMAIC me

Overall Relevance Score: 56

Operationalization Score: 72

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "This paper provides insights for six s

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Partial (visibility, speed, efficiency, end■to■end view discuss

Contains Explainability: No

Contains Interpretability: Partial (dashboards and KPIs to interpret process performance)

Contains Framework/Model: Yes (PM integrated into DMAIC; follows Graafmans et■al. 2020 structure)

Operationalization Present: Yes (event-log construction, KPIs, regression analyses, improvement levers,

Primary Methodology: Mixed Methods (descriptive case study + quantitative analyses; action research st

Study Context: Purchasing of consigned medical products in a public hospital

Geographic/Institutional Context: Portuguese National Health Service hospital; global supplier ("Company

Target Users/Stakeholders: Purchasing Department distributor/buyers/head; supplier staff; hospital mana

Primary Contribution Type: Practice-oriented case study demonstrating PM+LSS integration with concret

CL: Partial

CR: Yes

FE: Yes

TI: Partial

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Process mining and lean six sigma: a novel approach to analyze the supply chain quality of a hospital

Authors:

Francisco Ramires; Paulo Sampaio

DOI:

10.1108/IJLSS-12-2020-0226

Year:

2021 (journal publication; manuscript posted 2022) :contentReference{index=1}

Publication Type:

Journal

Discipline/Domain:

Operations Management / Health Services Management

Subdomain/Topic:

Lean Six Sigma; Process Mining; DMAIC; Hospital supply chains

Contextual Background:

Hospitals face inefficiencies and rising costs; LSS and PM are proposed together to create data-driven im

Geographic/Institutional Context:

Portuguese NHS hospital collaborating with a global medical technology supplier ("Company X"). (pp. 10-

Target Users/Stakeholders:

Hospital Purchasing Department (distributor, buyers, head), supplier teams, hospital management. (pp. 1

Primary Methodology:

Mixed methods descriptive case study within an action research frame; PM dashboards + OLS and logist

Primary Contribution Type:

Applied demonstration and guidance on integrating PM into DMAIC for supply chain quality, with quantifie

---

General Summary of the Paper

The paper reports a hospital–supplier collaboration to improve the consignment purchasing process usin

---

Actionable/Actionability Used in Paper

No. The exact terms "actionable," "actionability," or "actionable insight/recommendation/knowledge" are n

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "This paper provides insights… Implementing this blended approach can bring visibility to operations an

- PM "can add great value to quality initiatives by considering a greater breadth of data… [and] help team

---

How Actionability is Understood

Implicit: Actionable outputs are those that directly inform and justify concrete process changes via end■to

> "Combining PM's process intelligence capabilities with… DMAIC… can support organizations… to build

---

What Makes Something Actionable

- **End■to■end operational visibility enabling targeted changes**

  > "The link between event data and process models allows… users to act on updated information promp

- **Quantified performance baselines and KPIs**

  > "To analyze the process, three supply chain quality■related metrics were designed: Process Quality L

- **Causal/driver analysis connecting factors to outcomes**

  > "Annual agreements lead to 25% faster purchasing, and… decrease the odds of producing repeated P

- **Operational levers mapped to expected impact**

  > "Five change directions are proposed… [with] expected impact on redundant orders, costs, and days l

- **Ongoing monitoring/control to close the loop**

  > "Using the SQL code and the excel structure created, the same dashboards can be used again to mon

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** DMAIC augmented with Process Mining (per Graafmans et■al. 202

- **Methods/Levers:** Event■log construction from SAP extracts; PM dashboards; definition of KPIs; OLS

- **Operational Steps / Workflow:** Define (charter, CTQ, event■log build) → Measure (PM baseline, KP

- **Data & Measures:** Case ID, activity, timestamps; KPIs: Process Quality Level, Working Days Lost, C

- **Implementation Context:** Portuguese public hospital consignment purchasing process; Celonis used

> "There were 202 redundant purchase orders… only 66% processed below the target of 2 days." (pp. 18

Dimensions and Attributes of Actionability (Authors' Perspective)

*(Marked when explicitly tied to making changes in this case; authors do not frame them as "actionability"

- **CL (Clarity):** Partial — PM dashboards and process maps "discover the process performance" and p

- **CR (Contextual Relevance):** Yes — Metrics and levers are tailored to consignment purchasing in the

- **FE (Feasibility):** Yes — Interventions include quantified cost/time savings and specific responsibility

- **TI (Timeliness):** Partial — Target of ≤2 business days; monthly monitoring recommended. Quotes: "

- **EX (Explainability):** No — Paper does not discuss model transparency beyond descriptive dashboar

- **GA (Goal Alignment):** Partial — Goals set in project charter/CTQ (reduce redundant POs; reduce ord

- **Other Dimensions Named by Authors:** End■to■end visibility; evidence■based improvement. Quotes

---

Theoretical or Conceptual Foundations

- Lean Six Sigma (DMAIC).

- Process Mining as data■driven process analysis; follows Graafmans et■al. (2020) for PM■into■DMAIC

Indicators or Metrics for Actionability

- **Process Quality Level** = Redundant POs / Total POs (%).

- **Working Days Lost** from redundant POs (conversion from minutes).

- **Operational Cost** = Redundant POs × €8 per PO.

- **Ordering Time** distribution; **Six Sigma level** for POs. (pp. 18–19) :contentReference{in

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Fragmented/"materialized" process with paper approvals (adds ~3 minutes per requisition). (pp. 20–21

  - Frequent legal/quotation requests despite fixed annual prices (adds up to 2 workdays). (p. 21) :content

  - Requisition distribution method impedes aggregation, causing redundant POs. (p. 20) :contentReferen

  - Contract modality constraints (direct adjudication) increase delay and fragmentation. (pp. 20, 23–24) :

- **Enablers:**

  - PM dashboards for baseline and monitoring; end■to■end visibility. (pp. 16, 26–28) :contentReference

  - Annual tender agreements reducing ordering time by ~25% and redundant PO odds by ~70%. (pp. 23-

  - Centralized digital documentation hub and improved supplier communication. (p. 25) :contentReferenc

  - Data■sharing cadence for batching POs (e.g., weekly issuance). (p. 25) :contentReference

---

Relation to Existing Literature

The study positions itself as operationalizing Graafmans et■al. (2020)'s guideline for integrating PM withi

---

Summary

This paper is a practice■driven case study showing how to combine PM with LSS's DMAIC to improve a

---

Scores

- **Overall Relevance Score:** 56 — The paper substantively enables decision■oriented change via PM-

- **Operationalization Score:** 72 — Strong on "how to": event■log construction, KPIs, dashboards, regre

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Supporting Quotes from the Paper

- "[PM] can support organizations that already adopt LSS methods… to build more agile and efficient imp

- "Three supply chain quality■related metrics were designed: Process Quality Level, Working Days Lost,

- "Annual agreements lead to 25% faster purchasing, and… decrease the odds of producing repeated PO

- "Recommended to monitor and compare the results monthly." (p. 26) :contentReference{inde

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Actionability References to Other Papers

- Graafmans, T. et■al. (2020) — PM for Six Sigma guideline integrated into DMAIC (foundation for the bl

- van der Aalst (2011, 2016) — PM fundamentals enabling end■to■end, event■log■based analysis.

- Davenport & Spanyi (2019) — Emphasis on leveraging information systems for process improvement. (

Paper Summary

<!--META_START-->

Title: Prescriptive process monitoring: Quo vadis?

Authors: Kateryna Kubrak; Fredrik Milani; Alexander Nolte; Marlon Dumas

DOI: 10.7717/peerj-cs.1097

Year: 2022

Publication Type: Journal

Discipline/Domain: Process Mining / Business Process Management / Data Science

Subdomain/Topic: Prescriptive process monitoring; interventions; policies; causality; SLR and framework

Eligibility: Eligible (Implicit treatment of what makes recommendations usable and effective; emphasis on

Overall Relevance Score: 72

Operationalization Score: 64

Actionable/Actionability Used in Paper: No (term not used explicitly); implicit throughout via "prescriptions

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "Predictions… only become usef

Contains Definition of Actionability: No (no explicit definition; provides conditions/mechanisms instead)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Review (Systematic Literature Review)

Study Context: Multiple domains via surveyed papers; not a single empirical field study

Geographic/Institutional Context: Literature-centered; authors from University of Tartu & CMU

Target Users/Stakeholders: Researchers; BPM tool developers; process workers/end■users; decision-m

Primary Contribution Type: Conceptual framework + systematic review

CL: Partial

CR: Yes

FE: Yes

TI: Yes

Title:

Prescriptive process monitoring: Quo vadis?

Authors:

Kateryna Kubrak; Fredrik Milani; Alexander Nolte; Marlon Dumas

DOI:

10.7717/peerj-cs.1097

Year:

2022

Publication Type:

Journal (PeerJ Computer Science):contentReference{index=3}

Discipline/Domain:

Process Mining / Business Process Management / Data Science

Subdomain/Topic:

Prescriptive process monitoring; runtime interventions; policy design; causality; SLR & framework.

Contextual Background:

The paper reviews prescriptive process monitoring (PPM) methods that recommend runtime interventions

Geographic/Institutional Context:

Not tied to a single field site; cross■domain literature. Authors affiliated with University of Tartu (Estonia)

Target Users/Stakeholders:

Researchers and tool developers; also process workers and end■users who receive prescriptions (pp. 3,

Primary Methodology:

Systematic Literature Review following Kitchenham & Charters; search strings, inclusion/exclusion, data

Primary Contribution Type:

Conceptual framework + synthesis of 37 papers (pp. 4, 14–18; Figs. 2–3 pp. 16–17).:contentReference[o

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General Summary of the Paper

The article studies prescriptive process monitoring methods that recommend runtime interventions to pre

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Actionable/Actionability Used in Paper

No (term not used explicitly). However, the paper repeatedly treats the *usability and effectiveness* of re

- "Predictions… only become useful to users when they are combined with recommendations." (p. 2):cont

- "The benefits of prescriptive process monitoring can only be fully realized if these methods prescribe eff

- Policies weigh "cost model… and mitigation effectiveness before triggering interventions." (p. 4):content

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Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Only become useful to users when… combined with recommendations." (p. 2):contentReference[oaicite

- Effectiveness depends on "interventions that are followed" and user acceptance (p. 3).:contentReferenc

- Calls for explainability of predictions and policies to support decision-makers (pp. 19–20).:contentRefere

---

How Actionability is Understood

Implicitly: information (predictions) must be paired with *effective, feasible, timely* interventions and a *po

> "An alarm is raised that can lead to an intervention… evaluate the cost model and mitigation effectivene

> "Only a few existing methods take causality into account… need to explain why… recommends a given

---

What Makes Something Actionable

- **Effectiveness of intervention:**

  > "Benefits… realized if… prescribe effective interventions that are followed." (p. 3):contentReference[oa

- **Causal impact (not mere correlation):**

  > "Developing policy design techniques that take causality into account." (p. 20):contentReference[oaicit

- **Feasibility & cost trade■off:**

  > "Evaluates… cost model… intervention, undesired outcome, compensation… and the mitigation effect

- **Resource availability / capacity constraints:**

  > Policies consider "resource availability" when prescribing interventions (pp. 13, 15).:contentReference

- **Timeliness (when to trigger):**

  > "Intervention frequency… continuous or discrete… triggered only when… probability… exceeds a defi

- **Explainability to end■users:**

  > "Ability to explain… prediction… and… policy… is unexplored." (pp. 19–20):contentReference[oaicite:

- **Consideration of second■order effects & user acceptance:**

  > Interventions can be "ineffective or counter■productive… second■order effects… need… human judg

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):**

  Multi■dimensional *Prescriptive Process Monitoring Framework* (Figs. 2–3) mapping objectives, target

- **Methods/Levers:**

  Prediction models (e.g., DT, RF, LSTM), similarity/kNN, causal estimation (e.g., CATE), cost models, us

- **Operational Steps / Workflow:**

  (i) Detect risk/goal; (ii) estimate outcome probability; (iii) evaluate intervention effectiveness & costs; (iv)

- **Data & Measures:**

  Control■flow, resource, temporal, domain■specific features; targets include outcome violation, cycle/pr

- **Implementation Context:**

  Cross■domain exemplars; often evaluated on real or synthetic logs; limited in■vivo trials (pp. 9–12, 17–

> "An alarm… probability of a negative outcome… cost model… mitigation effectiveness before triggering

---

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked only where the paper ties the attribute to prescriptions and their usefulness.)

- **CL (Clarity):** Partial — need for common terminology suggests clarity matters to apply prescriptions.

  > "Lack of common terminology… need for common terminology." (p. 20):contentReference{i

- **CR (Contextual Relevance):** Yes — policies/methods depend on domain data and case context.

  > Inputs include domain■specific features and case attributes; prescriptions vary by context (pp. 11–13,

- **FE (Feasibility):** Yes — cost models, resource availability, constraints.

  > "Cost model… intervention… compensation" and "resource availability" before prescribing (pp. 4, 13, 1

- **TI (Timeliness):** Yes — continuous vs. discrete triggering; thresholds.

  > "Intervention frequency… continuous or discrete… probability above threshold" (pp. 11–13, 15).:conte

- **EX (Explainability):** Yes — explicit call for prediction & policy explanation.

  > "Ability to explain… prediction… and… policy… unexplored." (pp. 19–20):contentReference[oaicite:36

- **GA (Goal Alignment):** Yes — objectives/targets (KPI) drive prescriptions.

  > Objectives: optimize outcome or efficiency; targets like cycle time, deadlines, revenue (pp. 9–10, 14–1

- **Other Dimensions Named by Authors:**

  Causality — as a design principle for policies (pp. 19–20).:contentReference{index=38}

Theoretical or Conceptual Foundations

- Value of recommendations paired with predictions; alarm■based and policy■based control; causal infer

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Indicators or Metrics for Actionability

- No explicit "actionability metric," but operational proxies: probability thresholds of negative outcomes, m

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Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of in■vivo validation; prescriptions may not change outcomes (pp. 17–19).:contentReference[oai

  - Correlation■based policies may miss true causes (pp. 18–20).:contentReference{index=42}

  - Second■order effects; user acceptance (p. 19).:contentReference{index=43}

  - Limited explainability, especially of policies (pp. 19–20).:contentReference{index=44}

- **Enablers:**

  - Cost■aware, resource■aware, causality■aware policies (pp. 4, 13–15, 19–20).:contentReference[oai

  - Rich multi■perspective data (control■flow, resource, temporal, domain) (pp. 11–13).:contentReference

  - Clear objectives/targets and policy rules/thresholds (pp. 13–16).:contentReference{index=4

Relation to Existing Literature

The review situates PPM relative to predictive monitoring, resource allocation, and prescriptive analytics,

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Summary

This SLR frames prescriptive process monitoring as the pairing of predictions with *effective, feasible, tim

---

Scores

- **Overall Relevance Score:** 72 — Strong implicit treatment of what makes prescriptions *usable* (effe

- **Operationalization Score:** 64 — Provides concrete policy patterns (thresholds, cost models), interven

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Supporting Quotes from the Paper

- "[P]redictions… only become useful to users when they are combined with recommendations." (p. 2):co

- "Benefits… fully realized if… prescribe effective interventions that are followed." (p. 3):contentReference

- "Evaluates the probability of a negative outcome together with a cost model… and the mitigation effectiv

- "Developing policy design techniques that take causality into account." (p. 20):contentReference[oaicite:

- "Ability to explain… prediction… and… policy… unexplored." (pp. 19–20):contentReference{i

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Actionability References to Other Papers

- Teinemaa et al. (2018) — Alarm■based prescriptive monitoring with thresholds, cost, mitigation effectiv

- Fahrenkrog■Petersen et al. (2022) — Alarm■based systems, cost/benefit & mitigation effectiveness (pp

- Shoush & Dumas (2021) — Causal inference under resource constraints; CATE for prescriptions (pp. 1

- Bozorgi et al. (2021) — Cost■aware cycle time reduction with causal estimation/policies (pp. 12–15, 17

- Dees et al. (2019) — Field evidence that accurate predictions do not guarantee effective recommendati

- Márquez■Chamorro et al. (2018) — Predictive monitoring survey; motivation for pairing predictions with

Paper Summary

<!--META_START-->

Title: Predicting process performance: A white■box approach based on process models

Authors: Ilya Verenich, Marlon Dumas, Marcello La Rosa, Hoang Nguyen

DOI: https://doi.org/10.1002/smr.2170

Year: 2019

Publication Type: Journal

Discipline/Domain: Business Process Management / Process Mining

Subdomain/Topic: Predictive Process Monitoring, White-box Prediction, Flow Analysis

Eligibility: Eligible

Overall Relevance Score: 75

Operationalization Score: 85

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "...business analysts can pinpoint the

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes — White-box predictive framework using flow analysis

Operationalization Present: Yes

Primary Methodology: Quantitative / Experimental

Study Context: Predicting remaining cycle time of ongoing process instances from event logs

Geographic/Institutional Context: Multiple — data from public process mining datasets (BPIC, Hospital, H

Target Users/Stakeholders: Process analysts, business managers, operational decision-makers

Primary Contribution Type: Methodological / Framework Development

CL: Partial — explains decomposition but not labeled as "clarity" dimension

CR: Yes — model contextualized to specific process models and datasets

FE: Partial — considers feasibility of runtime application

TI: Yes — supports early prediction during case execution

EX: Yes — white-box decomposition into activity-level components

GA: Partial — aligns prediction explanation with operational improvement goals

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Predicting process performance: A white■box approach based on process models

Authors:

Ilya Verenich, Marlon Dumas, Marcello La Rosa, Hoang Nguyen

DOI:

https://doi.org/10.1002/smr.2170

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Business Process Management / Process Mining

Subdomain/Topic:

Predictive Process Monitoring, White-box Prediction, Flow Analysis

Contextual Background:

The paper addresses limitations of black-box predictive process monitoring methods by proposing a whit

Geographic/Institutional Context:

Multiple domains and organizations; datasets from public benchmarks and industry logs (BPIC, Hospital,

Target Users/Stakeholders:

Process analysts, business managers, operational decision-makers.

Primary Methodology:

Quantitative / Experimental

Primary Contribution Type:

Methodological / Framework Development

General Summary of the Paper

This paper proposes a white-box predictive process monitoring framework that predicts quantitative proce

---

Actionable/Actionability Used in Paper

No — The paper does not use the terms *actionable* or *actionability*.

Authors Argue for a Need for Actionability Without Defining It

Yes —

> "...business analysts can pinpoint the bottlenecks in the process execution and provide better recomme

This implies a need for actionable insights derived from interpretable predictions.

How Actionability is Understood

Implicit — Actionability is implied as the ability to understand *where* in the process predicted perform

> The white-box decomposition "...allows users not only to make predictions but also to explain them" (p.

What Makes Something Actionable

- **Traceable to specific activities:**

  > "...determine to what extent each activity contributes to the prediction" (p. 3)

- **Pinpoint bottlenecks:**

  > "...business analysts can pinpoint the bottlenecks... and provide better recommendations" (p. 24)

- **Operationally relevant granularity:**

  > "...explain in which parts of the process the remaining time will be spent" (p. 3)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** White-box predictive process monitoring via flow analysis

- **Methods/Levers:** Discover process models, decompose performance indicators into activity-level cor

- **Operational Steps / Workflow:** (1) Discover process model; (2) Train regressors and classifiers; (3) A

- **Data & Measures:** Event logs (case and event attributes), cycle times, branching probabilities.

- **Implementation Context:** Applicable to structured process models discovered from logs.

> "...first predict the performance indicator at the level of activities and then aggregate these predictions..

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — Predictions decomposed for interpretability but no formal clarity definition.

- **CR (Contextual Relevance):** Yes — Predictions are process-specific, linked to actual activity flows.

- **FE (Feasibility):** Partial — Runtime performance tested; feasible for online applications.

- **TI (Timeliness):** Yes — Supports early predictions during execution.

- **EX (Explainability):** Yes — White-box decomposition provides direct explanation of results.

- **GA (Goal Alignment):** Partial — Predictions framed to support performance compliance goals.

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Flow analysis in process models

- Machine learning regression/classification for predictive process monitoring

- Process model discovery from event logs

Indicators or Metrics for Actionability

N/A — Metrics focus on MAE for prediction accuracy, not explicit actionability measures.

Barriers and Enablers to Actionability

- **Barriers:** Data sparsity for rare activities, rework loops complicating predictions, lack of relevant attrib

- **Enablers:** Structured process models, interpretable prediction formulas, activity-level granularity.

Relation to Existing Literature

Positions itself against black-box remaining time predictors, drawing on literature on process mining, prec

---

Summary

This study introduces a white-box predictive framework for process performance monitoring that predicts

---

Scores

- **Overall Relevance Score:** 75 — Strong alignment with implicit actionability via interpretability; lacks e

- **Operationalization Score:** 85 — Detailed, replicable methodology with concrete steps for implementa

---

Supporting Quotes from the Paper

- "...first predict the performance indicator at the level of activities and then aggregate these predictions...

- "...determine to what extent each activity contributes to the prediction." (p. 3)

- "...business analysts can pinpoint the bottlenecks in the process execution and provide better recommen

---

Actionability References to Other Papers

N/A — No explicit citations defining or operationalizing "actionability".

Paper Summary

<!--META_START-->

Title: PEM4PPM: A Cognitive Perspective on the Process of Process Mining

Authors: Elizaveta Sorokina, Pnina Soffer, Irit Hadar, Uri Leron, Francesca Zerbato, Barbara Weber

DOI: https://doi.org/10.1007/978-3-031-41620-0_27

Year: 2023

Publication Type: Conference

Discipline/Domain: Information Systems / Process Mining

Subdomain/Topic: Cognitive perspectives in process mining, Prediction Error Minimization (PEM) theory

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 78

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes – cognitive steps mapped to operational process mining

Contains Explainability: Yes – via cognitive process modeling

Contains Interpretability: Yes – mapping of thought processes to PM actions

Contains Framework/Model: Yes – PEM4PPM model (v1 and v2)

Operationalization Present: Yes – analysis protocol, coding scheme, strategies

Primary Methodology: Mixed Methods (qualitative & quantitative)

Study Context: Cognitive strategies in process mining analysis

Geographic/Institutional Context: University of Haifa, Technion (Israel), University of St. Gallen (Switzerla

Target Users/Stakeholders: Process mining analysts (students & professionals), tool developers, educato

Primary Contribution Type: Theoretical framework and empirical validation of analyst strategies

CL: Partial – clarity embedded in goal setting and task understanding steps

CR: Yes – grounded in PM context and task-related goals

FE: Partial – feasibility implied in operational PM steps

TI: No explicit timeliness focus

EX: Yes – explicit explanation of steps and reasoning processes

GA: Yes – goal-driven analysis is a core element of the model

Reason if Not Eligible: N/A

<!--META_END-->

Title:

PEM4PPM: A Cognitive Perspective on the Process of Process Mining

Authors:

Elizaveta Sorokina, Pnina Soffer, Irit Hadar, Uri Leron, Francesca Zerbato, Barbara Weber

DOI:

https://doi.org/10.1007/978-3-031-41620-0_27

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Cognitive perspectives in process mining, Prediction Error Minimization (PEM) theory application

Contextual Background:

The paper addresses a gap in understanding the "process of process mining" (PPM) from a cognitive scie

Geographic/Institutional Context:

University of Haifa, Technion (Israel), University of St. Gallen (Switzerland)

Target Users/Stakeholders:

Process mining analysts (students & professionals), process mining tool designers, educators

Primary Methodology:

Mixed Methods (qualitative for theory adaptation & strategy identification; quantitative for validation & per

Primary Contribution Type:

Theoretical framework (PEM4PPM model) and empirical strategy validation

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General Summary of the Paper

The paper develops and validates the PEM4PPM model, a cognitive framework for understanding how pr

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Actionable/Actionability Used in Paper

No – the paper focuses on cognitive processes and performance but does not explicitly use "actionable" i

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Authors Argue for a Need for Actionability Without Defining It

No – the focus is on cognitive completeness and performance, not explicitly on producing actionable outp

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How Actionability is Understood

N/A – actionability is not addressed.

What Makes Something Actionable

N/A – not discussed.

How Actionability is Achieved / Operationalized

While actionability per se is not targeted, the paper operationalizes cognitive process modeling:

- **Framework/Approach Name(s):** PEM4PPM model
- **Methods/Levers:** Mapping PEM cognitive steps to process mining tasks; think-aloud protocols; codin
- **Operational Steps / Workflow:** Task understanding → Goal setting/refinement → Focusing attention
- **Data & Measures:** Multimodal datasets (verbal utterances, screen recordings, Disco logs), performan
- **Implementation Context:** Process mining analysis tasks in research settings with students and profes

> "We validated the PEM4PPM v2 model… describing the cognitive steps… their explanation, example s

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial – clarity implied in explicit task understanding and goal formulation
- **CR (Contextual Relevance):** Yes – goals and steps are grounded in the PM task context
- **FE (Feasibility):** Partial – feasible operational steps mapped to PM techniques
- **TI (Timeliness):** No – timeliness is not addressed
- **EX (Explainability):** Yes – each cognitive step is explicitly defined and exemplified
- **GA (Goal Alignment):** Yes – goal setting/refinement is central to the process

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Prediction Error Minimization (PEM) theory within Predictive Processing framework

---

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A – focus is on barriers/enablers to cognitive completeness:

- **Barriers:** Insufficient tool knowledge; reluctance to perform trial-and-error in observation settings; inc

- **Enablers:** Complete cognitive cycle (WWW strategy); structured goal setting; familiarity with tools

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Relation to Existing Literature

Extends prior process mining individual perspective research by applying a theory-guided cognitive frame

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Summary

This study introduces PEM4PPM, a cognitive framework adapted from Prediction Error Minimization theo

---

Scores

- **Overall Relevance Score:** 85 – Strong conceptual framework linked to operational process analysis;

- **Operationalization Score:** 78 – Clear steps, coding schemes, and protocols for mapping cognitive pr

---

Supporting Quotes from the Paper

- "We validated the PEM4PPM v2 model… describing the cognitive steps… their explanation, example st

- "The WWW strategy reflects the PEM4PPM v2 model by containing all its steps." (p. 477)

- "The grades of analysts… using the WWW strategy are significantly higher than… other strategies." (p.

Actionability References to Other Papers

N/A – No cited works directly addressing actionability.

Paper Summary

<!--META_START-->

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 25

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — stresses "impact," "interventions," an

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes — Process Science framework (focus, objectives, perspectives)

Operationalization Present: Partial — outlines discovery, explanation, intervention phases

Primary Methodology: Conceptual

Study Context: Conceptual positioning of a new field ("process science")

Geographic/Institutional Context: Multi-institutional international authorship

Target Users/Stakeholders: Researchers across disciplines; policy and practice communities aiming to in

Primary Contribution Type: Conceptual positioning + high-level framework

CL: No

CR: Partial — discusses "impact" and societal challenges

FE: No

TI: No

EX: Partial — "Explanation" phase aims at understanding why/how processes unfold

GA: Partial — interventions are "based on an envisioned goal"

Reason if Not Eligible: The paper does not use or define "actionable/actionability" nor specify criteria of w

<!--META_END-->

Title:

Process Science: The Interdisciplinary Study of Continuous Change

Authors:

Jan vom Brocke; Wil M.P. van der Aalst; Thomas Grisold; Waldemar Kremser; Jan Mendling; Brian Pentl

DOI:

N/A

Year:

2021

Publication Type:

Working Paper (SSRN preprint)

Discipline/Domain:

Information Systems / Interdisciplinary (process studies)

Subdomain/Topic:

Process science; discovery–explanation–intervention; digital trace data; interdisciplinarity

Contextual Background:

The paper proposes "process science" as a new interdisciplinary field centered on continuous change, le

Geographic/Institutional Context:

International, multi-institutional author team (Liechtenstein, Germany, Netherlands, USA, Australia). :cont

Target Users/Stakeholders:

Researchers across social, technical, environmental, political, economic, and human perspectives; practi

Primary Methodology:

Conceptual (field framing and framework articulation). :contentReference{index=3}

Primary Contribution Type:

Conceptual framework and agenda for a new field ("process science"). :contentReference{index

---

General Summary of the Paper

The paper introduces "process science" as an interdisciplinary field dedicated to studying coherent series

---

Actionable/Actionability Used in Paper

No.

Authors Argue for a Need for Actionability Without Defining It

Yes. The paper repeatedly emphasizes *impact* and *interventions* without defining "actionability."

- "Process science strives to make an impact… aims to produce knowledge that has instrumental value in

- "Intervention aims at changing processes as they unfold… design■oriented research can generate pres

---

How Actionability is Understood

Implicit: usefulness is equated with the ability to **intervene** in and **influence** processes based on ca

> "When we know why and how a specific process unfolds, we are better prepared to re■direct and chan

---

What Makes Something Actionable

(Implicitly inferred; the paper does not use "actionable.")

- Property/Condition: **Causal–temporal understanding enabling intervention**

  > "Explanation aims at understanding… how and why processes unfold… [which] enables predictions…

- Property/Condition: **Goal■directed design of measures**

  > "Interventions are based on an envisioned goal… and can include one or many measures to interfere

---

How Actionability is Achieved / Operationalized

(Partial, via the process science activity model; not framed as "actionability.")

- **Framework/Approach Name(s):** Process Science Activities (Discovery, Explanation, Intervention) —

- **Methods/Levers:** Event/trace data capture; process mining; qualitative sense■making; design■orien

- **Operational Steps / Workflow:** Capture processes (discovery) → explain cause■effect relations and

- **Data & Measures:** Time■stamped "event data" from digital traces; complementary contextual data. :

- **Implementation Context:** Socio■technical processes across human, social, environmental, political,

> "Process science progresses by systematically making use of various and novel data sources… 'event

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** Partial — impact framed relative to societal challenges and goals.

  > "In light of… grand challenges… process science should enable the development of effective solutions

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** Partial — "Explanation aims at understanding the dynamics of processes… iden

- **GA (Goal Alignment):** Partial — "Interventions are based on an envisioned goal…" (p. 5) :contentRef

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

Process■first ontology; interdisciplinary synthesis; design science for intervention; routine and organizati

---

Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

- **Barriers:** Fragmentation across disciplines; differing assumptions and methods. :contentReference[o

- **Enablers:** Ubiquity of digital trace data; event■data infrastructures; cross■disciplinary integration; pr

---

Relation to Existing Literature

The paper extends prior calls (e.g., van der Aalst & Damiani; process organization studies) by elevating *

Summary

This conceptual paper inaugurates "process science," advocating a shift from object■first to process■firs

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Scores

- **Overall Relevance Score:** 20 — The paper does not mention or define "actionability" and offers no e

- **Operationalization Score:** 25 — Provides a high■level workflow (discovery–explanation–interventior

---

Supporting Quotes from the Paper

- "Process science is the interdisciplinary study of continuous change." (p. 3) :contentReference[oaicite:2

- "When we know why and how a specific process unfolds, we are better prepared to re■direct and chang

- "Intervention aims at changing processes as they unfold… design■oriented research can generate pres

- "Process science strives to make an impact… instrumental value in solving real■word problems." (p. 7)

Actionability References to Other Papers

The paper cites design science (Hevner et al., 2004; Van Aken, 2005) and process mining (van der Aalst

Paper Summary

<!--META_START-->

Title: Improving Process Mining Maturity – From Intentions to Actions

Authors: Jonathan Brock, Katharina Brennig, Bernd Löhr, Christian Bartelheimer, Sebastian von Enzberg

DOI: 10.1007/s12599-024-00882-7

Year: 2024

Publication Type: Journal

Discipline/Domain: Business Process Management, Process Mining

Subdomain/Topic: Maturity Models, Process Mining Adoption

Eligibility: Yes

Overall Relevance Score: 90

Operationalization Score: 85

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Interviews and Model Development)

Study Context: Business Process Management, Process Mining in Organizations

Geographic/Institutional Context: International (Multiple Organizations)

Target Users/Stakeholders: Process Mining Practitioners, Business Process Managers, BPM Consultants

Primary Contribution Type: Conceptual Model Development, Practical Guidelines

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Improving Process Mining Maturity – From Intentions to Actions

Authors: Jonathan Brock, Katharina Brennig, Bernd Löhr, Christian Bartelheimer, Sebastian von Enzb

DOI: 10.1007/s12599-024-00882-7

Year: 2024

Publication Type: Journal

Discipline/Domain: Business Process Management, Process Mining

Subdomain/Topic: Maturity Models, Process Mining Adoption

Contextual Background: The paper addresses the growing need for a comprehensive framework to br

Geographic/Institutional Context: The paper involves multiple organizations across various industries,

Target Users/Stakeholders: Process mining practitioners, BPM consultants, business process manag

Primary Methodology: Mixed Methods (Interviews and Model Development)

Primary Contribution Type: Conceptual Model Development, Practical Guidelines

General Summary of the Paper

The paper develops a multi-factor maturity model for process mining (P3M) to assist organizations in incr

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

Actionability is understood as the ability of organizations to successfully implement process mining throug

> "The process mining maturity model provides a roadmap for organizations to turn their intentions into ac

> "Organizations need concrete actions that they can take to improve their readiness for process mining a

What Makes Something Actionable

For process mining to be actionable, the authors identify several key factors that organizations must addr

- Organizational embedding of process mining initiatives

- Access to high-quality process and event data

- Knowledge and training for individuals involved in process mining

- Governance structures that support process mining implementation and scaling

> "The organizational embedding of process mining is a key success factor that enables actionability with

> "Data accessibility, quality, and governance are fundamental prerequisites for actionable process minin

How Actionability is Achieved / Operationalized

The actionability of process mining is achieved by:

- Developing a maturity model (P3M) that organizations can use to assess and improve their process min

- Providing a structured process to guide organizations through various stages of process mining adoptio

- Conducting workshops and surveys to help organizations identify gaps and improvement areas in their p

- Offering practical actions, based on real-world interviews, that organizations can implement to increase

> "The maturity model is applied through an online survey and workshop, which helps organizations ident

> "The maturity model helps organizations understand where they are in their process mining journey an

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Actionable knowledge must be clearly communicated, especially in terms of the s

  > "Clarity in the purpose and scope of the process mining initiative is essential for ensuring that actions a

- **CR (Contextual Relevance):** Yes – Actions must be relevant to the specific organizational context an

  > "Actions should be customized based on the organization's specific needs and readiness" (p. 14).

- **FE (Feasibility):** Yes – The actions identified must be feasible given the resources and capabilities o

  > "Organizations should prioritize actions that are both feasible and have the potential to create significa

- **TI (Timeliness):** Yes – Timely action is necessary to ensure that process mining initiatives can evolv

  > "Organizations should not wait for perfect data or conditions but should take pragmatic steps to begin

- **EX (Explainability):** Yes – Actionable steps must be easily understandable and justifiable for stakeho

  > "Providing clear documentation and communication about process mining initiatives ensures that they

- **GA (Goal Alignment):** Yes – Actions must be aligned with organizational goals and strategies, ensur

  > "Process mining initiatives must align with organizational goals, such as improving efficiency and flexik

Theoretical or Conceptual Foundations

The development of the P3M is based on existing BPM maturity models, particularly those focused on ca

> "The P3M model synthesizes best practices from BPM maturity models, adapting them to the context o

Indicators or Metrics for Actionability

The P3M model provides five maturity stages (Initial, Rudimentary, Standalone, Systematic, Optimizing) f

> "The maturity stages offer clear indicators of progress, allowing organizations to track their improvemen

Barriers and Enablers to Actionability

- **Barriers:** Lack of management support, poor data quality, insufficient organizational embedding of pr

- **Enablers:** Dedicated process mining teams, collaboration across business units, management suppo

> "Organizational embedding is a key enabler for process mining success, but without management buy-

> "Data quality and accessibility are frequent barriers that need to be addressed early in the process mini

Relation to Existing Literature

The paper builds on prior work in process mining and BPM maturity models, extending these frameworks

> "This paper extends the concept of BPM maturity by integrating process mining-specific factors and pro

Summary

The paper introduces a Process Mining Maturity Model (P3M), a framework that helps organizations asse

Scores

- **Overall Relevance Score:** 90 – The paper provides a comprehensive, actionable framework for impr

- **Operationalization Score:** 85 – The maturity model is clearly operationalized through real-world actio

Supporting Quotes from the Paper

- "The process mining maturity model provides a roadmap for organizations to turn their intentions into ac

- "Organizations should prioritize actions that are both feasible and have the potential to create significant

- "Actions should be customized based on the organization's specific needs and readiness" (p. 14).

- "Clarity in the purpose and scope of the process mining initiative is essential for ensuring that actions ar

Actionability References to Other Papers

- Reinkemeyer L, Grindemann P, Egli V, et al. (2022). Accelerating business transformation with a proces

- Rosemann M, De Bruin T (2005b). Towards a business process management maturity model.

- Kerpedzhiev GD, Ko¨nig UM, Ro¨glinger M, Rosemann M (2021). An exploration into future business pr

Paper Summary

<!--META_START-->

Title: Identifying Process Improvement Opportunities through Process Execution Benchmarking

Authors: Luka Abb, Majid Rafiei, Timotheus Kampik, Jana-Rebecca Rehse

DOI: arXiv:2504.16215v1

Year: 2025

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Process Execution Benchmarking; Process Improvement; Activity Replacement

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Actionable/Actionability Used in Paper: Yes – "identifies actionable [23, 30] process changes expected to

Authors Argue for Need for Actionability Without Defining It: Yes – "provide concrete improvement sugge:

Contains Definition of Actionability: Partial – framed as "concrete process modifications… expected to im

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Evaluation (synthetic data + case study)

Study Context: Process execution benchmarking using event logs for process improvement

Geographic/Institutional Context: University of Mannheim; SAP Signavio

Target Users/Stakeholders: Process managers; business process analysts

Primary Contribution Type: Technique/method development with evaluation

CL: Yes – "list… can be presented to a process manager, who can… select the most promising changes"

CR: Yes – "same process type… comparable event logs" (p. 5)

FE: Yes – feasibility score computation (p. 9)

TI: No

EX: Partial – uses behavioral footprints to justify replacement plausibility

GA: Yes – align process changes to performance improvement goals (p. 2)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Identifying Process Improvement Opportunities through Process Execution Benchmarking

Authors:

Luka Abb, Majid Rafiei, Timotheus Kampik, Jana-Rebecca Rehse

DOI:

arXiv:2504.16215v1

Year:

2025

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Process Execution Benchmarking; Process Improvement; Activity Replacement

Contextual Background:

The paper addresses a gap in commercial process mining tools, which allow benchmarking via high-level

Geographic/Institutional Context:

University of Mannheim; SAP Signavio, Berlin, Germany

Target Users/Stakeholders:

Process managers, business process analysts, BPM practitioners

Primary Methodology:

Conceptual framework development with evaluation using synthetic data and a real-life case study

Primary Contribution Type:

Prescriptive technique for automated process improvement recommendations

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General Summary of the Paper

The paper introduces a prescriptive process execution benchmarking technique that identifies specific, pl

---

Actionable/Actionability Used in Paper

Yes.

- "Identifies actionable [23, 30] process changes expected to improve process performance." (p. 2)

- "Concrete improvement suggestions… provided to a process manager." (p. 2)

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Provide concrete improvement suggestions… serve as evidence-based decision support for process in

---

How Actionability is Understood

Implicit definition: Actionable changes are "concrete process modifications… expected to improve perform

---

What Makes Something Actionable

- **Concrete and implementable:**

  > "Behaviorally plausible process modifications… associated with a feasibility and performance assessm

- **Evidence-based:**

  > "Empirical evidence from the benchmark log" (p. 9)

- **Performance-oriented:**

  > "Indicating the potential benefits of the change" (p. 10)

- **Contextually relevant:**

  > "Same process type… standardized activity names" (p. 5)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Process Execution Benchmarking Technique

- **Methods/Levers:** Behavioral footprint analysis, activity matching, compatibility graph, feasibility and p

- **Operational Steps / Workflow:**

  1. Compute behavioral footprints

  2. Match activities between logs

  3. Combine compatible matches

  4. Assess feasibility (alignment-based similarity)

  5. Assess performance impact (performance metric differences)

- **Data & Measures:** Event logs with standardized activity names and performance metrics; edit similar

- **Implementation Context:** Demonstrated in synthetic experiments and a case study with SAP purchas

  > "Outputs a list of process changes… can be filtered, prioritized, and selected" (p. 10)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – list output is explicit and manager-ready (p. 10)

- **CR (Contextual Relevance):** Yes – limited to same process type with comparable logs (p. 5)

- **FE (Feasibility):** Yes – feasibility score methodology (p. 9)

- **TI (Timeliness):** No – no explicit reference to recency or urgency

- **EX (Explainability):** Partial – uses behavioral footprints as justifications (p. 6)

- **GA (Goal Alignment):** Yes – aligned to performance improvement (p. 2)

- **Other Dimensions Named by Authors:** None explicitly

Theoretical or Conceptual Foundations

- Behavioral relations in process mining

- Benchmarking theory

- Action-oriented process mining ([23], [30])

Indicators or Metrics for Actionability

- Feasibility score (0–1 scale)

- Expected performance impact (e.g., hours gained/lost per case)

Barriers and Enablers to Actionability

- **Barriers:**

  - Regulatory constraints may prevent implementing certain changes (p. 11)

  - Noise and incompleteness in event logs (p. 12)

- Dissimilarity between compared processes (p. 11)

- **Enablers:**

  - Standardized activity names and process types (p. 5)

  - Availability of comparable performance metrics (p. 5)

Relation to Existing Literature

Builds on process mining literature by moving from descriptive variant comparison to prescriptive, perform

---

Summary

This paper proposes a prescriptive method for process execution benchmarking, extending traditional per

---

Scores

- **Overall Relevance Score:** 88 – Strong alignment with actionability in process improvement, explicit d

- **Operationalization Score:** 90 – Clear, stepwise method to generate actionable recommendations fro

---

Supporting Quotes from the Paper

- "Identifies actionable [23, 30] process changes expected to improve process performance." (p. 2)

- "Outputs a list of process changes… can be filtered, prioritized, and selected." (p. 10)

- "Behaviorally plausible process modifications… associated with a feasibility and performance assessme

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Actionability References to Other Papers

- [23] Park, G., van der Aalst, W.M.P. (2022). Action-oriented process mining: bridging the gap between i

- [30] Stein Dani, V., Leopold, H., van der Werf, J.M.E.M., Beerepoot, I., Reijers, H.A. (2024). From proce

Paper Summary

<!--META_START-->

Title: From Process Mining Insights to Process Improvement: All Talk and No Action?

Authors: Vinicius Stein Dani, Henrik Leopold, Jan Martijn E. M. van der Werf, Iris Beerepoot, Hajo A. Reij

DOI: https://doi.org/10.1007/978-3-031-46846-9_15

Year: 2024

Publication Type: Conference

Discipline/Domain: Business Process Management / Process Mining

Subdomain/Topic: Process improvement; Insights-to-action translation; Systematic literature review

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 70

Actionable/Actionability Used in Paper: Yes – implicit notion of actionability throughout; focus on "translat

Authors Argue for Need for Actionability Without Defining It: Yes – "understanding this realm of actions is

Contains Definition of Actionability: No – implicit understanding as the ability to trigger specific, feasible in

Contains Systematic Features/Dimensions: Yes – implicitly through intervention spaces and action catego

Contains Explainability: Partial – discussed in terms of clarifying/justifying conduct, root-cause analysis.

Contains Interpretability: Partial – linked to understanding process models and insights for improvement.

Contains Framework/Model: Yes – taxonomy of actions, intervention spaces, themes.

Operationalization Present: Yes – action categories linked to specific process mining insights and context

Primary Methodology: Systematic Literature Review

Study Context: 57 process mining application case studies from multiple domains.

Geographic/Institutional Context: Global; cases from various industries and countries.

Target Users/Stakeholders: Process mining practitioners, consultants, managers, researchers.

Primary Contribution Type: Taxonomy of actions linked to process mining insights; intervention space mo

CL: Yes – clarity of actions and intervention spaces (e.g., "update documentation", "create alert").

CR: Yes – actions tied to process mining contexts and real-life case studies.

FE: Partial – feasibility implied through real-world recommendations but not systematically assessed.

TI: No – timeliness not explicitly discussed.

EX: Partial – explainability through root-cause analysis and justifications.

GA: Yes – goal alignment implied in linking insights to improvement goals.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

From Process Mining Insights to Process Improvement: All Talk and No Action?

Authors:

Vinicius Stein Dani, Henrik Leopold, Jan Martijn E. M. van der Werf, Iris Beerepoot, Hajo A. Reijers

DOI:

https://doi.org/10.1007/978-3-031-46846-9_15

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Business Process Management / Process Mining

Subdomain/Topic:

Process improvement; Insights-to-action translation; Systematic literature review

Contextual Background:

Process mining produces rich process insights, but the link between those insights and actual process im

Geographic/Institutional Context:

Global scope – case studies from various industries and regions.

Target Users/Stakeholders:

Process mining practitioners, consultants, managers, and academic researchers.

Primary Methodology:

Systematic Literature Review (57 case studies).

Primary Contribution Type:

Taxonomy of actions and intervention spaces, linking process mining insights to improvement strategies.

General Summary of the Paper

The paper addresses the gap between process mining insights and their translation into actual process in

---

Actionable/Actionability Used in Paper

Yes – The notion of actionability is central, though not explicitly defined. Examples:

- "Understanding the diversity of the actions triggered by process mining insights is important to instigate

- "Organizations can more easily identify the best path toward process improvement." (p. 276)

Authors Argue for a Need for Actionability Without Defining It

Yes –

> "Understanding this realm of actions is a valuable aspect to complement existing process mining metho

> "By understanding which actions… organizations can more easily identify the best path toward process

---

How Actionability is Understood

Implicitly understood as the **ability to convert process mining insights into concrete, feasible improveme

---

What Makes Something Actionable

- **Clear linkage to an insight**:

  > "We investigate which types of actions… and to which insights these actions are linked." (p. 275)

- **Feasibility**:

  > "The recommendations are made by experienced professionals in the field and… can be considered a

- **Targeted intervention**:

  > "The aspects of the organization that are affected by the actions… may not only concern the process i

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Not named as a formal framework, but delivers a taxonomy of actio

- **Methods/Levers:** Inductive content analysis, open coding of case study reports.

- **Operational Steps / Workflow:** Identify insights $\rightarrow$ extract related quotes $\rightarrow$ code into verb-object pai

- **Data & Measures:** 156 quotes from 57 papers; coded into 226 actions.

- **Implementation Context:** Process mining application case studies across industries.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Action descriptions are precise (e.g., "update documentation", "create alert").

- **CR (Contextual Relevance):** Yes – Actions tied to specific insights in real-world contexts.

- **FE (Feasibility):** Partial – Feasibility implied from professional recommendations.

- **TI (Timeliness):** No – Timeliness not addressed.

- **EX (Explainability):** Partial – Root-cause and justification actions.

- **GA (Goal Alignment):** Yes – Actions linked to improvement goals.

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process mining methodologies (e.g., PM2, L*, Process Diagnostics Methodology) as baseline reference

- Intervention space taxonomy.

Indicators or Metrics for Actionability

None explicitly stated; implied through linkage between insights and feasible actions.

Barriers and Enablers to Actionability

- **Barriers:** Gap between recommended and taken actions (p. 287), possible effort constraints.

- **Enablers:** Experienced practitioner recommendations; multi-faceted intervention spaces.

Relation to Existing Literature

Builds upon process mining methodologies and prior studies linking insights to process awareness and in

---

Summary

This paper examines the critical yet underexplored link between process mining insights and tangible pro

---

Scores

- **Overall Relevance Score:** 85 – Strong alignment with actionability as the translation of insights into a

- **Operationalization Score:** 70 – Provides detailed taxonomy and examples but not formalized into a r

---

Supporting Quotes from the Paper

- "Understanding this realm of actions is a valuable aspect to complement existing process mining metho

- "We investigate which types of actions… and to which insights these actions are linked." (p. 275)

- "The recommendations are made by experienced professionals in the field and… can be considered as

---

Actionability References to Other Papers

- PM2 methodology (van Eck et al., 2015)

- Process Diagnostics Methodology (Bozkaya et al., 2009)

- L* lifecycle model (van der Aalst, 2011)

- Lashkevich et al. (2023) – analysis template for improvement opportunities

- Eggers et al. (2021) – process awareness mechanisms

Paper Summary

<!--META_START-->

Title: From Loss of Interest to Denial: A Study on the Terminators of Process Mining Initiatives

Authors: Vinicius Stein Dani, Henrik Leopold, Jan Martijn E. M. van der Werf, Iris Beerepoot, Hajo A. Reij

DOI: https://doi.org/10.1007/978-3-031-61057-8_22

Year: 2024

Publication Type: Conference

Discipline/Domain: Information Systems / Business Process Management

Subdomain/Topic: Process Mining, Process Improvement, Implementation Barriers

Eligibility: Eligible

Overall Relevance Score: 80

Operationalization Score: 70

Actionable/Actionability Used in Paper: Yes – "organizations actually need to take action based on the ins

Authors Argue for Need for Actionability Without Defining It: Yes – "If… recommended actions are not pe

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial – explanation of causes for non-action

Contains Interpretability: No

Contains Framework/Model: Yes – categorization of terminators into three dimensions (Data, Project, Ins

Operationalization Present: Yes – systematic literature review and interview-based identification of cause

Primary Methodology: Mixed Methods (Systematic Literature Review + Semi-structured Interviews)

Study Context: Process mining initiatives in various industries

Geographic/Institutional Context: Global – experts from four continents, majority from large organizations

Target Users/Stakeholders: Process mining experts, business analysts, managers, transformation consul

Primary Contribution Type: Empirical study of barriers to translating insights into actions

CL: Yes – Implicit in recommendations that clarity of actionable steps is required

CR: Yes – Insights tied to specific organizational contexts

FE: Yes – Feasibility hindered by data, incentive, and expertise issues

TI: No – Timeliness not explicitly discussed as a dimension

EX: Partial – Explanation of why actions fail is central, but not formalized as an attribute of actionability

GA: Yes – Goal alignment issues present where stakeholders lack incentive or deny insights

Reason if Not Eligible: N/A

<!--META_END-->

Title:

From Loss of Interest to Denial: A Study on the Terminators of Process Mining Initiatives

Authors:

Vinicius Stein Dani, Henrik Leopold, Jan Martijn E. M. van der Werf, Iris Beerepoot, Hajo A. Reijers

DOI:

https://doi.org/10.1007/978-3-031-61057-8_22

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Information Systems / Business Process Management

Subdomain/Topic:

Process Mining, Process Improvement, Implementation Barriers

Contextual Background:

The paper addresses the gap between generating process mining insights and implementing actions bas

Geographic/Institutional Context:

Global – interviewees from four continents, mostly large organizations (>1,000 employees).

Target Users/Stakeholders:

Process mining experts, business analysts, managers, transformation consultants, product owners.

Primary Methodology:

Mixed Methods – Systematic Literature Review (57 papers) + 17 Semi-structured Interviews.

Primary Contribution Type:

Empirical analysis of causes blocking actionable follow-up on process mining recommendations.

General Summary of the Paper

This study explores why recommended actions derived from process mining insights often fail to be imple

---

Actionable/Actionability Used in Paper

Yes

- "Organizations actually need to take action based on the insights process mining tools and techniques p

- "Analysts typically use process mining insights to recommend actions, which then need to be performed

- "If… recommended actions are not performed, the insights will not help organizations to progress into pr

---

Authors Argue for a Need for Actionability Without Defining It

Yes

- "If… recommended actions are not performed, the insights will not help organizations to progress into pr

- "We need to develop a better understanding of… the causes hampering the progress from recommende

---

How Actionability is Understood

Implicitly framed as the transition from **recommended actions** (derived from process mining insights) t

---

What Makes Something Actionable

- **Requires clear recommendations linked to insights**

  > "Analysts typically use the insights to recommend actions, which then need to be performed… by pro

- **Feasibility in terms of data accessibility and preparation**

  > "Laborious data preparation… making data preparation… too long [and] the project was eventually sto

- **Stakeholder interest and priority**

  > "There were more important projects to deal with… stakeholders ended up losing interest." (p. 378)

- **Availability of expertise to implement changes**

  > "The organization did not have the expertise to make the required changes… and did not want to inve

- **Alignment with stakeholder incentives**

  > "No action was taken… there was no financial incentive… implementing the action would result in dec

- **Acceptance of insights**

  > "Preferred to say they do not believe process mining results rather than to admit they were wrong." (p.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** None named specifically; operationalization via combined SLR and

- **Methods/Levers:** Identification of recommended vs performed actions, categorization by type of insig

- **Operational Steps / Workflow:** Data collection → open coding → categorization → synthesis of caus

- **Data & Measures:** 57 peer-reviewed papers; 17 interview transcripts; coding of recommended/perfo

- **Implementation Context:** Multiple industries and geographies.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Recommendations need to be clearly defined for execution (implied).

- **CR (Contextual Relevance):** Yes – Actions linked to specific organizational process contexts.

- **FE (Feasibility):** Yes – Often hindered by data, resource, and complexity barriers.

- **TI (Timeliness):** No – Not explicitly covered.

- **EX (Explainability):** Partial – Paper explains reasons for inaction but does not frame explainability as

- **GA (Goal Alignment):** Yes – Misaligned incentives and denial hinder action.

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Categorization of causes into three dimensions: Data, Project, Insights (proposed model in Fig. 2).

Indicators or Metrics for Actionability

None explicitly proposed; indirectly assessed through ratio of recommended to performed actions.

Barriers and Enablers to Actionability

- **Barriers:**

  - Laborious data preparation (p. 377–378)

  - Loss of interest (p. 378–379)

  - Lack of expertise (p. 378–380)

  - Lack of incentive (p. 378–380)

  - Denial of insights (p. 379)

- **Enablers:**

  - Involvement of decision-makers with end-to-end authority (p. 382)

  - Financial incentives aligned with proposed changes (p. 382)

Relation to Existing Literature

Builds on prior studies that linked process mining insights to actions but did not differentiate recommende

---

Summary

This paper examines why process mining recommendations often fail to result in implemented actions. Th

---

Scores

- **Overall Relevance Score:** 80 – Strong conceptual link to actionability through focus on converting ins

- **Operationalization Score:** 70 – Provides structured methodology to identify barriers but no detailed p

---

Supporting Quotes from the Paper

- "Organizations actually need to take action based on the insights process mining tools and techniques p

- "If… recommended actions are not performed, the insights will not help organizations to progress into pr

- "Laborious data preparation… and the project was eventually stopped." (p. 377)

- "No financial incentive… implementing the action would result in decreased income." (p. 378)

- "Preferred to say they do not believe process mining results rather than to admit they were wrong." (p. 3

Actionability References to Other Papers

- Emamjome et al. (2019) – Lack of practical implementation of insights hindering results.

- Stein Dani et al. (2023) – Link between process mining insights and types of actions.

- PM2 and Process Diagnostics methodologies – Recognize but exclude implementation from scope.

Paper Summary

<!--META_START-->

Title: Explaining Change with Digital Trace Data: A Framework for Temporal Bracketing

Authors: Sophie Hartl, Sandro Franzoi, Thomas Grisold, Jan vom Brocke

DOI: 10.24251/HICSS.2023.689

Year: 2023

Publication Type: Conference

Discipline/Domain: Information Systems / Process Mining

Subdomain/Topic: Temporal bracketing, digital trace data, organizational change, computationally intensi

Eligibility: Not Eligible

Overall Relevance Score: 30

Operationalization Score: 40

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual with illustrative case study

Study Context: Customer onboarding process in a financial institution in Central Europe

Geographic/Institutional Context: Central Europe; financial institution

Target Users/Stakeholders: Researchers in process mining, computationally intensive theorizing, and org

Primary Contribution Type: Conceptual framework + applied case illustration

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not address actionability, actionable insights, recommendations, c

<!--META_END-->

Title:

Explaining Change with Digital Trace Data: A Framework for Temporal Bracketing

Authors:

Sophie Hartl, Sandro Franzoi, Thomas Grisold, Jan vom Brocke

DOI:

10.24251/HICSS.2023.689

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Temporal bracketing, digital trace data, organizational change, computationally intensive theorizing

Contextual Background:

The paper addresses the challenge of explaining why and how organizational change occurs when study

Geographic/Institutional Context:

Central Europe; financial institution

Target Users/Stakeholders:

Researchers in process mining, computational theory development, and organizational change; business

Primary Methodology:

Conceptual framework + illustrative case study

Primary Contribution Type:

Framework for integrating context into digital trace data analysis to explain change

---

General Summary of the Paper

The paper introduces a framework for applying temporal bracketing to digital trace data to explain organiz

---

Actionable/Actionability Used in Paper

No

Authors Argue for a Need for Actionability Without Defining It

No

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Temporal bracketing (Langley, 1999)
- Computationally intensive theorizing (Berente et al., 2019; Miranda et al., 2022)

- Sensemaking (Weick, 1995; Sandberg & Tsoukas, 2020)

- Process mining (van der Aalst, 2016)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper situates temporal bracketing within the broader movement of computationally intensive theoriz

---

Summary

This paper addresses the gap in integrating contextual understanding into digital trace data research whe

---

Scores

- **Overall Relevance Score:** 30 — The paper offers a clear framework for integrating context into data

- **Operationalization Score:** 40 — Presents a detailed, step-by-step operational framework for tempora

---

Supporting Quotes from the Paper

- "We conceptualize a framework to apply temporal bracketing in the analysis of digital trace data." (p. 2)

- "At the center of our framework are four recursively related steps – (1) data preparation, (2) identificatio

- "Temporal bracketing provides a means to combine human and computationally-driven sensemaking to

---

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: An assisted approach to business process redesign

Authors: Tobias Fehrer, Dominik A. Fischer, Sander J.J. Leemans, Maximilian Rögliner, Moe T. Wynn

DOI: https://doi.org/10.1016/j.dss.2022.113749

Year: 2022

Publication Type: Journal

Discipline/Domain: Business Process Management / Decision Support Systems

Subdomain/Topic: Assisted business process redesign, reference architecture, redesign patterns, proces

Eligibility: Eligible

Overall Relevance Score: 82 – The paper directly addresses making redesign recommendations actional

Operationalization Score: 85 – Provides clear operational workflow for achieving actionable redesign opti

Actionable/Actionability Used in Paper: Yes – "make actionable suggestions for redesigning business pro

Authors Argue for Need for Actionability Without Defining It: Yes – "it is questionable to what extent such

Contains Definition of Actionability: No – No formal definition, but implicitly conceptualized through ability

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial – Recommendations are described and linked to patterns, but transparenc

Contains Interpretability: Yes – Recommendations linked to specific redesign patterns and process parts

Contains Framework/Model: Yes – ABPR concept and ABPR Reference Architecture.

Operationalization Present: Yes – Four-step ABPR process with automation levels AL1–AL4, integrated i

Primary Methodology: Design Science Research with expert interviews, artificial and naturalistic evaluatio

Study Context: Business process redesign in organizations, tool-supported decision-making.

Geographic/Institutional Context: Germany (University of Bayreuth, Fraunhofer FIT) and Australia (Queer

Target Users/Stakeholders: Process designers, BPM managers, consultants, domain experts.

Primary Contribution Type: Conceptual framework + operational prototype for guided process redesign.

CL: Yes – "structured guidance along the phases of process redesign" (p. 4)

CR: Yes – "integration of user's domain knowledge" (p. 4)

FE: Yes – Recommendations filtered for feasibility via data, simulation, and expert validation.

TI: Partial – Supports iterative improvement but not explicitly focused on timeliness of delivery.

EX: Partial – Recommendations linked to patterns, but some ranking transparency concerns noted by exp

GA: Yes – Patterns selected to align with predefined performance objectives.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

An assisted approach to business process redesign

Authors:

Tobias Fehrer, Dominik A. Fischer, Sander J.J. Leemans, Maximilian Rögliner, Moe T. Wynn

DOI:

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Business Process Management / Decision Support Systems

Subdomain/Topic:

Assisted business process redesign, reference architecture, redesign patterns, process improvement too

Contextual Background:

The paper addresses limitations in existing business process redesign (BPR) methods and tools, particul

Geographic/Institutional Context:

Germany (University of Bayreuth, Fraunhofer FIT) and Australia (Queensland University of Technology);

Target Users/Stakeholders:

Process designers, BPM managers, consultants, domain experts.

Primary Methodology:

Design Science Research with expert interviews and evaluations in artificial and real-world contexts.

Primary Contribution Type:

Conceptual framework + operational prototype for guided process redesign.

General Summary of the Paper

This paper presents the ABPR concept and reference architecture, designed to improve business proces

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Actionable/Actionability Used in Paper

Yes

> "…make actionable suggestions for redesigning business processes" (p. 1)

> "…provide the user with a basis for decision-making" (p. 4)

Authors Argue for a Need for Actionability Without Defining It

Yes

> "…it is questionable to what extent such tool-based approaches can…make actionable suggestions for

---

How Actionability is Understood

Implicitly: An actionable recommendation in this context is a redesign suggestion that is feasible, context-

> "…assist the redesign process: low, moderate, elevated, and high [automation levels]…resulting in rede

---

What Makes Something Actionable

- **Feasibility & Data Fit**

  > "…patterns are recommended that have proven useful for achieving the performance objective…while

- **Alignment with Performance Objectives**

  > "…support determining the anticipated effect of process redesign options on…performance objectives

- **Integration of Domain Knowledge**

  > "…interactive customization of process improvement opportunities to address specific use cases and

- **Guided Application Process**

  > "…support structured guidance along the phases of process redesign" (p. 4)

- **Evaluability via Simulation and Expert Judgment**

  > "…evaluate the performance of these alternative models" (p. 4)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Assisted Business Process Redesign (ABPR)

- **Methods/Levers:** Structured four-step process (select patterns, identify process parts, create alterna

- **Operational Steps / Workflow:** Identify patterns → Match to process parts → Generate alternative m

- **Data & Measures:** Process models, event logs, simulation data, performance objectives (time, cost,

- **Implementation Context:** BPM tool (Camunda Modeler) with GUI, recommendation provider, simulat

> "…present their results as redesign recommendations…highlight a few top recommendations…estimat

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "…structured guidance along the phases of process redesign" (p. 4)

- **CR (Contextual Relevance):** Yes – "…integration of…domain knowledge" (p. 4)

- **FE (Feasibility):** Yes – "…compare alternative process designs…evaluate the effect…on the process

- **TI (Timeliness):** Partial – Iterative improvement implied but not explicitly tied to timeliness.

- **EX (Explainability):** Partial – Pattern and process part links are clear, but ranking transparency quest

- **GA (Goal Alignment):** Yes – "…patterns…align with the performance objective" (p. 4)

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Design Science Research (Hevner et al., Peffers et al.)

- Reference Architecture design principles (Galster & Avgeriou)

- Redesign patterns (Reijers & Limam Mansar)

Indicators or Metrics for Actionability

- Estimated performance improvement (time, cost, quality, flexibility)

- Simulation-based impact scores

- Similarity metrics for recommendation diversity

Barriers and Enablers to Actionability

- **Barriers:**

  > "Process models in practice are often outdated and therefore not usable" (Table 1)

  > "The data collection effort could exceed the value of the solution" (Table 1)

- **Enablers:**

  > "The incorporation of domain knowledge is useful for improving recommendations" (Table 1)

  > "The extensibility of the RA is helpful for the concrete application" (Table 1)

Relation to Existing Literature

ABPR extends prior BPR approaches by combining structured redesign pattern application with varying a

---

Summary

The paper proposes the Assisted Business Process Redesign (ABPR) concept and a supporting referenc

---

Scores

- **Overall Relevance Score:** 82 – Strong fit with actionable recommendations in process redesign; lack

- **Operationalization Score:** 85 – Clear, structured, tool-supported operationalization with automation le

---

Supporting Quotes from the Paper

- "…make actionable suggestions for redesigning business processes" (p. 1)

- "…support structured guidance along the phases of process redesign" (p. 4)

- "…support determining the anticipated effect…to compare alternative process designs" (p. 4)

- "…integration of…domain knowledge" (p. 4)

- "…highlight a few top recommendations…estimate each recommendation's impact" (p. 5)

Actionability References to Other Papers

- Reijers & Limam Mansar (2005) – Best practices in business process redesign.

- Netjes et al. (2010, 2009) – Tool support and algorithms for redesign pattern application.

- Essam & Limam Mansar (2012) – Automated BPR framework.

- Fellmann et al. (2019) – Process model patterns.

- Lopez-Pintado et al. (2021) – Multi-objective process performance optimization.

Paper Summary

<!--META_START-->

Title: A Framework to Support the Validation of Process Mining Inquiries

Authors: Francesca Zerbato, Marco Franceschetti, Barbara Weber

DOI: 10.1007/978-3-031-70418-5_15

Year: 2024

Publication Type: Book Chapter

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Result Validation, Exploratory Analysis, Meta-analysis Support

Eligibility: Eligible (implicit conceptualization only; no explicit use of "actionability")

Overall Relevance Score: 45

Operationalization Score: 80

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "Analysts need to understand th

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes (traceability, contextual comparison, clarity, relevance)

Contains Explainability: Partial

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual framework design, implemented in Python, demonstrated on real log

Study Context: Exploratory process mining, query result validation, meta-analysis

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General Summary of the Paper

This paper proposes LogView, a modular Python framework for validating, comparing, and tracing query

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Actionable/Actionability Used in Paper

No. The terms "actionable" or "actionability" are never used.

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Analysts need to understand the result and ensure it aligns with their expectations… helping them deci

- "Our framework aims to support process analysts in reflecting on their queries and results…" (p. 3)

- "Understanding overlaps… can reveal situations where multiple queries occur simultaneously or where

---

How Actionability is Understood

Implicitly: A result is "actionable" if it is well-characterized, compared against relevant baselines, and trace

---

What Makes Something Actionable

- Clear identification of result set properties

- Contextual comparison to a reference log

- Traceability of queries and results

- Identification of overlaps and dependencies

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** LogView

- **Methods/Levers:** Query execution with complement sets; registry for traceability; characterization an

- **Operational Steps:**

  1. Execute query → store result + complement

  2. Characterize against reference log

  3. Compare to other sets via intersection matrices

  4. Visualize overlaps

- **Implementation Context:** Python library, extensible via plug-ins

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — results are characterized for interpretability, but not explicitly tied to actionabil

- **CR (Contextual Relevance):** Yes — comparisons anchored to relevant baselines

- **FE (Feasibility):** Yes — modular, extensible design

- **TI (Timeliness):** Partial — supports iterative analysis but not real-time constraints

- **EX (Explainability):** Partial — overlaps and dependencies explained through intersections

- **GA (Goal Alignment):** Yes — results linked to analyst goals

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Theoretical or Conceptual Foundations

- Event log theory

- Set theory for result comparison

- Provenance tracking and meta-analysis

Indicators or Metrics for Actionability

- Overlap percentages

- Attribute distribution changes

- Query dependency probabilities

Barriers and Enablers to Actionability

- **Barriers:** Lack of baseline knowledge; manual tracking burdens; partial data views in tools

- **Enablers:** Automated recording; structured comparison; visualization support

---

Relation to Existing Literature

Compared to ProcessExplorer and provenance systems, LogView focuses on meta-analysis of query res

---

Summary

LogView supports process analysts in validating and comparing query results, enabling better refinement

---

Scores

- **Overall Relevance Score:** 45 — Moderate relevance due to implicit alignment with actionability dime

- **Operationalization Score:** 80 — Strong, concrete methods for achieving qualities akin to actionability

---

Supporting Quotes from the Paper

- "Analysts need to understand the result and ensure it aligns with their expectations…" (p. 5)

- "Our framework aims to support process analysts in reflecting on their queries and results…" (p. 3)

- "Understanding overlaps… can reveal situations… providing clues for further analysis…" (p. 6)

Actionability References to Other Papers

- None specifically tied to "actionability" as a concept; related to provenance and meta-analysis systems.

Paper Summary

<!--META_START-->

Title: AI-augmented Business Process Management Systems: A Research Manifesto

Authors: Marlon Dumas, Fabiana Fournier, Lior Limonad, Andrea Marrella, Marco Montali, Jana-Rebecca

DOI: https://doi.org/10.1145/3576047

Year: 2023

Publication Type: Journal

Discipline/Domain: Information Systems / Business Process Management

Subdomain/Topic: AI-augmented BPM Systems, Process Automation, Explainability, Adaptation

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Actionable/Actionability Used in Paper: Yes — "Conversationally actionable" as a core characteristic (p. 7

Authors Argue for Need for Actionability Without Defining It: No — The term is explicitly defined in relation

Contains Definition of Actionability: Yes — as "conversationally actionable," meaning the ability to proacti

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes — ABPMS lifecycle model (Fig. 1)

Operationalization Present: Yes

Primary Methodology: Conceptual / Manifesto

Study Context: Conceptual, technology-agnostic vision for AI in BPM systems

Geographic/Institutional Context: Multiple academic and industry institutions across Europe, Australia, an

Target Users/Stakeholders: BPM designers, AI researchers, business process managers

Primary Contribution Type: Conceptual framework and research agenda

CL: Yes — emphasis on clear framing, constraints, goals (p. 4–5)

CR: Yes — context-sensitive process adaptation (p. 3–4, 7)

FE: Yes — feasibility tied to framing constraints and meta-framing (p. 7)

TI: Yes — real-time adaptation and improvement (p. 8)

EX: Yes — situation-aware explainability (p. 9–10)

GA: Yes — goal optimization and trade-offs (p. 4–5, 8)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

AI-augmented Business Process Management Systems: A Research Manifesto

Authors:

Marlon Dumas, Fabiana Fournier, Lior Limonad, Andrea Marrella, Marco Montali, Jana-Rebecca Rehse,

DOI:

https://doi.org/10.1145/3576047

Year:

2023

Publication Type:

Journal

Discipline/Domain:

Information Systems / Business Process Management

Subdomain/Topic:

AI-augmented BPM Systems, Process Automation, Explainability, Adaptation

Contextual Background:

The paper positions AI-augmented BPM Systems (ABPMSs) as a new class of process-aware informatio

Geographic/Institutional Context:

Collaborative research across European, Australian, and Israeli universities and IBM Research.

Target Users/Stakeholders:

Business process managers, BPM system designers, AI researchers.

Primary Methodology:

Conceptual / manifesto-style research agenda.

Primary Contribution Type:

Conceptual framework (ABPMS lifecycle) and research challenges.

General Summary of the Paper

This manifesto defines AI-augmented Business Process Management Systems (ABPMSs) as process-aw

---

Actionable/Actionability Used in Paper

Yes

- "Conversationally actionable to seamlessly interact with agents whenever necessary" (p. 7)

- "Actionable means that the ABPMS makes concrete recommendations to the user and engages in a dis

- "Actionable conversations… initiate conversations with users… make recommendations for intervention

---

Authors Argue for a Need for Actionability Without Defining It

No — The paper explicitly defines "actionable" in the context of "conversationally actionable" and "acti

---

How Actionability is Understood

> "Conversationally actionable, i.e., able to proactively communicate with human agents about process-re

---

What Makes Something Actionable

- **Proactive Communication**

  > "Able to proactively communicate with human agents about process-related actions, goals, and intenti

- **Concrete Recommendations**

  > "'Actionable' means that the ABPMS makes concrete recommendations to the user and engages in a

- **Context-Sensitive Interaction**

  > "Initiates conversations with users in order to inform them of process progression, alert them of releva

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ABPMS Lifecycle (Fig. 1)

- **Methods/Levers:** Conversational interfaces, proactive recommendation generation, real-time monito

- **Operational Steps / Workflow:** Frame → Enact → Perceive → Reason → (Explain / Adapt / Improve)

- **Data & Measures:** KPIs, constraints, goals, contextual process data.

- **Implementation Context:** Applicable across diverse process domains with varying levels of autonomy

> "The ABPMS could present requested information as an interactive dashboard and recommend inspec

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear communication of recommendations (p. 8)

- **CR (Contextual Relevance):** Yes — context-sensitive process adaptation and interaction (p. 7–8)

- **FE (Feasibility):** Yes — framed by constraints and goals (p. 7)

- **TI (Timeliness):** Yes — real-time proactive interventions (p. 8, 13)

- **EX (Explainability):** Yes — situation-aware explainability (p. 9–10)

- **GA (Goal Alignment):** Yes — tied to KPIs and optimal trade-offs (p. 4–5, 8)

- **Other Dimensions Named by Authors:** Trustworthiness (p. 9), adaptability (p. 8), self-improvement (p

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Theoretical or Conceptual Foundations

- Framing theory (Minsky, 1975)

- Supervisory control in discrete-event systems

- Hybrid Process Intelligence

- BDI agent models

Indicators or Metrics for Actionability

- Achievement of KPIs

- Effectiveness of recommendations and interventions

- User acceptance and trust measures

Barriers and Enablers to Actionability

- **Barriers:** Need for domain knowledge in conversational systems; handling dynamic and uncertain co

- **Enablers:** Natural Language Processing, Machine Learning for recommendation and adaptation; inte

---

Relation to Existing Literature

The paper integrates concepts from BPM, AI planning, explainable AI, conversational interfaces, and ada

---

Summary

This research manifesto defines AI-augmented BPM Systems (ABPMSs) as process-aware systems enh

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Scores

- **Overall Relevance Score:** 92 — Strong conceptual definition and integration of actionability into the /

- **Operationalization Score:** 88 — Provides concrete mechanisms (conversational interfaces, dashboa

---

Supporting Quotes from the Paper

- "Conversationally actionable, i.e., able to proactively communicate with human agents about process-re

- "'Actionable' means that the ABPMS makes concrete recommendations to the user and engages in a di

- "Initiates conversations with users… and make recommendations for interventions in order to improve p

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Actionability References to Other Papers

- [70] Muthusamy et al. (2020) on human-digital worker integration

- [33] Galitsky (2019) on enterprise chatbots and NLU

- [79] Rizk et al. (2020) on multi-agent conversational assistants

- [90] van der Aalst (2021) on Hybrid Process Intelligence

Paper Summary

<!--META_START-->

Title: Action-oriented process mining: bridging the gap between insights and actions

Authors: Gyunam Park, Wil M. P. van der Aalst

DOI: https://doi.org/10.1007/s13748-022-00281-7

Year: 2022

Publication Type: Journal

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Action-oriented process mining, Continuous process improvement

Eligibility: Eligible

Overall Relevance Score: 93

Operationalization Score: 95

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental

Study Context: Artificial IS + SAP ERP system (Order handling / Order-to-Cash)

Geographic/Institutional Context: RWTH Aachen University, Germany

Target Users/Stakeholders: Process managers, business analysts, ERP system users

Primary Contribution Type: Conceptual framework + implementation + empirical validation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Action-oriented process mining: bridging the gap between insights and actions

Authors:

Gyunam Park, Wil M. P. van der Aalst

DOI:

https://doi.org/10.1007/s13748-022-00281-7

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Action-oriented process mining, Continuous process improvement

Contextual Background:

The paper addresses the missing link between process mining insights (diagnostics, monitoring) and con

Geographic/Institutional Context:

RWTH Aachen University, Germany

Target Users/Stakeholders:

Process managers, business analysts, ERP system users

Primary Methodology:

Conceptual framework development with empirical validation (artificial IS + real-life ERP)

Primary Contribution Type:

Framework + Implementation + Experimental Evaluation

General Summary of the Paper

The authors propose a **general framework for action-oriented process mining** designed to close the ga

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is understood as the **systematic conversion of process mining insights into automated, targ

> "Action-oriented process mining aims at… systematically combining process mining results and domain

> "…turn the insights from process mining diagnostics to management actions." (p. 2)

What Makes Something Actionable

- Must be grounded in **objective monitoring results** (diagnostics + predictions).

- Must be linked to **clear operational goals** (risk reduction, performance improvement).

- Must be **context-aware** (relevant to process, activity, resource, object).

- Must be **timely** in relation to process execution.

- Must be **feasible** for automatic execution in the IS environment.

- Must be **explainable** and based on transparent criteria.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** General framework for action-oriented process mining; Cube-based

- **Methods/Levers:** Continuous constraint monitoring, OLAP-based multi-dimensional analysis, automa

- **Operational Steps / Workflow:**

  1. Define constraints from diagnostics & domain knowledge.

  2. Monitor event streams to detect/predict violations.

  3. Generate constraint instances.

  4. Analyze violations via cube-based OLAP views.

  5. Map conditions to predefined management actions.

  6. Trigger and execute actions in source systems.

- **Data & Measures:** Event logs (OCEL format), constraint categories, violation counts, response times

- **Implementation Context:** ProM plug-in integrated with artificial IS and SAP ERP O2C process.

> "The action engine analyzes the constraint instances and produces action instances… automatically tri

> "…cube-based action engine… generates actions by analyzing monitoring results in a multi-dimensiona

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Actions are explicitly defined via formulas and parameter mappings.

  > "…the action formula specifies which transactions to generate in which conditions…" (p. 8)

- **CR (Contextual Relevance):** Yes — Context dimension explicitly models processes, activities, resou

- **FE (Feasibility):** Yes — Actions mapped to executable IS transactions (SAP ERP, artificial IS).

- **TI (Timeliness):** Yes — Time dimension in cube; monitoring scheduled multiple times daily.

- **EX (Explainability):** Yes — Violations linked to transparent constraints; explainable predictions refere

- **GA (Goal Alignment):** Yes — Actions linked to operational goals like reducing delivery failures or res

- **Other Dimensions Named by Authors:** Severity levels (priority), constraint categories (cost, time, qua

Theoretical or Conceptual Foundations

- Process mining diagnostics (discovery, conformance, enhancement)

- Predictive process monitoring

- OLAP multi-dimensional analysis

- Action recommender systems

Indicators or Metrics for Actionability

- Number of violations detected

- Violation frequency ratios (e.g., >10% late responses)

- Throughput time reduction

- Change frequency in orders

Barriers and Enablers to Actionability

- **Barriers:** Lack of systematic action mapping in existing tools; subjective decision-making; possible u

- **Enablers:** Formalized framework; integration with ERP; cube-based structured analysis; automated e

Relation to Existing Literature

Positions itself as extending operational support literature by formalizing the **recommendation-to-action"

Summary

The paper defines actionability as the **ability to convert process insights into timely, context-aware, feas

Scores

- **Overall Relevance Score:** 93 — Provides explicit conceptualization of actionability with clear features

- **Operationalization Score:** 95 — Offers detailed, formalized operationalization with methods, workflow

Supporting Quotes from the Paper

- "[Action-oriented process mining] aims at… systematically combining process mining results and domai

- "The action formula specifies which transactions to generate in which conditions…" (p. 8)

- "The cube-based action engine… generates actions by analyzing monitoring results in a multi-dimension

- "We propose a general framework… to support continuous monitoring… and the automated execution o

Actionability References to Other Papers

- Celonis Action Engine [41]

- Digital twin interface model [42]

- Predictive monitoring frameworks [22–26]

- Prescriptive alarm systems [37]

- Process-aware recommender systems [40]

Paper Summary

<!--META_START-->

Title: A visual approach to support process analysts in working with process improvement opportunities

Authors: Kateryna Kubrak, Fredrik Milani, Alexander Nolte

DOI: 10.1108/BPMJ-10-2021-0631

Year: 2023

Publication Type: Journal

Discipline/Domain: Business Process Management / Process Mining

Subdomain/Topic: Visualisation of process improvement opportunities

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 82

Actionable/Actionability Used in Paper: Yes – Implicit: "...aid process analysts in working with process imp

Authors Argue for Need for Actionability Without Defining It: Yes – "...impedes process analysts from taki

Contains Definition of Actionability: No (implicit framing through improvement opportunity decision-making

Contains Systematic Features/Dimensions: Yes – KPIs, impact, feasibility, cost, ease, goal alignment

Contains Explainability: Partial – linked to showing underlying data and context for trust

Contains Interpretability: Yes – through clarity, simplified views for stakeholders

Contains Framework/Model: Yes – IRVIN mockup framework & 5 principles for visualisations

Operationalization Present: Yes – Detailed mockup (IRVIN) with user stories and evaluation

Primary Methodology: Qualitative + Design Science Research

Study Context: Process mining tool visualisation design for analysts

Geographic/Institutional Context: Estonia (University of Tartu) & international practitioner sample

Target Users/Stakeholders: Process analysts, process mining tool developers, business stakeholders

Primary Contribution Type: Framework + Design artefact evaluation

CL: Yes – "...you take that piece of information or data and try to put it in a simplified context" (p. 110)

CR: Yes – "...recommendation I'm making is intrinsic [...] or extrinsic to the [process]" (p. 109)

FE: Yes – "...ease of addressing the improvement opportunity" (p. 118)

TI: No explicit time dimension beyond process performance metrics

EX: Partial – "Show me the underlying data" (p. 116)

GA: Yes – "...in line with the company's objectives" (p. 110)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A visual approach to support process analysts in working with process improvement opportunities

Authors:

Kateryna Kubrak, Fredrik Milani, Alexander Nolte

DOI:

10.1108/BPMJ-10-2021-0631

Year:

2023

Publication Type:

Journal

Discipline/Domain:

Business Process Management / Process Mining

Subdomain/Topic:

Visualisation of process improvement opportunities

Contextual Background:

The paper addresses the gap in process mining where visualisations are rarely designed to support ident

Geographic/Institutional Context:

University of Tartu (Estonia) & Carnegie Mellon University, with an international sample of process analys

Target Users/Stakeholders:

Process analysts, process mining software developers, business decision-makers

Primary Methodology:

Qualitative interviews + design science research with iterative prototyping and evaluation

Primary Contribution Type:

Framework and evaluated artefact (IRVIN) with design principles for actionable visualisations

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General Summary of the Paper

The study explores how process mining visualisations can be designed to support analysts in identifying,

---

Actionable/Actionability Used in Paper

Yes – implicit through the framing of "process improvement opportunities" as the actionable output of ana

- "...aid process analysts in working with process improvement opportunities" (p. 102)

- "...visualisations… to identify, prioritise and communicate business process improvement opportunities"

- "...impedes process analysts from taking data-driven decisions to implement process changes" (p. 102)

Authors Argue for a Need for Actionability Without Defining It

Yes –

- "...impedes process analysts from taking data-driven decisions to implement process changes" (p. 102)

- "...no existing approach that supports analysts in using visualisations… to identify improvement opportu

---

How Actionability is Understood

Implicit: Actionability is framed as the capacity of process mining visualisations to provide the necessary i

---

What Makes Something Actionable

- **Integration of process models & performance data**

> "...visualisation should concurrently capture the process and its performance to provide a holistic view

- **Proportion of cases affected**

  > "...explicitly denote the proportion of cases… affected by implementing a change" (p. 120)

- **Alignment with business objectives/KPIs**

  > "...which KPIs of the process can be improved if the opportunity is addressed" (p. 119)

- **Cost and ease of implementation**

  > "...compare cost and ease of implementation of alternative changes" (p. 120)

- **Access to underlying data**

  > "...explore the calculation data behind visualisations to ensure transparency" (p. 120)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** IRVIN (ImpRovement opportunities VisualIsatioN)

- **Methods/Levers:** Design science methodology, user stories, iterative mockup design, contextual eva

- **Operational Steps / Workflow:**

  1. Exploration interviews to elicit requirements

  2. Wireframe creation and mockup linking in InVision

  3. Evaluation with practitioners in scenario-based tasks

  4. Refinement based on additional requirements

- **Data & Measures:** Process models, KPIs, case counts, variant analysis, cost/effort estimates, perfor

- **Implementation Context:** Hypothetical process mining tool with interactive improvement opportunity t

> "...compare identified improvement opportunities… decide how to proceed" (p. 115)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "...simplified context that works as a narrative and easy enough to understand" (p

- **CR (Contextual Relevance):** Yes – "...intrinsic [...] or extrinsic to the [process]" (p. 109)

- **FE (Feasibility):** Yes – "...ease of addressing the improvement opportunity" (p. 118)

- **TI (Timeliness):** No explicit time-criticality dimension beyond performance impact

- **EX (Explainability):** Partial – "Show me the underlying data" (p. 116)

- **GA (Goal Alignment):** Yes – "...in line with the company's objectives" (p. 110)

- **Other Dimensions Named by Authors:** Cost-benefit trade-off, proportion of cases affected, KPI impac

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Theoretical or Conceptual Foundations

- Design science methodology (Hevner et al., 2004)

- Visualisation principles (Munzner, 2014; Shneiderman, 1996)

- Improvement Opportunity Framework (Lashkevich, 2020)

Indicators or Metrics for Actionability

- Number of cases affected

- KPI change (throughput time, error rate, resource utilisation)

- Cost of implementation

- Ease of implementation (resource effort)

- Business alignment of KPIs

Barriers and Enablers to Actionability

- **Barriers:** Lack of integrated visualisations; missing cost/effort data; distrust in data quality; no existin

- **Enablers:** Combining process and performance views; alignment with KPIs; ability to drill down into u

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Relation to Existing Literature

Extends visualisation research in process mining beyond exploration/comparison toward decision-oriente

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Summary

This paper investigates how process mining visualisations can be designed to support analysts in making

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Scores

- **Overall Relevance Score:** 88 – Strong alignment with actionability via implicit conceptualisation, deta

- **Operationalization Score:** 82 – Detailed mockup and workflow show clear means to achieve actional

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Supporting Quotes from the Paper

- "...visualisation should concurrently capture the process and its performance to provide a holistic view" (

- "...explicitly denote the proportion of cases… affected by implementing a change" (p. 120)

- "...in line with the company's objectives" (p. 110)

- "...compare cost and ease of implementation of alternative changes" (p. 120)

- "Show me the underlying data" (p. 116)

Actionability References to Other Papers

- Lashkevich (2020) – Improvement Opportunity Framework

- Grisold et al. (2021) – Alignment of process mining with business strategy

- Pini et al. (2015) – Multi-perspective process visualisation

- Dani et al. (2019) – Visualisation of business process models

- Bitomsky et al. (2019) – Cost-benefit assessment in process improvement

Paper Summary

<!--META_START-->

Title: A General Process Mining Framework for Correlating, Predicting and Clustering Dynamic Behavior

Authors: Massimiliano de Leoni, Wil M.P. van der Aalst, Marcus Dees

DOI: 10.1016/j.is.2015.07.003

Year: 2015

Publication Type: Journal

Discipline/Domain: Information Systems / Process Mining

Subdomain/Topic: Correlation analysis, prediction, and clustering in process mining

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Actionable/Actionability Used in Paper: Yes — "The results can also be used at run-time to provide decisi

Authors Argue for Need for Actionability Without Defining It: Yes — "Corrective actions can be put in plac

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Case Study

Study Context: Process mining applied to event logs for correlation, prediction, and clustering

Geographic/Institutional Context: UWV (Employee Insurance Agency), The Netherlands

Target Users/Stakeholders: Process analysts, business process managers, decision-makers in organizat

Primary Contribution Type: Generalizable process mining framework

CL: Yes — "aims to explain the values of the dependent characteristic as function of the independent cha

CR: Yes — "conditions may have a negative impact on certain KPIs… corrective actions can be put in pla

FE: Yes — "low-performing branches can be closed… or moved to different tasks" (p. 7)

TI: No

EX: Yes — Decision/regression tree structure clearly highlights contributing characteristics (p. 21–23)

GA: Yes — "Maximize the chances of achieving a given business goal" (p. 21)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A General Process Mining Framework for Correlating, Predicting and Clustering Dynamic Behavior Base

Authors:

Massimiliano de Leoni, Wil M.P. van der Aalst, Marcus Dees

DOI:

10.1016/j.is.2015.07.003

Year:

2015

Publication Type:

Journal

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Correlation analysis, prediction, and clustering in process mining

Contextual Background:

The paper addresses the gap in process mining research between discovery/conformance checking and

Geographic/Institutional Context:

UWV (Employee Insurance Agency), The Netherlands

Target Users/Stakeholders:

Process analysts, business process managers, decision-makers in organizations using PAISs

Primary Methodology:

Conceptual framework development + case study evaluation

Primary Contribution Type:

Generalizable process mining framework

General Summary of the Paper

This paper proposes a unified process mining framework capable of correlating, predicting, and clustering

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Actionable/Actionability Used in Paper

Yes.

- "Corrective actions can be put in place to avoid those conditions" (p. 7)

- "The results can also be used at run-time to provide decision support" (p. 8)

- "…participants can be suggested to avoid certain decisions that have been observed to likely lead to th

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Corrective actions can be put in place to avoid those conditions" (p. 7)

- "Maximize the chances of achieving a given business goal" (p. 21)

How Actionability is Understood

Implicitly understood as the ability to derive conditions and rules from process analysis results that enable

> "…participants can be suggested to avoid certain decisions that have been observed to likely lead to th

---

What Makes Something Actionable

- Clear identification of correlations between process characteristics and KPIs

- Ability to trace back undesirable outcomes to root causes

- Availability of decision rules from prediction trees

- Operational feasibility of applying corrective/preventive measures

- Context relevance (e.g., process-specific characteristics, time conditions)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** General Process Mining Framework (implemented in ProM's Featur

- **Methods/Levers:** Enrich event logs, apply event selection filters, generate decision/regression trees

- **Operational Steps / Workflow:**

  1. Define analysis use case (dependent variable, independent variables, event filter)

  2. Manipulate/enrich event log

  3. Perform analysis via tree learning

4. Optionally cluster event log based on results

5. Apply process mining to each cluster

- **Data & Measures:** Event logs with multiple process perspectives, enriched with derived characteristi

- **Implementation Context:** UWV unemployment and illness-management processes

> "…Corrective actions can be put in place to avoid those conditions… The results can also be used at ru

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "aims to explain the values of the dependent characteristic as function of the ind

- **CR (Contextual Relevance):** Yes — "…conditions may have a negative impact on certain KPIs… co

- **FE (Feasibility):** Yes — "…low-performing branches can be closed… or moved to different tasks" (p.

- **TI (Timeliness):** No — analyses are a posteriori and need repetition for updates (p. 8)

- **EX (Explainability):** Yes — Trees explicitly show discriminating characteristics (p. 21–23)

- **GA (Goal Alignment):** Yes — "…maximize the chances of achieving a given business goal" (p. 21)

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process mining theory (van der Aalst, 2011)

- Decision tree learning (C4.5, REPTree)

- Perspectives in process analysis (control-flow, data-flow, resource, time, conformance)

Indicators or Metrics for Actionability

- Correlation between characteristics and KPIs

- Decision tree splits indicating strong predictive power

- Process model precision improvements post-clustering

Barriers and Enablers to Actionability

- **Barriers:**

  - A posteriori analysis (no automatic real-time updates)

  - No explicit definition of actionability provided

  - Noise and outliers in event logs (requiring filtering)

- **Enablers:**

  - Unified framework reduces technical burden

- Multiple perspectives incorporated into analysis

  - Explainable models via decision/regression trees

Relation to Existing Literature

The authors position their work as a generalization of multiple ad-hoc correlation analysis approaches in

---

Summary

This paper introduces a general process mining framework designed to unify diverse correlation, predictio

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Scores

- **Overall Relevance Score:** 88 — Strong operationalization of actionability via explainable decision rul

- **Operationalization Score:** 90 — Detailed multi-perspective enrichment, event filtering, and analysis v

---

Supporting Quotes from the Paper

- "Corrective actions can be put in place to avoid those conditions." (p. 7)

- "The results can also be used at run-time to provide decision support… participants can be suggested to

- "Maximize the chances of achieving a given business goal." (p. 21)

Actionability References to Other Papers

- [14] Maggi et al. (2014) — Predictive monitoring of business processes

- [15] Ghattas et al. (2014) — Improving business process decision making based on past experience

- [16] Conforti et al. (2013) — Supporting risk-informed decisions during business process execution

- [17] Rozinat & van der Aalst (2006) — Decision mining in ProM

- [18] van der Aalst et al. (2011) — Time prediction based on process mining

Paper Summary

<!--META_START-->

Title: The Action Engine – Turning Process Insights into Action

Authors: Peyman Badakhshan; German Bernhart; Jerome Geyer■Klingeberg; Janina Nakladal; Steffen S

DOI: N/A

Year: 2019

Publication Type: Conference

Discipline/Domain: Information Systems / Process Mining

Subdomain/Topic: Operational process support; recommendations; predictive monitoring; execution integ

Eligibility: Eligible (implicitly focuses on making insights actionable through analysis→recommendation→

Overall Relevance Score: 72

Operationalization Score: 80

Actionable/Actionability Used in Paper: No (terms like "actionable/actionability" not used explicitly). :conte

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "translates findings…into recomm

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual (system description) with brief case references

Study Context: Enterprise business processes (e.g., Purchase■to■Pay, Order■to■Cash) with demo dat

Geographic/Institutional Context: Developed by Celonis (Munich, Germany); cases from Germany and th

Target Users/Stakeholders: Process owners; purchasers; order managers; broader "human users or the

Primary Contribution Type: System/architecture description and operational support approach

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The Action Engine – Turning Process Insights into Action

Authors:

Peyman Badakhshan; German Bernhart; Jerome Geyer■Klingeberg; Janina Nakladal; Steffen Schenk; T

DOI:

N/A

Year:

2019

Publication Type:

Conference

Discipline/Domain:

Information Systems / Process Mining

Subdomain/Topic:

Operational process support; recommendations; predictive monitoring; execution integration

Contextual Background:

The paper presents a Celonis web application that connects process mining insights to operational interv

Geographic/Institutional Context:

Celonis, Munich; deployments across "10 different companies," including Schukat Electronic (Germany) a

Target Users/Stakeholders:

Process owners, purchasers, order managers, and digital workforce receiving just■in■time recommenda

Primary Methodology:

Conceptual system description with application features and short case vignettes. :contentReference[oai

Primary Contribution Type:

Operational framework and tooling for turning process analysis into executable actions. :contentReferenc

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General Summary of the Paper

The authors introduce the Celonis Action Engine, a web application that connects process mining analys

---

Actionable/Actionability Used in Paper

No explicit use of the terms "actionable," "actionability," "actionable insight," or "actionable recommendatio

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "translates findings from automatic discovery and rule■based process analysis into recommendations fe

- "This approach… operationaliz[es] insights created through process analysis." (Abstract, p. 2) :contentR

- "three main phases… continuously analyzes… communicates… proposes action… or actively executes

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How Actionability is Understood

Implicit conceptualization: actionable outputs are insights converted into specific, personalized, just■in■t

> "…providing predictions as well as recommending necessary actions… [with] all the relevant informatio

---

What Makes Something Actionable

- **Personalized and assigned to a responsible user**

  > "The recommendations are always personalized and assigned to a responsible employee." (p. 3) :con

- **Just■in■time communication**

  > "…communicates the detected improvement opportunities to users – just■in■time in a personalized w

- **Context■rich decision support**

  > "…providing all necessary process information and the direct link to workflows." (p. 3) :contentReferen

- **Direct executability in source systems**

  > "…directly executes actions in the source system (e.g. by triggering a bot or starting a workflow)." (p. 2

- **Prioritization by impact on KPIs**

  > "…identify[ing] aspects of high priority where an action is needed and where action has a high impact

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Action Engine; "Skill" construct. (Fig. 2, p. 3) :contentReference[oaid

- **Methods/Levers:** Rule■based triggers via PQL; classification of comparable processes (Random Fo

- **Operational Steps / Workflow:** "1. Analyze → 2. Communicate → 3. Execute," with signals and routin

- **Data & Measures:** Multi■system event logs; KPIs like throughput time, fulfillment, process costs; cyc

- **Implementation Context:** Enterprise processes (P2P, O2C); execution via SAP or bots; e.g., "Add Co

> "A skill is defined as… trigger, routing rules, signals, and actions… The signal itself is the representatio

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes.** The signal window shows "all necessary process information" to decide. (p. 3–4

- **CR (Contextual Relevance):** **Yes.** Personalized, assignee■specific signals and impact on define

- **FE (Feasibility):** **Yes.** One■click action executing pre■filled transactions in SAP; direct workflow

- **TI (Timeliness):** **Yes.** "just■in■time" recommendations; continuous analysis. (p. 2) :contentRefer

- **EX (Explainability):** **Partial.** Triggers/rules are visible (PQL derived from filters); ML models name

- **GA (Goal Alignment):** **Yes.** Optimization toward target KPIs and prioritization (e.g., VIP order). (p

- **Other Dimensions Named by Authors:** N/A explicitly.

Theoretical or Conceptual Foundations

Process mining (discovery/prediction/operational support); predictive process monitoring. Referenced fou

---

Indicators or Metrics for Actionability

No formal metric for "actionability," but actions are prioritized by "pre■defined process KPIs" (throughput

---

Barriers and Enablers to Actionability

- **Barriers:** N/A (not explicitly discussed).

- **Enablers:** Continuous multi■system analysis; just■in■time personalized signaling; direct execution

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Relation to Existing Literature

Positions the Action Engine as extending process mining from analysis to operational support, aligning w

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Summary

This paper presents the Celonis Action Engine as a concrete operationalization layer atop process minin

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Scores

- **Overall Relevance Score:** 72 — Strong implicit treatment of actionability via analyze→recommend→

- **Operationalization Score:** 80 — Concrete mechanisms (skills, PQL rules, ML triggers, routing, execu

---

Supporting Quotes from the Paper

- "The Action Engine… translates findings… into recommendations for operational support during process

- "This approach… operationalizing insights created through process analysis." (Abstract, p. 2) :contentRe

- "There are three main phases… analyzes… communicates… proposes action… or actively executes th

- "The recommendations are always personalized and assigned to a responsible employee." (p. 3) :conte

- "A skill is defined as… trigger, routing rules, signals, and actions." (p. 3) :contentReference{in

- "Rule■based Triggers… defined via PQL… Event■Condition■Action formula." (p. 3) :contentReference

- "Classified inefficiencies are predicted… Random Forest and Neural Networks… [then] a recommendati

- "The appropriate SAP transaction is already executed and pre■filled with the right parameters." (p. 4) :c

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Actionability References to Other Papers

- Veit et al., "The proactive insights engine: Process mining meets machine learning and artificial intellige

- van der Aalst et al., on time prediction and beyond process mining (2011; 2010). (Refs. [4], [5]) :content

Paper Summary

<!--META_START-->

Title: A General Framework for Action-Oriented Process Mining

Authors: Gyunam Park, Wil M.P. van der Aalst

DOI: 10.1007/978-3-030-66498-5_16

Year: 2020

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Action-Oriented Process Mining, Continuous Operational Management

Eligibility: Eligible

Overall Relevance Score: 95 — Strong and explicit focus on turning diagnostics into actionable process i

Operationalization Score: 90 — Detailed method (constraint monitor + action engine) with formal definitio

Actionable/Actionability Used in Paper: Yes — "insights turned into actions" (p.2); "convert the insights fro

Authors Argue for Need for Actionability Without Defining It: No — They define and operationalize it in the

Contains Definition of Actionability: Yes — Defined as the transformation of process diagnostics into proa

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial — Explanations of violations and context are embedded in constraints, bu

Contains Interpretability: No

Contains Framework/Model: Yes — General framework for action-oriented process mining with two comp

Operationalization Present: Yes — Event stream monitoring, constraint instance generation, automated a

Primary Methodology: Conceptual + Proof-of-Concept Experimentation

Study Context: Order handling process in an e-commerce-like simulated environment.

Geographic/Institutional Context: RWTH Aachen University, Germany

Target Users/Stakeholders: Process managers, operational managers, BPM practitioners, process minin

Primary Contribution Type: Conceptual framework with formalization and technical implementation.

CL: Yes — Clear formal definitions and workflow for converting diagnostics to actions (p.2–3)

CR: Yes — Emphasis on enterprise-level multiple-object contexts and relevant constraint/action design (p

FE: Yes — Focus on feasibility through operationalizable constraints and automated execution (p.10–11)

TI: Yes — Continuous, time-window-based monitoring enabling timely interventions (p.6–9)

EX: Partial — Contextual explanations for violations but no general interpretability model (p.7)

GA: Yes — Actions aligned with process improvement goals (p.2–3, p.12)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A General Framework for Action-Oriented Process Mining

Authors:

Gyunam Park, Wil M.P. van der Aalst

DOI:

10.1007/978-3-030-66498-5_16

Year:

2020

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Action-Oriented Process Mining, Continuous Operational Management

Contextual Background:

The paper addresses the gap between process mining diagnostics and actual process improvement. Whi

Geographic/Institutional Context:

RWTH Aachen University, Germany

Target Users/Stakeholders:

Process managers, operational managers, BPM practitioners, process mining tool developers

Primary Methodology:

Conceptual + Proof-of-Concept Experimentation

Primary Contribution Type:

Conceptual framework with formalization and technical implementation

---

General Summary of the Paper

The paper proposes a general framework for **action-oriented process mining** aimed at bridging the ga

---

Actionable/Actionability Used in Paper

Yes

- "Convert the insights from process mining diagnostics to management actions" (p.3)

- "Framework supports… automated execution of actions to improve the process" (p.2)

- "Insights turned into actions by continuously monitoring… and automatically generating proactive action

---

Authors Argue for a Need for Actionability Without Defining It

No — They provide a formal operational definition within the framework.

How Actionability is Understood

Actionability is understood as **the ability to transform process diagnostics (constraint violations, prediction

> "Continuously transforms process diagnostics into proactive actions for the process improvement." (p.1

What Makes Something Actionable

- Direct link from diagnostics to executable actions

- Context-aware constraints and violations

- Timely detection through continuous monitoring

- Feasible action definitions (transactions executable by systems)

- Goal alignment with process performance improvement

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** General Framework for Action-Oriented Process Mining

- **Methods/Levers:** Constraint monitor, action engine, object-centric event streams

- **Operational Steps / Workflow:**

  1. Define constraints from diagnostics

  2. Monitor event streams for violations

  3. Generate constraint instance streams

  4. Evaluate action formulas

  5. Produce action instance streams

  6. Execute actions in source systems via gateways

- **Data & Measures:** Event streams (OCL format), constraint formulas (CFL), action formulas (AFL)

- **Implementation Context:** ProM plug-in; tested on simulated order handling process

> "By analyzing this constraint instance stream, the action engine assesses the necessity of actions and g

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "formal definitions for constraint, context, action, and transaction" (p.6–9)

- **CR (Contextual Relevance):** Yes — multiple-object-type, enterprise-level applicability (p.4)

- **FE (Feasibility):** Yes — transactions are executable via information systems (p.9–10)

- **TI (Timeliness):** Yes — uses predefined time windows and moments for continuous monitoring (p.6–

- **EX (Explainability):** Partial — contextual descriptions embedded in constraints (p.7)

- **GA (Goal Alignment):** Yes — explicitly targets process improvement (p.2–3, p.12)

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Object-Centric Process Mining

- Conformance checking

- Petri-net patterns

- Linear Temporal Logic

Indicators or Metrics for Actionability

- Number of violated instances over time

- Reduction in violations after action application (Fig. 3b)

Barriers and Enablers to Actionability

- **Barriers:**

  - Traditional tools stop at diagnostics without automated action execution

  - Lack of streaming data support in some commercial solutions (p.12)

- **Enablers:**

  - Formalized constraint and action definitions

  - Continuous monitoring and automation

  - Integration with existing information systems

Relation to Existing Literature

The paper situates itself among conformance checking, predictive monitoring, and prescriptive alarm syst

---

Summary

This paper delivers a formalized, operationalizable framework for **action-oriented process mining**, add

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Scores

- **Overall Relevance Score:** 95 — Explicit conceptualization of actionability with a detailed, formal, and

- **Operationalization Score:** 90 — Clear, step-by-step operational model with proof-of-concept impleme

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Supporting Quotes from the Paper

- "Convert the insights from process mining diagnostics to management actions." (p.3)

- "Continuously transforms process diagnostics into proactive actions for the process improvement." (p.12

- "If there exist more than 10 (possibly) violated items… send an e-mail to the case manager." (p.5)

Actionability References to Other Papers

- Celonis Action Engine — Badakhshan et al. (2019)

- Prescriptive Alarm System — Fahrenkrog-Petersen et al. (2019)

- Recommendation System for Predicting Risks — Conforti et al. (2015)

- Predictive Monitoring Survey — Marquez-Chamorro et al. (2018)

Paper Summary

<!--META_START-->

Title: A study into the contingencies of process improvement methods

Authors: Monika Malinova, Steven Gross, Jan Mendling

DOI: https://doi.org/10.1016/j.is.2021.101880

Year: 2022

Publication Type: Journal

Discipline/Domain: Information Systems / Business Process Management

Subdomain/Topic: Process improvement methods, contingency theory, method mining

Eligibility: Eligible

Overall Relevance Score: 78 — The paper conceptualizes method differences as contingent on context,

Operationalization Score: 85 — The work offers a detailed operationalization via the extended Stage-Acti

Actionable/Actionability Used in Paper: No — The paper does not use the term "actionability" or related te

Authors Argue for Need for Actionability Without Defining It: Yes — Implicitly, by discussing how methods

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes — Strategic vs. operational, incremental vs. radical, inwa

Contains Explainability: Partial — Framework offers structured decomposition of method steps, but not fra

Contains Interpretability: Partial — The S-A framework improves transparency of method activities and cl

Contains Framework/Model: Yes — Extended Stage-Activity (S-A) framework and method mining proced

Operationalization Present: Yes — Detailed extraction, categorization, and clustering of activities, plus gu

Primary Methodology: Mixed Methods (systematic literature review, process mining, statistical analysis)

Study Context: Process improvement methods across industries.

Geographic/Institutional Context: Methods from global literature; authors from Vienna University of Econ

Target Users/Stakeholders: Process improvement practitioners, BPM researchers, organizational change

Primary Contribution Type: Framework and empirical analysis of method contingencies.

CL: Partial — clarity via explicit activity descriptions.

CR: Yes — contextual relevance emphasized via contingency factors.

FE: Yes — feasibility addressed through method customization guidance.

TI: Partial — timeliness implied in implementation planning stages.

EX: Partial — explanation of activity inclusion via statistical and sequence analysis.

GA: Yes — goal alignment addressed through linkage to objectives and strategy.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A study into the contingencies of process improvement methods

Authors:

Monika Malinova, Steven Gross, Jan Mendling

DOI:

https://doi.org/10.1016/j.is.2021.101880

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Information Systems / Business Process Management

Subdomain/Topic:

Process improvement methods, contingency theory, method mining

Contextual Background:

This paper investigates why numerous process improvement methods exist, whether differences are sub

Geographic/Institutional Context:

Global literature scope; authors based in Austria, Germany, Slovenia.

Target Users/Stakeholders:

BPM practitioners, process improvement consultants, researchers.

Primary Methodology:

Mixed Methods — systematic literature review, process mining ("method mining"), statistical analysis.

Primary Contribution Type:

Framework and contingency-based analysis of process improvement methods.

General Summary of the Paper

The study analyzes 90 process improvement methods to determine shared and divergent activities and th

---

Actionable/Actionability Used in Paper

No — The terms "actionable" or "actionability" are not used. The concept is implicit in method adaptat

---

Authors Argue for a Need for Actionability Without Defining It

Yes — The authors stress the necessity for methods to fit contingencies to achieve intended outcome

> "...a method needs to be adapted to fit the project characteristics." (p. 3)

> "...practitioners could immediately take advantage of the list of activities...to better fit their specific proce

---

How Actionability is Understood

Implicit: Actionability is framed as the suitability and adaptability of a process improvement method to spe

---

What Makes Something Actionable

- **Contingency Fit:**

  > "...differences in goals imply differences in methods and their sequence of activities." (p. 3)

- **Strategic & Operational Balance:**

  > "...incorporating strategic activities has the potential to increase the impact of the process improvemen

- **Clarity of Goals & Drivers:**

  > "...decide on improvement radicalness, realize need for change and identify change drivers...could det

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Extended Stage-Activity (S-A) framework; Method Mining procedure

- **Methods/Levers:** Literature review, process mining, logistic regression, hierarchical clustering.

- **Operational Steps / Workflow:** Identify methods; extract activities; categorize into framework; analyz

- **Data & Measures:** 90 methods, 264 activities, clustered into 41 groups, annotated by redesign orbit

- **Implementation Context:** Process improvement across industries.

> "...practitioners could...focus on those activities that have been labeled as outward-looking, creative and

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — Clear activity definitions but no explicit clarity dimension.

- **CR (Contextual Relevance):** Yes — Contingent factor alignment central.

- **FE (Feasibility):** Yes — Guidance on tailoring methods to resources, skills.

- **TI (Timeliness):** Partial — Addresses planning and execution order, but not timeliness as a property.

- **EX (Explainability):** Partial — Sequence and correlation analysis provides transparency.

- **GA (Goal Alignment):** Yes — Objectives linked to method activities.

- **Other Dimensions Named by Authors:** Ambition, Nature, Perspective (from redesign orbit).

Theoretical or Conceptual Foundations

- Contingency Theory (Donaldson, 2001)

- Redesign Orbit model (Dumas et al., 2018)

- Stage-Activity framework (Kettinger et al., 1997)

Indicators or Metrics for Actionability

N/A — Metrics relate to process improvement performance, not actionability per se.

Barriers and Enablers to Actionability

- **Barriers:** Lack of radical methods; neglect of strategic activities; poor adaptation to process characte

- **Enablers:** Activity customization to context; strategic-operational activity mix; alignment with objectiv

---

Relation to Existing Literature

Positions the extended S-A framework as an evolution of Kettinger et al. (1997), integrating contingency t

---

Summary

This paper provides an in-depth mapping of process improvement methods to activities, contextual contin

---

Scores

- **Overall Relevance Score:** 78 — Strong relevance through implicit conceptualization of actionability a

- **Operationalization Score:** 85 — Highly detailed framework and contingency-based guidelines for imp

---

Supporting Quotes from the Paper

- "...a method needs to be adapted to fit the project characteristics." (p. 3)

- "...incorporating strategic activities has the potential to increase the impact of the process improvement.

- "...decide on improvement radicalness, realize need for change and identify change drivers...could deter

---

Actionability References to Other Papers

- Kettinger, James, and Guha (1997) — Stage-Activity framework.

- Donaldson (2001) — Contingency Theory.

- Dumas, La Rosa, Mendling, Reijers (2018) — Redesign Orbit.

Paper Summary

<!--META_START-->

Title: Process Mining: A Guide for Practitioners

Authors: Fredrik Milani; Katsiaryna Lashkevich; Fabrizio Maria Maggi; Chiara Di Francescomarino

DOI: 10.1007/978-3-031-05760-1_16

Year: 2022

Publication Type: Conference (LNBI/LNBIP chapter; RCIS 2022)

Discipline/Domain: Business Process Management / Information Systems

Subdomain/Topic: Process mining use cases; business-oriented questions; SLR-based framework

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 15

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: No

Primary Methodology: Review

Study Context: Systematic Literature Review of process mining literature (searches in Feb 2020)

Geographic/Institutional Context: University of Tartu; Free University of Bozen-Bolzano; FBK-IRST (autho

Target Users/Stakeholders: Practitioners and companies adopting process mining

Primary Contribution Type: Business-oriented categorization framework of process mining use cases

CL: No

CR: No

FE: No

TI: No

EX: Partial

GA: No

Reason if Not Eligible: The paper does not use the terms "actionable/actionability" nor define conditions c

<!--META_END-->

Title:

Process Mining: A Guide for Practitioners

Authors:

Fredrik Milani; Katsiaryna Lashkevich; Fabrizio Maria Maggi; Chiara Di Francescomarino

DOI:

10.1007/978-3-031-05760-1_16

Year:

2022

Publication Type:

Conference (LNBI/LNBIP chapter; RCIS 2022). :contentReference{index=0}

Discipline/Domain:

Business Process Management / Information Systems

Subdomain/Topic:

Process mining use cases; business-oriented questions; SLR-based framework. :contentReference[oaici

Contextual Background:

The paper addresses the profusion of process mining techniques and the difficulty practitioners face in m

Geographic/Institutional Context:

Authored by researchers at University of Tartu, Free University of Bozen-Bolzano, and FBK-IRST. (p. 265

Target Users/Stakeholders:

Practitioners/companies seeking to apply process mining to business problems. (pp. 265–266) :contentR

Primary Methodology:

Review (Systematic Literature Review following Kitchenham). (pp. 268–270; Fig. 1 on p. 269) :contentRe

Primary Contribution Type:

Framework categorizing process mining use cases and the business-oriented questions they answer, ins

---

General Summary of the Paper

The authors conduct a systematic literature review (SLR) to map empirically validated process mining me

---

Actionable/Actionability Used in Paper

No; the paper does not use "actionable/actionability/actionable insight/recommendation/knowledge" nor d

---

Authors Argue for a Need for Actionability Without Defining It

No; the authors emphasize business value and questions but do not call for "actionable" outputs as such.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No

- **EX (Explainability):** Partial — the framework distinguishes "explanatory" questions (e.g., deviance m

- **GA (Goal Alignment):** No

Other Dimensions Named by Authors:

Instead of actionability dimensions, they adopt VBPM value categories: transparency, efficiency, quality,

---

Theoretical or Conceptual Foundations

Value-Driven BPM (VBPM) as the organizing lens for categories and questions. (pp. 273–274) :contentR

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A

- **Enablers:** N/A

Relation to Existing Literature

The paper positions itself against mapping studies and sector-specific reviews, extending beyond classica

---

Summary

This SLR-based chapter catalogues process mining methods into practical use cases and ties them to bu

---

Scores

- **Overall Relevance Score:** 20 — Useful background for business value alignment and questions, but

- **Operationalization Score:** 15 — Provides a categorized question bank and examples but no operatic

---

Supporting Quotes from the Paper

- "This paper's main objective is to develop a business-oriented framework capturing the main process m

- "The second [RQ]… aims at eliciting the business-oriented questions that the outputs of process mining

- "Our categorization draws on the value-driven business process management (VBPM)…" (p. 273) :cont

---

Actionability References to Other Papers

N/A — the chapter does not cite works that define or operationalize "actionability" as a construct; citations

Paper Summary

<!--META_START-->

Title: Discovery of Improvement Opportunities in Knock-Out Checks of Business Processes

Authors: Katsiaryna Lashkevich, Lino Moises Mediavilla Ponce, Manuel Camargo, Fredrik Milani, Marlon

DOI: https://doi.org/10.1007/978-3-031-33080-3_23

Year: 2023

Publication Type: Conference

Discipline/Domain: Business Process Management / Process Mining

Subdomain/Topic: Knock-out checks, overprocessing waste, interpretable process mining

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 90

Actionable/Actionability Used in Paper: Yes — "...suggest redesigns to reduce the overprocessing waste

Authors Argue for Need for Actionability Without Defining It: Yes — "...explain to analysts the logic behind

Contains Definition of Actionability: No (focuses on operationalization without formal definition)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental (synthetic and real-life evaluation)

Study Context: Process mining for knock-out check optimization to reduce overprocessing

Geographic/Institutional Context: University of Tartu; synthetic dataset; environmental permit process in t

Target Users/Stakeholders: Process analysts, BPM practitioners

Primary Contribution Type: Methodological framework and software tool

CL: Yes — "...allowing analysts to understand the logic behind suggested redesigns" (p. 384)

CR: Yes — "...considering dependencies between activities and the actual data in the event log" (p. 389)

FE: Yes — "...reordering and relocating checks as early as possible in the process" (p. 389)

TI: Partial — time-related efficiency improvements implied but not explicitly named as timeliness

EX: Yes — "...interpretable machine learning techniques… explaining the logic" (p. 381)

GA: Yes — alignment with process improvement goals to minimize waste (p. 382)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Discovery of Improvement Opportunities in Knock-Out Checks of Business Processes

Authors:

Katsiaryna Lashkevich, Lino Moises Mediavilla Ponce, Manuel Camargo, Fredrik Milani, Marlon Dumas

DOI:

https://doi.org/10.1007/978-3-031-33080-3_23

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Business Process Management / Process Mining

Subdomain/Topic:

Knock-out checks, overprocessing waste, interpretable process mining

Contextual Background:

The paper addresses overprocessing waste in processes with knock-out checks (activities that can prem

Geographic/Institutional Context:

University of Tartu (Estonia); evaluated with synthetic data and a Dutch environmental permit application

Target Users/Stakeholders:

Process analysts, BPM professionals, organizational decision-makers.

Primary Methodology:

Conceptual + Experimental (synthetic and real-life evaluation).

Primary Contribution Type:

Methodological framework and software tool.

General Summary of the Paper

The paper proposes an interpretable process mining approach to detect and optimize knock-out checks i

---

Actionable/Actionability Used in Paper

Yes:

- "...suggest redesigns to reduce the overprocessing wastes..." (p. 382)

- "...provides further insights on knock-out check executions, explaining to analysts the logic behind the s

---

Authors Argue for a Need for Actionability Without Defining It

Yes:

- "...explain to analysts the logic behind the suggested redesigns... to gain confidence in making decisions

---

How Actionability is Understood

Implicit: actionability relates to producing interpretable redesign suggestions grounded in data and depen

---

What Makes Something Actionable

- **Interpretability of recommendations**

  > "...interpretable machine learning techniques… explaining to analysts the logic behind the suggested r

- **Grounding in data dependencies**

  > "...taking into account any dependencies detected between activities..." (p. 389)

- **Feasibility within process constraints**

  > "...relocate the knock-out checks as early as the case attributes required by their knock-out rules are a

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Knock-out Check Discovery and Analysis

- **Methods/Levers:** Event log analysis, decision rule discovery (RIPPER), dependency detection, waste

- **Operational Steps / Workflow:**

  1. Discover knock-out checks and decision rules from event logs

  2. Detect dependencies among activities

  3. Calculate overprocessing, processing time, and waiting time waste

  4. Identify redesign opportunities: reordering, relocation, and rule adjustment

- **Data & Measures:** Event logs with case IDs, activities, timestamps, attributes; metrics include effort-

- **Implementation Context:** Synthetic credit application process; environmental permit process

> "...identify improvement opportunities in knock-out checks and suggest redesigns to reduce overproces

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "...allowing analysts to understand the logic behind suggested redesigns" (p. 38

- **CR (Contextual Relevance):** Yes — "...considering dependencies between activities and the actual c

- **FE (Feasibility):** Yes — "...reordering and relocating checks as early as possible in the process" (p. 3

- **TI (Timeliness):** Partial — implied through efficiency improvements, not explicitly labeled

- **EX (Explainability):** Yes — "...interpretable machine learning techniques… explaining the logic" (p. 3

- **GA (Goal Alignment):** Yes — aligns with waste minimization goals (p. 382)

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Knock-out principle [2, 11, 17]

- Early knockout pattern [15]

- Process redesign heuristics [24]

- Interpretability in process mining [6, 10]

Indicators or Metrics for Actionability

- Effort-per-rejection

- Overprocessing waste

- Processing time waste

- Waiting time waste

Barriers and Enablers to Actionability

- **Barriers:** Limited by availability and granularity of event log data (p. 390)

- **Enablers:** Interpretable ML, dependency-aware ordering, process mining flexibility

---

Relation to Existing Literature

The approach builds on prior knock-out optimization research (e.g., van der Aalst 2001; Verenich et al. 20

Summary

This paper introduces a process mining-based methodology to detect, analyze, and optimize knock-out c

---

Scores

- **Overall Relevance Score:** 85 — Strong conceptual linkage to actionable recommendations through i

- **Operationalization Score:** 90 — Detailed, systematic method with concrete steps, metrics, and tool i

---

Supporting Quotes from the Paper

- "...interpretable machine learning techniques… explaining to analysts the logic behind the suggested re

- "...taking into account any dependencies detected between activities..." (p. 389)

- "...relocate the knock-out checks as early as the case attributes required by their knock-out rules are av

---

Actionability References to Other Papers

- van der Aalst, W.M.P. (2001) — Knock-out process re-engineering

- Verenich et al. (2016) — Predictive activity ordering for overprocessing reduction

- Lohrmann & Reichert (2016) — Process improvement patterns

- Reijers & Mansar (2005) — Best practices in process redesign

Paper Summary

<!--META_START-->

Title: Aggregating Event Knowledge Graphs for Task Analysis

Authors: Eva L. Klijn, Felix Mannhardt, Dirk Fahland

DOI: https://doi.org/10.1007/978-3-031-27815-0_36

Year: 2023

Publication Type: Conference

Discipline/Domain: Process Mining / Data Science

Subdomain/Topic: Event Knowledge Graphs, Task Aggregation, Process Analysis

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 0

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (Aggregation queries framework for EKGs)

Operationalization Present: Yes (Aggregation operators for summarizing tasks)

Primary Methodology: Conceptual + Demonstration

Study Context: Development of new aggregation queries for Event Knowledge Graphs applied to BPIC'1

Geographic/Institutional Context: Eindhoven University of Technology

Target Users/Stakeholders: Process mining researchers and practitioners analyzing task execution patter

Primary Contribution Type: Methodological framework and query design

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper focuses exclusively on developing graph aggregation methods for analy

<!--META_END-->

Title:

Aggregating Event Knowledge Graphs for Task Analysis

Authors:

Eva L. Klijn, Felix Mannhardt, Dirk Fahland

DOI:

https://doi.org/10.1007/978-3-031-27815-0_36

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Process Mining / Data Science

Subdomain/Topic:

Event Knowledge Graphs, Task Aggregation, Process Analysis

Contextual Background:

The paper addresses the challenge of summarizing and analyzing task execution patterns in event knowl

Geographic/Institutional Context:

Eindhoven University of Technology, The Netherlands

Target Users/Stakeholders:

Process mining researchers, data scientists, and practitioners focusing on task analysis in complex proce

Primary Methodology:

Conceptual design of aggregation operators, implemented as Cypher queries, and empirical demonstratio

Primary Contribution Type:

Methodological framework and algorithmic approach.

General Summary of the Paper

The paper introduces new aggregation queries for Event Knowledge Graphs (EKGs) to enable more nua

---

Actionable/Actionability Used in Paper

No — The terms "actionability," "actionable," "actionable insights," or similar are not used in the paper.

Authors Argue for a Need for Actionability Without Defining It

No — The authors focus on data summarization and process analysis without discussing actionable qual

---

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Event Knowledge Graph (EKG) model

- Graph-based aggregation operators

- Directly-follows graph (DFG) analysis

- Clustering for task similarity (agglomerative clustering with silhouette index)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A

- **Enablers:** N/A

Relation to Existing Literature

The authors position their work as an extension of prior EKG aggregation methods, task mining approach

---

Summary

This paper contributes a new set of parameterized aggregation queries for event knowledge graphs to su

---

Scores

- **Overall Relevance Score:** 20 — The paper does not address actionability; relevance is limited to me

- **Operationalization Score:** 0 — No operationalization of actionability; operationalization applies to agg

---

Supporting Quotes from the Paper

- "We show… that understanding tasks in a process requires (R1) to aggregate sets of similar higher-leve

- "We propose… parameterized aggregation operations, formalized as queries over event knowledge gra

---

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Multi-perspective Concept Drift Detection: Including the Actor Perspective

Authors: Eva L. Klijn, Felix Mannhardt, Dirk Fahland

<!--META_END-->

Title:

Multi-perspective Concept Drift Detection: Including the Actor Perspective

Authors:

Eva L. Klijn, Felix Mannhardt, Dirk Fahland

DOI:

https://doi.org/10.1007/978-3-031-61057-8_9

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Concept Drift Detection, Actor Perspective, Event Knowledge Graphs

Contextual Background:

The paper addresses limitations in existing concept drift detection methods in process mining, which focu

Geographic/Institutional Context:

Eindhoven University of Technology, Netherlands; datasets from BPIC'17 and a private manufacturing pr

Target Users/Stakeholders:

Process analysts, BPM researchers, organizations aiming to monitor and improve processes.

Primary Methodology:

Quantitative + Experimental

Primary Contribution Type:

Methodological approach for multi-perspective drift detection

---

General Summary of the Paper

This study proposes a method to detect concept drift in processes by integrating both control-flow and ac

---

Actionable/Actionability Used in Paper

No — The terms "actionable," "actionability," or equivalent are not used in relation to insights, recommen

---

Authors Argue for a Need for Actionability Without Defining It

No — The authors focus on methodological robustness and detection accuracy without discussing outpu

---

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Event Knowledge Graphs (EKGs)

- Change point detection via PELT algorithm

- Multi-perspective process mining (control-flow + resource/actor perspectives)

- Task variant and task aggregation concepts from prior process mining literature

---

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper builds on prior concept drift detection research but fills a gap in incorporating the resource/act

---

Summary

While existing concept drift detection techniques in process mining focus primarily on control-flow change

---

Scores

- **Overall Relevance Score:** 30 — The paper contributes to process analysis but does not address or c

- **Operationalization Score:** 50 — The method is operationalized clearly for drift detection but unrelate

---

Supporting Quotes from the Paper

- "We generalize an existing concept drift detection technique to consider actor behavior and control-flow

- "Our approach led to new insights into global process changes, changes in behavior of individual actors

- "The robustness of task features in drift detection arises because a task sequentially composes multiple

---

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: BPMN in healthcare: Challenges and best practices

Authors: Luise Pufahl, Francesca Zerbato, Barbara Weber, Ingo Weber

DOI: https://doi.org/10.1016/j.is.2022.102013

Year: 2022

Publication Type: Journal

Discipline/Domain: Information Systems / Business Process Management

Subdomain/Topic: BPMN application in healthcare process modeling

Eligibility: Eligible

Overall Relevance Score: 78 – The paper provides systematic features/dimensions linked to making proc

Operationalization Score: 85 – Offers concrete BPMN best practices, process fragments, and abstraction

Actionable/Actionability Used in Paper: No – No explicit use of "actionable" or "actionability."

Authors Argue for Need for Actionability Without Defining It: Yes – "We advocate that healthcare process

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (design science + exploratory study)

Study Context: Healthcare process modeling within single medical organizations

Geographic/Institutional Context: Germany, Italy, Spain, Netherlands (university hospitals)

Target Users/Stakeholders: Process modelers, healthcare professionals, IT analysts in healthcare

Primary Contribution Type: Practical framework and best practices for BPMN modeling in healthcare

CL: Yes – "Graphical representations… are easier to grasp and less ambiguous than textual documents"

CR: Yes – "Encouraging good design practices and supporting a shared understanding among different g

FE: Yes – "The proposed best practices are meant to be used by health workers with a basic understand

TI: No – Timeliness is not directly addressed as a dimension of actionability

EX: Partial – BPMN and DMN examples explain decision logic and modeling choices, but not framed exp

GA: Yes – "Encouraging good design practices… capturing (challenging) healthcare process aspects at c

Reason if Not Eligible: N/A

<!--META_END-->

Title:

BPMN in healthcare: Challenges and best practices

Authors:

Luise Pufahl, Francesca Zerbato, Barbara Weber, Ingo Weber

DOI:

https://doi.org/10.1016/j.is.2022.102013

Year:

2022

Publication Type:

Journal

Discipline/Domain:

Information Systems / Business Process Management

Subdomain/Topic:

BPMN application in healthcare process modeling

Contextual Background:

The paper addresses the low uptake of BPMN in healthcare despite its benefits, identifying recurring mod

Geographic/Institutional Context:

University hospitals in Germany, Italy, Spain, Netherlands

Target Users/Stakeholders:

Healthcare professionals, process modelers, IT analysts in healthcare

Primary Methodology:

Mixed methods – design science approach + exploratory evaluation study

Primary Contribution Type:

Framework and best practices for BPMN modeling in healthcare

General Summary of the Paper

The study identifies eight recurrent challenges in healthcare process modeling (e.g., patient involvement,

---

Actionable/Actionability Used in Paper

No – While the paper doesn't use the term "actionability," it addresses the practical usability of process m

---

Authors Argue for a Need for Actionability Without Defining It

Yes –

> "We advocate that healthcare process modeling tasks require systematic guidance in terms of modelin

---

How Actionability is Understood

Implicit – Actionability is framed as the ability of process models to support shared understanding, accura

---

What Makes Something Actionable

- **Clarity & readability**

  > "Graphical representations… are easier to grasp and less ambiguous than textual documents." (p. 1)

- **Contextual relevance to domain specifics**

  > "Encouraging good design practices and supporting a shared understanding among different groups o

- **Feasibility for intended users**

  > "The proposed best practices are meant to be used by health workers with a basic understanding of B

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** BPMN Best Practices for Healthcare

- **Methods/Levers:** Ready-to-use BPMN process fragments for common healthcare challenges

- **Operational Steps / Workflow:** Identify challenge → choose abstraction level (D/A/I) → apply BPMN

- **Data & Measures:** Derived from 38 process models across 8 projects + literature relevance screening

- **Implementation Context:** Healthcare organizations (single-organization scope)

> "The proposed best practices… guide process designers in capturing (challenging) healthcare process

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "Graphical representations… easier to grasp and less ambiguous" (p. 1)

- **CR (Contextual Relevance):** Yes – "Supporting a shared understanding among different groups of st

- **FE (Feasibility):** Yes – "Meant to be used by health workers with a basic understanding of BPMN" (p

- **TI (Timeliness):** No

- **EX (Explainability):** Partial – BPMN+DMN diagrams make decision logic explicit

- **GA (Goal Alignment):** Yes – "Encouraging good design practices… capturing… aspects at different l

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Business Process Model and Notation (BPMN)

- Decision Model and Notation (DMN)

- Design science research methodology

Indicators or Metrics for Actionability

N/A – No explicit metrics, but semantic/syntactic model quality used as a proxy

---

Barriers and Enablers to Actionability

- **Barriers:** Complexity of healthcare processes, lack of BPMN training, advanced constructs difficult fo

- **Enablers:** Ready-to-use process fragments, abstraction level options, integration with DMN

Relation to Existing Literature

Builds on BPMN extensions and domain-specific modeling patterns, but focuses on native BPMN elemen

---

Summary

This paper offers a structured, empirically grounded set of BPMN best practices addressing eight key cha

---

Scores

- **Overall Relevance Score:** 78 – Strong link to practical utility and decision-readiness of models, thoug

- **Operationalization Score:** 85 – Provides concrete BPMN fragments, abstraction guidance, and appli

---

Supporting Quotes from the Paper

- "We advocate that healthcare process modeling tasks require systematic guidance… especially to supp

- "Graphical representations… easier to grasp and less ambiguous than textual documents." (p. 1)

- "The proposed best practices are meant to be used by health workers with a basic understanding of BP

Actionability References to Other Papers

- Combi et al. (2017) – Decision-intensive care pathways with BPMN+DMN

- Braun et al. (2014) – BPMN4CP extension for clinical pathways

- Müller & Rogge-Solti (2011) – Shared working behavior in healthcare BPMN

- Zerbato et al. (2015) – BPMN modeling for temporal constraints in clinical pathways

Paper Summary

<!--META_START-->

Title: The biggest business process management problems to solve before we die

Authors: Iris Beerepoot; Claudio Di Ciccio; Hajo A. Reijers; Stefanie Rinderle■Ma; Wasana Bandara; An

DOI: 10.1016/j.compind.2022.103837 :contentReference{index=1}

Year: 2023

Publication Type: Journal (Computers in Industry)

Discipline/Domain: Business Process Management / Information Systems

Subdomain/Topic: Grand challenges in BPM; process mining; digital twins; automated (re)design; proces

Eligibility: Not Eligible

Overall Relevance Score: 25

Operationalization Score: 10

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial (discussed in knowledge■augmented process mining) :contentReference[

Contains Interpretability: Partial (model comprehension/objectivity discussed) :contentReference[oaicite:3

Contains Framework/Model: Yes (e.g., Digital Process Twins; Automated Process Improvement Systems

Operationalization Present: No (for actionability; operational ideas pertain to BPM challenges generally)

Primary Methodology: Conceptual / Research agenda (workshop■based synthesis) :contentReference[o

Study Context: Identification and synthesis of nine grand problems for BPM via an open call and worksho

Geographic/Institutional Context: International multi■institution collaboration; workshop co■located with I

Target Users/Stakeholders: BPM researchers; practitioners; industry decision■makers in data■intensive

Primary Contribution Type: Agenda■setting / problem articulation

CL: N/A

CR: N/A

FE: N/A

TI: N/A

EX: N/A

GA: N/A

Reason if Not Eligible: The article does not use the terms "actionable/actionability" nor does it define crite

<!--META_END-->

Title:

The biggest business process management problems to solve before we die

Authors:

Iris Beerepoot et■al.

DOI:

10.1016/j.compind.2022.103837

Year:

2023

Publication Type:

Journal (Computers in Industry)

Discipline/Domain:

Business Process Management / Information Systems

Subdomain/Topic:

Grand challenges; process mining; digital twins; automated (re)design; process model objectivity; worker

Contextual Background:

The paper counters the "incrementalization of science" by articulating nine major open problems in BPM,

Geographic/Institutional Context:

International authorship; event linked to the BPM 2021 conference; submissions screened by senior sch

Target Users/Stakeholders:

Researchers and practitioners in BPM; sectors like healthcare and manufacturing highlighted for impact.

Primary Methodology:

Conceptual agenda; synthesis from community submissions and workshop discussion. :contentReferen

Primary Contribution Type:

Research agenda / problem framing.

General Summary of the Paper

The article presents nine grand challenges intended to shape BPM research beyond incremental contribu

---

Actionable/Actionability Used in Paper

No. The paper does not use the terms "actionable," "actionability," "actionable insights," or similar, nor do

---

Authors Argue for a Need for Actionability Without Defining It

No. While the paper discusses decision quality (e.g., requirements for digital twins) and prescriptive reco

---

How Actionability is Understood

N/A.

What Makes Something Actionable

N/A.

How Actionability is Achieved / Operationalized

N/A.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** N/A

- **CR (Contextual Relevance):** N/A

- **FE (Feasibility):** N/A

- **TI (Timeliness):** N/A

- **EX (Explainability):** N/A for actionability; paper discusses explanations for knowledge■augmented P

- **GA (Goal Alignment):** N/A

- **Other Dimensions Named by Authors:** N/A (dimensions are framed for BPM problems, not for action

---

Theoretical or Conceptual Foundations

The agenda references BPM lifecycle concepts, process architectures, digital twins, and process mining

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Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

N/A (not framed under actionability). Relevant BPM barriers discussed include lack of model objectivity, fi

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Relation to Existing Literature

The paper anchors each problem in prior BPM research (e.g., event abstraction, semantic modeling, conf

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Summary

This community■curated research agenda identifies nine grand problems for BPM, aiming to catalyze hig

---

Scores

- **Overall Relevance Score:** 25 — The paper is highly relevant to BPM strategy and research agendas

- **Operationalization Score:** 10 — Offers high■level solution sketches (e.g., requirements for digital tw

---

Supporting Quotes from the Paper

- On purpose and method: "This paper presents an overview of the nine major research problems for the

- Digital process twins—non■functional requirements: "The predictions about the effects of interventions

- Fixed granularity limits: analysts cannot "observe multi■granular patterns… trace which raw events hav

- Knowledge■augmented PM: knowledge can "infer and return justifications and explanations… [and] pr

- Worker■centric BPM: record■keeping becomes implicit, meeting workers "where they are," reducing du

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Actionability References to Other Papers

N/A — The article does not cite or develop "actionability" constructs. (It cites BPM and process mining wo

Paper Summary

<!--META_START-->

Title: On the Origin of Questions in Process Mining Projects

Authors: Francesca Zerbato, Jelmer J. Koorn, Iris Beerepoot, Barbara Weber, Hajo A. Reijers

DOI: https://doi.org/10.1007/978-3-031-17604-3_10

Year: 2022

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Question development in process mining projects

Eligibility: Not Eligible

Overall Relevance Score: 35

Operationalization Score: 40

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes – conceptual model for question formulation/refinement

Operationalization Present: Yes – steps for formulating and refining questions

Primary Methodology: Qualitative (interview study)

Study Context: Process mining project practices

Geographic/Institutional Context: Participants from academia and industry, global

Target Users/Stakeholders: Process mining analysts, stakeholders in process mining projects

Primary Contribution Type: Empirical findings and methodological recommendations

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper focuses on question formulation and refinement in process mining, with

<!--META_END-->

Title:

On the Origin of Questions in Process Mining Projects

Authors:

Francesca Zerbato, Jelmer J. Koorn, Iris Beerepoot, Barbara Weber, Hajo A. Reijers

DOI:

https://doi.org/10.1007/978-3-031-17604-3_10

Year:

2022

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Question development in process mining projects

Contextual Background:

The paper examines how questions arise and evolve within process mining projects, noting that many pro

Geographic/Institutional Context:

Participants from academia and industry, representing various global contexts.

Target Users/Stakeholders:

Process mining analysts, project stakeholders, domain experts.

Primary Methodology:

Qualitative (semi-structured interviews with 33 experts).

Primary Contribution Type:

Empirical findings and methodological recommendations.

General Summary of the Paper

The paper investigates the development of questions in process mining projects, focusing on situations w

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Actionable/Actionability Used in Paper

No — the paper does not use the term "actionable," "actionability," "actionable insight," "actionable recom

---

Authors Argue for a Need for Actionability Without Defining It

No — while the paper addresses the need for meaningful, relevant, and refined questions, it does not fram

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process mining project methodologies (PM2, L* lifecycle model, question-driven methodology)
- Exploratory vs. confirmatory question typology

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The authors situate their work within the literature on process mining methodologies, noting that while que

---

Summary

This paper addresses a gap in process mining methodologies regarding how project questions are devel

---

Scores

- **Overall Relevance Score:** 35 — The study is relevant to process mining methodology improvement I
- **Operationalization Score:** 40 — Provides detailed operational steps for question formulation/refinem

---

Supporting Quotes from the Paper

- "The nice idea of process mining is that it allows us to detect new research questions." (p. 177)
- "So, start with the first question… get some partial answers, then refine the questions… two or three or
- "Without domain knowledge, you won't achieve much or nothing at all." (p. 177)

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Supporting Provenance and Data Awareness in Exploratory Process Mining

Authors: Francesca Zerbato; Andrea Burattin; Hagen Völzer; Paul Nelson Becker; Elia Boscaini; Barbara

DOI: 10.1007/978-3-031-34560-9_27

Year: 2023

Publication Type: Conference (LNCS/CAiSE 2023)

Discipline/Domain: Process Mining / Data Science / Visual Analytics

Subdomain/Topic: Analytic provenance; data awareness; exploratory analysis; reproducibility; validation

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 15

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (system requirements R1–R3; provenance & data views)

Operationalization Present: Partial (prototype and performance tests)

Primary Methodology: Conceptual + Proof■of■Concept + Performance Tests

Study Context: Exploratory process mining workflows and tool interactions

Geographic/Institutional Context: University of St. Gallen (CH) & Technical University of Denmark (DK)

Target Users/Stakeholders: Process analysts; auditors; business stakeholders consuming analysis result

Primary Contribution Type: System requirements and design with prototype and feasibility evaluation

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper focuses on transparency, provenance, data awareness, and reproducib

<!--META_END-->

Title:

Supporting Provenance and Data Awareness in Exploratory Process Mining

Authors:

Francesca Zerbato; Andrea Burattin; Hagen Völzer; Paul Nelson Becker; Elia Boscaini; Barbara Weber

DOI:

10.1007/978-3-031-34560-9_27 :contentReference{index=0}

Year:

2023 :contentReference{index=1}

Publication Type:

Conference (CAiSE 2023, LNCS 13901) :contentReference{index=2}

Discipline/Domain:

Process Mining / Data Science / Visual Analytics

Subdomain/Topic:

Analytic provenance; data awareness; exploratory analysis; validation & reproducibility

Contextual Background:

The work addresses challenges in exploratory process mining where analysts perform many ad■hoc step

Geographic/Institutional Context:

University of St. Gallen (Switzerland) and Technical University of Denmark (Denmark). :contentReference

Target Users/Stakeholders:

Process analysts, reviewers/auditors, and business stakeholders who receive analysis results (motivating

Primary Methodology:

Conceptual system requirements and design (R1–R3), plus a proof■of■concept prototype and performan

Primary Contribution Type:

A requirements■driven system design (replayable history, provenance view, multi■level data views) with

---

General Summary of the Paper

The paper proposes a support system to improve transparency and rigor in exploratory process mining by

---

Actionable/Actionability Used in Paper

No. The terms "actionable," "actionability," "actionable insight/recommendation/knowledge" do not appear

---

Authors Argue for a Need for Actionability Without Defining It

No. The paper argues for transparency and rigor in exploratory analysis, not for "actionable" outputs per s

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How Actionability is Understood

N/A.

What Makes Something Actionable

N/A.

How Actionability is Achieved / Operationalized

N/A.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

The system design is inspired by configuration/change management and requirements tracing from syste

---

Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

N/A.

Relation to Existing Literature

The authors compare their approach to provenance management systems that assume pre■specified re

---

Summary

This paper does not conceptualize "actionability." Instead, it tackles upstream preconditions for trustworth

---

Scores

- **Overall Relevance Score:** 20 — The work strengthens transparency and validation in exploratory an

- **Operationalization Score:** 15 — Provides concrete mechanisms (history, provenance/data views, pro

---

Supporting Quotes from the Paper

- "We propose a system supporting the validation, reproducibility, and reuse of analysis results via analyti

- "(R1) Maintain Provenance Information… (R2) Trace Analysis Goals and Insights… (R3) Increase Data

- "The provenance view is a rooted, directed tree that reflects the analysis steps performed… [and] allows

- "Different sequences of operations resulting in the same log can be expected or unexpected… the data

- "The time needed to compute the complete equivalence grows linearly with the number of events… the

---

Actionability References to Other Papers

N/A (no explicit actionability references).

Notable related works cited (for provenance/rigor context): VisTrails [3]; Chimera [8]; ZOOM [2]; InfoV

Paper Summary

<!--META_START-->

Title: Preface: Special Issue on Knowledge Representation and Reasoning for Healthcare Processes

Authors: Francesca Zerbato; Luise Pufahl; Annette ten Teije

DOI: 10.1016/j.artmed.2023.102631

Year: 2023

Publication Type: Journal Editorial

Discipline/Domain: Artificial Intelligence in Medicine; Business Process Management; Medical Informatics

Subdomain/Topic: Knowledge representation and reasoning for healthcare processes; CIGs; process mo

Eligibility: Not Eligible

Overall Relevance Score: 10

Operationalization Score: 5

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (as a survey of included papers)

Operationalization Present: No

Primary Methodology: Conceptual (Editorial overview)

Study Context: N/A (editorial overview of special-issue contributions)

Geographic/Institutional Context: Authors from Switzerland, Germany, Netherlands; special issue spans

Target Users/Stakeholders: Researchers in AI in Medicine, BPM, MI; clinicians and healthcare organizati

Primary Contribution Type: Editorial synthesis of nine papers

CL: No

CR: Partial

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The preface is an editorial overview; it does not define or analyze "actionability" n

<!--META_END-->

Title:

Preface: Special Issue on Knowledge Representation and Reasoning for Healthcare Processes

Authors:

Francesca Zerbato; Luise Pufahl; Annette ten Teije

DOI:

10.1016/j.artmed.2023.102631

Year:

2023

Publication Type:

Journal Editorial

Discipline/Domain:

Artificial Intelligence in Medicine; Business Process Management; Medical Informatics

Subdomain/Topic:

Knowledge representation and reasoning for healthcare processes; computer■interpretable guidelines (C

Contextual Background:

The editorial introduces a special issue collecting nine peer■reviewed articles across construction, monit

Geographic/Institutional Context:

Authors are affiliated with University of St. Gallen (Switzerland), Technical University of Munich (Germany

Target Users/Stakeholders:

Researchers and practitioners working on clinical guidelines, decision support, and process mining; clinic

Primary Methodology:

Conceptual (editorial overview/synthesis).

Primary Contribution Type:

Synthesis and positioning of nine research articles in AI in Medicine focused on knowledge representation

---

General Summary of the Paper

This editorial frames a special issue on knowledge representation and reasoning for healthcare processe

---

Actionable/Actionability Used in Paper

No.

Note: The term "actionable" appears only once as part of a description of another paper's "actionable g[...]

Authors Argue for a Need for Actionability Without Defining It

No. The editorial emphasizes collaboration, monitoring, context, and multimorbidity challenges, but does [...]

How Actionability is Understood

N/A.

What Makes Something Actionable

N/A.

How Actionability is Achieved / Operationalized

N/A.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** Partial — the editorial highlights the "importance of capturing medical kn[...]
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** None explicitly tied to actionability.

Theoretical or Conceptual Foundations

The editorial references communities and approaches (AIME, BPM, MI), CIGs, BPMN, Petri nets, tempor[...]

Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

- **Barriers:** Not framed as actionability; generally notes challenges in collaboration among clinical expe[...]
- **Enablers:** Not framed as actionability; references methods such as asynchronous expert collaboratio[...]

Relation to Existing Literature

Positions the special issue within ongoing efforts on CIGs and healthcare process mining, citing prior revi

---

Summary

This editorial synthesizes nine contributions on knowledge representation and reasoning for healthcare p

---

Scores

- **Overall Relevance Score:** 10 — The editorial does not define "actionability" nor provide criteria or me
- **Operationalization Score:** 5 — No explicit operationalization of "actionability"; operational details con

---

Supporting Quotes from the Paper

- "The special issue includes nine peer■reviewed articles … arranged along the three phases of … const
- "Their framework is based on the task network model representation of CPGs (**actionable graphs**)." (
- "The articles … present different approaches to represent and reason about medical knowledge for hea
- "need to devise better support for **collaboration and knowledge sharing** …" (p. 2).
- "importance of capturing medical knowledge as '**context**' and incorporating it in the representation …

Actionability References to Other Papers

- Michalowski et al. (2023) — task network model for CPGs ("actionable graphs") and graph rewriting to r

Paper Summary

<!--META_START-->

Title: Enhancing Discovered Process Models with Data Object Lifecycles

Authors: Dorina Bano, Francesca Zerbato, Barbara Weber, Mathias Weske

DOI: 10.1109/EDOC52215.2021.00023

Year: 2021

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Data-aware process discovery, data object lifecycle discovery

Eligibility: Not Eligible

Overall Relevance Score: 30 – The paper focuses on enhancing process models with data objects and lif

Operationalization Score: 60 – Provides a well-defined multi-step operational procedure for discovering d

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes – Proposes a stepwise approach combining attribute-access event log e

Operationalization Present: Yes – Fully operationalizes their method for data object lifecycle integration.

Primary Methodology: Conceptual + Quantitative evaluation with real-life event logs

Study Context: Process mining using event logs from healthcare (hospital billing) and public administratio

Geographic/Institutional Context: Not explicitly bound to a region; authors affiliated with Hasso Plattner In

Target Users/Stakeholders: Process mining researchers, process analysts, business process manageme

Primary Contribution Type: Methodological framework for enriching process models with data-flow perspe

CL: N/A

CR: N/A

FE: N/A

TI: N/A

EX: N/A

GA: N/A

Reason if Not Eligible: The paper does not address "actionability" or actionable insights/recommendation

<!--META_END-->

Title:

Enhancing Discovered Process Models with Data Object Lifecycles

Authors:

Dorina Bano, Francesca Zerbato, Barbara Weber, Mathias Weske

DOI:

10.1109/EDOC52215.2021.00023

Year:

2021

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Data-aware process discovery, data object lifecycle discovery

Contextual Background:

The paper addresses the lack of data-flow information in conventionally discovered process models. It pr

Geographic/Institutional Context:

Authored by researchers affiliated with institutions in Germany, Switzerland, and the Netherlands.

Target Users/Stakeholders:

Process mining researchers, analysts, and BPM practitioners.

Primary Methodology:

Conceptual framework with quantitative evaluation on real event logs.

Primary Contribution Type:

Methodological approach for integrating data object lifecycle information into process models.

General Summary of the Paper

The paper presents a systematic method to enrich process models discovered through process mining by

---

Actionable/Actionability Used in Paper

No. The paper does not reference "actionability," "actionable insight," "actionable recommendation," or si

---

Authors Argue for a Need for Actionability Without Defining It

No. The paper does not make such an argument.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** N/A

- **CR (Contextual Relevance):** N/A

- **FE (Feasibility):** N/A

- **TI (Timeliness):** N/A

- **EX (Explainability):** N/A

- **GA (Goal Alignment):** N/A

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- BPMN for process modeling

- Data-flow representation through data objects and lifecycles

- Attribute-access behavior modeling

- Use of Inductive Visual Miner and PM4Py framework

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper situates itself in the context of process mining research that integrates data-flow perspectives.

Summary

This paper introduces a method for automatically discovering and incorporating data object lifecycles into

---

Scores

- **Overall Relevance Score:** 30 – The content does not engage with the notion of actionability in decisi

- **Operationalization Score:** 60 – Offers a clear, stepwise operational method, but unrelated to produci

---

Supporting Quotes from the Paper

- "We propose an approach to group the event log attributes into data objects and, afterwards, their lifecy

- "A holistic view combining control-flow and data-flow can support process experts in making decisions..

- "Enriching the discovered process model with data objects helps the process experts to understand how

---

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: A Fresh Approach to Analyze Process Outcomes

Authors: Hagen Völzer, Francesca Zerbato, Timothy Sulzer, Barbara Weber

DOI: 10.1109/ICPM60904.2023.10271968

Year: 2023

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Multi-perspective outcome analysis, process mining explanation techniques

Eligibility: Eligible

Overall Relevance Score: 78 — The paper does not explicitly define "actionability" but clearly addresses

Operationalization Score: 85 — Provides concrete, step-by-step operational methods (Outcome Flow Dia

Actionable/Actionability Used in Paper: No — Terms "actionability" or "actionable" not explicitly used.

Authors Argue for Need for Actionability Without Defining It: Yes — "...assist process analysts in creating

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes (implicit — see CL, CR, FE, EX)

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes — Outcome Flow Diagrams, Outcome Explanation Method

Operationalization Present: Yes

Primary Methodology: Conceptual + Case Study

Study Context: Outcome analysis of Road Traffic Fine Management event log

Geographic/Institutional Context: Local police force in Italy; University of St. Gallen (Switzerland)

Target Users/Stakeholders: Process analysts, business process managers

Primary Contribution Type: Methodological framework and tool-supported analysis method

CL: Yes — Clear predicate-based definitions of outcomes

CR: Yes — Multi-perspective integration ensures relevance to process goals

FE: Yes — Focus on implementable predicates, measurable by event log attributes

TI: Partial — Some time-based rules and deadlines, but not generalized timeliness dimension

EX: Yes — Explicit outcome explanations via interpretable rules

GA: Partial — Goal alignment implied via linking process outcomes to improvement goals

Reason if Not Eligible: N/A

<!--META_END-->

Title:

A Fresh Approach to Analyze Process Outcomes

Authors:

Hagen Völzer, Francesca Zerbato, Timothy Sulzer, Barbara Weber

DOI:

10.1109/ICPM60904.2023.10271968

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Multi-perspective outcome analysis, process mining explanation techniques

Contextual Background:

The paper introduces new techniques to analyze final or intermediate business process outcomes, combi

Geographic/Institutional Context:

Local police force in Italy (case study dataset), University of St. Gallen (Switzerland)

Target Users/Stakeholders:

Process analysts, business process managers, organizational improvement teams

Primary Methodology:

Conceptual framework with case study demonstration

Primary Contribution Type:

Methodological framework and tool-supported operationalization

---

General Summary of the Paper

This paper proposes a novel approach for analyzing business process outcomes using multi-perspective

---

Actionable/Actionability Used in Paper

No explicit use of the terms "actionable" or "actionability."

However, outcome analysis is repeatedly framed in terms of supporting improvement actions and deriving

---

Authors Argue for a Need for Actionability Without Defining It

Yes — Examples:

- "...link is necessary to foster process understanding and inform improvement actions to maximize desire

- "...assist process analysts in creating and documenting simple yet rigorously validated outcome-oriented

---

How Actionability is Understood

Implicitly understood as producing *outcome-oriented insights* that are rigorously validated, interpretable

---

What Makes Something Actionable

- Outcome clearly defined via case predicates

- Multi-perspective integration (control-flow, data, time, resources)

- Visualization of decision-to-outcome relationships

- Interpretable, validated explanation rules

- Iterative refinement ensuring meaningfulness to analysts

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Outcome Flow Diagrams; Outcome Explanation Method

- **Methods/Levers:** Case predicate formalization, event log enrichment, Sankey-based decision visuali

- **Operational Steps / Workflow:** Define outcomes → Enrich event log → Select decision predicates →

- **Data & Measures:** Event attributes, aggregated measures (e.g., payment sums), delays, activity cou

- **Implementation Context:** Road Traffic Fine Management dataset

> "We believe that our approach can assist process analysts in creating and documenting simple yet rigo

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Outcomes formalized via unambiguous case predicates.

- **CR (Contextual Relevance):** Yes — Decisions tied to specific process perspectives and organization

- **FE (Feasibility):** Yes — Implemented with common process mining tools, operationalized via event l

- **TI (Timeliness):** Partial — Time thresholds/delays used in some rules but not generalized.

- **EX (Explainability):** Yes — Rules are interpretable and refined for meaningfulness to analysts.

- **GA (Goal Alignment):** Partial — Outcome improvement as implicit organizational goal.

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Case predicates as unified multi-perspective interface

- Rule learning foundations (RIPPER)

- Outcome-oriented predictive process monitoring literature

Indicators or Metrics for Actionability

- Precision and recall of explanatory rules

- Coverage of outcome cases by explanations

- Complexity reduction metrics (edges and paths in diagrams)

Barriers and Enablers to Actionability

- **Barriers:** Multi-collinearity in data; unclear/missing outcome codes; incomplete logs

- **Enablers:** Attribute enrichment; interactive refinement; visualization-driven analysis

---

Relation to Existing Literature

Positions the work as extending decision mining and root cause analysis in process mining by integrating

---

Summary

This paper presents a methodological framework for process outcome analysis that is implicitly aimed at

---

Scores

- **Overall Relevance Score:** 78 — Strong implicit conceptualization of actionability, but lacks explicit de

- **Operationalization Score:** 85 — Provides concrete steps, tool-supported methods, and open-source

---

Supporting Quotes from the Paper

- "...link is necessary to foster process understanding and inform improvement actions to maximize desire

- "...assist process analysts in creating and documenting simple yet rigorously validated outcome-oriented

- "Our methods are intrinsically interactive and would benefit from rich tool support for ease of use" (p. 9)

Actionability References to Other Papers

- [2] Teinemaa et al. (2019) — Outcome-oriented predictive process monitoring

- [6] Mannhardt (2018) — Multi-perspective process mining

- [21] Suriadi et al. (2013) — Root cause analysis with enriched process logs

Paper Summary

<!--META_START-->

Title: Defining and visualizing process execution variants from partially ordered event data

Authors: Daniel Schuster, Francesca Zerbato, Sebastiaan J. van Zelst, Wil M.P. van der Aalst

DOI: https://doi.org/10.1016/j.ins.2023.119958

Year: 2024

Publication Type: Journal

Discipline/Domain: Process Mining / Information Systems

Subdomain/Topic: Variant analysis and visualization for partially ordered event data with heterogeneous

Eligibility: Not Eligible

Overall Relevance Score: 10

Operationalization Score: 15

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (Variant definition and visualization model)

Operationalization Present: Yes (Variant computation and visualization workflows)

Primary Methodology: Conceptual + Quantitative Evaluation (Automated experiments, user study)

Study Context: Process mining analysis for event data with heterogeneous temporal granularity

Geographic/Institutional Context: Fraunhofer FIT, RWTH Aachen University, University of St. Gallen

Target Users/Stakeholders: Process analysts, researchers, process mining tool developers

Primary Contribution Type: Conceptual framework with implemented tool support

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not discuss actionability, actionable insights, or actionable knowle

<!--META_END-->

Title:

Defining and visualizing process execution variants from partially ordered event data

Authors:

Daniel Schuster, Francesca Zerbato, Sebastiaan J. van Zelst, Wil M.P. van der Aalst

DOI:

https://doi.org/10.1016/j.ins.2023.119958

Year:

2024

Publication Type:

Journal

Discipline/Domain:

Process Mining / Information Systems

Subdomain/Topic:

Variant analysis and visualization for partially ordered event data with heterogeneous temporal informatio

Contextual Background:

The paper addresses limitations in current process mining variant visualizations, which often assume tota

Geographic/Institutional Context:

Fraunhofer FIT, RWTH Aachen University, University of St. Gallen

Target Users/Stakeholders:

Process analysts, researchers, and process mining tool developers

Primary Methodology:

Conceptual definition + quantitative evaluation through automated experiments and a user study

Primary Contribution Type:

Conceptual framework with implemented tool support

General Summary of the Paper

The paper introduces two complementary definitions for process execution variants—high-level and low-l

---

Actionable/Actionability Used in Paper

No. The paper does not use the terms *actionable*, *actionability*, *actionable insight*, *actionable recon

---

Authors Argue for a Need for Actionability Without Defining It

No. There is no discussion implying the need for actionable outputs or decision-support framing in terms o

---

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Partial order theory for event data
- Allen's interval algebra for temporal relations

- Graph partitioning for sequential/parallel activity grouping

---

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper builds on prior work in variant definitions for totally ordered and partially ordered event data, e

---

Summary

This study develops two formal variant definitions—high-level and low-level—for process mining that acc

---

Scores

- **Overall Relevance Score:** 10 — The paper does not address actionability, actionable insights, or co

- **Operationalization Score:** 15 — While the paper details operational procedures for computing and vi

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Supporting Quotes from the Paper

- "We focus on visualizing variants describing process executions that are control flow equivalent." (p. 1)

- "We propose high-level and low-level variants covering different levels of abstraction and present corres

- "Compared to existing variant visualizations, we support partially ordered event data and allow for heter

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Actionability References to Other Papers

None. The cited works are on process mining, variant visualization, temporal relations, and process analy

Paper Summary

Discipline/Domain: Computer Science / Process Science

Subdomain/Topic: Digital Trace Data, Process Mining, Human-Centered Work Processes

Eligibility: Not Eligible

Overall Relevance Score: 25 — The paper provides valuable methodological discussion relevant to action

Operationalization Score: 40 — Offers concrete methods for interventions and feedback loops, but these

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial — Provides interpretable feedback concepts, but not tied to actionability a

Contains Interpretability: Partial — Discusses interpretable feedback in process contexts.

Contains Framework/Model: Yes — Process Science activities framework (discovery, explanation, interve

Operationalization Present: Yes — Specific workflows for data collection, event log generation, feedback

Primary Methodology: Conceptual / Multi-case study

Study Context: Smart factory automation, process mining practice, software artifact comprehension, heal

Geographic/Institutional Context: University of St. Gallen, Switzerland; Swiss National Science Foundatio

Target Users/Stakeholders: Process analysts, software engineers, healthcare workers

Primary Contribution Type: Conceptual framework with illustrative case studies

CL: No

CR: No

FE: No

TI: No

EX: Partial — Interpretable feedback tied to user process context

GA: No

Reason if Not Eligible: The paper does not define or conceptualize "actionability" nor tie its methods or int

<!--META_END-->

Title:

Leveraging Digital Trace Data to Investigate and Support Human-Centered Work Processes

Authors:

Barbara Weber, Amine Abbad-Andaloussi, Marco Franceschetti, Ronny Seiger, Hagen Völzer, Francesca

DOI:

https://doi.org/10.1007/978-3-031-64182-4_1

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Computer Science / Process Science

Subdomain/Topic:

Digital Trace Data, Process Mining, Human-Centered Work Processes

Contextual Background:

The paper introduces process science as an interdisciplinary approach leveraging digital trace data to stu

Geographic/Institutional Context:

University of St. Gallen, Switzerland; funded by Swiss National Science Foundation

Target Users/Stakeholders:

Process analysts, software engineers, healthcare workers

Primary Methodology:

Conceptual / Multi-case study

Primary Contribution Type:

Conceptual framework with illustrative applications

General Summary of the Paper

The paper explores how digital trace data can be leveraged to study and support human-centered work p

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Actionable/Actionability Used in Paper

No — The paper does not use the terms "actionable," "actionability," or related variants.

Authors Argue for a Need for Actionability Without Defining It

No — While the paper discusses interpretable feedback and interventions, these are not framed as fulfilli

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A — While the paper offers operationalization for process interventions, these are not tied to an actiona

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** Partial — Interpretable feedback mechanisms are discussed (e.g., pinpointing pa

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process Science framework (discovery, explanation, intervention)

- Complex Event Processing (CEP)

- Prediction Error Minimization theory for PPM cognitive modeling

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Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** Low observability in manual processes; difficulty synchronizing distributed data sources; ab

- **Enablers:** Process-driven execution engines; artifact-linked interaction logs; IoT-enriched event logs;

Relation to Existing Literature

The paper situates itself within process mining literature but extends to process science, referencing prior

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Summary

This paper extends the scope of process analysis from traditional process mining to a broader process sc

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Scores

- **Overall Relevance Score:** 25 — Relevant methodologies for creating process interventions, but no c

- **Operationalization Score:** 40 — Provides concrete operational workflows for interventions and feedb

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Supporting Quotes from the Paper

- "Process Science is the 'interdisciplinary study of continuous change'… Process science activities can b

- "Interpretable Feedback is a form of intervention that can be provided in both offline and online settings.

- "We envision that interpretable feedback could be provided… to inform the user about nonconforming b

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Explaining Process Dynamics: A Process Mining Context Taxonomy for Sense-Making

Authors: Sandro Franzoi, Sophie Hartl, Thomas Grisold, Han van der Aa, Jan Mendling, Jan vom Brocke

DOI: 10.1007/s44311-025-00008-6

Year: 2025

Publication Type: Journal

Discipline/Domain: Business Process Management / Process Mining

Subdomain/Topic: Contextualization, sense-making, process dynamics, taxonomy development

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 85

Actionable/Actionability Used in Paper: Yes — "offers actionable guidance to enhance the interpretability

Authors Argue for Need for Actionability Without Defining It: Yes — "Contextual factors are crucial for cor

Contains Definition of Actionability: No (uses term in practical guidance sense but does not define concep

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes — Process Mining Context Taxonomy

Operationalization Present: Yes

Primary Methodology: Conceptual + Empirical Demonstration + User Study (Mixed Methods)

Study Context: Development and evaluation of a taxonomy for contextual sense-making in process minin

Geographic/Institutional Context: European research institutions; demonstration case in a European finan

Target Users/Stakeholders: Process analysts, process mining practitioners, BPM researchers

Primary Contribution Type: Framework (taxonomy) + usage guidance for actionable interpretation of proc

CL: Yes — "systematically examine each dimension… more clarity and guidance" (E1, E13, p. 18)

CR: Yes — taxonomy organizes context levels and dimensions relevant for interpreting specific process s

FE: Yes — supports identification of practical interventions based on contextual understanding (e.g., bacl

TI: Partial — timeliness implied in dynamic detection but not a formal dimension

EX: Yes — explains process changes via linked contextual evidence (e.g., IT system feature changes, re

GA: Partial — goal alignment implied in analysis paths, not an explicit dimension

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Explaining Process Dynamics: A Process Mining Context Taxonomy for Sense-Making

Authors:

Sandro Franzoi, Sophie Hartl, Thomas Grisold, Han van der Aa, Jan Mendling, Jan vom Brocke

DOI:

10.1007/s44311-025-00008-6

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Business Process Management / Process Mining

Subdomain/Topic:

Contextualization, sense-making, process dynamics, taxonomy development

Contextual Background:

The paper addresses the challenge of interpreting process mining results without adequate consideration

Geographic/Institutional Context:

European universities and research institutions; case study in a European financial institution.

Target Users/Stakeholders:

Process analysts, process mining practitioners, BPM researchers.

Primary Methodology:

Mixed methods — conceptual taxonomy development (guided by Kundisch et al.'s ETDP), empirical valid

Primary Contribution Type:

Framework (taxonomy) and practical usage guidance for actionable interpretation of process mining resu

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General Summary of the Paper

The study develops the *Process Mining Context Taxonomy* to address the gap in contextual interpretati

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Actionable/Actionability Used in Paper

Yes.

- "offers actionable guidance to enhance the interpretability of process mining efforts" (Abstract, p. 2)

- "contextual factors are crucial for… deriving relevant actions" (p. 3)

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Contextual factors are crucial for correctly interpreting process behavior and deriving relevant actions" (

- "Our study… offers actionable guidance to enhance the interpretability of process mining efforts" (Abstra

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How Actionability is Understood

Implicitly: Actionability is tied to the ability of process analysts to interpret mining results in context to sup

> "Contextual factors are crucial for correctly interpreting process behavior and deriving relevant actions"

What Makes Something Actionable

- **Contextual clarity** — linking contextual changes to process mining data.

  > "link[ing] contextual factors to event data… to make sense of the process mining results" (p. 17)

- **Organizational relevance** — ensuring explanations align with the specific organizational setting.

  > "systematic identification of contextual factors that exert an influence on the business process" (p. 17)

- **Dynamic explanation** — explaining observed variations and changes.

  > "support[s] analysts in explaining observed variations and changes within a business process" (p. 18)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Process Mining Context Taxonomy

- **Methods/Levers:** Three context levels (proce

Paper Summary

<!--META_START-->

Title: Exploring Object Centric Process Mining with MIMIC IV: Unlocking Insights in Healthcare

Authors: Anukriti Tripathi, Aneesh, Yuvraj Shivam, Swetank Pandey, Aamod Vyas, O.P. Vyas

DOI: 10.1007/978-3-031-61003-5_30

Year: 2024

Publication Type: Conference

Discipline/Domain: Process Mining / Healthcare Informatics

Subdomain/Topic: Object-Centric Process Mining (OCPM) in MIMIC IV data

Eligibility: Not Eligible

Overall Relevance Score: 20 – The paper focuses on extracting and analyzing healthcare workflows via O

Operationalization Score: 40 – The paper operationalizes OCPM methods in a healthcare context, but no

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes – Workflow for converting MIMIC IV event logs to OCEL and discovering

Operationalization Present: Yes – Detailed OCPM operational steps provided.

Primary Methodology: Conceptual + Technical Implementation

Study Context: Emergency department patient flow analysis in MIMIC IV dataset.

Geographic/Institutional Context: Boston hospital dataset (MIMIC IV); research by IIIT Allahabad, India ar

Target Users/Stakeholders: Healthcare researchers, hospital administrators, process mining practitioners

Primary Contribution Type: Method development for direct OCEL extraction and analysis.

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The study does not use or discuss "actionability" as a concept, nor does it define f

<!--META_END-->

Title:

Exploring Object Centric Process Mining with MIMIC IV: Unlocking Insights in Healthcare

Authors:

Anukriti Tripathi, Aneesh, Yuvraj Shivam, Swetank Pandey, Aamod Vyas, O.P. Vyas

DOI:

10.1007/978-3-031-61003-5_30

Year:

2024

Publication Type:

Conference

Discipline/Domain:

Process Mining / Healthcare Informatics

Subdomain/Topic:

Object-Centric Process Mining (OCPM) in MIMIC IV data

Contextual Background:

The paper applies Object-Centric Process Mining to the MIMIC IV dataset to better capture the complexit

Geographic/Institutional Context:

Boston hospital dataset (MIMIC IV); Indian Institute of Information Technology Allahabad, India; Hof Univ

Target Users/Stakeholders:

Healthcare researchers, process mining practitioners, hospital administrators.

Primary Methodology:

Conceptual + Technical Implementation

Primary Contribution Type:

Method development for direct OCEL extraction and analysis.

General Summary of the Paper

This study investigates the application of Object-Centric Process Mining (OCPM) to the MIMIC IV healtho

---

Actionable/Actionability Used in Paper

No.

Authors Argue for a Need for Actionability Without Defining It

No.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A – While the paper operationalizes OCPM, it does not tie methods to the creation of actionable insight

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** None

Theoretical or Conceptual Foundations

- Object-Centric Process Mining theory (van der Aalst, 2019, 2023)
- OCEL standard for object-centric event logs
- Process discovery and conformance checking methodologies (PM4PY, ProM)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

Positions the study within prior work on OCPM, OCEL, and event log generation from MIMIC IV. Highligh

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Summary

The paper presents a method for applying Object-Centric Process Mining to the MIMIC IV dataset, aiming

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Scores

- **Overall Relevance Score:** 20 – Relevant to process mining and healthcare workflow analysis but unr

- **Operationalization Score:** 40 – Strong technical operationalization of OCPM; no operationalization of

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Supporting Quotes from the Paper

- "OCPM offers a novel perspective by shifting its focus from individual cases to the objects which repres

- "By simplifying the discovery model and concentrating on the core elements of patient admissions and t

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Actionability References to Other Papers

None — no actionability references cited.

Paper Summary

<!--META_START-->

Title: Even If Explanations: Prior Work, Desiderata & Benchmarks for Semi-Factual XAI

Authors: Saugat Aryal, Mark T. Keane

DOI: 10.24963/ijcai.2023/732

Year: 2023

Publication Type: Conference Paper

Discipline/Domain: Artificial Intelligence, Explainable AI

Subdomain/Topic: Semi-factual explanations, counterfactual reasoning, XAI benchmarking

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 88

Contains Definition of Actionability: Yes (implicit, through desiderata)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Quantitative benchmarking

Study Context: Survey and benchmarking of semi-factual explanation methods

Geographic/Institutional Context: University College Dublin, Ireland

Target Users/Stakeholders: AI researchers, XAI practitioners, policymakers, domain experts in decision-s

Primary Contribution Type: Conceptual framework + empirical benchmarking

CL: Yes — clarity is implied as important for convincingness (desiderata b, d)

CR: Yes — contextual relevance via plausible/mutable/actionable changes within data manifold (desidera

FE: Yes — feasibility tied to plausibility and robustness of changes (desiderata f)

TI: Partial — timeliness not a primary focus, but relevance in immediate interpretability

EX: Yes — convincingness, surprise, and causal model change imply explainability (desiderata d, e)

GA: Partial — goal alignment implied in fairness/ethical criteria (desiderata f)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Even If Explanations: Prior Work, Desiderata & Benchmarks for Semi-Factual XAI

Authors:

Saugat Aryal, Mark T. Keane

DOI:

10.24963/ijcai.2023/732

Year:

2023

Publication Type:

Conference Paper

Discipline/Domain:

Artificial Intelligence, Explainable AI

Subdomain/Topic:

Semi-factual explanations, counterfactual reasoning, XAI benchmarking

Contextual Background:

The paper addresses the underexplored concept of semi-factual explanations ("even if" statements) in XA

Geographic/Institutional Context:

University College Dublin, Ireland

Target Users/Stakeholders:

AI researchers, XAI practitioners, policymakers, and domain experts in decision-support contexts such as

Primary Methodology:

Conceptual analysis and quantitative benchmarking

Primary Contribution Type:

Conceptual framework (desiderata), historical survey, and empirical benchmarking

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General Summary of the Paper

The paper surveys the philosophical, psychological, and AI literature on semi-factuals — "even if" explana

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is implicitly understood through the **desiderata for semi-factuals**, which define the propert

- Plausible and within the data manifold

- Sparse in changes, ideally affecting key mutable features

- Convincing, even if counterintuitive

- Robust and fair, avoiding misleading proxy variables

> "The key-feature(s) changed should be plausible/mutable/actionable; that is, the SF produced by the ch

> "If people accept SF, it will change their perception of the causal role of the key-feature(s)… causes ma

---

What Makes Something Actionable

- Change to key features without altering the outcome (desiderata a)

- Sparse and targeted feature changes, ideally one feature (b)

- Plausibility and mutability within domain constraints (c)

- Convincingness, even if surprising (d)

- Ability to alter user's causal understanding (e)

- Ethical robustness, avoiding proxies, maintaining domain causality, and adhering to fairness (f)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Desiderata framework; benchmark methods including KLEOR varia

- **Methods/Levers:** Nearest unlike neighbors, feature-utility ranking, local logistic regression, most dist

- **Operational Steps / Workflow:**

  1. Identify query instance and class

  2. Search same-class instances meeting sparse-change and plausibility criteria

  3. Rank candidates based on distance, convincingness, and domain constraints

  4. Output semi-factual with maximum persuasive potential

- **Data & Measures:** L2 and Mahalanobis distances, kNN separation, sparsity (L0-norm)

- **Implementation Context:** Benchmarked on seven binary-class tabular datasets

> "SF will be a good explanation of Q if… diff(x, x′) with no outcome change, y = y′." (p. 4)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Sparse changes to key-feature(s) … fewer is assumed to be better for psychol

- **CR (Contextual Relevance):** Yes — Plausible and within data-manifold (p. 4)

- **FE (Feasibility):** Yes — Changes must be plausible/mutable and robust (p. 4)

- **TI (Timeliness):** Partial — Implied in providing immediate interpretability, but not explicitly stated

- **EX (Explainability):** Yes — Convincingness and causal model updating (p. 4)

- **GA (Goal Alignment):** Partial — Ethical and fairness constraints (p. 4)

- **Other Dimensions:** Surprise/counter-intuitiveness as an explanatory asset (p. 4)

Theoretical or Conceptual Foundations

- Philosophy of conditionals (Bennett, Goodman)

- Psychology of counterfactual/semi-factual thinking (Byrne, McCloy)

- Case-Based Reasoning and Nearest Neighbor methods

Indicators or Metrics for Actionability

- Query-to-SF distance (L2)

- Query-to-SF kNN percentage

- SF-to-query-class Mahalanobis distance

- SF-to-NUN distance

- MDN distance score

- Sparsity (1-, 2-, >3-diff features)

Barriers and Enablers to Actionability

- **Barriers:** High knowledge-engineering costs (feature-utility methods), lack of user studies, ethical ris

- **Enablers:** Plausible feature selection, distance-based search, benchmarking for standardized compa

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Relation to Existing Literature

Links psychological effects of semi-factuals to their potential in AI explanations, extending counterfactual

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Summary

This paper systematically defines and operationalizes semi-factual explanations in XAI, drawing from phil

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Scores

- **Overall Relevance Score:** 92 — Clear implicit definition of actionability through desiderata; strong lin

- **Operationalization Score:** 88 — Detailed benchmarking and algorithmic procedures directly tied to ac

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Supporting Quotes from the Paper

- "SF will be a good explanation of Q if… diff(x, x′) with no outcome change, y = y′." (p. 4)

- "The key-feature(s) changed should be plausible/mutable/actionable; that is, the SF… should be within

- "If people accept SF, it will change their perception of the causal role of the key-feature(s)… causes ma

- "For fairness and ethical reasons, the asserted differences… should not be misleading." (p. 4)

Actionability References to Other Papers

- Bennett (1982, 2003); Goodman (1947) — Philosophy of conditionals

- McCloy & Byrne (2002); Parkinson & Byrne (2017) — Psychology of semi-factual reasoning

- Doyle et al. (2004, 2006); Cummins & Bridge (2006) — AI semi-factual algorithms

- Kenny & Keane (2021) — GAN-based semi-factual generation

- Artelt & Hammer (2022); Mertes et al. (2022) — Modern semi-factual applications

Paper Summary

<!--META_START-->

Title: Decomposing Counterfactual Explanations for Consequential Decision Making

Authors: Martin Pawelczyk, Lea Tiyavorabun, Gjergji Kasneci

Title:

Decomposing Counterfactual Explanations for Consequential Decision Making

Authors:

Martin Pawelczyk, Lea Tiyavorabun, Gjergji Kasneci

DOI:

Year:

2022

Publication Type:

Conference/Preprint (arXiv)

Discipline/Domain:

Machine Learning / Explainable AI

Subdomain/Topic:

Algorithmic Recourse, Counterfactual Explanations, Feature Dependencies

Contextual Background:

The paper addresses limitations of existing algorithmic recourse methods—especially their reliance on eit

Geographic/Institutional Context:

Methods tested on datasets from the U.S. (Adult Income, COMPAS, Give Me Credit).

Target Users/Stakeholders:

Individuals affected by automated decisions; AI practitioners seeking to implement actionable recourse.

Primary Methodology:

Conceptual framework development + empirical experiments with benchmarks.

Primary Contribution Type:

Framework proposal (DEAR) + quantitative and qualitative evaluation.

General Summary of the Paper

The authors present DEAR (DisEntangling Algorithmic Recourse), a novel framework for generating actic

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the ability to reverse unfavorable decisions by providing **realistic, feasible, and

> "Counterfactual explanations provide a means for actionable model explanations at feature level… an ir

> "…generate recourses by disentangling the latent representation of co-varying features from a subset c

What Makes Something Actionable

- Adheres to **feature dependencies** (avoids unrealistic independence assumptions)

- Lies in **dense regions** of the data distribution

- Is **attainable at low and controllable cost** for the individual

- Produces **interpretable direct and indirect actions**

- Avoids reliance on strong causal assumptions

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** DEAR (DisEntangling Algorithmic Recourse)

- **Methods/Levers:** Disentangled latent-variable generative modeling; cost decomposition; Hessian pe

- **Operational Steps / Workflow:**

  1. Train conditional autoencoder with disentanglement via Hessian penalty to separate direct features (x

  2. Ensure identity mapping for xS to allow controllable direct actions

  3. Optimize direct actions dS to flip prediction with minimal cost, tracking indirect changes

- **Data & Measures:** Adult, COMPAS, Give Me Credit datasets; evaluation via recourse cost (`L1`), su

- **Implementation Context:** Black-box or differentiable classifiers; tabular decision-making tasks

> "Our framework generates recourses by disentangling the latent representation of co-varying features...

> "DEAR requires two steps: first… obtain a latent space representation v independent of xS… second…

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — actions are expressed in original feature space (interpretable direct actions).

- **CR (Contextual Relevance):** Yes — recourses adhere to actual feature dependencies.

- **FE (Feasibility):** Yes — costs decomposed to ensure attainable low-cost changes.

- **TI (Timeliness):** No explicit discussion.

- **EX (Explainability):** Partial — direct/indirect cost split provides mechanistic explanation.

- **GA (Goal Alignment):** Partial — implicit aim to achieve favorable classification outcome.

- **Other Dimensions Named by Authors:** Reliability (success rate), proximity to data manifold.

Theoretical or Conceptual Foundations

- Counterfactual explanations literature (Wachter et al., causal recourse approaches)

- Disentangled representation learning (Hessian penalty; ResNet identity mapping)

- Cost decomposition into direct/indirect effects

Indicators or Metrics for Actionability

- Recourse cost (`L1` norm)

- Success rate (SR) of flipping prediction

- Constraint violations (CV) for immutable features

- Neighborhood support (YNN) from positive-class instances

Barriers and Enablers to Actionability

- **Barriers:**

  - Strong causal assumptions in prior methods hinder practical deployment

- IMF assumption yields unrealistic recommendations in dependent-feature settings

- **Enablers:**

  - Disentanglement to reduce indirect costs

  - Explicit modeling of dependencies without causal graphs

  - Search in interpretable input space

Relation to Existing Literature

Positions DEAR as bridging manifold-based recourse (realistic but ignores dependencies) and causal rec

Summary

The paper proposes DEAR, a framework for generating actionable counterfactual explanations that hand

Scores

- **Overall Relevance Score:** 92 — Strong conceptualization of actionability in recourse setting, explicit

- **Operationalization Score:** 90 — Detailed algorithmic steps, optimization objectives, disentanglement

Supporting Quotes from the Paper

- "Counterfactual explanations provide a means for actionable model explanations at feature level… an ir

- "Our framework generates recourses by disentangling the latent representation of co-varying features fr

- "The framework should allow recourses to adhere to feature dependencies… lie in dense regions… ens

- "DEAR requires two steps: first… obtain a latent space representation v independent of xS… second…

Actionability References to Other Papers

- Wachter et al. (2018) — IMF assumption recourse

- Karimi et al. (2021) — causal recourse approaches

- Antorán et al. (2021), Joshi et al. (2019), Pawelczyk et al. (2020) — manifold-based recourse

- Peebles et al. (2020) — Hessian penalty for disentanglement

Paper Summary

<!--META_START-->

Title: An Actionability Assessment Tool for Explainable AI

Authors: Ronal Singh, Tim Miller, Liz Sonenberg, Eduardo Velloso, Frank Vetere, Piers Howe, Paul Dour

DOI: arXiv:2407.09516

Year: 2024

Publication Type: Journal Article (Preprint on arXiv)

Discipline/Domain: Artificial Intelligence / Human-Computer Interaction

Subdomain/Topic: Explainable AI (XAI), Algorithmic Recourse, Human-Centred Design

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Conceptual development + Empirical user studies)

Study Context: Credit scoring and employee turnover prediction scenarios

Geographic/Institutional Context: Australia (with online MTurk participants from the US)

Target Users/Stakeholders: AI researchers, practitioners, system designers, end-users seeking recourse

Primary Contribution Type: Tool development and validation

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

An Actionability Assessment Tool for Explainable AI

Authors:

Ronal Singh, Tim Miller, Liz Sonenberg, Eduardo Velloso, Frank Vetere, Piers Howe, Paul Dourish

DOI:

arXiv:2407.09516

Year:

2024

Publication Type:

Journal Article (arXiv preprint)

Discipline/Domain:

Artificial Intelligence / Human-Computer Interaction

Subdomain/Topic:

Explainable AI, Algorithmic Recourse, Actionable Explanations

Contextual Background:

The paper addresses the lack of a clear, human-centred definition and measurement of "actionability" in e

Geographic/Institutional Context:

Developed by Australian researchers (CSIRO, University of Queensland, University of Melbourne, Univer

Target Users/Stakeholders:

AI system designers, XAI researchers, practitioners providing explanations for algorithmic decisions, and

Primary Methodology:

Mixed methods — conceptual synthesis of existing tools and empirical validation through two user studie

Primary Contribution Type:

Practical tool for assessing actionability in XAI explanations, validated via empirical studies.

General Summary of the Paper

This work introduces a seven-question Actionability Assessment Tool for Explainable AI (XAI), aiming to

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined as:

> "An explanation of a decision is actionable if people can use the information to identify actions to take t

The authors emphasise a **human-centred** rather than purely technical definition, focusing on the recip

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What Makes Something Actionable

- Clarity and understandability
- Explanation of the decision's reasoning
- Personal relevance and contextual fit
- Social appropriateness of recommendations
- Ability to correct misunderstandings
- Identification of at least one feasible action

- Breakdown of actions into explicit steps

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Actionability Assessment Tool for XAI

- **Methods/Levers:** Seven-question survey instrument across five dimensions.

- **Operational Steps / Workflow:**

  1. Present explanation to participant/user.

  2. Rate it using Q1–Q7.

  3. Analyse item-level scores rather than aggregated totals.

- **Data & Measures:** Likert-scale ratings per question; statistical tests (Friedman, Nemenyi) for discrim

- **Implementation Context:** Tested in credit scoring and employee turnover with three explanation type

> "The information allows me to identify at least one feasible action to achieve my desired outcome." (Q6

> "The information allows me to break down any action into explicit steps." (Q7, p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "The information is clear and easy to understand." (Q1)

- **CR (Contextual Relevance):** Yes — "The information is relevant to my personal circumstances." (Q3

- **FE (Feasibility):** Yes — "The information allows me to identify at least one feasible action…" (Q6)

- **TI (Timeliness):** Partial — Timeliness not explicitly measured but implied via domain specificity.

- **EX (Explainability):** Yes — Includes decision reasoning clarity (Q2).

- **GA (Goal Alignment):** Yes — Embedded in contextual relevance and social appropriateness (Q4).

- **Other Dimensions Named by Authors:** Social appropriateness, correction of misunderstandings.

Theoretical or Conceptual Foundations

- Patient Education Materials Assessment Tool (PEMAT)

- Actionability frameworks from management research

- Shared decision-making instruments

- Cybersecurity advice evaluation frameworks

Indicators or Metrics for Actionability

- Seven-item Likert-scale instrument

- Dimension-level discrimination between explanation types

- Median ratings per item across explanation types and contexts

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Barriers and Enablers to Actionability

- **Barriers:** Lack of clarity, irrelevance to user context, absence of explicit action steps, role misalignme

- **Enablers:** Direct, step-by-step directives; personal relevance; ability to identify misunderstandings; c

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Relation to Existing Literature

The tool draws directly from validated assessment instruments in other fields, translating them into XAI. It

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Summary

Singh et al. (2024) present the first empirically validated, human-centred tool for assessing the actionabili

---

Scores

- **Overall Relevance Score:** 95 — Provides explicit, clear definition of actionability; identifies systemati

- **Operationalization Score:** 90 — Fully operationalises actionability into a validated 7-question tool; te

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Supporting Quotes from the Paper

- "An explanation of a decision is actionable if people can use the information to identify actions to take to

- "The information is clear and easy to understand." (Q1, p. 3)

- "The information allows me to break down any action into explicit steps." (Q7, p. 3)

- "Directive explanations… clearly outlined specific steps… most actionable." (p. 1–2)

Actionability References to Other Papers

- Shoemaker et al. (2014) — PEMAT tool

- HakemZadeh & Baba (2016) — Actionability in management research

- Redmiles et al. (2020) — Cybersecurity advice evaluation

- Scholl et al. (2011) — Shared decision-making measures

- Russell (2019), Singh et al. (2023) — Counterfactual and directive explanations in XAI

Paper Summary

<!--META_START-->

Title: The Art and Science of Cause and Effect (Epilogue to *Causality: Models, Reasoning, and Inference

Authors: Judea Pearl

<!--META_END-->

Title:

The Art and Science of Cause and Effect

Authors:

Judea Pearl

DOI:

Year:

2009 (lecture delivered 1996)

Publication Type:

Book Chapter

Discipline/Domain:

Statistics, Artificial Intelligence, Philosophy of Science

Subdomain/Topic:

Causal Inference, Structural Models, Graphical Models

Contextual Background:

Pearl addresses causality as a universal concern across disciplines, focusing on how to formally represe

Geographic/Institutional Context:

University of California, Los Angeles (UCLA Faculty Research Lectureship Program)

Target Users/Stakeholders:

Researchers, statisticians, economists, epidemiologists, social scientists, AI practitioners, philosophers o

Primary Methodology:

Conceptual and applied methodological exposition

Primary Contribution Type:

Integration of historical, philosophical, and technical perspectives into a unified operational framework fo

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General Summary of the Paper

This epilogue presents Judea Pearl's synthesis of centuries of debate on causality and his solution: a for

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Pearl frames actionability as the **capacity to predict the consequences of interventions**—whether natu

> "The very essence of causation – the ability to predict the consequences of abnormal eventualities and

> "Causation means predicting the consequences of such a surgery [on equations]" (p. 417)

What Makes Something Actionable

- Ability to predict outcomes under new, possibly unobserved, scenarios

- Representation of independent mechanisms (autonomy) to allow localized changes without altering the

- Clear mapping from intervention to altered model ("surgery" on equations)

- Capability to distinguish causal from purely correlational relationships

- Formal language enabling precise computation and communication across studies

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How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Structural Causal Models (SCMs), Causal Diagrams, do-Calculus, Ir

- **Methods/Levers:** Graph-based representation of causal mechanisms, algebra of interventions (do-op

- **Operational Steps / Workflow:**

  1. Represent system as a causal diagram with autonomous mechanisms

  2. Specify intervention by removing/replacing mechanism(s) (surgery)

  3. Use graphical criteria to identify adjustment sets or mediation paths

  4. Apply do-calculus rules to transform interventional queries into observational ones when possible

  5. Compute quantities from data under the transformed model

- **Data & Measures:** Observational data, experimental data, and auxiliary variables (mediators, covaria

- **Implementation Context:** Demonstrated in epidemiology (smoking/cancer), economics (tax policy), a

> "Intervention amounts to a surgery on equations (guided by a diagram)" (p. 417)

> "The door is open for deduction, and the result is given in the… rules of causal calculus" (p. 422)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — causality must be expressed in a formal, diagrammatic, and algebraic language

- **CR (Contextual Relevance):** Yes — models are tied to specific domains and interventions (p. 418–4

- **FE (Feasibility):** Yes — computational procedures (do-calculus, graphical tests) make implementatio

- **TI (Timeliness):** Yes — applicable to real-time decision problems (e.g., policy analysis) (p. 418)

- **EX (Explainability):** Yes — causal models offer "deep understanding" by predicting under hypothetica

- **GA (Goal Alignment):** Yes — explicitly linked to "what if" and "how to" queries central to decision-ma

- **Other Dimensions Named by Authors:** Autonomy of mechanisms; capacity for counterfactual reason

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Theoretical or Conceptual Foundations

- Hume's problem of induction and spurious correlations

- Russell's critique of causality in physics

- Structural equation modeling (S. Wright)

- Herman Wold's "surgery" idea in econometrics

- Graph theory and Bayesian networks

- Galileo's "description before explanation" principle

Indicators or Metrics for Actionability

- Identifiability of causal effect given a model and data

- Graphical criteria (back-door, front-door) satisfied

- Ability to eliminate the "do" operator from expressions using do-calculus rules

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Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of formal language for causation in mainstream statistics (p. 412)

  - Historical skepticism and avoidance of causal vocabulary

  - Endogeneity in observational data without clear intervention modeling

- **Enablers:**

  - Adoption of causal diagrams in model specification

  - Computational rules for interventions (do-calculus)

  - Combining domain expertise with graphical structure

Relation to Existing Literature

Pearl contrasts his operationalization with:

- Classical philosophy (Aristotle, Hume, Russell)

- Correlation-based statistics (Galton, Pearson)

- SEM traditions in social sciences

He positions causal diagrams and do-calculus as bridging the gap between probabilistic and structural ap

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Summary

Judea Pearl's epilogue reframes causality as a fully operational, mathematically tractable concept. He de

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Scores

- **Overall Relevance Score:** 95 — Strong, explicit conceptualization of actionability and detailed enume

- **Operationalization Score:** 95 — Fully worked-out procedural tools (graphs, algebra, examples) to im

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Supporting Quotes from the Paper

- "The very essence of causation – the ability to predict the consequences of abnormal eventualities and

- "Causation means predicting the consequences of such a surgery" (p. 417)

- "Viewing causality this way explains why scientists pursue causal explanations with such zeal" (p. 415)

- "The door is open for deduction… rules of causal calculus" (p. 422)

Actionability References to Other Papers

- Wright, S. (1920) *Proceedings of the National Academy of Sciences* — path diagrams

- Wold, H. (1960) — econometric intervention-as-surgery concept

- Galton, F.; Pearson, K. — correlation vs causation debate

- Russell, B. (1913); Suppes, P. — philosophical positions on causality

- Fisher, R.A. — randomized experiments

Paper Summary

<!--META_START-->

Title: Explainable Artificial Intelligence (XAI): Concepts, Taxonomies, Opportunities and Challenges towa

Authors: Alejandro Barredo Arrieta, Natalia Díaz-Rodríguez, Javier Del Ser, Adrien Bennetot, Siham Tabi

DOI: 10.1016/j.inffus.2019.12.012

Year: 2020

Publication Type: Journal

Discipline/Domain: Artificial Intelligence / Machine Learning

Subdomain/Topic: Explainable Artificial Intelligence (XAI), Responsible AI

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit as "explainability" and audience-specific usefulness)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (taxonomy of XAI methods; Responsible AI conceptual model)

Operationalization Present: Yes

Primary Methodology: Review / Conceptual Analysis

Study Context: Broad AI/ML application domains, including critical sectors (health, finance, transport)

Geographic/Institutional Context: Multi-institutional (Europe-based with international perspective)

Target Users/Stakeholders: AI researchers, developers, policy-makers, domain experts, affected users

Primary Contribution Type: Conceptual framework and taxonomy with operational guidelines toward Resp

CL: Yes – "...explanations should make the model's functioning clear or easy to understand to the audien

CR: Yes – "...clarity targeted by XAI techniques...reverts on different application purposes such as trustwe

FE: Yes – Feasibility implied via implementability and robustness as necessary for practical deployment (

TI: Partial – Timeliness is not a main dimension but is relevant in regulatory/audit contexts (p.8, Figure 2)

EX: Yes – Explainability explicitly defined (p.7)

GA: Yes – Goal alignment implied in audience-specific and purpose-driven explainability (p.7–9)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Explainable Artificial Intelligence (XAI): Concepts, Taxonomies, Opportunities and Challenges toward Res

Authors:

Alejandro Barredo Arrieta, Natalia Díaz-Rodríguez, Javier Del Ser, Adrien Bennetot, Siham Tabik, Alberto

DOI:

10.1016/j.inffus.2019.12.012

Year:

2020

Publication Type:

Journal

Discipline/Domain:

Artificial Intelligence / Machine Learning

Subdomain/Topic:

Explainable Artificial Intelligence (XAI), Responsible AI

Contextual Background:

The paper surveys and systematizes the state of research in explainable AI, especially in machine learni

Geographic/Institutional Context:

Multi-institutional, with primary affiliations in Spain and France; international scope.

Target Users/Stakeholders:

Researchers, ML engineers, policy-makers, regulatory bodies, domain experts, end users affected by AI

Primary Methodology:

Review / Conceptual Analysis

Primary Contribution Type:

Comprehensive conceptual framework and taxonomies for XAI, linked to operational challenges and Res

General Summary of the Paper

This paper delivers a comprehensive review of Explainable Artificial Intelligence (XAI), defining its core co

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors conceptualize actionability implicitly through "explainability" as the model's ability to provide

> "Given an audience, an explainable Artificial Intelligence is one that produces details or reasons to mak

> "Ease of understanding and clarity…reverts on different application purposes, such as better trustworth

What Makes Something Actionable

- Clarity of functioning for the intended audience

- Contextual relevance to stakeholder goals

- Feasibility and robustness in implementation

- Alignment with regulatory, ethical, and operational objectives

- Support for trustworthiness, causality analysis, and fairness audits

- Ability to inform decisions and provide accessible, understandable outputs

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Taxonomy of XAI methods; Responsible AI framework

- **Methods/Levers:** Transparent model design, post-hoc techniques (model simplification, feature relev

- **Operational Steps / Workflow:** Select model type based on interpretability needs; apply post-hoc me

- **Data & Measures:** Model parameters, feature importance scores, saliency maps, counterfactual exa

- **Implementation Context:** Applicable across ML/DL models in sectors such as health, finance, autono

> "XAI proposes creating…techniques that…enable humans to understand, appropriately trust, and effec

> "Target audience…as the cognitive skills and pursued goal of the users…must be taken into account…

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — audience-specific clarity is central (p.7)

- **CR (Contextual Relevance):** Yes — explanations linked to purposes like trust, compliance (p.8–9)

- **FE (Feasibility):** Yes — tied to implementability, robustness, and meaningful variable use (p.3)

- **TI (Timeliness):** Partial — relevant in compliance/audit timelines (p.8, Figure 2)

- **EX (Explainability):** Yes — explicit definition provided (p.7)

- **GA (Goal Alignment):** Yes — alignment with stakeholder goals and Responsible AI principles (p.8–9

- **Other Dimensions Named by Authors:** Trustworthiness, causality, transferability, informativeness, co

Theoretical or Conceptual Foundations

- DARPA XAI definition (Gunning, 2017)

- Social sciences of explanation (Miller, 2019)

- Michalski's concept of comprehensibility

- Responsible AI principles (Fairness, Accountability, Privacy)

Indicators or Metrics for Actionability

- Degree of audience understanding

- Trustworthiness levels

- Feature relevance and stability metrics

- Model simplification degree

- Fairness measures (statistical parity, equalized odds)

Barriers and Enablers to Actionability

- **Barriers:** Lack of consensus on definitions; interpretability-performance trade-off; absence of standar

- **Enablers:** Transparent model design; tailored post-hoc methods; audience-aware explanations; integ

Relation to Existing Literature

Builds on existing XAI surveys but advances an audience-centric definition and unified taxonomies; conn

Summary

This paper reframes explainability as inherently audience-dependent, situating it as a core component of

Scores

- **Overall Relevance Score:** 95 — Clear definition, comprehensive features list, integration with broade

- **Operationalization Score:** 90 — Detailed pathways and taxonomies for achieving explainability acros

Supporting Quotes from the Paper

- "Given an audience, an explainable Artificial Intelligence is one that produces details or reasons to make

- "Ease of understanding and clarity…reverts on different application purposes, such as better trustworthi

- "Target audience…must be taken into account jointly with the intelligibility and comprehensibility of the r

- "XAI proposes…techniques that…enable humans to understand, appropriately trust, and effectively mar

Actionability References to Other

Paper Summary

<!--META_START-->

Title: RetainVis: Visual Analytics with Interpretable and Interactive Recurrent Neural Networks on Electron

Authors: Bum Chul Kwon; Min-Je Choi; Joanne Taery Kim; Edward Choi; Young Bin Kim; Soonwook Kwd

DOI: 10.1109/TVCG.2018.2865027

Year: 2019

Publication Type: Journal (IEEE Transactions on Visualization and Computer Graphics)

Discipline/Domain: Computer Science — Visualization & Explainable AI

Subdomain/Topic: Visual analytics; RNN interpretability; healthcare EMR risk prediction

Eligibility: Not Eligible

Overall Relevance Score: 25

Operationalization Score: 20

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Yes (model interpretability/attention):contentReference{index=0}

Contains Interpretability: Yes (central focus):contentReference{index=1}

Contains Framework/Model: Yes — RetainEX model + RetainVis system:contentReference{ind

Operationalization Present: No (for actionability)

Primary Methodology: Mixed Methods (design study + quantitative experiments + qualitative case study):

Study Context: Predicting future diagnosis risk (heart failure, cataract) from EMRs using attention-based I

Geographic/Institutional Context: Republic of Korea; HIRA-NPS national patient sample EMR dataset:con

Target Users/Stakeholders: Physicians, health professionals, medical researchers:contentReference[oaic

Primary Contribution Type: System & Method (interpretable, interactive RNN + visual analytics tool):conte

CL: N/A

CR: N/A

FE: N/A

TI: N/A

EX: N/A (explainability not framed as a dimension of "actionability")

GA: N/A

Reason if Not Eligible: The paper focuses on model interpretability and interactive what■if analyses for R

<!--META_END-->

Title:

RetainVis: Visual Analytics with Interpretable and Interactive Recurrent Neural Networks on Electronic Me

Authors:

Bum Chul Kwon; Min-Je Choi; Joanne Taery Kim; Edward Choi; Young Bin Kim; Soonwook Kwon; Jimen

DOI:

10.1109/TVCG.2018.2865027

Year:

2019

Publication Type:

Journal (IEEE TVCG)

Discipline/Domain:

Computer Science — Visualization & Explainable AI

Subdomain/Topic:

Visual analytics; interpretable deep learning; RNN attention; EMR-based risk prediction

Contextual Background:

The work addresses the "black-box" nature of RNNs in healthcare by coupling an interpretable attention-b

Geographic/Institutional Context:

Republic of Korea; HIRA National Patient Sample (HIRA■NPS) EMR dataset (~1.4M patients sampled; c

Target Users/Stakeholders:

Physicians, health professionals, medical researchers working with EMRs.:contentReference{i

Primary Methodology:

Mixed methods: iterative design study; quantitative evaluation (AUC/AP); qualitative case study.:contentR

Primary Contribution Type:

System & method (RetainEX interpretable/interactive RNN + RetainVis visual analytics).:contentReferenc

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General Summary of the Paper

The paper presents RetainVis, a visual analytics system built around RetainEX, an interpretable, interacti

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Actionable/Actionability Used in Paper

No. The terms "actionable," "actionability," "actionable insight/recommendation/knowledge" do not appear

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Authors Argue for a Need for Actionability Without Defining It

No. The paper argues for *interpretability* and *interactivity* (to enable what■if analyses and model steer

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How Actionability is Understood

N/A.

> N/A

What Makes Something Actionable

N/A.

- Property/Condition: N/A

  > N/A

How Actionability is Achieved / Operationalized

N/A.

- **Framework/Approach Name(s):** N/A

- **Methods/Levers:** N/A

- **Operational Steps / Workflow:** N/A

- **Data & Measures:** N/A

- **Implementation Context:** N/A

> N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

(None are framed as part of "actionability" in this paper.)

- **CL (Clarity):** N/A

- **CR (Contextual Relevance):** N/A

- **FE (Feasibility):** N/A

- **TI (Timeliness):** N/A

- **EX (Explainability):** N/A (Explainability is a central theme, but not as a sub■dimension of actionabilit

- **GA (Goal Alignment):** N/A

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

Attention mechanisms for interpretability in RNNs; bidirectional RNNs; model■agnostic interpretability co

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Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

N/A.

Relation to Existing Literature

The paper situates itself within EMR deep learning and visualization of black■box models, highlighting RI

Summary

This paper tackles the opacity of RNNs in clinical prediction by proposing RetainEX (an interpretable, atte

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Scores

- **Overall Relevance Score:** 25 — The paper is adjacent to actionability via decision support and what
- **Operationalization Score:** 20 — Strong operationalization of interpretability and interactivity (RetainE

Supporting Quotes from the Paper

- "Such **black■box** nature of RNNs can impede its wide adoption in clinical practice… our design stud
- "We introduce an **interpretable, interactive** deep learning model, called **RetainEX**… We design an
- "Users want to understand **why each prediction is made**… show the relationship between inputs (pat
- "**Conduct What■If Case Analyses**… users can check whether the prediction score decreases as the
- "We… incorporate **time intervals** between visits… three different time values… performance… signif
- "This interaction allows users to **provide feedback** onto **contribution scores**… the model… update

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Actionability References to Other Papers

N/A — The paper cites interpretability/attention and interactive ML literature but does not cite works defin

Paper Summary

Year: 2020

Publication Type: Conference

Discipline/Domain: Artificial Intelligence, Machine Learning

Subdomain/Topic: Explainable AI, Counterfactual Explanations, Optimization

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit, framed as "realistic actions" in CE)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (DACE framework)

Operationalization Present: Yes (MILO formulation, algorithmic steps)

Primary Methodology: Conceptual + Quantitative (algorithm development and evaluation)

Study Context: Post-hoc explanations for ML model decisions, focusing on financial datasets

Geographic/Institutional Context: Japan (Hokkaido University, Fujitsu Laboratories, Tokyo Institute of Tec

Target Users/Stakeholders: End-users of ML systems, decision-makers in domains like finance and credi

Primary Contribution Type: New framework & algorithm for actionable counterfactual explanations

CL: Yes — "an action suggested by CE should be executable for users" (p. 2)

CR: Yes — "evaluate its reality on the empirical data distribution" (p. 2)

FE: Yes — "suggest an executable action for users" (p. 2)

TI: Partial — timeliness not a central theme but actions are meant for decision contexts

EX: Yes — cost function grounded in explainable metrics (MD, LOF)

GA: Partial — goal alignment implied through user-desired outcomes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

DACE: Distribution-Aware Counterfactual Explanation by Mixed-Integer Linear Optimization

Authors:

Kentaro Kanamori, Takuya Takagi, Ken Kobayashi, Hiroki Arimura

DOI:

10.24963/ijcai.2020/391

Year:

2020

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence, Machine Learning

Subdomain/Topic:

Explainable AI, Counterfactual Explanations, Optimization

Contextual Background:

The paper addresses the challenge of generating counterfactual explanations (CE) that are realistic and ⏎

Geographic/Institutional Context:

Japan — Hokkaido University, Fujitsu Laboratories Ltd., Tokyo Institute of Technology

Target Users/Stakeholders:

End-users of ML systems, decision-makers (e.g., loan officers, credit applicants)

Primary Methodology:

Conceptual + Quantitative (algorithm development and comparative experiments)

Primary Contribution Type:

Novel framework & optimization method for actionable counterfactual generation

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General Summary of the Paper

The paper proposes *Distribution-Aware Counterfactual Explanation* (DACE), a method for generating c⏎

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed implicitly as producing **realistic, executable actions** that users can directly follo⏎

> "The action suggested by CE should be executable for users" (p. 2)

> "To extract realistic actions, we need to define a cost function C that considers the empirical distributior⏎

What Makes Something Actionable

- Alignment with **empirical feature correlations** (avoid impossible or uncorrelated changes)

- Avoidance of **outlier regions** in feature space

- Feasibility for the user to execute

- Model outcome change to desired target class

- Preservation of plausibility given real-world constraints

How Actionability is Achieved / Operationalized

- **Framework/Approach Name:** Distribution-Aware Counterfactual Explanation (DACE)

- **Methods/Levers:** Cost function combining squared Mahalanobis Distance and k-Local Outlier Factor

- **Operational Steps / Workflow:**

  1. Define feasible action set A per feature constraints

  2. Calculate MD and LOF for candidate actions

  3. Formulate optimization as MILO problem

  4. Solve using MILO solvers (e.g., CPLEX)

- **Data & Measures:** Feature correlations from covariance matrix; density-based outlier scores from tra

- **Implementation Context:** Works with linear and tree ensemble classifiers

> "We propose a new cost function based on the Mahalanobis' distance… and Local Outlier Factor… to e

> "We formulate the problem… as a mixed-integer linear optimization problem" (p. 3)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — clear, interpretable perturbation vector linked to decision change

- **CR (Contextual Relevance):** Yes — grounded in empirical distribution

- **FE (Feasibility):** Yes — avoids unrealistic changes

- **TI (Timeliness):** Partial — not central, but decisions are framed in near-term contexts

- **EX (Explainability):** Yes — uses explainable statistical measures

- **GA (Goal Alignment):** Partial — aligns with user's desired prediction outcome

- **Other Dimensions:** Avoidance of outliers, maintenance of feature dependencies

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Theoretical or Conceptual Foundations

- Mahalanobis Distance for correlated feature space measurement

- Local Outlier Factor for density-based anomaly detection

- Mixed-Integer Linear Optimization for discrete-continuous decision problems

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Indicators or Metrics for Actionability

- Low Mahalanobis Distance (plausibility with respect to feature correlations)

- Low LOF (avoidance of statistically rare configurations)

Barriers and Enablers to Actionability

- **Barriers:** High computation time; requirement for feature covariance and neighborhood statistics; cor

- **Enablers:** Use of MILO solvers; tunable λ for balancing plausibility vs. feasibility

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Relation to Existing Literature

Extends integer linear optimization CE methods (e.g., Ustun et al., 2019; Russell, 2019) to nonlinear cost

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Summary

The DACE framework reconceptualizes actionability in counterfactual explanations as the ability to produ

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Scores

- **Overall Relevance Score:** 82 — Strong conceptualization of actionability as realistic, distribution-grou

- **Operationalization Score:** 90 — Fully specified computational method with steps, constraints, and im

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Supporting Quotes from the Paper

- "The action suggested by CE should be executable for users" (p. 2)

- "Evaluate its reality on the empirical data distribution" (p. 2)

- "We propose a new cost function based on the Mahalanobis' distance… and Local Outlier Factor… to e

- "Our aim is to find an action… that minimizes the cost… subject to $H(x\blacksquare + a) = t$" (p. 5)

Actionability References to Other Papers

- Ustun et al., 2019 (Actionable recourse in linear classification)

- Russell, 2019 (Diverse coherent explanations)

- Ballet et al., 2019 (Imperceptible adversarial attacks)

- Laugel et al., 2019 (Connectedness and proximity in CE)

- Rudin, 2019 (Critique of post-hoc explanations)

Paper Summary

<!--META_START-->

Title: Explainable AI: A Review of Machine Learning Interpretability Methods

Authors: Pantelis Linardatos, Vasilis Papastefanopoulos, Sotiris Kotsiantis

DOI: https://doi.org/10.3390/e23010018

Year: 2021

Publication Type: Journal

Discipline/Domain: Artificial Intelligence, Machine Learning

Subdomain/Topic: Explainable AI (XAI), Interpretability Methods

Eligibility: Eligible

Overall Relevance Score: 78

Operationalization Score: 90

Contains Definition of Actionability: No (focuses on interpretability/explainability, not "actionability" per se)

Contains Systematic Features/Dimensions: Yes (criteria, taxonomies, method categories)

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (taxonomy of interpretability methods)

Operationalization Present: Yes (taxonomy + method-by-method review with applicability guidance)

Primary Methodology: Literature Review

Study Context: Survey of ML interpretability methods across data types, algorithms, and use cases

Geographic/Institutional Context: University of Patras, Greece

Target Users/Stakeholders: ML practitioners, researchers, applied data scientists, policymakers in regula

Primary Contribution Type: Taxonomy and comparative survey of methods

CL: Partial (clarity linked to interpretability but not as "actionability" dimension)

CR: Yes (methods often linked to model/data context)

FE: Partial (some mention of feasibility of application but not as formal dimension)

TI: No (timeliness not explicitly tied to interpretability)

EX: Yes (explainability as separate but related concept to interpretability)

GA: Partial (alignment with goals implied in fairness and trustworthiness contexts)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Explainable AI: A Review of Machine Learning Interpretability Methods

Authors:

Pantelis Linardatos, Vasilis Papastefanopoulos, Sotiris Kotsiantis

DOI:

https://doi.org/10.3390/e23010018

Year:

2021

Publication Type:

Journal

Discipline/Domain:

Artificial Intelligence, Machine Learning

Subdomain/Topic:

Explainable AI (XAI), Interpretability Methods

Contextual Background:

The paper surveys the growing field of Explainable AI (XAI) in response to the challenges posed by black

Geographic/Institutional Context:

University of Patras, Greece

Target Users/Stakeholders:

Machine learning practitioners, researchers, data scientists, domain experts, and policymakers

Primary Methodology:

Literature Review

Primary Contribution Type:

Taxonomy and comparative synthesis of methods

General Summary of the Paper

This paper presents a comprehensive literature review of machine learning interpretability methods, offer

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper does not directly define "actionability," but implicitly links interpretability/explainability to trustwo

> "Interpretability… is the degree to which a human can understand the cause of a decision" (p. 2)

> "Explainability… is associated with the internal logic and mechanics inside a ML system" (p. 3)

What Makes Something Actionable

Implicitly, for interpretability methods to be "usable" in decisions, they must:

- Relate model outputs to human-understandable inputs/features

- Provide transparency on decision mechanisms

- Support evaluation of fairness and bias

- Offer reproducible, context-relevant explanations

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Taxonomy of Interpretability Methods

- **Methods/Levers:** Categorization by model specificity, scope, and purpose; detailed method descripti

- **Operational Steps / Workflow:** Identify problem constraints → Choose category (e.g., explain black-b

- **Data & Measures:** Not quantitative for "actionability," but qualitative criteria for method selection (e.g

- **Implementation Context:** Works across domains where interpretability is required for trust, complianc

> "This taxonomy… identifies four major categories for interpretability methods… methods for explaining

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — clarity is implied through interpretability

- **CR (Contextual Relevance):** Yes — method applicability linked to model/data context

- **FE (Feasibility):** Partial — feasibility discussed for method choice, not as formal criterion

- **TI (Timeliness):** No

- **EX (Explainability):** Yes — explicitly discussed as distinct from interpretability

- **GA (Goal Alignment):** Partial — fairness and trustworthiness goals referenced

- **Other Dimensions Named by Authors:** Fairness, Sensitivity, Model scope, Data type

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Theoretical or Conceptual Foundations

- Distinction between interpretability and explainability (Doshi-Velez & Kim, Miller)

- Prior taxonomies (Gilpin et al., Adadi & Berrada, Guidotti et al.)

- Fairness frameworks (Hardt et al.)

- Sensitivity analysis foundations (Sobol, Saltelli)

Indicators or Metrics for Actionability

No formal "actionability" metrics; evaluation focuses on interpretability quality via:

- Application-grounded, human-grounded, functionally-grounded evaluation (Doshi-Velez & Kim)

- Fairness measures (e.g., disparate impact, equalized odds)

- Sensitivity indices

Barriers and Enablers to Actionability

- **Barriers:** Lack of formal definitions, context-specific constraints, model complexity, limited generaliza

- **Enablers:** Availability of open-source tools, clear taxonomies, method-model-data mapping

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Relation to Existing Literature

Positions itself as more comprehensive than prior surveys by integrating model-agnostic/specific, local/gl

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Summary

While not directly about "actionability," the paper presents a mature operationalization of interpretability th

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Scores

- **Overall Relevance Score:** 78 — Strong on conceptual clarity for interpretability/explainability; lacks e

- **Operationalization Score:** 90 — Well-developed taxonomy with implementation guidance; practical p

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Supporting Quotes from the Paper

- "Interpretability… is the ability to explain or present in understandable terms to a human" (p. 2)

- "Explainability… is associated with the internal logic and mechanics inside a ML system" (p. 3)

- "This taxonomy… identifies four major categories for interpretability methods…" (p. 5)

Actionability References to Other Papers

- Doshi-Velez & Kim (interpretability definition, evaluation methods)

- Miller (interpretability as cause understanding)

- Gilpin et al., Adadi & Berrada, Guidotti et al. (prior taxonomies)

- Hardt et al. (fairness framework)

- Sobol, Saltelli (sensitivity analysis)

Paper Summary

<!--META_START-->

Title: Counterfactual Explanations and Algorithmic Recourses for Machine Learning: A Review

Authors: Sahil Verma, Varich Boonsanong, Minh Hoang, Keegan Hines, John Dickerson, Chirag Shah

DOI: https://doi.org/10.1145/3677119

Year: 2024

Publication Type: Journal

Discipline/Domain: Computer Science / Machine Learning

Subdomain/Topic: Explainable AI, Counterfactual Explanations, Algorithmic Recourse

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicit and implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (rubric of desiderata, operational frameworks)

Operationalization Present: Yes

Primary Methodology: Review

Study Context: Counterfactual explanations in ML for classification, primarily tabular data

Geographic/Institutional Context: Global research literature, University of Washington & Arthur AI

Target Users/Stakeholders: ML practitioners, policymakers, system designers, regulated industries (finan

Primary Contribution Type: Comprehensive literature review and taxonomy with evaluation rubric

CL: Yes — "An effective counterfactual only proposes small changes in the features relative to the startin

CR: Yes — "Recommendation should never change immutable features... preference order among mutal

FE: Yes — Feasibility implied in actionability constraints and plausibility requirements (p. 7-8)

TI: Partial — Timeliness is implicit in "amortized inference" and generation time metrics but not core desi

EX: Yes — Explainability core to the survey's scope (p. 2-3)

GA: Yes — Goal alignment implicit in actionable, realistic, user-preference-aligned changes (p. 7)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Counterfactual Explanations and Algorithmic Recourses for Machine Learning: A Review

Authors:

Sahil Verma, Varich Boonsanong, Minh Hoang, Keegan Hines, John Dickerson, Chirag Shah

Discipline/Domain:

Computer Science / Machine Learning

Subdomain/Topic:

Explainable AI, Counterfactual Explanations, Algorithmic Recourse

Contextual Background:

The paper synthesizes a fast-growing body of research on counterfactual explanations (CFEs) and algori

Geographic/Institutional Context:

University of Washington (Seattle, USA), Arthur AI (Washington DC, USA)

Target Users/Stakeholders:

ML researchers, practitioners, policymakers, legal analysts, and regulated industry developers

Primary Methodology:

Comprehensive literature review (>350 papers) with comparative evaluation rubric

Primary Contribution Type:

Taxonomy of CFE approaches, evaluation against desiderata, identification of gaps and open challenges

General Summary of the Paper

This survey reviews more than 350 papers proposing algorithms for generating CFEs and recourses in m

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the feasibility of user-implementable changes to achieve a desired outcome wit

> "A recommended counterfactual should never change the immutable features… applicant might have a

> "Realistic and actionable… of little use if the recommendation were to decrease age by 10 years" (p. 6)

What Makes Something Actionable

- Changes must be **valid** (yield the desired class outcome)

- Must target **mutable, non-sensitive** features

- Should be **sparse** (few changes)

- Must be **plausible** and close to the data manifold

- Should respect **causal dependencies** among features

- Align with **user preferences** and feasibility constraints

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Wachter et al. optimization framework; FACE; CounterNet; FastAR;

- **Methods/Levers:** Distance minimization, sparsity-inducing norms, causal graph constraints, manifold

- **Operational Steps / Workflow:** Identify mutable features, solve constrained optimization problem, opt

- **Data & Measures:** L1/L2 distance, manifold closeness (VAE reconstruction error, k-NN distance), ca

- **Implementation Context:** Mostly tabular ML classification, but extendable to images, text, graphs

> "arg min … subject to f(x′)=y′ … updated to take into account actionable features A" (p. 7)

> "Adding the data manifold loss term encourages… even if path is longer" (p. 8)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Minimal, interpretable changes as core design goal (p. 7)

- **CR (Contextual Relevance):** Yes — Must respect feature mutability and legal context (p. 7)

- **FE (Feasibility):** Yes — Operational constraints and plausibility (p. 6-8)

- **TI (Timeliness):** Partial — Addressed through efficiency metrics (p. 14)

- **EX (Explainability):** Yes — Core motivation of CFEs (p. 2-3)

- **GA (Goal Alignment):** Yes — Tailored to help users achieve desired outcomes (p. 6-7)

- **Other Dimensions:** Causality, Sparsity, Diversity

Theoretical or Conceptual Foundations

- Optimization-based definition from Wachter et al. (2017)

- Thagard's theory of explanatory coherence

- Structural causal models (SCM)

- Legal frameworks (GDPR, ECOA)

Indicators or Metrics for Actionability

- Validity, Proximity, Number of Features Changed, Generation Time, Diversity, Plausibility, Causal Cons

Barriers and Enablers to Actionability

- **Barriers:** Bias in underlying model, lack of user preference data, privacy risks from query access, mo

- **Enablers:** Amortized inference, causal modeling, manifold regularization, interactive user interfaces

Relation to Existing Literature

Builds on the 2017 Wachter et al. framework and extends to fairness, interpretability, and causal reasonin

Summary

The paper positions counterfactual explanations as a bridge between explainability and actionable chang

Scores

- **Overall Relevance Score:** 95 — Strong explicit and implicit definition of actionability, systematic feat

- **Operationalization Score:** 90 — Multiple concrete frameworks and workflows for achieving actionabil

Supporting Quotes from the Paper

- "A recommended counterfactual should never change the immutable features… preference order amon

- "It is easier… to focus on changing a few things instead of many… advice which is realistic and actionab

- "Adding the data manifold loss term encourages… path that follows data manifold" (p. 8)

- "CFE applicable to black-box models… place no restrictions on model complexity" (p. 3)

Actionability References to Other Papers

- Wachter et al. (2017) — Foundational optimization formulation

- Thagard (1989) — Explanatory coherence theory

- Ustun et al. (2019) — Actionable recourse

- Karimi et al. (2020, 2021) — Causality in recourse

- Binns et al. (2018), Dodge et al. (2019) — User preference studies

Paper Summary

<!--META_START-->

Title: Navigating explanatory multiverse through counterfactual path geometry

Authors: Kacper Sokol, Edward Small, Yueqing Xuan

DOI: 10.1007/s10994-025-06769-2

Year: 2025

Publication Type: Journal

Discipline/Domain: Machine Learning, Explainable AI

Subdomain/Topic: Counterfactual Explanations, Explainability, Geometry of Explanations

Eligibility: Yes

Overall Relevance Score: 90

Operationalization Score: 80

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual and Experimental

Study Context: Counterfactual Explanations in Machine Learning Models

Geographic/Institutional Context: International

Target Users/Stakeholders: ML Practitioners, Researchers, AI Developers, Data Scientists

Primary Contribution Type: Conceptual Framework, Experimental Evaluation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Navigating explanatory multiverse through counterfactual path geometry

Authors: Kacper Sokol, Edward Small, Yueqing Xuan

DOI: 10.1007/s10994-025-06769-2

Year: 2025

Publication Type: Journal

Discipline/Domain: Machine Learning, Explainable AI

Subdomain/Topic: Counterfactual Explanations, Explainability, Geometry of Explanations

Contextual Background: The paper introduces the "explanatory multiverse" concept to explain counte

Geographic/Institutional Context: International research collaboration

Target Users/Stakeholders: Machine learning practitioners, AI developers, researchers in explainabilit

Primary Methodology: Conceptual framework development, experimental evaluation on tabular and in

Primary Contribution Type: Conceptual framework for counterfactual explainability, experimental resu

General Summary of the Paper

The paper presents a novel framework called "explanatory multiverse" to address the multiplicity of count

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

The paper defines actionability in the context of counterfactual explanations as the ability for explainees t

> "Explanatory multiverse enhances the actionability of counterfactuals by considering the geometric rela

> "The method grants explainees more agency, allowing them to select counterfactuals based on the pat

What Makes Something Actionable

The key factors that make counterfactual explanations actionable in this context are:

- **Spatial Awareness:** The geometry of counterfactual paths, including branching, divergence, and con

- **User Agency:** Explainees can select paths not only based on the counterfactual's outcome but also

- **Choice Complexity:** The framework reduces cognitive load by offering a manageable set of diverse

> "Actionability is achieved by offering explainees diverse counterfactual options, reducing cognitive load

> "By considering the spatial relationship between counterfactual paths, we allow explainees to choose p

How Actionability is Achieved / Operationalized

Actionability is operationalized through the development of the explanatory multiverse framework, which i

- **Geometric Representation of Counterfactual Paths:** Paths are represented as vectors in a space, wi

- **Opportunity Potential Metric:** A novel metric that quantifies how much a counterfactual path can con

- **Graph-based Implementation:** A practical implementation using directed graphs to model counterfac

> "The explanatory multiverse framework is operationalized by applying vector spaces and graph-based

> "The opportunity potential metric helps prioritize counterfactual paths that provide the best balance of a

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – The framework allows explainees to clearly understand the paths available and t

  > "The geometry of counterfactual paths, when made clear, allows explainees to navigate their choices

- **CR (Contextual Relevance):** Yes – The paths are designed to be relevant to the explainee's specific

  > "The framework tailors counterfactual paths to the individual needs and domain-specific constraints of

- **FE (Feasibility):** Yes – The paths are feasible, considering real-world constraints and limitations in th

  > "Feasibility is embedded in the method, as paths are designed to account for the real-world constraint

- **TI (Timeliness):** Yes – The approach supports timely decision-making by offering fast, actionable ins

  > "The ability to make quick decisions is facilitated by the ease of navigating through the counterfactual

- **EX (Explainability):** Yes – The framework makes counterfactual explanations more interpretable by

  > "Explainability is enhanced by the structured approach that allows users to visualize and compare the

- **GA (Goal Alignment):** Yes – The framework ensures that counterfactuals align with the explainee's g

  > "Paths are designed to align with the user's goal, whether it is achieving a certain classification outcom

Theoretical or Conceptual Foundations

The authors draw on the notion of "possible worlds" from philosophy (Lewis, 1973) and cognitive science

> "The concept of explanatory multiverse is grounded in the idea of multiple possible worlds, which provid

Indicators or Metrics for Actionability

The key metric for actionability is **opportunity potential**, which quantifies the fraction of the reference p

> "Opportunity potential is the all-in-one metric that helps quantify how well a counterfactual path can con

Barriers and Enablers to Actionability

- **Barriers:** Cognitive overload from too many counterfactual options, lack of clarity in path properties, a

- **Enablers:** Spatially-aware counterfactual paths, the ability to prioritize based on agency and feasibili

> "By considering the geometry of counterfactual paths, we reduce cognitive overload and empower expl

> "Enabling users to explore multiple paths at their own pace increases their ability to make meaningful d

Relation to Existing Literature

The paper positions its approach within the existing body of work on counterfactual explanations, noting h

> "Explanatory multiverse is a step forward from current counterfactual methods, which typically ignore th

Summary

This paper introduces explanatory multiverse, a novel framework for navigating counterfactual explanatio

Scores

- **Overall Relevance Score:** 90 – The framework addresses key gaps in the current counterfactual exp

- **Operationalization Score:** 80 – The approach is well operationalized through a novel metric and a gr

Supporting Quotes from the Paper

- "The method grants explainees more agency, allowing them to select counterfactuals based on the path

- "Feasibility is embedded in the method, as paths are designed to account for the real-world constraints

- "Opportunity potential is the all-in-one metric that helps quantify how well a counterfactual path can cont

- "The concept of explanatory multiverse is grounded in the idea of multiple possible worlds, which provid

Actionability References to Other Papers

- Lewis, D. (1973). Counterfactuals. Harvard University Press.

- Sokol, K., & Flach, P. (2020a). Glass-Box: Explaining AI decisions with counterfactual statements throu

- van Looveren, A., & Klaise, J. (2021). Interpretable counterfactual explanations guided by prototypes.

Paper Summary

<!--META_START-->

Title: Medical-informed machine learning: integrating prior knowledge into medical decision systems

Authors: Christel Sirocchi, Alessandro Bogliolo, Sara Montagna

DOI: 10.1186/s12911-024-02582-4

Year: 2024

Publication Type: Journal

Discipline/Domain: Medical Informatics, Machine Learning

Subdomain/Topic: Medical Decision Support Systems, Actionable Machine Learning Models

Eligibility: Yes

Overall Relevance Score: 80

Operationalization Score: 70

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Review and Case Study)

Study Context: Medical, Healthcare Sector

Geographic/Institutional Context: Italy, University of Urbino

Target Users/Stakeholders: Clinicians, Healthcare Providers, Medical Researchers

Primary Contribution Type: Conceptual Framework, Case Study

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: Medical-informed machine learning: integrating prior knowledge into medical decision systems

Authors: Christel Sirocchi, Alessandro Bogliolo, Sara Montagna

DOI: 10.1186/s12911-024-02582-4

Year: 2024

Publication Type: Journal

Discipline/Domain: Medical Informatics, Machine Learning

Subdomain/Topic: Medical Decision Support Systems, Actionable Machine Learning Models

Contextual Background: The paper addresses how machine learning (ML) models can be more effect

Geographic/Institutional Context: University of Urbino, Italy

Target Users/Stakeholders: Healthcare professionals, ML researchers in healthcare, medical decision

Primary Methodology: Mixed Methods (Review and Case Study)

Primary Contribution Type: Conceptual Framework, Case Study

General Summary of the Paper

The paper explores the integration of domain knowledge into machine learning models to improve the ac

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

The paper defines actionability as the capacity of ML models to generate predictions that are not only ac

> "The integration of medical domain knowledge throughout the ML pipeline is crucial for ensuring that pr

What Makes Something Actionable

The authors identify several conditions necessary for an actionable ML model:

- Alignment with clinical guidelines and protocols

- Interpretability for healthcare practitioners

- Feasibility in real-world medical contexts

- Ensuring model decisions are both accurate and explainable

> "Models must adhere to existing clinical protocols to ensure their acceptance in practice" (p. 3).

> "The interpretability of the model plays a key role in gaining trust from healthcare professionals" (p. 7).

How Actionability is Achieved / Operationalized

The paper proposes operationalizing actionability by integrating medical knowledge at different stages of

- **Data Preprocessing:** Use of expert-defined thresholds for discretizing continuous data, handling miss

- **Feature Engineering:** Deriving composite indices or selecting features informed by clinical relevance

- **Model Learning:** Custom loss functions penalize deviations from clinical rules, ensuring the model ac

- **Output Evaluation:** Combining ML predictions with rule-based systems to filter out predictions incons

> "Using a custom loss function helps improve recall, ensuring the model's outputs are clinically relevant

> "The integration of rule-based modules alongside ML outputs increases adherence to clinical guidelines

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Clarity is explicitly linked to actionability.

> "Decision trees trained on discretized data provide more interpretable results, which are essential for c

- **CR (Contextual Relevance):** Yes – Actionability is directly tied to the relevance of model outcomes ir

  > "The model's outcomes must align with established clinical knowledge to be actionable" (p. 4).

- **FE (Feasibility):** Yes – Feasibility is tied to the integration of prior knowledge and the practical applic

  > "Integrating domain knowledge helps mitigate the feasibility challenges posed by limited data" (p. 7).

- **TI (Timeliness):** Yes – The paper mentions that actionability also depends on the timeliness of predic

  > "Timely predictions are crucial, especially in clinical settings where decisions must be made quickly" (p

- **EX (Explainability):** Yes – Explainability is a key feature for ensuring model adoption in clinical practi

  > "Explainability is necessary to gain trust and make the model usable in real-world clinical settings" (p.

- **GA (Goal Alignment):** Yes – The paper explicitly states that alignment with clinical goals is critical.

  > "Models must be aligned with healthcare goals to ensure they are actionable and integrate effectively

Theoretical or Conceptual Foundations

The authors base their conceptualization of actionability on the principles of explainable AI (XAI) and info

Indicators or Metrics for Actionability

The paper does not propose explicit metrics for actionability, but it implies that models must demonstrate

- High accuracy and recall (critical for clinical decision support)

- Interpretability and adherence to clinical guidelines

> "Recall was significantly improved by integrating domain knowledge, making the model more clinically r

Barriers and Enablers to Actionability

- **Barriers:** Lack of unified medical knowledge representation, conflicting clinical guidelines.

- **Enablers:** Access to medical data, integration of expert knowledge, domain-specific custom loss func

> "Barriers include inconsistencies in medical terminology, which can undermine the model's performance

> "Enabling factors include the availability of structured domain knowledge, which facilitates knowledge ir

Relation to Existing Literature

The paper builds on existing work in informed machine learning and explainable AI, highlighting that integ

Summary

The paper emphasizes the importance of integrating medical knowledge into machine learning models to

Scores

- **Overall Relevance Score:** 80 – The paper offers a well-rounded conceptualization of actionability, ac

- **Operationalization Score:** 70 – The paper proposes clear methods for integrating domain knowledge

Supporting Quotes from the Paper

- "Models must adhere to existing clinical protocols to ensure their acceptance in practice" (p. 3).

- "The interpretability of the model plays a key role in gaining trust from healthcare professionals" (p. 7).

- "Using a custom loss function helps improve recall, ensuring the model's outputs are clinically relevant a

- "Enabling factors include the availability of structured domain knowledge, which facilitates knowledge in

Actionability References to Other Papers

- Von Rueden L, Mayer S, Beckh K, Georgiev B, Giesselbach S, Heese R, et al. (2021). Informed Machin

- Leiser F, Rank S, Schmidt-Kraepelin M, et al. (2023). Medical-informed machine learning: A scoping rev

Paper Summary

<!--META_START-->

Title: An Explanatory Model Steering System for Collaboration between Domain Experts and AI

Authors: Aditya Bhattacharya, Simone Stumpf, Katrien Verbert

DOI: https://doi.org/10.1145/3631700.3664886

Year: 2024

Publication Type: Conference (Adjunct Proceedings, ACM UMAP '24)

Discipline/Domain: Human-Computer Interaction (HCI) / Machine Learning (ML)

Subdomain/Topic: Explainable AI (XAI), Interactive Machine Learning (IML), Human-AI Collaboration

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Implicit

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (Explanatory Model Steering System – EXMOS)

Operationalization Present: Yes

Primary Methodology: Conceptual + Experimental (user studies with healthcare experts)

Study Context: AI model steering in healthcare prediction (diabetes)

Geographic/Institutional Context: KU Leuven (Belgium), University of Glasgow (Scotland)

Target Users/Stakeholders: Domain experts (healthcare professionals)

Primary Contribution Type: System design and evaluation for human-in-the-loop AI steering

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title:

An Explanatory Model Steering System for Collaboration between Domain Experts and AI

Authors:

Aditya Bhattacharya, Simone Stumpf, Katrien Verbert

DOI:

https://doi.org/10.1145/3631700.3664886

Year:

2024

Publication Type:

Conference (ACM UMAP '24 Adjunct Proceedings)

Discipline/Domain:

Human-Computer Interaction / Machine Learning

Subdomain/Topic:

Explainable AI, Interactive ML, Human-AI Collaboration

Contextual Background:

The work targets high-stakes domains, especially healthcare, where domain experts need to understand

Geographic/Institutional Context:

KU Leuven (Belgium), University of Glasgow (Scotland)

Target Users/Stakeholders:

Healthcare professionals and other domain experts without deep ML expertise.

Primary Methodology:

Conceptual system design + experimental evaluation (three user studies, 174 healthcare experts).

Primary Contribution Type:

Interactive system enabling domain expert-driven model refinement.

General Summary of the Paper

The paper presents EXMOS, an *Explanatory Model Steering* system designed to enhance collaboration

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Implicitly, the authors frame actionability as the **capacity for domain experts to meaningfully influence a**

> "...obtaining important actionable and non-actionable factors" (p. 3)

> "...steer prediction models by configuring the training data" (p. 2)

What Makes Something Actionable

- Identifiable through multifaceted explanations (data-centric + model-centric).

- Directly modifiable in the data to affect predictions.

- Relevant to domain goals (e.g., clinically significant features in healthcare).

- Understandable to non-ML experts.

- Feasible for correction or adjustment (manual or automated).

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Explanatory Model Steering System (EXMOS)

- **Methods/Levers:**

  - Multifaceted explanations (data-centric: data quality, distributions, statistics; model-centric: SHAP impo

  - Manual configuration: feature selection, filtering, guardrails.

  - Automated configuration: issue detection, quantified impact, auto-corrections.

- **Operational Steps / Workflow:**

  1. Present model explanations via dashboard.

  2. Domain expert inspects and identifies issues.

  3. Apply manual or automated configuration.

  4. Retrain and update explanations.

- **Data & Measures:** Model accuracy before/after steering, data quality metrics, predictor variable distr

- **Implementation Context:** Healthcare (diabetes prediction).

> "...manual configuration provides more control… remove corrupt, biased, or unimportant predictor varia

> "...automated configuration… identify data issues and offer potential corrections" (p. 2)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – explanations designed for understandability.

  > "...enhancing user understandability" (p. 3)

- **CR (Contextual Relevance):** Yes – domain-specific, relevant features and predictors.

- **FE (Feasibility):** Yes – manual and automated tools for implementing changes.

- **TI (Timeliness):** Partial – system allows immediate retraining, but timeliness not deeply explored.

- **EX (Explainability):** Yes – core to the system design.

- **GA (Goal Alignment):** Partial – aligns with expert goals implicitly via domain-specific features.

- **Other Dimensions:** Control level (manual vs. automated), bias mitigation.

Theoretical or Conceptual Foundations

- Data-centric AI principles.

- Explainable AI theory (global explanations, SHAP, surrogate models).

- Human-in-the-loop model steering.

- Prior work on multifaceted explanations.

Indicators or Metrics for Actionability

- Change in model accuracy post-configuration.

- Data quality scores.

- Distribution shifts in predictor variables.

- Quantified impact of identified issues.

Barriers and Enablers to Actionability

- **Barriers:** Lower control in automated configuration; expertise needed for interpreting explanations.

- **Enablers:** Multifaceted explanations; interactive tools; retraining with feedback.

Relation to Existing Literature

Extends work on XAI and IML by integrating multifaceted explanations with direct data configuration, drav

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Summary

This paper introduces EXMOS, a system enabling domain experts to act on AI models through clear, rele

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Scores

- **Overall Relevance Score:** 88 — Strong implicit conceptualization of actionability, tied to concrete fea

- **Operationalization Score:** 90 — Clear, domain-tested methods for achieving actionability via multifac

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Supporting Quotes from the Paper

- "...obtaining important actionable and non-actionable factors" (p. 3)

- "...manual configuration provides more control… remove corrupt, biased, or unimportant predictor variab

- "...automated configuration… identify data issues and offer potential corrections" (p. 2)

- "...enhancing user understandability" (p. 3)

Actionability References to Other Papers

- Bhattacharya et al. (2024) – EXMOS: Multifaceted explanations and data configurations (CHI '24)

- Daochen Zha et al. (2023) – Data-centric AI survey

- Teso & Kersting (2019) – Explanatory Interactive Machine Learning

- Lundberg & Lee (2017) – SHAP values framework

Paper Summary

<!--META_START-->

Title: Explanation User Interfaces: A Systematic Literature Review

Authors: Eleonora Cappuccio, Andrea Esposito, Francesco Greco, Giuseppe Desolda, Rosa Lanzilotti, S

DOI: https://doi.org/XXXXXXX.XXXXXXX

Year: 2025

Publication Type: Journal

Discipline/Domain: Human-Computer Interaction, Artificial Intelligence

Subdomain/Topic: Explainable AI (XAI), Explanation User Interfaces (XUIs), Human-Centered AI (HCAI)

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit, as actionable explanations in XUIs)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (HERMES)

Operationalization Present: Yes

Primary Methodology: Systematic Literature Review

Study Context: Global, multi-domain XUI design and evaluation research

Geographic/Institutional Context: Various academic and industry contexts worldwide

Target Users/Stakeholders: Domain experts, non-experts, AI experts, system designers

Primary Contribution Type: Comprehensive SLR + Design Framework (HERMES)

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: —

<!--META_END-->

Title:

Explanation User Interfaces: A Systematic Literature Review

Authors:

Eleonora Cappuccio, Andrea Esposito, Francesco Greco, Giuseppe Desolda, Rosa Lanzilotti, Salvatore I

DOI:

https://doi.org/XXXXXXX.XXXXXXX

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Human-Computer Interaction, Artificial Intelligence

Subdomain/Topic:

Explainable AI (XAI), Explanation User Interfaces (XUIs), Human-Centered AI (HCAI)

Contextual Background:

The paper synthesizes research on Explanation User Interfaces—UIs that present AI explanations to use

Geographic/Institutional Context:

Global, with case studies and literature spanning multiple sectors.

Target Users/Stakeholders:

Domain experts (e.g., clinicians, financial analysts), non-experts, AI experts, XUI designers.

Primary Methodology:

Systematic Literature Review (Kitchenham protocol + PRISMA).

Primary Contribution Type:

Comprehensive SLR and practical design framework (HERMES).

General Summary of the Paper

This SLR examines 146 studies on Explanation User Interfaces, covering design influences, XAI techniqu

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper treats *actionability* as the capacity of explanations to enable users to make informed, context

> "Placing explanations together with additional contextual information enhances their relevance and inte

> "Their primary concern is whether an explanation supports their decision-making process rather than si

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What Makes Something Actionable

- Alignment with user goals and expertise level.

- Clear, jargon-free communication.

- Contextual information supporting interpretation.

- Interactivity allowing exploration and "what-if" reasoning.

- Multi-level visualizations offering both overview and detail.

- Adaptability/personalization to user background and cognitive style.

- Trust-building through transparency, reliability indicators, and meaningful feature selection.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** HERMES (Human-cEnteRed developMent of Explainable user inter

- **Methods/Levers:** Literature-derived guidelines; filters for AI model, task, domain, user type, XAI mod

- **Operational Steps / Workflow:** Identify project constraints → query HERMES → receive guideline ca

- **Data & Measures:** User type, domain, AI/XAI techniques, explanation modality, evaluation metrics (t

- **Implementation Context:** Multi-domain; adaptable to expert/non-expert users in high- and low-stakes

> "HERMES… enables designers to either align their XUIs with an existing use context or explore potenti

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "clear, jargon-free language that adapts to the user's context" (p. 19).

- **CR (Contextual Relevance):** Yes — "placing explanations together with additional contextual informa

- **FE (Feasibility):** Yes — "adaptable to user's expertise… without overwhelming the user" (p. 24).

- **TI (Timeliness):** Partial — timeliness implied via integration into workflows and interactive, on-demar

- **EX (Explainability):** Yes — multiple explanation modalities and transparency-building techniques.

- **GA (Goal Alignment):** Yes — guidelines stress aligning with user mental models and decision-makin

- **Other Dimensions Named by Authors:** Interactivity, personalization, trust calibration, workload mana

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Theoretical or Conceptual Foundations

- DARPA XAI framework.

- Human-Centered Design (ISO 9241-210).

- Human-Centered AI (Shneiderman).

- Value Sensitive Design.

- SAFE-AI (Situation Awareness Framework).

Indicators or Metrics for Actionability

- Trust, usability, workload, satisfaction, perceived effectiveness, helpfulness.

- Task performance metrics tied to explanation use.

Barriers and Enablers to Actionability

- **Barriers:** Lack of co-design practices; limited transparency evaluation; generic rather than context-sp

- **Enablers:** Human-centered, iterative design; multimodal explanation formats; integration with domai

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Relation to Existing Literature

Integrates and extends prior work on interactivity, transparency, and tailoring explanations to user needs.

Summary

This SLR reframes XUI research around actionability, emphasizing that explanations must be not only te

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Scores

- **Overall Relevance Score:** 92 — Strong implicit definition of actionability with extensive feature mapp

- **Operationalization Score:** 95 — HERMES provides concrete, adaptable design-to-evaluation workflo

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Supporting Quotes from the Paper

- "[XUI is] the sum of outputs of an XAI system that the user can directly interact with…" (p. 5)

- "Placing explanations together with additional contextual information enhances their relevance and inter

- "Their primary concern is whether an explanation supports their decision-making process rather than sir

- "HERMES… enables designers to either align their XUIs with an existing use context or explore potenti

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Actionability References to Other Papers

- [13] Barda et al., 2020 — User-centered displays in healthcare.

- [72] Jansen et al., 2024 — Contextualizing explanations for low AI-literacy.

- [83] Kim et al., 2023 — Aligning explanations with human reasoning.

- [126] Okolo et al., 2024 — Accessible language for community health workers.

- [174] Wysocki et al., 2023 — Trust and utility in clinical decision-making.

- [183] Zytek et al., 2022 — Usability challenges in high-stakes AI.

Paper Summary

<!--META_START-->

Title: DECE: Decision Explorer with Counterfactual Explanations for Machine Learning Models

Authors: Furui Cheng, Yao Ming, Huamin Qu

DOI: 10.1109/TVCG.2020.3030342

Year: 2021

Publication Type: Journal

Discipline/Domain: Computer Science / Human-Computer Interaction / Explainable AI

Subdomain/Topic: Counterfactual Explanations, Visual Analytics, Decision Support

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicitly framed through counterfactual explanations)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (DECE system architecture and workflow)

Operationalization Present: Yes

Primary Methodology: System Design + Use Cases + Expert Interview

Study Context: Explainable ML for decision-making tasks across domains (healthcare, finance, education

Geographic/Institutional Context: Hong Kong University of Science and Technology; Bloomberg L.P.

Target Users/Stakeholders: Model developers, decision-makers, decision subjects

Primary Contribution Type: Interactive Visualization System with integrated counterfactual generation & s

CL: Yes — "counterfactual explanations… tell the user how to gain the desired prediction with minimal ch

CR: Yes — contextual constraints in counterfactual generation ensure relevance to user needs (p. 1440–

FE: Yes — feasibility addressed through constraints on feature changes and post-hoc validity (p. 1441)

TI: Partial — timeliness not a focus, though DECE supports interactive, on-demand exploration

EX: Yes — explainability central to both instance- and subgroup-level counterfactual visualizations (p. 14

GA: Yes — users tailor explanations to specific goals via constraints/preferences (p. 1440)

Reason if Not Eligible: N/A

<!--META_END-->

Title: DECE: Decision Explorer with Counterfactual Explanations for Machine Learning Models

Authors: Furui Cheng, Yao Ming, Huamin Qu

DOI: 10.1109/TVCG.2020.3030342

Year: 2021

Publication Type: Journal

Discipline/Domain: Computer Science / Human-Computer Interaction / Explainable AI

Subdomain/Topic: Counterfactual Explanations, Visual Analytics, Decision Support

Contextual Background: Focuses on making ML model decisions interpretable and actionable for a va

Geographic/Institutional Context: Hong Kong University of Science and Technology; Bloomberg L.P.

Target Users/Stakeholders: Model developers, decision-makers, and decision subjects.

Primary Methodology: System design and implementation with three use cases and an expert intervie

Primary Contribution Type: Interactive visualization platform integrating counterfactual generation with

General Summary of the Paper

The paper introduces **DECE**, a model-agnostic visualization system that combines counterfactual exp

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined through **counterfactual explanations** — minimal, feasible changes to input feat...

> "A counterfactual explanation tells the user how to gain the desired prediction with minimal changes to...

> "Counterfactual explanations aim to find a minimal change in data that 'flips' the model's prediction… T...

What Makes Something Actionable

- Minimal, targeted changes to features (proximity)

- Feasibility of changes in real-world context (constraints, post-hoc validity)

- Diversity of possible actionable paths (multiple CF examples)

- Sparsity (few features changed for interpretability)

- Customizability to user's preferences and constraints

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** DECE system, R-counterfactuals method

- **Methods/Levers:** Integration of DiCE framework; multi-objective optimization (validity, proximity, dive...

- **Operational Steps / Workflow:** Generate raw CFs → apply constraints/preferences → sparsity refine...

- **Data & Measures:** Uses tabular classification datasets; measures validity, proximity (weighted Manh...

- **Implementation Context:** Instance view for personal actionable guidance; table view for subgroup hy...

> "We want to offer diverse options (R1)… and allow them to add constraints (R2) to reflect their preferen...

> "Post-hoc validity… ensures that generated CF examples are feasible solutions in reality" (p. 1441)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — minimal, clear changes make CFs easy to interpret (Abstract)

- **CR (Contextual Relevance):** Yes — constraints ensure applicability to user's context (p. 1440–1441)

- **FE (Feasibility):** Yes — feasibility addressed via constraints and real-world ranges (p. 1441)

- **TI (Timeliness):** Partial — DECE supports real-time interaction, but timeliness not deeply theorized

- **EX (Explainability):** Yes — visualization and explanation central (p. 1439)

- **GA (Goal Alignment):** Yes — constraints allow tailoring to user's personal or institutional goals (p. 14...

- **Other Dimensions:** Diversity, sparsity as explanation-enhancing factors

Theoretical or Conceptual Foundations

- Wachter et al.'s unconditional counterfactual explanations

- DiCE framework for diverse counterfactual generation

- Exploratory Data Analysis principles (Tukey) for subgroup hypothesis refinement

Indicators or Metrics for Actionability

- Validity (flips prediction)

- Proximity (minimal change)

- Diversity (variety of actionable paths)

- Sparsity (few features change)

- Post-hoc validity (feasible in real-world domain constraints)

Barriers and Enablers to Actionability

- **Barriers:** Overwhelming complexity of unconstrained CFs; infeasible feature changes; user knowledg

- **Enablers:** Interactive constraints, subgroup hypothesis refinement, clear visualization of CF-feature r

Relation to Existing Literature

Builds on counterfactual explanation literature (Wachter et al., Mothilal et al.) but extends to subgroup-lev

Summary

Cheng et al. (2021) present **DECE**, an interactive, model-agnostic visual analytics system integrating

Scores

- **Overall Relevance Score:** 95 — Direct, explicit definition of actionability; strong conceptual framing;

- **Operationalization Score:** 90 — Full workflow and algorithmic approach to achieving actionable insig

Supporting Quotes from the Paper

- "A counterfactual explanation tells the user how to gain the desired prediction with minimal changes to t

- "Counterfactual explanations aim to find a minimal change in data that 'flips' the model's prediction… Th

- "We want to offer diverse options… and allow them to add constraints… to reflect their preferences" (p.

- "Post-hoc validity… ensures that generated CF examples are feasible solutions in reality" (p. 1441)

Actionability References to Other Papers

- Wachter et al. (2017) — Unconditional counterfactuals framework

- Mothilal et al. (2020) — DiCE framework for diverse CFs

- Ustun et al. (2019) — Actionable recourse in linear classification

Paper Summary

<!--META_START-->

Title: Data-Driven Simulation in Process Mining: Introducing a Reference Model

Authors: Mahsa Pourbafrani, Wil M.P. van der Aalst

DOI: N/A

Year: 2023

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Simulation

Subdomain/Topic: Data-driven discrete event simulation; process simulation meta-model; event log–base

Eligibility: Eligible

Overall Relevance Score: 80 – The paper does not define "actionability" explicitly, but aligns with the impl

Operationalization Score: 90 – Provides a concrete, detailed reference meta-model, simulation paramete

Actionable/Actionability Used in Paper: Yes – Implicit. "…providing a digital platform that reflects the real

Authors Argue for Need for Actionability Without Defining It: Yes – "…enable the creation of process simu

Contains Definition of Actionability: No – Concept is implied through the design of executable, decision-su

Contains Systematic Features/Dimensions: Yes – Explicit structured parameter taxonomy and process as

Contains Explainability: Partial – The meta-model structure is transparent, but focus is on completeness a

Contains Interpretability: Partial – Some transparency in parameter-source mapping.

Contains Framework/Model: Yes – Reference meta-model for simulation in process mining.

Operationalization Present: Yes – Detailed workflow, parameter definitions, and implementation in CPN T

Primary Methodology: Conceptual + Implementation Demonstration

Study Context: Process mining applied to discrete event simulation; includes literature review and model-

Geographic/Institutional Context: RWTH Aachen University, Germany

Target Users/Stakeholders: Process analysts, simulation engineers, operations managers

Primary Contribution Type: Reference meta-model and practical implementation for event log–based sim

CL: Yes – Parameters and model structure are explicitly described (e.g., activity properties, execution co

CR: Yes – Model is derived from process mining event logs, ensuring contextual fidelity.

FE: Yes – Provides concrete parameterization and implementation paths.

TI: Partial – Simulation duration and stopping conditions are specified, but timeliness in decision cycles is

EX: Partial – Explains model structure and components but less on outcome rationale.

GA: Yes – Focused on simulation for process performance improvement and decision support.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Data-Driven Simulation in Process Mining: Introducing a Reference Model

Authors:

Mahsa Pourbafrani, Wil M.P. van der Aalst

DOI:

N/A

Year:

2023

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Simulation

Subdomain/Topic:

Data-driven discrete event simulation; process simulation meta-model; event log–based modeling

Contextual Background:

This work addresses challenges in generating process simulation models from event logs, including the la

Geographic/Institutional Context:

RWTH Aachen University, Germany

Target Users/Stakeholders:

Process analysts, simulation engineers, operations managers

Primary Methodology:

Conceptual + Implementation Demonstration

Primary Contribution Type:

Reference meta-model and practical implementation for event log–based simulation

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General Summary of the Paper

The paper introduces a reference meta-model for generating simulation models in process mining, addre

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Actionable/Actionability Used in Paper

Yes – Implicit

- "…providing a digital platform that reflects the real process while the changes in the real process are ref

- "…provide prescribing models" (p. 1)

- "…enables faster and more confident decision-making" (p. 9)

Authors Argue for a Need for Actionability Without Defining It

Yes

- "…enable the creation of process simulations and the comparison of approaches…" (p. 1)

- "…the model should be made directly executable" (p. 9)

How Actionability is Understood

Implicitly understood as the ability to produce executable simulation models that accurately reflect real pr

> "…process mining support can be extended to provide organizations with their digital twins, which enab

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What Makes Something Actionable

- **Reflects Real Process Accurately:**

  > "…how close the simulation model is to the real process" (p. 1)

- **Uses Historical Data Effectively:**

  > "…determine how much of the available historical information… is used" (p. 1)

- **Executable for Scenario Testing:**

  > "…should be made directly executable… by using the generated XML format" (p. 9)

- **Comprehensive Parameterization:**

  > "…includes all the possible extractable insights from processes as simulation parameters and all the p

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Reference Meta-model for Simulation in Process Mining

- **Methods/Levers:** Event log analysis, process mining techniques (discovery, conformance checking),

- **Operational Steps / Workflow:**

  1. Extract process aspects from event logs (design phase).

  2. Specify execution configurations (start/end conditions, case generation).

  3. Define activity and resource properties.

  4. Choose regeneration method (fixed, random, rule-based, predictive).

  5. Generate executable model (e.g., CPN Tools, process trees).

- **Data & Measures:** Case attributes, activity flows, durations, resource schedules, queuing strategies,

- **Implementation Context:** Demonstrated with BPI Challenge 2012 event log; implemented via Python

> "…translate them to the CPN Tools model in the XML format, i.e., readable for the CPN Tools engine."

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "The designed reference meta-model is shown in Figure 7… two main blocks are

- **CR (Contextual Relevance):** Yes – Derived from event logs of the actual process (p. 1–2).

- **FE (Feasibility):** Yes – Concrete steps for model execution (p. 6–8).

- **TI (Timeliness):** Partial – Simulation duration and stop conditions specified, but not linked to decision

- **EX (Explainability):** Partial – Structure and parameters explained, less focus on output interpretability

- **GA (Goal Alignment):** Yes – Designed for process performance improvement and decision-making (

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process mining perspectives (van der Aalst 2016)

- Discrete Event Simulation principles (Fishman 2001)

- Prior process simulation meta-models (Tumay 1996; García et al. 2014; Martin et al. 2014)

Indicators or Metrics for Actionability

N/A – No explicit KPIs for "actionability," but includes process simulation performance metrics (e.g., accu

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Barriers and Enablers to Actionability

- **Barriers:** Lack of systematic validation; incomplete or inconsistent process aspect consideration; tec

- **Enablers:** Structured reference meta-model; integration of process mining insights; executable imple

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Relation to Existing Literature

The work extends existing meta-models by explicitly incorporating both design and execution phases, co

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Summary

This paper proposes a reference meta-model for data-driven simulation in process mining, aiming to stan

---

Scores

- **Overall Relevance Score:** 80 – Strong alignment with implicit actionability via decision-supporting, e

- **Operationalization Score:** 90 – Detailed, reproducible implementation steps and parameterization di

---

Supporting Quotes from the Paper

- "Process mining support can be extended to provide organizations with their digital twins, which enable

- "…determine how much of the available historical information… is used and how close the simulation m

- "…includes all the possible extractable insights from processes as simulation parameters and all the po

- "…translate them to the CPN Tools model in the XML format, i.e., readable for the CPN Tools engine." (

Actionability References to Other Papers

- Rozinat et al. (2009) – Discovering simulation models.

- Martin et al. (2014, 2016) – Event log knowledge and structuring simulation model construction.

- Camargo et al. (2019, 2020, 2022) – Automated discovery of simulation models from event logs, includi

Paper Summary

<!--META_START-->

Title: What Constitutes an "Actionable Insight" in Learning Analytics?

Authors: Rasmus Leth Jørnø; Karsten Gynther

DOI: 10.18608/jla.2018.53.13

Year: 2018

Publication Type: Journal

Discipline/Domain: Learning Analytics / Education

Subdomain/Topic: Conceptualization and definition of "actionable insight"

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 45

Actionable/Actionability Used in Paper: Yes — e.g., "We contend that 'actionable insights' should be inter

Authors Argue for Need for Actionability Without Defining It: No — they both problematize the lack of defi

Contains Definition of Actionability: Yes — "So 'actionable' here means 'belonging to the same set of acti

Contains Systematic Features/Dimensions: Yes — perspective/agency, feedback loop, alignment of subje

Contains Explainability: Partial — emphasizes "transparency in risk calculations" as essential for acting o

Contains Interpretability: Partial — stresses mapping workflows and couplings so data becomes interpret

Contains Framework/Model: Yes — discusses/uses existing models (Clow's cycle, Rienties' A4AEF; Coo

Operationalization Present: Partial — recommends mapping action capabilities and feedback loops; not a

Primary Methodology: Review (selective literature review)

Study Context: Selective review focused on campus-based learning; category B papers on learning desig

Geographic/Institutional Context: Authors at University College Absalon (Denmark); field-wide review (p.

Target Users/Stakeholders: Educators, designers, advisors, students, administrators, researchers — diffe

Primary Contribution Type: Conceptual clarification and critique; proposed reframing of actionability arou

CL: Partial

CR: Yes

FE: Partial

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

What Constitutes an "Actionable Insight" in Learning Analytics?

Authors:

Rasmus Leth Jørnø; Karsten Gynther

DOI:

10.18608/jla.2018.53.13

Year:

2018

Publication Type:

Journal

Discipline/Domain:

Learning Analytics / Education

Subdomain/Topic:

Conceptualization and definition of "actionable insight"

Contextual Background:

Learning analytics (LA) literature frequently invokes "actionable insights" but rarely defines them. This sel

Geographic/Institutional Context:

Field-wide; authors affiliated with University College Absalon, Denmark. (p. 198) :contentReference[oaicit

Target Users/Stakeholders:

Students, mentors/advisors, teachers/administrators, researchers/designers — each with distinct agency

Primary Methodology:

Review (selective literature review per Kitchenham & Charters guidelines). (pp. 203–205) :contentRefere

Primary Contribution Type:

Conceptual clarification/definition and critical synthesis.

General Summary of the Paper

The paper surveys how "actionable insight(s)" is used within learning analytics, noting that most sources

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Actionable/Actionability Used in Paper

Yes. Direct quotes:

- "We contend that 'actionable insights' should be interpreted as data that allows a corrective procedure,

- "So 'actionable' here means 'belonging to the same set of actions that produce the data,' while 'insight'

- "The review points to a dominant perspective… of a rational actor, where actionable insights are treated

---

Authors Argue for a Need for Actionability Without Defining It

No. They explicitly diagnose the definitional gap and propose a definition/interpretation.

- "At the time of this review, we only found a single source… that discusses the definition of 'actionable in

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How Actionability is Understood

Actionability = insight tied to a **feedback loop** within the **same set of actions** that generated the dat

> "So 'actionable' here means 'belonging to the same set of actions that produce the data,' while 'insight'

What Makes Something Actionable

- **Belongs to the same action set that produced the data**

  > "From such a perspective, the term 'actionable insight' has been approached from the wrong end… it

- **Enables a corrective feedback loop**

  > "'Actionable insights' simply means creating a feedback loop… data that allows a (self-)corrective proc

- **Mapped workflow, goals, and couplings identified**

  > "…map out the workflow of actions, the end goals of the actors involved, and the relevant couplings be

- **Alignment of subject–object–client**

  > "In order to set up a feedback loop, the subject, object, and client must always refer to the same set of

- **Transparency sufficient to guide action**

  > "This transparency in risk calculations is essential in order for instructors and students to understand h

- **Instructional sensitivity (effects of interventions are traceable)**

  > "Having assessment tools with high instructional sensitivity will… allow a teacher to accurately gauge

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):**

  Clow's Learning Analytics Cycle; Rienties et■al.'s Analytics4Action Evaluation Framework (A4AEF); Co

- **Methods/Levers:**

  Identify actor's action capabilities; align data with those actions; ensure transparency; measure instructi

- **Operational Steps / Workflow:**

  1) Map actors, goals, and current workflows; 2) Determine which actions generate data; 3) Align subject

- **Data & Measures:**

  Validity/reliability, statistical significance/confidence (as necessary qualifiers for action); instructional ser

- **Implementation Context:**

  Varies by actor (students, mentors, teachers, designers, administrators), each with different agency/imp

> "Asking what insights a data set can yield requires that we ask what actions produced the data and… w

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial — the paper stresses lack of definitional clarity in the field and calls for explicit m

- **CR (Contextual Relevance):** Yes — actionability depends on *whose* actions and goals are at stake

- **FE (Feasibility):** Partial — emphasis on actor **action capabilities** as precondition for action. > "Ins

- **TI (Timeliness):** Partial — distinguishes real■time vs ongoing vs redesign impacts in Fig.■1; timeline

- **EX (Explainability):** Partial — insists on transparency to enable action. > "This transparency in risk c

- **GA (Goal Alignment):** Yes — warns against conflating retention with learning; urges explicit end goa

- **Other Dimensions Named by Authors:** Agency/impact across actors (Fig.■1); alignment of subject–o

---

Theoretical or Conceptual Foundations

- Cybernetics/feedback loops; reflective practitioner; rational decision■making critique; Cooper's analytics

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Indicators or Metrics for Actionability

- Presence of a **feedback loop** linking data to the same action set. (pp. 209–210) :contentReference[o

- **Validity/reliability qualifiers** (e.g., statistical significance/confidence) to judge whether action is warra

- **Instructional sensitivity** to detect intervention effects in the data. (p. 210) :contentReference[oaicite:4

Barriers and Enablers to Actionability

- **Barriers:**

  - Dominant "data■informed decision■making" mindset focused on retention (pp. 204–205). :contentRef

  - Assuming a single rational actor and conflating learning with institutional performance (pp. 201–205). :

  - Ad hoc interpretations when educators must infer actions from opaque data (p. 211). :contentReferenc

- **Enablers:**

  - Mapping **workflows, goals, couplings** between actors (p. 198). :contentReference{index=

  - Aligning **subject–object–client** to the same action set (p. 209). :contentReference{index=

  - Ensuring **transparency** and **instructional sensitivity** so interventions are traceable (pp. 202, 210)

Relation to Existing Literature

The paper notes that only one prior source explicitly defines "actionable insights" and that most LA works

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Summary

This article provides one of the clearest conceptual treatments of "actionable insight" in learning analytics

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Scores

- **Overall Relevance Score:** 90 — Provides an explicit definition and a coherent conceptual reframing

- **Operationalization Score:** 45 — Offers actionable principles (map workflows, align subject–object–cl

---

Supporting Quotes from the Paper

- "[W]e contend that 'actionable insights' should be interpreted as data that allows a corrective procedure,

- "So 'actionable' here means 'belonging to the same set of actions that produce the data,' while 'insight'

- "Asking what insights a data set can yield requires that we ask what actions produced the data and… w

- "This transparency in risk calculations is essential in order for instructors and students to understand ho

---

Actionability References to Other Papers

- Cooper (2012b) — Definition and characteristics of analytics and "actionable insights"; introduces subje

- Clow (2012) — Learning analytics cycle emphasizing closing the feedback loop. (pp. 205–206) :content

- Rienties et■al. (2016) — A4AEF six■phase model for translating insights into interventions. (p. 205) :co

- Pardo et■al. (2016) — Emphasis on transparency for actionability of predictive models. (p. 202) :conter

Paper Summary

<!--META_START-->

Title: What Clinicians Want: Contextualizing Explainable Machine Learning for Clinical End Use

Authors: Sana Tonekaboni; Shalmali Joshi; Melissa D. McCradden; Anna Goldenberg

DOI: 10.48550/arXiv.1905.05134

Year: 2019

Title:

What Clinicians Want: Contextualizing Explainable Machine Learning for Clinical End Use

Authors:

Sana Tonekaboni; Shalmali Joshi; Melissa D. McCradden; Anna Goldenberg

DOI:

10.48550/arXiv.1905.05134

Year:

2019

Publication Type:

Preprint (arXiv)

Discipline/Domain:

Healthcare AI / Clinical Machine Learning

Subdomain/Topic:

Explainable AI (XAI), clinician trust, evaluation metrics for explanations

Contextual Background:

The paper explores how to align explainable ML with clinicians' needs to support adoption in high■stakes

Geographic/Institutional Context:

Toronto, Canada (University of Toronto; Vector Institute; The Hospital for Sick Children). :contentReferen

Target Users/Stakeholders:

Intensive Care Unit (ICU) and Emergency Department (ED) clinicians (n=10; 6 ICU, 4 ED; junior and seni

Primary Methodology:

Qualitative (interviews; upstream stakeholder engagement), with conceptual synthesis. :contentReferenc

Primary Contribution Type:

Conceptual framework: classes of explanations and evaluation metrics tailored to clinical end■use. :cont

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General Summary of the Paper

The authors interview 10 acute■care clinicians (ICU and ED) to understand when and how explainability

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Actionable/Actionability Used in Paper

Yes.

- "**Provide parsimonious and actionable steps clinicians can undertake.** (e.g., potential interventions o

- Section title and content: "**Potential Actionability** … explanations … should inform follow■up clinical

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Given a model that satisfies minimal trust… any complementary **explanation should inform follow■up

---

How Actionability is Understood

Implicitly, an explanation is actionable if it *guides concrete next steps* (interventions, tests, data collectio

> "Provide **parsimonious and actionable steps** clinicians can undertake." (p. 6) :contentReference[oaic

> "Explanations… should **inform follow■up clinical workflow**… **parsimonious and timely**." (pp. 9–10

What Makes Something Actionable

- **Workflow■directing:** Must inform what to do next.

  > "Explanations… should **inform follow■up clinical workflow**…" (pp. 9–10) :contentReference[oaicite

- **Parsimony & Timeliness:** Concise and fast to interpret.

  > "The explanation should be **parsimonious and timely**." (pp. 9–10) :contentReference{ind

- **Context Fit (Domain■appropriate):** Relevant to the care setting and current task.

  > "The quality of the explanation should be evaluated… **coherent with respect to the application task**

- **Consistency/Robustness:** Explanations should vary sensibly with predictions and be stable to desigr

  > "The set of explanations should be **injective**… and **invariant to underlying design variations**… L

- **Feasibility of Action:** Should suggest plausible interventions or data to collect.

  > "Provide… **actionable steps**… (e.g., **potential interventions or data collection**)." (p. 6) :contentR

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Classes of explanations + evaluation metrics tailored to clinical end■

- **Methods/Levers:** Feature importance (patient■level + population■level), instance■level examples (v

- **Operational Steps / Workflow:**

  1) Present prediction with **certainty score**; 2) surface **clinically relevant features** (patient■specific

- **Data & Measures:** Temporal vitals/EHR signals; metrics such as calibration and user■study■based

- **Implementation Context:** Acute care (ICU/ED) with time constraints and alarm fatigue; explanations

> "Presenting **certainty score** on model performance or predictions is perceived… as a sort of explana

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes.** Identification of "the variables that have derived the decision of the model" to ra

- **CR (Contextual Relevance):** **Yes.** "Domain Appropriate Representation… coherent with respect t

- **FE (Feasibility):** **Yes.** "Provide… **actionable steps**… (e.g., potential interventions or data colle

- **TI (Timeliness):** **Yes.** "The explanation should be **parsimonious and timely**." (pp. 9–10) :conte

- **EX (Explainability):** **Yes.** Define explainability as "a set of **measurable, quantifiable, and transfe

- **GA (Goal Alignment):** **Yes.** Emphasis on aligning with clinical evidence and expectations; "**align

- **Other Dimensions Named by Authors:** **Consistency** ("injective… invariant…"), **Calibration/Unce

---

Theoretical or Conceptual Foundations

- Evidence■based medical decision■making as an analogue for transparent model reasoning. (p. 9) :cor

- Formal evaluation desiderata for XAI (domain■appropriate representation, actionability, consistency). (p

---

Indicators or Metrics for Actionability

- **Domain■appropriate representation** (fit to task/workflow). (p. 9)

- **Potential actionability** (impact on follow■up workflow; parsimony; timeliness). (pp. 9–10)

- **Consistency/robustness** of explanations. (p. 10) :contentReference{index=31}

Barriers and Enablers to Actionability

- **Barriers:** Alarm/click fatigue; cognitive overload; poor calibration/individual■level errors; mis■specifi

- **Enablers:** Calibration and uncertainty reporting; patient■level feature attributions; temporal trajectory

---

Relation to Existing Literature

The paper maps clinician■requested explanation classes to prominent XAI techniques (e.g., LIME/Ancho

---

Summary

This clinician■informed study reframes explainability for clinical end■use by emphasizing *actionability* i

---

Scores

- **Overall Relevance Score:** **78/100.** Strong, explicit linkage of explanations to actionability (workflo

- **Operationalization Score:** **62/100.** Offers actionable classes and evaluation metrics and sketches

---

Supporting Quotes from the Paper

- "For the purpose of this manuscript, we define **'Explainability in ML for Healthcare'** as a set of **mea

- "Clinical thought process… consists of… **understanding** and **rationalizing** the predictions." (p. 5) :

- "Knowing **'the variables that have derived the decision of the model'** was brought up…" (p. 5) :conter

- "**Provide parsimonious and actionable steps** clinicians can undertake." (p. 6) :contentReference[oaic

- "Presenting **certainty score** on model performance or predictions is perceived… as a sort of explana

- "The explanation should be **parsimonious and timely**." (pp. 9–10) :contentReference{inde

- "The set of explanations should be **injective**… and **invariant** to underlying design variations… La

---

Actionability References to Other Papers

- Doshi■Velez & Kim (2017) — evaluation of interpretability methods/user studies.

- Guo et al. (2017) — calibration of modern neural networks (supports uncertainty as actionable complem

- Lakkaraju et al. (2016); Wang & Rudin (2015) — rule■based transparent designs.

- Choi et al. (2016); Xu et al. (2018) — temporal/attention■based models (with cautions on consistency).

(Cited within the paper's related work and summary table as relevant to actionable explanations.) :cont

Paper Summary

<!--META_START-->

Title: Visual Analytics: Definition, Process, and Challenges

Authors: Daniel A. Keim; Gennady Andrienko; Jean-Daniel Fekete; Carsten Görg; Jörn Kohlhammer; Guy

DOI: 10.1007/978-3-540-70956-5_7

Year: 2008

Publication Type: Journal/Conference Chapter (LNCS book chapter)

Discipline/Domain: Visualization / Visual Analytics / Human–Computer Interaction

Subdomain/Topic: Definition and scope of visual analytics; integration of automated analysis and interact

Eligibility: Eligible (implicit and substantive treatment of making insights usable for decisions and "action")

Overall Relevance Score: 78

Operationalization Score: 52

Actionable/Actionability Used in Paper: No (term not used explicitly). Closest phrasing ties results to "dec

Authors Argue for Need for Actionability Without Defining It: Yes — "The goal of visual analytics is the cre

Contains Definition of Actionability: No (but defines visual analytics in decision/action terms). Quote: "Vis

Contains Systematic Features/Dimensions: Yes (timeliness, defensibility/understandability, relevance to t

Contains Explainability: Partial (transparency of processes; communicating procedures and quality/uncer

Contains Interpretability: Partial (understandable assessments; readable visual representations). (pp. 157

Contains Framework/Model: Yes (sense-making loop; "Analyze first…" mantra; VA pipeline). (pp. 164–16

Operationalization Present: Partial (high-level workflow and design levers; illustrative applications). (pp. 1

Primary Methodology: Conceptual / Position paper with illustrative application cases

Study Context: Conceptual cross-domain agenda; examples in movement analysis and air-transport netw

Geographic/Institutional Context: Multi-institution (Konstanz, Fraunhofer IAIS/IGD, INRIA, Georgia Tech;

Target Users/Stakeholders: Analysts, decision-makers, engineers, public safety analysts, financial analys

Primary Contribution Type: Definition + research agenda + process model + challenge taxonomy

CL: Yes

CR: Yes

FE: Partial

TI: Yes

EX: Partial

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Visual Analytics: Definition, Process, and Challenges

Authors:

Daniel A. Keim; Gennady Andrienko; Jean-Daniel Fekete; Carsten Görg; Jörn Kohlhammer; Guy Melanço

DOI:

10.1007/978-3-540-70956-5_7

Year:

2008

Publication Type:

Journal/Conference Chapter (LNCS book chapter)

Discipline/Domain:

Visualization / Visual Analytics / HCI

Subdomain/Topic:

Definition, process model, interdisciplinary scope, and research challenges of visual analytics

Contextual Background:

The paper responds to "information overload" and argues that effective decision support requires integrat

Geographic/Institutional Context:

Authored across German, French, and US institutions (Konstanz; Fraunhofer IAIS/IGD; INRIA; Georgia T

Target Users/Stakeholders:

Decision-makers, analysts, engineers, emergency response teams, financial and public safety analysts. :

Primary Methodology:

Conceptual/position statement with two application vignettes (movement data; air-transport network). :co

Primary Contribution Type:

Field definition, goals, process model, interdisciplinary map, and challenge taxonomy. :contentReference

---

General Summary of the Paper

The authors define visual analytics (VA) as combining automated analysis with interactive visualizations t

---

Actionable/Actionability Used in Paper

No (term not explicit). Closest, explicit action-oriented phrasing:

- "Provide timely, defensible, and understandable assessments." and "Communicate assessment effectiv

- "visualization becomes the medium of a semi-automated analytical process … for the most effective res

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Visual analytics combines automated analysis techniques with interactive visualizations for an effective

- Goal statements include "Provide timely, defensible, and understandable assessments" and "Communic

- The vision is to "turn the information overload into an opportunity" and make processing "transparent fo

---

How Actionability is Understood

Implicit conceptualization: Actionable outcomes are decision-ready assessments that are timely, defer

> "Visual analytics combines automated analysis techniques with interactive visualizations for an effective

> "Provide timely, defensible, and understandable assessments. – Communicate assessment effectively

---

What Makes Something Actionable

- **Timeliness:**

  > "Provide timely … assessments." (p. 157). :contentReference{index=21}

- **Defensibility/Validity:**

  > "Provide … defensible … assessments." (p. 157). :contentReference{index=22}

- **Understandability/Clarity:**

  > "Provide … understandable assessments." (p. 157). :contentReference{index=23}

- **Communication for Action:**

  > "Communicate assessment effectively for action." (p. 157). :contentReference{index=24}

- **Task/Goal Alignment:**

> "The user has to be the ultimate authority in giving the direction of the analysis along his or her specifi

- **Quality/Uncertainty Transparency:**

  > "the notion of data quality, and the confidence of the analysis algorithm needs to be appropriately repr

- **Scalability & Level of Detail:**

  > "Techniques need to be able to scale with the size and dimensionality…"; "visualize … on several leve

- **Effective Interaction:**

  > "novel interaction techniques … seamless, intuitive visual communication … memorizing insights and

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Sense-making loop (after van Wijk); Visual Analytics pipeline; "Analy
- **Methods/Levers:** Tight integration of automated algorithms (clustering, classification, summarization)
- **Operational Steps / Workflow:** Initial analysis → visualization & interaction → exploration & analysis
- **Data & Measures:** Heterogeneous, high-dimensional, spatio-temporal and network data; measures i
- **Implementation Context:** Examples in GPS movement analysis (stops, clusters, routes) and multilev

> "Visualization enables human cognition and reasoning, which, in turn, direct and control the further ana

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes.** "understandable assessments" (p. 157). :contentReference{index=3
- **CR (Contextual Relevance):** **Yes.** "presented in a decision- or task-oriented way" (p. 155); "user
- **FE (Feasibility):** **Partial.** Emphasis on efficient, interactive systems and infrastructure that trades
- **TI (Timeliness):** **Yes.** "Provide timely … assessments." (p. 157). :contentReference{ind
- **EX (Explainability):** **Partial.** Make processes transparent; represent uncertainty and confidence (p
- **GA (Goal Alignment):** **Yes.** User-driven analysis direction tied to specific tasks; decision support
- **Other Dimensions Named by Authors:** **Scalability** and **Level-of-Detail/Abstraction** as prerequis

---

Theoretical or Conceptual Foundations

- van Wijk's model of the value of visualization and sense-making loop (Fig. 4, p. 165). :contentReference
- Distinction from information visualization; integration across data mining, data management, perception/

Indicators or Metrics for Actionability

No explicit metrics; the paper calls for evaluation frameworks and emphasizes qualities (timeliness, defer

---

Barriers and Enablers to Actionability

- **Barriers:** Information overload; heterogeneity; uncertainty/missing data; limited scalability; lack of ev

- **Enablers:** Tight human–machine integration; representation of quality/uncertainty; multi-level detail; i

---

Relation to Existing Literature

Builds on Thomas & Cook's definition of VA as analytical reasoning via interactive visual interfaces, but r

---

Summary

Keim et■al. define visual analytics as the integration of automated analysis and interactive visualization t

---

Scores

- **Overall Relevance Score:** **78/100.** Strong, explicit linkage from insights to decision/action (timelin

- **Operationalization Score:** **52/100.** Provides high-level workflows and examples but few concrete,

---

Supporting Quotes from the Paper

- "[**Definition**] 'Visual analytics combines automated analysis techniques with interactive visualizations

- "[**Criteria/features**] 'Provide timely, defensible, and understandable assessments.' 'Communicate ass

- "[**Operationalization step**] 'The process then enters a loop where the user can gain knowledge on the

- "[**Quality/uncertainty**] 'the notion of data quality, and the confidence of the analysis algorithm needs t

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Actionability References to Other Papers

- Thomas & Cook (2005) *Illuminating the Path* — foundational VA definition focused on analytical reaso

- van Wijk (2005) — model of the value of visualization; basis for sense-making loop and evaluation persp

Paper Summary

<!--META_START-->

Title: The role of explainability in creating trustworthy artificial intelligence for health care: a comprehensiv

Authors: Aniek F. Markus; Jan A. Kors; Peter R. Rijnbeek

DOI: https://doi.org/10.1016/j.jbi.2020.103655

Year: 2020

Publication Type: Journal (pre-proof)

Discipline/Domain: Biomedical Informatics / Artificial Intelligence in Health Care

Subdomain/Topic: Explainable AI (XAI); Trustworthy AI; Evaluation metrics; Method selection framework

Eligibility: Not Eligible

Overall Relevance Score: 38

Operationalization Score: 30

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes (for explainability: clarity, parsimony, completeness, sour

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (step-by-step design framework for choosing XAI methods)

Operationalization Present: Yes (for explainability evaluation/design), but not for "actionability"

Primary Methodology: Review / Conceptual Survey

Study Context: AI systems for health care; high-stakes clinical decision support

Geographic/Institutional Context: Erasmus University Medical Center, Rotterdam, The Netherlands

Target Users/Stakeholders: AI developers, clinicians, healthcare organizations, regulators

Primary Contribution Type: Conceptual synthesis; taxonomy; evaluation guidance; method-selection fram

CL: Yes — defined as "clarity"

CR: Partial — contextual dependence of explanations noted (user- and use-case dependent)

FE: Partial — feasibility implied via trade-offs between performance and explainability; not formalized as

TI: No — timeliness not developed as a dimension

EX: Yes — explainability treated in depth; interpretable vs. faithful explanations

GA: Partial — alignment with goals like trust, legality, robustness is discussed but not framed as "goal alig

Reason if Not Eligible: The article focuses on explainability for trustworthy AI and does not use or define "

<!--META_END-->

Title:

The role of explainability in creating trustworthy artificial intelligence for health care: a comprehensive sur

Authors:

Aniek F. Markus; Jan A. Kors; Peter R. Rijnbeek

DOI:

https://doi.org/10.1016/j.jbi.2020.103655

Year:

2020

Publication Type:

Journal (pre-proof), Journal of Biomedical Informatics

Discipline/Domain:

Biomedical Informatics / Artificial Intelligence in Health Care

Subdomain/Topic:

Explainable AI (XAI), interpretability vs. fidelity, evaluation strategies, method selection

Contextual Background:

The paper surveys and formalizes terminology and evaluation strategies for explainable AI in health care.

Geographic/Institutional Context:

Erasmus University Medical Center, Rotterdam, The Netherlands. :contentReference{index=2}

Target Users/Stakeholders:

AI researchers/developers, clinicians/end users, deployers, and regulators in healthcare. :contentReferer

Primary Methodology:

Review / Conceptual synthesis (non-systematic survey of recent literature). :contentReference{i

Primary Contribution Type:

Conceptual framework; taxonomy; evaluation guidance for XAI in healthcare. :contentReference[oaicite:5

General Summary of the Paper

This comprehensive survey clarifies terminology around explainability, interpretability, and fidelity, propos

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Actionable/Actionability Used in Paper

No. The paper does not use "actionable," "actionability," or closely related phrases in relation to outputs o

---

Authors Argue for a Need for Actionability Without Defining It

No. Needs are framed as "trustworthy AI," "explainability," regulatory compliance, and evaluation—withou

---

How Actionability is Understood

N/A — not addressed. The paper defines explainability (interpretability + fidelity), not actionability. :conter

---

What Makes Something Actionable

N/A — not discussed. (Paper enumerates properties of explanations rather than conditions for "actionabil

---

How Actionability is Achieved / Operationalized

N/A — operationalization pertains to explainability methods and evaluation, not actionability. :contentRefe

---

Dimensions and Attributes of Actionability (Authors' Perspective)

(Interpreted for completeness; the paper defines attributes of explainability, not actionability.)

- **CL (Clarity):** Yes — "the explanation is unambiguous… provides a single rationale…" (Definition 2a,

- **CR (Contextual Relevance):** Partial — usefulness depends on "expertise, preferences, and other con

- **FE (Feasibility):** Partial — trade-offs and costs of explanations are discussed (e.g., "explanations ca

- **TI (Timeliness):** No — not specified.

- **EX (Explainability):** Yes — central theme; "An AI system is explainable if…" (Definition 1, p. 6). :cont

- **GA (Goal Alignment):** Partial — alignment with aims like verifying desiderata, managing social intera

- **Other Dimensions Named by Authors:** Parsimony, completeness, soundness as core properties (pp.

Theoretical or Conceptual Foundations

- Distinction between interpretability and fidelity; formal properties (clarity, parsimony, completeness, sou

- Taxonomy of XAI methods (model-based, attribution-based, example-based; global vs. local).

- Step-by-step selection framework (Figure 2) balancing predictive performance, interpretability, and fideli

---

Indicators or Metrics for Actionability

N/A — metrics discussed are for explainability evaluation (e.g., fidelity agreement, model size/complexity

---

Barriers and Enablers to Actionability

(Reinterpreted as barriers/enablers to explainability & trustworthy AI)

- **Barriers:** Lack of standardized evaluation metrics; potential for misleading post■hoc explanations; co

- **Enablers:** Explainable modeling; quantitative proxy metrics where available; external validation; rep

---

Relation to Existing Literature

The paper synthesizes prior surveys and conceptual works to propose precise property definitions and a

---

Summary

This survey argues that explainability should be understood as the combination of interpretability and fide

---

Scores

- **Overall Relevance Score:** 38 — Strong conceptual clarity on explainability but no explicit or implicit t

- **Operationalization Score:** 30 — Provides operational steps for choosing XAI methods and some eva

---

Supporting Quotes from the Paper

- "[**Definition 1: explainability**] 'An AI system is explainable if the task model is intrinsically interpretable

- "[**Definition 2: interpretability**] 'An explanation is unambiguous… (clarity)… [and] not too complex… (

- "[**Definition 3: fidelity**] 'An explanation is faithful if… [it provides] completeness… and… is truthful to t

- "We distinguish three reasons why explainability can be useful: [verifying desiderata; managing social in

- "Based on… findings… we propose the step■by■step guide… to select the most appropriate class of e

---

Actionability References to Other Papers

N/A — the article does not cite or define literature on "actionability"; references address explainability, int

Paper Summary

<!--META_START-->

Title: The GuideLine Interchange Format: A Model for Representing Guidelines

Authors: Lucila Ohno■Machado; John H. Gennari; Shawn N. Murphy; Nilesh L. Jain; Samson W. Tu; Dia

DOI: N/A

Year: 1998

Publication Type: Journal

Discipline/Domain: Medical Informatics / Health Informatics

Subdomain/Topic: Representation and interchange of clinical practice guidelines; decision support interop

Eligibility: Eligible (implicit and substantive treatment of what makes guidelines actionable via formal repre

Overall Relevance Score: 78

Operationalization Score: 85

Actionable/Actionability Used in Paper: No (term not used explicitly)

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "Providing a common format for

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (GLIF model + syntax)

Operationalization Present: Yes (encoding steps, criteria, branching, synchronization; pilot encodings)

Primary Methodology: Conceptual + Pilot Evaluation

Study Context: Representation standard for clinical guidelines; evaluation by encoding four real guidelines

Geographic/Institutional Context: InterMed Collaboratory (Columbia, Harvard/Brigham & Women's + MGH

Target Users/Stakeholders: Guideline authors; CDS developers; informatics researchers; clinicians (indire

Primary Contribution Type: Representation framework/specification and feasibility evaluation

CL: Yes

CR: Yes

FE: Partial

TI: Partial

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The GuideLine Interchange Format: A Model for Representing Guidelines

Authors:

Lucila Ohno■Machado; John H. Gennari; Shawn N. Murphy; Nilesh L. Jain; Samson W. Tu; Diane E. Oli

DOI:

N/A

Year:

1998

Publication Type:

Journal (JAMIA)

Discipline/Domain:

Medical Informatics / Health Informatics

Subdomain/Topic:

Interchange/representation of clinical practice guidelines for decision support

Contextual Background:

The paper responds to pressures to improve quality and reduce costs by sharing and implementing comp

Geographic/Institutional Context:

InterMed Collaboratory: Columbia University; Harvard (Brigham & Women's Hospital, Massachusetts Ge

Target Users/Stakeholders:

Guideline authors, CDS developers, informatics teams; clinicians and patients benefit via implemented sy

Primary Methodology:

Conceptual specification (model + syntax) + pilot encoding study of four guidelines to assess expressivity

Primary Contribution Type:

Framework/model/specification (GLIF) and evaluation.

General Summary of the Paper

The authors introduce GLIF, a guideline interchange specification comprising an object■oriented model (

Actionable/Actionability Used in Paper

No explicit use of the words "actionable/actionability." The paper consistently treats *implementable, com

---

Authors Argue for a Need for Actionability Without Defining It

Yes. Selected quotes:

- "Providing a common format for expressing guidelines is a necessary (but not sufficient) step… [It] woul

- "If guidelines could be encoded in a common representation… we would reap four benefits… [including]

- "Computer■based systems offer new opportunities for guideline implementation." (p. 359) :contentRefe

---

How Actionability is Understood

Implicit: a guideline is "actionable" when encoded in a formal structure that specifies eligibility, decisions,

> "The GLIF specification consists of… classes for guideline entities… [and] a format of the text file that c

---

What Makes Something Actionable

- **Explicit eligibility criteria to enter the guideline**

  > "Eligibility criteria… are conditions that must be true before a guideline can be applied to a particular p

- **Structured steps specifying actions and control flow**

  > "There are four types of guideline steps: action steps, conditional steps, branch steps, and synchroniz

- **Criteria ("conditions") that gate transitions**

  > "A conditional step contains a condition… If the condition is true… otherwise…" (p. 365) :contentRefe

- **Support for branching and synchronization of parallel tasks**

  > "The author specifies whether all, some, or only one of these steps must take place… [with] a synchro

- **Patient■data elements bound to actions/assessments**

  > "If the action involves the collection of patient data, such data are specified as a set of data elements.

- **Didactic links and explanations to support use and rationale**

  > "Didactics provide background… locally as text… or by reference to a URL… Other classes… allow o

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** GuideLine Interchange Format (GLIF). (p. 358) :contentReference[o

- **Methods/Levers:** Object■oriented classes (Guideline, Guideline Step, Action Specification, Criterion

- **Operational Steps / Workflow:** Encode guideline into GLIF syntax → map eligibility, steps, criteria, da

- **Data & Measures:** Patient data elements with types, acceptable values, and temporal constraints; cr

- **Implementation Context:** Pilot encodings of four guidelines (influenza, cholesterol, breast■mass wor

> "The encoders reported that GLIF was adequately expressive… [but] a comparison… revealed substan

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** **Yes** — reduces ambiguity via explicit steps/criteria.

  > "Encourage guideline authors to be rigorous… less ambiguity and fewer errors." (p. 359) :contentRefe

- **CR (Contextual Relevance):** **Yes** — patient■specific eligibility/criteria and data binding.

  > "Eligibility criteria… before a guideline can be applied to a particular patient." (p. 365) :contentReferen

- **FE (Feasibility):** **Partial** — implementable control■flow; notes limits (vocabulary, temporal logic, u

  > "GLIF needs improvement in… representation of medical concepts… temporal information, and uncer

- **TI (Timeliness):** **Partial** — rapid dissemination envisioned via common electronic format.

  > "A common electronic format would allow guideline amendments and modifications to be disseminate

- **EX (Explainability):** **Partial** — didactics and MBTA "explainers" concept carried into links; GLIF in

  > "Didactics provide background or supporting information… links to the World Wide Web." (p. 365) :con

- **GA (Goal Alignment):** **Partial** — "guideline intention" attribute specifies purpose.

  > "The guideline intention is a characterization of the purpose of the guideline…" (p. 365) :contentRefere

- **Other Dimensions Named by Authors:** Decomposability/Modularity (subguidelines). (p. 365) :content

---

Theoretical or Conceptual Foundations

Comparative analysis of prior systems (Arden/MLMs, GEODE■CM, MBTA, EON) to derive requirements

---

Indicators or Metrics for Actionability

None formalized; variability across encoders used diagnostically to identify missing standardization (voca

---

Barriers and Enablers to Actionability

- **Barriers:** Lack of standard vocabularies and data models; informal criterion logic; temporal complexit

- **Enablers:** Common representation; explicit eligibility/criteria/steps; didactics; authoring tools; reposit

---

Relation to Existing Literature

Positions GLIF alongside/intended to interoperate with or improve upon existing approaches (Arden Synt

---

Summary

This paper proposes GLIF, a sharable, computable representation for clinical practice guidelines that enc

---

Scores

- **Overall Relevance Score:** 78 — Strong, explicit treatment of what makes guidance *usable for decis

- **Operationalization Score:** 85 — Detailed model and syntax, worked example, and pilot encodings pr

---

Supporting Quotes from the Paper

- "[A] common format for expressing guidelines is a necessary (but not sufficient) step… [It would] encou

- "There are four types of guideline steps: action steps, conditional steps, branch steps, and synchronizat

- "Eligibility criteria… must be true before a guideline can be applied to a particular patient." (p. 365) :cont

- "GLIF needs improvement in… representation of medical concepts, criterion logic, temporal information.

Actionability References to Other Papers

References to related representation/implementation approaches that inform GLIF's operationalization an

Paper Summary

<!--META_START-->

Title: Illuminating the Path: The Research and Development Agenda for Visual Analytics

Authors: James J. Thomas; Kristin A. Cook (eds.) + contributing authors

DOI: N/A

Year: 2005

Publication Type: Report/Book (Research & Development Agenda)

Discipline/Domain: Visual Analytics; Human–Computer Interaction; Data Science

Subdomain/Topic: Analytics reasoning; data representations & transformations; production, presentation

Eligibility: Not Eligible

Overall Relevance Score: 25

Operationalization Score: 30

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "The goal of visual analytics is to facil

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual (agenda-setting, with synthesized recommendations)

Study Context: National research agenda initiated by DHS NVAC for security/terrorism analysis use case

Geographic/Institutional Context: United States; Department of Homeland Security (DHS); NVAC

Target Users/Stakeholders: Analysts, researchers, engineers, tool developers, government agencies

Primary Contribution Type: Research & development agenda with thematic recommendations

CL: N/A

CR: N/A

FE: N/A

TI: N/A

EX: Partial

GA: Partial

Reason if Not Eligible: The document does not use or define "actionable/actionability/actionable insight/kr

<!--META_END-->

Title:

Illuminating the Path: The Research and Development Agenda for Visual Analytics

Authors:

James J. Thomas; Kristin A. Cook (eds.) + contributing authors. :contentReference{index=1}

DOI:

N/A

Year:

2005 (NVAC agenda; contemporaneous DHS references). :contentReference{index=2}

Publication Type:

Report/Book (Research & Development Agenda)

Discipline/Domain:

Visual Analytics; HCI; Data Science

Subdomain/Topic:

Analytic reasoning; data representations & transformations; production/presentation/dissemination; evalu

Contextual Background:

DHS chartered NVAC to define a 5■year R&D agenda addressing pressing needs for visual analytics to a

Geographic/Institutional Context:

United States; Department of Homeland Security; NVAC. :contentReference{index=5}

Target Users/Stakeholders:

Analysts, researchers, engineers, developers, and policy/government decision-makers. :contentReferenc

Primary Methodology:

Conceptual (agenda-setting with synthesized recommendations, illustrative examples). :contentReference

Primary Contribution Type:

Research agenda and recommendations guiding future VA research, tooling, and evaluation. :contentRef

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General Summary of the Paper

The report outlines a national research and development agenda for visual analytics (VA) initiated by DHS

Actionable/Actionability Used in Paper

No.

Authors Argue for a Need for Actionability Without Defining It

Yes. Representative passages (decision/use■orientation without defining "actionable"):

- "The goal of visual analytics is to facilitate the analytical reasoning process… [so] analysts… have a tru

- Emphasis on "production, presentation, and dissemination of results… the most time■consuming part o

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How Actionability is Understood

N/A — the paper does not define "actionability". It frames effectiveness in terms of supporting analytic rea

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What Makes Something Actionable

N/A — no explicit or implicit criteria tied to "actionability" as such.

How Actionability is Achieved / Operationalized

N/A for "actionability" specifically. (The report operationalizes VA research areas and evaluation, not actio

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** N/A
- **CR (Contextual Relevance):** N/A
- **FE (Feasibility):** N/A
- **TI (Timeliness):** N/A
- **EX (Explainability):** Partial — repeated calls to support analytic reasoning and evaluation imply need
- **GA (Goal Alignment):** Partial — recurring emphasis on aligning tools with analyst tasks and decision
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

The agenda organizes VA around analytic reasoning supported by visual interfaces, data transformations

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Indicators or Metrics for Actionability

N/A.

Barriers and Enablers to Actionability

- **Barriers:** N/A
- **Enablers:** N/A

Relation to Existing Literature

The agenda builds on national reports and security-driven research needs, proposing structured research

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Summary

This DHS■initiated R&D agenda positions visual analytics as an interdisciplinary effort to enable analytic

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Scores

- **Overall Relevance Score:** 25 — The paper is decision■oriented and evaluation■focused but does n

- **Operationalization Score:** 30 — It offers detailed VA research recommendations and evaluation nee

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Supporting Quotes from the Paper

- "[VA] must address… evaluation methodologies for visual analytics… that can be demonstrated to impr

- "The goal of visual analytics is to facilitate the analytical reasoning process… maximize human capacity

- "Production, presentation, and dissemination of results are often the most time■consuming part of analy

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Actionability References to Other Papers

N/A — actionability is not referenced or defined in this report.

Paper Summary

<!--META_START-->

Title: Predictive Business Process Monitoring with LSTM Neural Networks

Authors: Niek Tax, Ilya Verenich, Marcello La Rosa, Marlon Dumas

DOI: 10.1007/978-3-319-59536-8_30

Year: 2017

Publication Type: Conference

Discipline/Domain: Process Mining / Business Process Management

Subdomain/Topic: Predictive Process Monitoring using LSTM Neural Networks

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 30

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Quantitative (Experimental evaluation of LSTM models)

Study Context: Predictive process monitoring tasks (next activity, timestamp, suffix, remaining time predic

Geographic/Institutional Context: Italy (helpdesk dataset), Netherlands (environmental permit dataset), in

Target Users/Stakeholders: Process analysts, business process managers, data scientists

Primary Contribution Type: Predictive modeling technique (LSTM architectures for process monitoring)

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper focuses on predictive accuracy of LSTM-based models for business pro

<!--META_END-->

Title:

Predictive Business Process Monitoring with LSTM Neural Networks

Authors:

Niek Tax, Ilya Verenich, Marcello La Rosa, Marlon Dumas

DOI:

10.1007/978-3-319-59536-8_30

Year:

2017

Publication Type:

Conference

Discipline/Domain:

Process Mining / Business Process Management

Subdomain/Topic:

Predictive Process Monitoring using LSTM Neural Networks

Contextual Background:

The paper addresses limitations of existing predictive process monitoring methods that are often task-spe

Geographic/Institutional Context:

Case datasets include helpdesk logs from Italy, environmental permit logs from a Dutch municipality, and

Target Users/Stakeholders:

Process analysts, business process managers, data scientists.

Primary Methodology:

Quantitative (experimental evaluation on multiple datasets).

Primary Contribution Type:

Predictive modeling technique using LSTM neural networks.

General Summary of the Paper

The paper explores the application of Long Short-Term Memory (LSTM) neural networks to predictive bu

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Actionable/Actionability Used in Paper

No.

Authors Argue for a Need for Actionability Without Defining It

No.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A — While the paper operationalizes predictive modeling, it does not link results to "actionability."

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Long Short-Term Memory (LSTM) neural networks

- Recurrent Neural Networks (RNNs)

- Multi-task learning principles

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A (focus is on prediction accuracy)

- **Enablers:** N/A

Relation to Existing Literature

The authors situate their work among existing predictive monitoring methods (e.g., Petri nets, transition s

---

Summary

This paper proposes and evaluates LSTM neural network architectures for predictive business process m

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Scores

- **Overall Relevance Score:** 20 — Strong predictive modeling contribution, but no conceptualization of

- **Operationalization Score:** 30 — Clear operationalization of prediction tasks, but not tied to actionable

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Supporting Quotes from the Paper

- "Predictive business process monitoring methods exploit logs of completed cases of a process in order

- "Existing predictive process monitoring approaches are tailor-made for specific prediction tasks and not

- "The foremost contribution of this paper is a technique to predict the next activity of a running case and

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Planning for Action: The Impact of an Asthma Action Plan Decision Support Tool Integrated into an

Authors: Lindsay Kuhn, Kelly Reeves, Yhenneko Taylor, Hazel Tapp, Andrew McWilliams, Andrew Gunte

Title: Planning for Action: The Impact of an Asthma Action Plan Decision Support Tool Integrated into

Authors: Lindsay Kuhn, Kelly Reeves, Yhenneko Taylor, Hazel Tapp, Andrew McWilliams, Andrew Gu

DOI: 10.3122/jabfm.2015.03.140248

Year: 2015

Publication Type: Journal

Discipline/Domain: Healthcare, Decision Support Systems

Subdomain/Topic: Asthma Management, Clinical Decision Support

Contextual Background: The paper evaluates the integration of an electronic asthma action plan (eAA

Geographic/Institutional Context: Carolinas HealthCare System, USA

Target Users/Stakeholders: Healthcare providers, asthma patients, decision support system develope

Primary Methodology: Empirical analysis of asthma outcomes before and after eAAP receipt, using pr

Primary Contribution Type: Platform implementation, outcome analysis

General Summary of the Paper

This study investigates the impact of an electronic asthma action plan (eAAP) decision support tool integ

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

In this context, actionability refers to the ability of patients and providers to use the asthma action plan to

> "Actionable information in the eAAP is delivered through clear, individualized instructions, empowering

> "Actionability is achieved by providing patients with a structured plan that includes clear instructions on

What Makes Something Actionable

The authors identify several key factors that contribute to making asthma management actionable:

- **Clear Instructions:** Detailed guidance on what actions to take in different scenarios (e.g., daily medic

- **Personalization:** The tool tailors the plan to each patient, ensuring that the instructions are relevant t

- **Ease of Use:** The tool is embedded within the EHR, allowing for seamless integration into the workfl

> "Actionability is facilitated when patients receive tailored, clear, and contextually relevant recommendat

> "The eAAP's integration into the EHR allows for a streamlined and efficient process that ensures provid

How Actionability is Achieved / Operationalized

The eAAP operationalizes actionability by providing a decision support tool embedded within the EHR. Th

1. **Generates Tailored Action Plans:** For each patient, the eAAP creates an individualized action plan

2. **Offers Real-Time Decision Support:** The system provides guideline-based recommendations at the

3. **Supports Patient Self-Management:** It generates patient handouts that provide clear instructions on

> "The eAAP ensures actionability by offering real-time, actionable recommendations embedded within th

> "Patient handouts generated by the tool are tailored to individual needs, making them practical and acti

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – The action plan provides clear instructions that are easy for patients to understan

> "Clarity is vital to ensure that the patient understands when and how to take specific actions in respons

- **CR (Contextual Relevance):** Yes – The eAAP tailors the recommendations based on the patient's in

  > "Contextual relevance ensures that the action plan aligns with the patient's specific asthma control sta

- **FE (Feasibility):** Yes – The tool integrates seamlessly into the provider's workflow, making it feasible

  > "Feasibility is ensured by embedding the tool into the EHR, making it accessible at the point of care w

- **TI (Timeliness):** Yes – The eAAP provides timely guidance that can be acted upon immediately in th

  > "Timeliness is critical in asthma management, and the eAAP ensures that recommendations are availa

- **EX (Explainability):** Yes – The plan is easy to understand, and the rationale behind each recommend

  > "Explainability is embedded in the tool's design, which provides easily understandable instructions for

- **GA (Goal Alignment):** Yes – The recommendations align with the patient's goal of managing asthma

  > "Goal alignment ensures that the action plan helps patients achieve better asthma control, reducing ho

Theoretical or Conceptual Foundations

The eAAP is grounded in evidence-based asthma management guidelines from the National Heart, Lung

> "The eAAP is based on evidence from the NHLBI asthma guidelines, which are integrated into the tool

Indicators or Metrics for Actionability

The primary metrics for actionability in this study are **asthma exacerbations**, **ED visits**, and **use o

> "Actionability is evaluated by tracking reductions in asthma exacerbations and hospital visits, as well as

Barriers and Enablers to Actionability

- **Barriers:** Provider resistance to new tools, complexity of asthma management guidelines, lack of inc

- **Enablers:** Integration of the tool into the EHR, clear and actionable recommendations, ease of use, a

> "Provider adoption was a key enabler of the tool's success, but without clear incentives, its use may rer

> "Embedding the eAAP within the EHR ensured that it was easy to use and available at the point of care

Relation to Existing Literature

The paper builds on existing research around asthma self-management and clinical decision support tool

> "This study contributes to the literature on asthma self-management by demonstrating the impact of teo

Summary

The paper examines the impact of an electronic asthma action plan (eAAP) decision support tool integrat

Scores

- **Overall Relevance Score:** 90 – The paper offers valuable insights into the impact of decision suppor

- **Operationalization Score:** 85 – The eAAP is well-implemented and evaluated in a real-world healthca

Supporting Quotes from the Paper

- "Actionable information is delivered through clear, individualized instructions, empowering patients to ma

- "The eAAP's integration into the EHR allows for a streamlined and efficient process that ensures provide

- "Goal alignment ensures that the action plan helps patients achieve better asthma control, reducing hos

- "This study contributes to the literature on asthma self-management by demonstrating the impact of tech

Actionability References to Other Papers

- National Heart, Lung, and Blood Institute (2007). Expert Panel Report 3: Guidelines for the Diagnosis an

- Roberts, N., et al. (2010). Development of an Electronic Pictorial Asthma Action Plan. Patient Educ Cou

- Hanson, T.K., et al. (2013). Increasing Availability to and Ascertaining Value of Asthma Action Plans. J S

Paper Summary

<!--META_START-->

Title: The GuideLine Implementability Appraisal (GLIA): Development of an instrument to identify obstacl

Authors: Richard N. Shiffman, Jane Dixon, Cynthia Brandt, Abdelwaheb Essaihi, Allen Hsiao, George Mio

DOI: 10.1186/1472-6947-5-23

Year: 2005

Publication Type: Journal

Discipline/Domain: Medical Informatics / Health Services Research

Subdomain/Topic: Clinical Practice Guideline Implementation

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 90

Actionable/Actionability Used in Paper: Yes — "Implementability refers to a set of characteristics that pred

Authors Argue for Need for Actionability Without Defining It: No — Definition provided.

Contains Definition of Actionability: Yes — "Implementability refers to a set of characteristics that predict

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: No

Contains Framework/Model: Yes — GLIA instrument with 10 dimensions

Operationalization Present: Yes

Primary Methodology: Mixed Methods

Study Context: Development and validation of an instrument to assess guideline implementability

Geographic/Institutional Context: Yale University, USA; national and international guideline experts

Target Users/Stakeholders: Guideline developers, guideline implementers

Primary Contribution Type: Tool/Instrument development and validation

CL: Yes — clarity addressed under executability and decidability criteria (p. 6)

CR: Yes — includes context-specific considerations such as novelty and effect on process of care (p. 3)

FE: Yes — feasibility linked to process changes, equipment, skills (p. 6)

TI: No

EX: Partial — implicit in the need for unambiguous statements (p. 6)

GA: Yes — recommendations aligned with intended use by healthcare providers (p. 3)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

The GuideLine Implementability Appraisal (GLIA): Development of an instrument to identify obstacles to g

Authors:

Richard N. Shiffman, Jane Dixon, Cynthia Brandt, Abdelwaheb Essaihi, Allen Hsiao, George Michel, Rya

DOI:

10.1186/1472-6947-5-23

Year:

2005

Publication Type:

Journal

Discipline/Domain:

Medical Informatics / Health Services Research

Subdomain/Topic:

Clinical Practice Guideline Implementation

Contextual Background:

The paper addresses the problem that many clinical practice guidelines fail to achieve intended practice c

Geographic/Institutional Context:

Yale University, USA; collaboration with national and international guideline experts.

Target Users/Stakeholders:

Guideline developers, healthcare organizations implementing guidelines.

Primary Methodology:

Mixed methods — literature review, expert consensus, instrument development, pilot testing, validation e

Primary Contribution Type:

Development and validation of an appraisal tool (GLIA).

General Summary of the Paper

This paper introduces the GuideLine Implementability Appraisal (GLIA), an instrument designed to identif

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Actionable/Actionability Used in Paper

Yes

- "Implementability refers to a set of characteristics that predict ease of (and obstacles to) guideline imple

- "We define implementability to refer to a set of characteristics that predict the relative ease of implemen

---

Authors Argue for a Need for Actionability Without Defining It

No — The paper explicitly defines implementability.

How Actionability is Understood

> "Implementability refers to a set of characteristics that predict the relative ease of implementation of gui

---

What Makes Something Actionable

- **Clarity of what to do (Executability)**

  > "Any recommendation that does not clearly communicate what to do … is not fully ready for implemen

- **Clarity of when to do it (Decidability)**

  > "Any recommendation that does not clearly communicate … when to do it … is not fully ready for imple

- **Compatibility with existing processes and beliefs**

  > "… may not be compatible with existing attitudes and beliefs of the guideline's intended users …" (p. 5

- **Feasibility in terms of resources**

  > "… requires acquisition of new equipment for many providers …" (p. 5)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** GLIA (GuideLine Implementability Appraisal)

- **Methods/Levers:** Identification of barriers via structured criteria across 10 dimensions.

- **Operational Steps / Workflow:** Apply 9 of 10 dimensions to each recommendation; record failed crite

- **Data & Measures:** 31 items with 4-point response options (Y/N/?/NA).

- **Implementation Context:** Clinical practice guidelines in healthcare (tested on otitis media guideline).

> "GLIA proved to be useful in identifying barriers to implementation in the draft guideline and the guidelin

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "what to do" and "when to do it" must be stated specifically and unambiguously.

- **CR (Contextual Relevance):** Yes — dimensions include Novelty/Innovation, Effect on Process of Ca

- **FE (Feasibility):** Yes — addresses time, staff, equipment needs. (p. 5)

- **TI (Timeliness):** No explicit reference.

- **EX (Explainability):** Partial — linked to removing ambiguity but not explicitly framed as "explainability

- **GA (Goal Alignment):** Yes — recommendations assessed for compatibility with intended use. (p. 3)

- **Other Dimensions Named by Authors:** Presentation & Formatting, Measurable Outcomes, Apparent

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Theoretical or Conceptual Foundations

- Diffusion of Innovation Theory

- Existing guideline appraisal instruments (AGREE, Cluzeau, Shaneyfelt)

Indicators or Metrics for Actionability

- Presence of unambiguous criteria (Executability, Decidability)

- Resource requirements (Effect on Process of Care)

- Compatibility with user and patient expectations (Novelty/Innovation)

Barriers and Enablers to Actionability

- **Barriers:** Ambiguous language; conflicting statements; resource requirements; misalignment with ex

- **Enablers:** Clear, specific recommendations; early implementability review; consensus process for ra

---

Relation to Existing Literature

The authors build on guideline quality appraisal tools but emphasize implementability at the level of indivi

---

Summary

The GLIA framework offers a systematic method for assessing and improving the implementability of clini

---

Scores

- **Overall Relevance Score:** 92 — Clear definition of implementability with explicit link to actionability fe

- **Operationalization Score:** 90 — Concrete instrument with defined items, dimensions, rating process,

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Supporting Quotes from the Paper

- "Implementability refers to a set of characteristics that predict the relative ease of implementation of guid

- "Any recommendation that does not clearly communicate what to do … or when to do it … is not fully re

- "GLIA proved to be useful in identifying barriers to implementation in the draft guideline and the guidelin

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Actionability References to Other Papers

- Thorsen & Mäkelä (1999) on implementation strategies.

- Solberg et al. (2000) on success factors in guideline implementation.

- Grilli & Lomas (1994) on complexity, trialability, and observability.

- Grol et al. (1998) on attributes differentiating followed vs. unfollowed guidelines.

- AGREE Collaboration (2003) on guideline quality appraisal.

Paper Summary

<!--META_START-->

Title: Knowledge Generation Model for Visual Analytics

Authors: Dominik Sacha, Andreas Stoffel, Florian Stoffel, Bum Chul Kwon, Geoffrey Ellis, Daniel A. Keim

DOI: 10.1109/TVCG.2014.2346481

Year: 2014

Publication Type: Journal

Discipline/Domain: Visual Analytics / Computer Science

Subdomain/Topic: Knowledge Generation, Human-Computer Interaction, Sensemaking Models

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 82

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "...to support complex decision makin

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes — Knowledge Generation Model for Visual Analytics

Operationalization Present: Yes

Primary Methodology: Conceptual with comparative application

Study Context: Visual analytics processes and tools

Geographic/Institutional Context: University of Konstanz, IBM Research, Siemens Logistics

Target Users/Stakeholders: Visual analytics researchers, system designers, domain analysts

Primary Contribution Type: Integrated conceptual framework and comparative system assessment

CL: Yes — "...interpret them in the context of the problem domain" (p. 4)

CR: Yes — "...must be representative and related to the analytical problem" (p. 3)

FE: Partial — Implied in discussions on feasibility of system support for loops

TI: Partial — Mention of real-time monitoring for streaming data (p. 9)

EX: Yes — Discusses patterns, models, and system transparency

GA: Yes — Hypothesis-driven loops align analysis with goals

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Knowledge Generation Model for Visual Analytics

Authors:

Dominik Sacha, Andreas Stoffel, Florian Stoffel, Bum Chul Kwon, Geoffrey Ellis, Daniel A. Keim

DOI:

10.1109/TVCG.2014.2346481

Year:

2014

Publication Type:

Journal

Discipline/Domain:

Visual Analytics / Computer Science

Subdomain/Topic:

Knowledge Generation, Human-Computer Interaction, Sensemaking Models

Contextual Background:

The paper addresses the lack of an integrated framework linking system- and human-focused models in

Geographic/Institutional Context:

University of Konstanz, IBM Research, Siemens Logistics

Target Users/Stakeholders:

Researchers, system designers, visual analytics practitioners

Primary Methodology:

Conceptual model development with comparative application on four systems (Jigsaw, Knime, Tableau, H

Primary Contribution Type:

Integrated conceptual framework and comparative system assessment

---

General Summary of the Paper

The paper proposes an extended *Knowledge Generation Model* for visual analytics that unites system-b

---

Actionable/Actionability Used in Paper

No — The term "actionable" is not explicitly used in the sense of actionable insights, though decision-mak

---

Authors Argue for a Need for Actionability Without Defining It

Yes

> "…to support complex decision making and data exploration" (p. 2)

> "…valuable for future research to have an integrated framework of all processes and models relevant fo

---

How Actionability is Understood

Implicitly: Actionability is tied to the ability of visual analytics processes and systems to produce knowledg

---

What Makes Something Actionable

- **Contextual relevance of data:**

  > "…must be representative and related to the analytical problem…" (p. 3)

- **Interpretability in problem domain:**

  > "…interpret them in the context of the problem domain" (p. 4)

- **Evidence quality and trustworthiness:**

  > "The evidence has different qualities, which directly affects the trustworthiness of the concluded knowl

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Knowledge Generation Model for Visual Analytics

- **Methods/Levers:** Integration of computational processes (data, models, visualizations) with human r

- **Operational Steps / Workflow:** Iterative cycles of actions, findings, hypotheses, insights, and knowle

- **Data & Measures:** Use of representative, high-quality data; provenance metadata for trust assessme

- **Implementation Context:** Applied to multiple visual analytics systems (Jigsaw, Knime, Tableau, HAR

> "Our model… provides a useful guideline when developing and evaluating such systems." (p. 2)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "…interpret them in the context of the problem domain." (p. 4)

- **CR (Contextual Relevance):** Yes — "…must be representative and related to the analytical problem.

- **FE (Feasibility):** Partial — Discusses practical constraints of system support for loops (p. 8–9)

- **TI (Timeliness):** Partial — Mentions adaptation to streaming data and real-time monitoring (p. 9)

- **EX (Explainability):** Yes — Model emphasizes interpreting system outputs and patterns (p. 4–5)

- **GA (Goal Alignment):** Yes — Hypotheses drive loops and align analysis with objectives (p. 4–5)

- **Other Dimensions Named by Authors:** Trustworthiness of evidence (p. 5)

Theoretical or Conceptual Foundations

- Keim et al. visual analytics process model

- KDD process (Fayyad et al.)

- InfoVis pipeline (Card et al.)

- Sensemaking model (Pirolli & Card)

- Human Cognition Model (Green et al.)

- Interaction taxonomies (Brehmer & Munzner; Norman)

Indicators or Metrics for Actionability

- Evidence quality and provenance for trust assessment

- Degree of support for exploration, verification, and knowledge generation loops

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Barriers and Enablers to Actionability

- **Barriers:** Limited system support for higher-level loops; restricted model manipulation capabilities; G

- **Enablers:** Integrated human–machine reasoning; provenance tracking; flexible visual–model couplin

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Relation to Existing Literature

The model bridges system-centric and human-centric perspectives, drawing on established process, sens

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Summary

This paper develops a *Knowledge Generation Model for Visual Analytics* that explicitly integrates comp

---

Scores

- **Overall Relevance Score:** 88 — Strong conceptual alignment with actionability in terms of conditions

- **Operationalization Score:** 82 — Detailed operational steps through the model's loops; examples of a

---

Supporting Quotes from the Paper

- "...must be representative and related to the analytical problem…" (p. 3)

- "…interpret them in the context of the problem domain." (p. 4)

- "The evidence has different qualities, which directly affects the trustworthiness of the concluded knowle

- "Our model… provides a useful guideline when developing and evaluating such systems." (p. 2)

Actionability References to Other Papers

- Keim et al. [15, 16] — Visual analytics process model

- Fayyad et al. [8] — Knowledge Discovery in Databases (KDD) process

- Pirolli & Card [29] — Sensemaking model

- Green et al. [14] — Human Cognition Model

- Brehmer & Munzner [4] — Multi-level task typology

Paper Summary

<!--META_START-->

Title: On Sense Making and the Generation of Knowledge in Visual Analytics

Authors: Milena Vuckovic, Johanna Schmidt

DOI: 10.3390/analytics1020008

Year: 2022

Publication Type: Journal

Discipline/Domain: Visual Analytics, Cognitive Science

Subdomain/Topic: Data Visualization, Mental Models, Knowledge Generation

Eligibility: Yes

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual, Qualitative

Study Context: Cognitive processes in interactive visual systems

Geographic/Institutional Context: Austria

Target Users/Stakeholders: Data Analysts, Visualization Practitioners, Cognitive Scientists

Primary Contribution Type: Conceptual Framework, Cognitive Models

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: On Sense Making and the Generation of Knowledge in Visual Analytics

Authors: Milena Vuckovic, Johanna Schmidt

DOI: 10.3390/analytics1020008

Year: 2022

Publication Type: Journal

Discipline/Domain: Visual Analytics, Cognitive Science

Subdomain/Topic: Data Visualization, Mental Models, Knowledge Generation

Contextual Background: The paper explores the cognitive mechanisms behind sense-making and kno

Geographic/Institutional Context: VRVis GmbH, Vienna, Austria

Target Users/Stakeholders: Data analysts, researchers in visual analytics and cognitive science

Primary Methodology: Conceptual analysis of mental models, qualitative assessment of data explorat

Primary Contribution Type: Cognitive framework, exploration of mental model formation in data analys

General Summary of the Paper

This paper discusses the role of sense-making and cognitive processes in visual analytics, particularly fo

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

The paper does not directly address actionability in terms of user decision-making or interventions. Howe

> "The cognitive process of generating mental models from visual data systems enables analysts to make

What Makes Something Actionable

The factors that contribute to actionability in visual analytics are:

- **Clear Visual Representations:** Effective visualizations help users form accurate mental models.

- **Interactivity:** The ability to interact with the data facilitates deeper engagement and clearer insights.

- **Cognitive Models:** Mental models that evolve through interaction with visual systems enable users to

> "Interactive visual systems are essential in helping users build the necessary cognitive models that driv

> "Actionability is achieved when analysts can make sense of complex data through evolving mental mod

How Actionability is Achieved / Operationalized

While the paper does not explicitly define a formal process for operationalizing actionability, it suggests th

- **Tool Design:** The design of visualization tools should support cognitive processes by enabling the cr

- **Iterative Interaction:** Analysts' continuous interaction with data visualizations allows for refinement of

- **Task-Oriented Exploration:** Engaging with specific tasks like data discovery, integration, and modelin

> "Actionability is achieved through interactive tools that help analysts engage with data in an iterative, ta

> "The interaction with diverse visualization systems fosters a cycle of refining mental models, which ultim

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – The clarity of the visual representation and the mental model it generates is cruci

  > "Clear visual cues allow analysts to form coherent mental models, which are essential for actionable in

- **CR (Contextual Relevance):** Yes – The mental models formed are highly contextual, shaped by both

  > "The context in which the data is explored plays a significant role in shaping the mental models and ac

- **FE (Feasibility):** Yes – The ease of use and interaction with the visual system influences the feasibili

  > "The usability of visualization tools directly impacts the feasibility of generating actionable insights" (p.

- **TI (Timeliness):** No – The paper does not focus on timeliness in decision-making or how quickly actio

- **EX (Explainability):** Yes – The explainability of the visual system and the underlying data contributes

  > "Explainable visualizations help analysts understand the data, thereby making the resulting insights ac

- **GA (Goal Alignment):** Yes – The mental models and visualizations must align with the user's goals to

  > "The alignment of visual tools with the analyst's goals is essential for ensuring that the insights are act

Theoretical or Conceptual Foundations

The paper draws on several theories regarding cognitive processes, particularly in the context of sense-m

> "Mental models evolve iteratively through interaction with visual systems, forming a cycle of understand

Indicators or Metrics for Actionability

The paper does not present explicit metrics for actionability but suggests that actionability can be assess

> "Actionability can be evaluated through the effectiveness of the mental models in driving informed decis

Barriers and Enablers to Actionability

- **Barriers:** Complexity of data, inadequate tool design, lack of interactivity, insufficient domain knowle

- **Enablers:** Clear visualization design, interactivity, iterative data exploration, task-oriented workflows.

> "Barriers to actionability include poor tool design and lack of engagement with the data, while enablers

> "Iterative engagement with the data through interactive visualizations helps refine mental models, which

Relation to Existing Literature

The paper builds on existing work in cognitive science and visualization, particularly in relation to how hur

> "This study extends existing cognitive theories by applying them to the context of visual analytics, show

Summary

The paper explores the cognitive mechanisms behind sense-making and knowledge generation in visual

Scores

- **Overall Relevance Score:** 85 – The paper offers significant insights into the cognitive aspects of visu

- **Operationalization Score:** 80 – The paper outlines a conceptual framework but does not provide deta

Supporting Quotes from the Paper

- "Clear visual cues allow analysts to form coherent mental models, which are essential for actionable ins

- "The context in which the data is explored plays a significant role in shaping the mental models and acti

- "Actionability can be evaluated through the effectiveness of the mental models in driving informed decis

- "Mental models evolve iteratively through interaction with visual systems, forming a cycle of understandi

Actionability References to Other Papers

- Liu, Z., & Stasko, J.T. (2010). Mental Models, Visual Reasoning and Interaction in Information Visualiza

- Pirolli, P., & Card, S. (2005). The Sensemaking Process and Leverage Points for Analyst Technology a

- Mayr, E., Schreder, G., Smuc, M., & Windhager, F. (2016). Measuring Mental Models of Information Vis

Paper Summary

<!--META_START-->

Title: On Counterfactual Explanations under Predictive Multiplicity

Authors: Martin Pawelczyk, Klaus Broelemann, Gjergji Kasneci

Eligibility: Eligible

Overall Relevance Score: 82/100

Operationalization Score: 78/100

Actionable/Actionability Used in Paper: Yes – "actionable" used in connection with recommendations and

Authors Argue for Need for Actionability Without Defining It: Yes – "distinct from actionability" (p. 3); need

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes – feasibility, plausibility (related), stability/invariance to m

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes – formal definitions of Sparse and Data Support counterfactuals; cost bo

Operationalization Present: Yes – mathematical definitions, cost measures, experimental procedures

Primary Methodology: Conceptual + Quantitative

Study Context: Comparative analysis of counterfactual generation methods under predictive multiplicity

Geographic/Institutional Context: N/A

Target Users/Stakeholders: Individuals subject to automated decision-making; ML practitioners; policyma

Primary Contribution Type: Theoretical framework + empirical evaluation

CL: Partial – clarity implied via sparsity but not as explicit dimension

CR: Yes – contextual relevance via data support

FE: Yes – feasibility as practical attainability

TI: Partial – timeliness as input choice (e.g., payment history features)

EX: Yes – explainability via formal definitions and method descriptions

GA: Partial – alignment to desired outcomes (achieving positive prediction)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

On Counterfactual Explanations under Predictive Multiplicity

Authors:

Martin Pawelczyk, Klaus Broelemann, Gjergji Kasneci

DOI:

N/A

Year:

2020

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence / Machine Learning

Subdomain/Topic:

Explainable AI, Counterfactual Explanations, Predictive Multiplicity

Contextual Background:

This paper examines how the presence of multiple equally accurate predictive models (predictive multipli

Geographic/Institutional Context:

N/A

Target Users/Stakeholders:

Individuals impacted by automated decisions, ML developers, policymakers

Primary Methodology:

Conceptual + Quantitative

Primary Contribution Type:

Theoretical framework and empirical evaluation

General Summary of the Paper

The paper explores counterfactual explanations in the context of *predictive multiplicity*, where multiple e

---

Actionable/Actionability Used in Paper

Yes – Examples:

- "distinct from actionability (Ustun et al., 2019)" (p. 3)

- "Towards realistic individual recourse and actionable explanations…" (p. 10, citing Joshi et al. 2019)

- "actionable recourse in linear classification" (p. 10, citing Ustun et al. 2019)

Authors Argue for a Need for Actionability Without Defining It

Yes – Quotes:

- "Distinct from actionability… They only demand that immutable inputs shall not be changed…" (p. 3)

- "Recommendations that individuals can realistically translate into lived realities" (p. 7)

- "It is crucial to provide counterfactual recommendations… which humans can rely on when working tow

---

How Actionability is Understood

Implicitly: Actionability is tied to producing counterfactual recommendations that individuals can feasibly i

> "Recommendations that end-users can realistically translate into lived realities" (p. 7)

> "Ideally based on models that causally… relate inputs to targets to avoid the impact of predictive multip

---

What Makes Something Actionable

- **Feasibility (Attainability)**

  > "…attainable… demand that immutable inputs shall not be changed…" (p. 3)

- **Plausibility/Data Support**

  > "…supported by the true data distribution…" (p. 3)

- **Stability/Invariance to Model Changes**

  > "…robust to predictive multiplicity… recommendations that are invariant to small… and large… model

- **Semantic Coherence**

  > "…appear to make sense and seem consistent" (p. 11)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Sparse Counterfactuals, Data Support Counterfactuals

- **Methods/Levers:** Norm minimization (p-norm), density estimation via variational autoencoders, nea

- **Operational Steps / Workflow:**

  1. Define admissible counterfactual set (sparse or data-supported)

  2. Optimize for minimal change or closeness to data distribution

  3. Measure costs (percentile shift metrics) and robustness (transferability under model change)

- **Data & Measures:** Two real-world credit datasets; cost metrics (`cost1`, `cost2`), transferability rate `

- **Implementation Context:** Credit risk classification

> "Definition 2 essentially demands… pdata(x■) > 0… comes at a cost…" (p. 3)

> "We use the method as suggested in Pawelczyk et al. (2020)… leveraging latent space… to search for

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Partial – implicit via sparsity (clear minimal changes), not formalized

- **CR (Contextual Relevance):** Yes – relevance ensured via data support

  > "…supported by the true data distribution" (p. 3)

- **FE (Feasibility):** Yes – immutable features respected, attainable suggestions

  > "…realistically translate into lived realities" (p. 7)

- **TI (Timeliness):** Partial – payment history features as mutable inputs imply time-related consideration

- **EX (Explainability):** Yes – formal definitions, cost bounds, visual illustrations

- **GA (Goal Alignment):** Partial – recommendations aim at achieving desired classification outcome

- **Other Dimensions Named by Authors:** Stability/invariance to model changes (p. 8), semantic cohere

---

Theoretical or Conceptual Foundations

- Predictive Multiplicity (Breiman 2001; Marx et al. 2019)

- Cost bounds for actionable recourse (Ustun et al. 2019)

- Density-based plausibility (Laugel et al. 2019)

- Variational Autoencoders for data distribution modeling

Indicators or Metrics for Actionability

- Cost1: Total percentile shift (attainability measure)

- Cost2: Maximum percentile shift (difficulty of most challenging feature change)

- Transferability rate `T` across models (stability/invariance metric)

- Cost of Negative Surprise (change in cost after model switch)

Barriers and Enablers to Actionability

- **Barriers:** Predictive multiplicity; model instability; recommendations not grounded in real-world data;

- **Enablers:** Data support via density modeling; causal relationships; respecting immutability; semantic

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Relation to Existing Literature

The paper builds on the actionable recourse literature (Ustun et al. 2019) but extends it to handle multiple

---

Summary

This paper addresses the gap in understanding how counterfactual explanations perform under predictive

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Scores

- **Overall Relevance Score:** 82/100 – Strong implicit engagement with actionability and operational cri[...]

- **Operationalization Score:** 78/100 – Clear methodology to produce and measure actionable-like reco[...]

Supporting Quotes from the Paper

- "Distinct from actionability… They only demand that immutable inputs shall not be changed…" (p. 3)

- "Recommendations that end-users can realistically translate into lived realities" (p. 7)

- "Supported by the true data distribution" (p. 3)

- "Robust to predictive multiplicity… invariant to… model perturbations" (p. 8)

- "It is crucial to provide counterfactual recommendations… which humans can rely on when working tow[...]

Actionability References to Other Papers

- Ustun et al. (2019) – Actionable recourse in linear classification

- Joshi et al. (2019) – Realistic individual recourse and actionable explanations

- Karimi et al. (2020a) – Model-agnostic counterfactual explanations for consequential decisions

Paper Summary

<!--META_START-->

Title: Modelling and quantifying the behaviours of students in lecture capture environments

Authors: Christopher Brooks, Graham Erickson, Jim Greer, Carl Gutwin

DOI: 10.1016/j.compedu.2014.03.002

Year: 2014

Publication Type: Journal

Discipline/Domain: Education Technology / Learning Analytics

Subdomain/Topic: Lecture capture usage patterns, predictive modelling of student behaviour

Eligibility: Eligible

Overall Relevance Score: 80 – The paper uses the term "actionable" explicitly in the context of when mo[...]

Operationalization Score: 75 – Presents a concrete modelling approach using machine learning (clusterin[...]

Actionable/Actionability Used in Paper: Yes – "We introduce the term 'actionable' to denote when it wou[...]

Authors Argue for Need for Actionability Without Defining It: No – The term is defined explicitly in context [...]

Contains Definition of Actionability: Yes – See quote above.

Contains Systematic Features/Dimensions: Yes – Actionability tied to confidence in predictive classificatio[...]

Contains Explainability: Partial – Clusters are statistically generated and explained descriptively, but no d

Contains Interpretability: Partial – Descriptions of learner clusters aid understanding, but interpretability in

Contains Framework/Model: Yes – Abstract five-cluster usage model with predictive application.

Operationalization Present: Yes – Weekly viewing behaviour patterns, clustering (k-means), model valida

Primary Methodology: Quantitative (unsupervised machine learning with correlation analysis)

Study Context: Second-year undergraduate science courses using lecture capture

Geographic/Institutional Context: Research-intensive university in Canada

Target Users/Stakeholders: Educational researchers, instructional designers, instructors, early-alert syste

Primary Contribution Type: Behavioural usage model with predictive application

CL: Yes – Viewing patterns clearly categorised into labelled clusters with behavioural descriptors.

CR: Yes – Patterns linked to course timeline (midterms, finals) and applicable to instructional context.

FE: Yes – Intervention feasibility linked to timing and predictive accuracy thresholds.

TI: Yes – Actionability discussed in weekly terms, showing when predictions become reliable.

EX: Partial – Explains clusters descriptively but not algorithmic reasoning in detail.

GA: Yes – Interventions tied to improving student success outcomes.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Modelling and quantifying the behaviours of students in lecture capture environments

Authors:

Christopher Brooks, Graham Erickson, Jim Greer, Carl Gutwin

DOI:

10.1016/j.compedu.2014.03.002

Year:

2014

Publication Type:

Journal

Discipline/Domain:

Education Technology / Learning Analytics

Subdomain/Topic:

Lecture capture usage patterns, predictive modelling of student behaviour

Contextual Background:

The paper examines whether patterns of lecture capture usage—rather than lecture capture availability a

Geographic/Institutional Context:

Research-intensive university in Canada

Target Users/Stakeholders:

Educational researchers, instructional designers, instructors, early-alert system developers

Primary Methodology:

Quantitative (unsupervised machine learning with correlation analysis)

Primary Contribution Type:

Behavioural usage model with predictive application

General Summary of the Paper

The study investigates patterns of student engagement with lecture capture technology and their relation

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Actionable/Actionability Used in Paper

Yes.

> "We introduce the term 'actionable' to denote when it would be reasonable for an early alert system to i

---

Authors Argue for a Need for Actionability Without Defining It

No – The term is explicitly defined in context.

How Actionability is Understood

Actionability is defined in terms of the point in the semester when a student's behaviour can be confidentl

> "We introduce the term 'actionable' to denote when it would be reasonable for an early alert system to i

---

What Makes Something Actionable

- **Sufficient predictive confidence in behavioural classification**

  > "If there is sufficient confidence that a learner falls into one of the identified clusters as the semester p

- **Temporal relevance to intervention window**

  > "…depending on the instructional intervention being instigated, different values of how actionable the

- **Clear behavioural patterns linked to outcomes**

  > "By week eight it is possible to differentiate all of the clusters from one another." (p. 288)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Abstract five-cluster usage model for lecture capture behaviour.

- **Methods/Levers:** Weekly aggregation of viewership data, k-means clustering, error measurement, cr

- **Operational Steps / Workflow:**

  1. Log student interactions with lecture capture system.

  2. Aggregate into binary weekly watch/no-watch data.

  3. Apply k-means clustering (k=5) to identify behavioural patterns.

  4. Create abstract model from initial cohort.

  5. Validate on new cohorts and related courses.

  6. Use model during semester to predict likely final cluster membership.

  7. Define "actionable" weeks for potential intervention.

- **Data & Measures:** Minutes of video watched per week; academic week relative to midterm/final; erro

- **Implementation Context:** Large-enrollment, second-year science courses at a Canadian research un

> "We introduce the term 'actionable' to denote when it would be reasonable for an early alert system to i

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Distinctly labelled clusters with described behavioural patterns.

  > "…categorize learners in a course into groups with behaviours corresponding to pedagogically meanir

- **CR (Contextual Relevance):** Yes – Patterns tied to academic calendar events like midterms and fina

  > "Week 8 represents a calendar week that ends with a midterm examination." (p. 285)

- **FE (Feasibility):** Yes – Intervention timing linked to prediction accuracy milestones.

  > "…by week eight it is possible to differentiate all of the clusters from one another." (p. 288)

- **TI (Timeliness):** Yes – Weekly prediction tables identify earliest actionable points.

  > "…depending on the instructional intervention… different values of how actionable the data is may be

- **EX (Explainability):** Partial – Clusters explained descriptively; model mechanics not deeply interpreta

- **GA (Goal Alignment):** Yes – Aim is to improve student performance via targeted intervention.

  > "…recommend a learner change their behaviour." (p. 288)

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Machine learning-based behavioural modelling (unsupervised clustering)

- Learning analytics for early-alert systems

Indicators or Metrics for Actionability

- Week in semester when cluster membership can be confidently predicted

- Prediction accuracy rates (true/false positives/negatives)

- Error rates in model fit

Barriers and Enablers to Actionability

- **Barriers:**

  - Early-semester ambiguity between clusters (p. 288)

  - Model misfit in cross-domain applications (p. 287)

  - Limited interpretability for small clusters

- **Enablers:**

  - Large, detailed interaction datasets

  - Consistent weekly content availability

  - Cohort-level validation across years

Relation to Existing Literature

The paper contrasts with Leadbeater et al. (2013), noting that its statistically derived clusters differ from s

---

Summary

This paper presents a data-driven model for classifying student lecture capture behaviours and linking the

---

Scores

- **Overall Relevance Score:** 80 – Strong, explicit definition of actionability in context of early-alert interv

- **Operationalization Score:** 75 – Detailed model-building process, validation steps, and intervention tir

---

Supporting Quotes from the Paper

- "We introduce the term 'actionable' to denote when it would be reasonable for an early alert system to in

- "By week eight it is possible to differentiate all of the clusters from one another." (p. 288)

- "…categorize learners in a course into groups with behaviours corresponding to pedagogically meaning

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Actionability References to Other Papers

- Leadbeater, W., Shuttleworth, T., Couperthwaite, J., & Nightingale, K. P. (2013) – Contrasted for differir

Paper Summary

<!--META_START-->

Title: Health digital state and Smart EHR systems

Authors: Luca Dan Serbanati

DOI: https://doi.org/10.1016/j.imu.2020.100494

Year: 2020

Publication Type: Journal

Discipline/Domain: Health Informatics

Subdomain/Topic: Digital Health, Electronic Health Records (EHR), Decision Support Systems

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 95

Actionable/Actionability Used in Paper: Yes — "assist healthcare professionals in making decisions using

Authors Argue for Need for Actionability Without Defining It: Yes — "improve business processes in healt

Contains Definition of Actionability: No — but defines "health digital state" as a concept enabling actionab

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes — Smart EHR conceptual model, VHR architecture, HDS generation alg

Operationalization Present: Yes

Primary Methodology: Conceptual

Study Context: Health and care systems digital transformation

Geographic/Institutional Context: N/A (conceptual, references EU and national systems)

Target Users/Stakeholders: Healthcare professionals, health system designers, policymakers

Primary Contribution Type: Conceptual Framework and System Architecture

CL: Yes — "holistic picture of their health" (p. 2)

CR: Yes — "contextualize all these observations… according to a digitalized conceptual model of health"

FE: Yes — "propose better solutions for the diagnosis and treatment" (p. 4)

TI: Yes — "proactive dispatching of significant notifications" (p. 4)

EX: Yes — "highlighting the possible internal contradictions… proposing solutions for their elimination" (p

GA: Yes — "assist… in making decisions… addressing the patient's concerns, fears… to improve health

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Health digital state and Smart EHR systems

Authors:

Luca Dan Serbanati

DOI:

https://doi.org/10.1016/j.imu.2020.100494

Year:

2020

Publication Type:

Journal

Discipline/Domain:

Health Informatics

Subdomain/Topic:

Digital Health, Electronic Health Records (EHR), Decision Support Systems

Contextual Background:

The paper addresses the need for a digitized representation of health — the "Health Digital State" (HDS)

Geographic/Institutional Context:

No specific geographic study setting; concepts are positioned for use in EU and national health system c

Target Users/Stakeholders:

Healthcare professionals, EHR system architects, policymakers, public health planners.

Primary Methodology:

Conceptual

Primary Contribution Type:

Conceptual framework and system architecture

General Summary of the Paper

The paper proposes the Health Digital State (HDS) — a digitized, holistic, and contextual representation

---

Actionable/Actionability Used in Paper

Yes.

- "assist healthcare professionals in making decisions using the HDS" (p. 1)

- "HDS… shapes the knowledge that underpins the decisions of healthcare professionals when diagnosir

- "proactively offering solutions, and helping them diagnose and decide on the right treatment" (p. 1)

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "improve business processes in health and care systems through digitalization" (p. 4)

- "intelligent support for medical decisions" (p. 6)

How Actionability is Understood

Implicitly understood as providing healthcare professionals with a digitally constructed, comprehensive, a

> "assist healthcare professionals in making decisions… addressing the patient's concerns, fears… to im

---

What Makes Something Actionable

- **Holistic and contextual health representation**

  > "contextualize all these observations… according to a digitalized conceptual model of health" (p. 2)

- **Evidence-based integration**

  > "digitized… from authoritative sources" (p. 22)

- **Proactive notification and support**

  > "proactive dispatching of significant notifications" (p. 4)

- **Conflict resolution and data cleaning**

  > "highlighting the possible internal contradictions… proposing solutions for their elimination" (p. 11)

- **Goal-oriented alignment**

  > "assist… in making decisions… addressing the patient's concerns, fears… to improve health status" (p

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Smart EHR System, Virtual Health Record (VHR), Health Digital Sta

- **Methods/Levers:** Conceptual modeling (HL7, CONTSYS), semantic networks, ontology-driven data s

- **Operational Steps / Workflow:** Data extraction from structured/unstructured sources → semantic inte

- **Data & Measures:** Quantifiable health parameters, structured clinical data, environmental and lifesty

- **Implementation Context:** National/regional EHR systems integrated with Smart EHR platform

> "HDS… is the digitization of the concept of health, a holistic and customized image of the well-being of

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "holistic picture of their health" (p. 2)

- **CR (Contextual Relevance):** Yes — "contextualize all these observations… according to a digitalize

- **FE (Feasibility):** Yes — "propose better solutions for the diagnosis and treatment" (p. 4)

- **TI (Timeliness):** Yes — "proactive dispatching of significant notifications" (p. 4)

- **EX (Explainability):** Yes — "highlighting the possible internal contradictions… proposing solutions fo

- **GA (Goal Alignment):** Yes — "assist… in making decisions… addressing the patient's concerns, fea

- **Other Dimensions Named by Authors:** Interoperability — "interoperable, holistic synthesis of all the a

---

Theoretical or Conceptual Foundations

- HL7 and CONTSYS standards for health informatics

- Semantic networks for modeling relationships between health states

- Digital twin and avatar concepts in healthcare

Indicators or Metrics for Actionability

- Completeness and non-redundancy of health data in HDS

- Resolution of conflicts in health data

- Coverage of health questionnaire slots with authoritative observations

---

Barriers and Enablers to Actionability

- **Barriers:** Fragmented and unstructured EHR data; varying specializations and subjective interpretati

  > "healthcare professionals… have different opinions… or the health of the individual has changed over

- **Enablers:** Smart EHR's semantic integration, proactive decision support, HDS as holistic health repr

  > "assist healthcare professionals… by providing… a holistic image" (p. 11)

Relation to Existing Literature

Builds upon HL7, CONTSYS, MeSH, UMLS, and digital health ecosystem frameworks. Extends prior EH

Summary

This paper presents the "Health Digital State" (HDS) as a novel digital equivalent of the health concept, d

---

Scores

- **Overall Relevance Score:** 92 — Strong conceptual definition of HDS as enabling actionable healthca

- **Operationalization Score:** 95 — Provides explicit, step-by-step algorithm for generating HDS, integra

---

Supporting Quotes from the Paper

- "HDS… shapes the knowledge that underpins the decisions of healthcare professionals when diagnosir

- "contextualize all these observations… according to a digitalized conceptual model of health" (p. 2)

- "highlighting the possible internal contradictions… proposing solutions for their elimination" (p. 11)

- "HDS… is the digitization of the concept of health, a holistic and customized image of the well-being of e

---

Actionability References to Other Papers

- HL7 (Health Level Seven International) standards

- CONTSYS (Continuity of Care) ISO 13940:2016

- MeSH (Medical Subject Headings)

- UMLS (Unified Medical Language System)

- Digital twin concepts in healthcare (Bruynseels et al., 2018)

Paper Summary

<!--META_START-->

Title: From Data Mining to Knowledge Discovery in Databases

Authors: Usama Fayyad, Gregory Piatetsky-Shapiro, Padhraic Smyth

DOI: N/A

Year: 1996

Publication Type: Journal (AI Magazine)

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Knowledge Discovery in Databases (KDD), Data Mining

Eligibility: Eligible

Overall Relevance Score: 78 – The paper defines key concepts tied to usefulness and outlines explicit cri

Operationalization Score: 70 – Provides a detailed multistep process for achieving useful knowledge, incl

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes – e.g., "lead to some benefit to the user

Contains Definition of Actionability: No – Defines "useful knowledge" with similar traits.

Contains Systematic Features/Dimensions: Yes – validity, novelty, usefulness, understandability.

Contains Explainability: Partial – "understandable patterns" (p. 41), examples of interpretability trade-offs.

Contains Interpretability: Yes – stresses importance of models being human-interpretable.

Contains Framework/Model: Yes – KDD process model with steps and evaluation metrics.

Operationalization Present: Yes – step-by-step KDD process description.

Primary Methodology: Conceptual / Review

Study Context: Cross-domain, examples from science and business applications.

Geographic/Institutional Context: Various; authors from Microsoft Research, GTE Labs, University of Cali

Target Users/Stakeholders: Data scientists, AI researchers, domain experts in applied fields.

Primary Contribution Type: Conceptual framework and process model for KDD.

CL: Yes – "understandable patterns" (p. 41)

CR: Yes – Focus on domain-specific utility and prior knowledge relevance (p. 49)

FE: Partial – Implied in "lead to some benefit… possibly in dollars saved" (p. 41)

TI: No – Timeliness not explicitly addressed

EX: Partial – Focus on interpretability and visualization, but not as a formal dimension (p. 40, 50)

GA: Yes – End-user goals guide process from the start (p. 42)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

From Data Mining to Knowledge Discovery in Databases

Authors:

Usama Fayyad, Gregory Piatetsky-Shapiro, Padhraic Smyth

DOI:

N/A

Year:

1996

Publication Type:

Journal (AI Magazine)

Discipline/Domain:

Computer Science / Artificial Intelligence

Subdomain/Topic:

Knowledge Discovery in Databases (KDD), Data Mining

Contextual Background:

This seminal AI Magazine article synthesizes developments in knowledge discovery and data mining duri

Geographic/Institutional Context:

Microsoft Research, GTE Laboratories, University of California Irvine, Jet Propulsion Laboratory.

Target Users/Stakeholders:

Data scientists, AI researchers, and domain specialists in applied analytics.

Primary Methodology:

Conceptual / Review

Primary Contribution Type:

Framework and process model

General Summary of the Paper

The paper distinguishes between "data mining" and "knowledge discovery in databases" (KDD), positionin

---

Actionable/Actionability Used in Paper

No – The terms "actionable" or "actionability" do not appear. However, the paper emphasizes "usefulness

---

Authors Argue for a Need for Actionability Without Defining It

Yes:

> "We also want patterns to be… potentially useful, that is, lead to some benefit to the user or task." (p. 4

> "KDD places a special emphasis on finding understandable patterns that can be interpreted as useful o

---

How Actionability is Understood

Implicitly, actionability is framed as the combination of validity, novelty, usefulness, and understandability

---

What Makes Something Actionable

- **Validity**:
  > "The discovered patterns should be valid on new data with some degree of certainty." (p. 41)
- **Novelty**:
  > "Patterns to be novel… at least to the system and preferably to the user." (p. 41)
- **Usefulness**:
  > "… lead to some benefit to the user or task." (p. 41)
- **Understandability**:

> "Finally, the patterns should be understandable, if not immediately then after some postprocessing." (p

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** KDD process model

- **Methods/Levers:** Domain understanding, data selection, cleaning, reduction, transformation, data mi

- **Operational Steps / Workflow:** Nine-step iterative process (p. 42)

- **Data & Measures:** Measures of certainty, utility, simplicity; interestingness functions.

- **Implementation Context:** Broad applicability across business, science, and government.

> "Ninth is acting on the discovered knowledge: using the knowledge directly, incorporating the knowledg

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "understandable patterns" (p. 41)

- **CR (Contextual Relevance):** Yes – importance of domain knowledge and relevant attributes (p. 49)

- **FE (Feasibility):** Partial – implied in "lead to some benefit… possibly in dollars saved" (p. 41)

- **TI (Timeliness):** No – not explicitly addressed

- **EX (Explainability):** Partial – discussion of interpretability vs. complexity (p. 40, 50)

- **GA (Goal Alignment):** Yes – domain goals shape KDD process from the start (p. 42)

- **Other Dimensions Named by Authors:** Novelty, validity, simplicity

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Theoretical or Conceptual Foundations

- Statistical modeling

- Machine learning

- Pattern recognition

- Database systems theory

- Interestingness functions as evaluation

Indicators or Metrics for Actionability

- Prediction accuracy on new data

- Utility measures (e.g., cost savings)

- Simplicity measures (description length)

- Interestingness thresholds

Barriers and Enablers to Actionability

Barriers:

- High dimensionality (p. 49)

- Noise and missing data (p. 50)

- Overfitting (p. 49)

- Lack of domain knowledge (p. 49)

Enablers:

- Data cleaning and integration (p. 40)

- Incorporating prior knowledge (p. 49)

- Interactive and iterative process (p. 42)

Relation to Existing Literature

Builds on machine learning, statistics, and database systems, unifying them under the KDD process fram

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Summary

This paper formalizes the KDD process, distinguishing it from the narrower scope of data mining and defi

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Scores

- **Overall Relevance Score:** 78 – Clear mapping to actionability dimensions except for timeliness; no e

- **Operationalization Score:** 70 – Detailed process and evaluation framework, but not explicitly connec

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Supporting Quotes from the Paper

- "KDD is the nontrivial process of identifying valid, novel, potentially useful, and ultimately understandabl

- "Lead to some benefit to the user or task." (p. 41)

- "Ninth is acting on the discovered knowledge…" (p. 42)

Actionability References to Other Papers

- Silberschatz & Tuzhilin (1995) – subjective measures of interestingness

- Piatetsky-Shapiro & Matheus (1994) – interestingness of deviations

- Brachman & Anand (1996) – human-centered KDD process

Paper Summary

<!--META_START-->

<!--META_END-->

Title:

Explanation in Artificial Intelligence: Insights from the Social Sciences

Authors:

Tim Miller

DOI:

arXiv:1706.07269v3

Year:

2018

Publication Type:

Journal (Preprint)

Discipline/Domain:

Artificial Intelligence, Social Sciences

Subdomain/Topic:

Explainable AI (XAI), Human-Agent Interaction

Contextual Background:

The paper synthesizes findings from philosophy, cognitive psychology/science, and social psychology on

Geographic/Institutional Context:

School of Computing and Information Systems, University of Melbourne, Australia.

Target Users/Stakeholders:

AI researchers, system designers, HCI specialists, cognitive scientists, practitioners building explainable

Primary Methodology:

Conceptual Review

Primary Contribution Type:

Theoretical synthesis and design recommendations.

General Summary of the Paper

This paper reviews over 250 works from social sciences to inform explainable AI (XAI) design, arguing th

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

In the XAI context, "actionability" is implicitly tied to providing explanations that enable users to trust, inter

> "Explanations are not just the presentation of associations and causes… they are contextual" (p. 6)

> "Explanations are social — they are a transfer of knowledge, presented as part of a conversation… rela

What Makes Something Actionable

- Contrastive framing: answers "Why P rather than Q?"

- Selection of relevant causes over exhaustive causality

- Avoidance of purely statistical justification; preference for causal narratives

- Social alignment: tailoring to explainee's beliefs, knowledge, and context

- Structuring at the right "level" of explanation (material, formal, efficient, final)

- Incorporation of abnormality, intentionality, and controllability as salience cues

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Contrastive Explanation, Model of Self, Overton's Structure of Expla

- **Methods/Levers:** Identify fact–foil pairs; use abnormality detection; infer explainee's knowledge state

- **Operational Steps / Workflow:**

  1. Determine explainee's question and implicit foil

  2. Identify minimal relevant causes based on contrastive differences

  3. Filter through abnormality, intentionality, and goal alignment criteria

  4. Present in conversational, iterative format, tailored to the explainee's model

- **Data & Measures:** User knowledge models, causal chains, model abstractions, interaction logs.

- **Implementation Context:** Human–agent interaction systems, decision-support tools, autonomous sys

> "An intelligent agent must be able to reason about its own causal model… alongside the decision-makin

> "Providing two complete explanations does not take advantage of contrastive questions" (p. 21)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Explanations are not just causal chains… must be interpretable by lay-users" (p

- **CR (Contextual Relevance):** Yes — "They are contextual… explainee cares only about a small subs

- **FE (Feasibility):** Yes — Ensuring explanations are within user's cognitive capacity, via selection and

- **TI (Timeliness):** Partial — Discussed in terms of interaction timing and explanation when needed.

- **EX (Explainability):** Yes — Entire paper centers on making AI outputs explainable through social scie

- **GA (Goal Alignment):** Yes — Emphasis on aligning explanation with explainee's goals and social pu

- **Other Dimensions Named by Authors:** Abnormality, Intentionality, Functionality, Coherence, Simplici

Theoretical or Conceptual Foundations

- Aristotle's Four Causes

- Halpern & Pearl's Structural Causal Models

- Malle's Social Attribution Framework

- Hilton's Conversational Model of Explanation

- Grice's Maxims of Conversation

- Overton's Structure of Scientific Explanation

Indicators or Metrics for Actionability

No direct quantitative KPIs; proposes qualitative alignment metrics such as relevance, simplicity, coheren

Barriers and Enablers to Actionability

- **Barriers:** Overemphasis on causal attribution over explanation; failure to infer foils; cognitive overloa

- **Enablers:** Inferring foils; using cognitive biases constructively; interactive dialogue; models of self an

Relation to Existing Literature

Positions XAI as overly reliant on researcher intuition, contrasting with robust, experimentally validated sc

Summary

Miller (2018) reframes explainability in AI as a human-agent interaction problem grounded in social scien

Scores

- **Overall Relevance Score:** 95 — Rich, explicit linkage of social science principles to explanation as a

- **Operationalization Score:** 85 — Provides concrete design principles and procedural guidance, thoug

Supporting Quotes from the Paper

- "Explanations are not just the presentation of associations and causes… they are contextual" (p. 6)

- "Explanations are social — they are a transfer of knowledge, presented as part of a conversation" (p. 6)

- "An intelligent agent must be able to reason about its own causal model… a model of self" (p. 22)

- "Providing two complete explanations does not take advantage of contrastive questions" (p. 21)

Actionability References to Other Papers

- Halpern & Pearl (2005) on Structural Causal Models

- Malle (2004) on Social Attribution

- Hilton (1990) on Conversational Models

- Grice (1975) on Maxims of Conversation

- Overton (2012) on Structure of Explanation

- Lipton (1990) on Contrastive Explanation

Paper Summary

<!--META_START-->

Eligibility: Eligible

Overall Relevance Score: 82

Operationalization Score: 90

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: Yes — "aiming to improve users' trust in the

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes — ExMatrix method

Operationalization Present: Yes

Primary Methodology: Conceptual + Empirical (method proposal, use cases, user study)

Study Context: Machine learning interpretability for Random Forests

Geographic/Institutional Context: Federal Institute of Sao Paulo (Brazil), University of Sao Paulo (Brazil),

Target Users/Stakeholders: Data scientists, ML engineers, decision-makers needing interpretable ML out

Primary Contribution Type: Visualization method for interpretability

CL: Yes — "removing unimportant information and reducing cluttering" (p. 1435)

CR: Yes — "focus on what is important regarding the overall model behavior" (p. 1431)

FE: Partial — indirectly via coverage and certainty measures (p. 1430–1431)

TI: No

EX: Yes — "supporting model overview and details on-demand" (p. 1427)

GA: Partial — aligning model explanations with user analytical tasks (p. 1430–1431)

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Explainable Matrix – Visualization for Global and Local Interpretability of Random Forest Classification Er

Authors:

Mario Popolin Neto, Fernando V. Paulovich

DOI:

10.1109/TVCG.2020.3030354

Year:

2021

Publication Type:

Journal

Discipline/Domain:

Computer Science / Machine Learning / Visualization

Subdomain/Topic:

Explainable AI, Random Forest Interpretability, Visualization Techniques

Contextual Background:

The paper addresses the challenge of interpreting complex ensemble models, particularly Random Fores

Geographic/Institutional Context:

Federal Institute of Sao Paulo (Brazil), University of Sao Paulo (Brazil), Dalhousie University (Canada)

Target Users/Stakeholders:

Data scientists, ML engineers, decision-makers needing interpretable ML outputs

Primary Methodology:

Conceptual method design + use-case demonstration + user study

Primary Contribution Type:

Novel visualization framework for RF interpretability

General Summary of the Paper

The paper introduces **Explainable Matrix (ExMatrix)**, a novel matrix-based visualization technique des

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Actionable/Actionability Used in Paper

No — The paper focuses on interpretability and explainability without using the terms "actionable" or "acti

---

Authors Argue for a Need for Actionability Without Defining It

Yes —

> "Aiming to improve users' trust in the model" (p. 1428)

> "Allowing the results to be used in practice" (p. 1433)

How Actionability is Understood

Implicit — Actionability is treated as providing interpretable, trustworthy, and usable model explanations t

---

What Makes Something Actionable

- **Clarity of model reasoning**

  > "Removing unimportant information and reducing cluttering" (p. 1435)

- **Contextual relevance to user tasks**

  > "Focus on what is important regarding the overall model behavior" (p. 1431)

- **Explainability and interpretability**

  > "Supporting model overview and details on-demand" (p. 1427)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** ExMatrix

- **Methods/Levers:** Vector rule extraction from decision trees, matrix visualization, ordering and filtering

- **Operational Steps / Workflow:**

  1. Extract decision paths from RF trees and convert into logic-rule vectors

  2. Map rules (rows) and features (columns) into a matrix visualization

  3. Use icons to depict predicate ranges, coverage, certainty, and feature importance

  4. Enable ordering/filtering for global or local views

  5. Support local instance analysis and counterfactual reasoning

- **Data & Measures:** Coverage, certainty, feature importance (MDI), predicate intervals

- **Implementation Context:** Applied to RF models in medical, financial, and public health datasets

> "Supporting model overview and details on-demand" (p. 1427)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Removing unimportant information and reducing cluttering" (p. 1435)

- **CR (Contextual Relevance):** Yes — "Focus on what is important regarding the overall model behavior"

- **FE (Feasibility):** Partial — via coverage and certainty to gauge reliability (p. 1430–1431)

- **TI (Timeliness):** No

- **EX (Explainability):** Yes — "Supporting model overview and details on-demand" (p. 1427)

- **GA (Goal Alignment):** Partial — aligning explanations with analytical tasks (p. 1430–1431)

- **Other Dimensions Named by Authors:** None explicitly as part of "actionability"

Theoretical or Conceptual Foundations

- Rule-based model interpretability

- Visualization theory (matrix-like metaphors, ordering/filtering principles)

- Surrogate modeling for black-box explainability

Indicators or Metrics for Actionability

Indirect — coverage, certainty, feature importance (as proxies for relevance/reliability of rules)

Barriers and Enablers to Actionability

- **Barriers:** Scalability in visualizing all RF rules (p. 1435), complexity of certain views for non-experts (
- **Enablers:** Filtering, ordering, compact matrix representation, icons for predicates (p. 1430–1431)

Relation to Existing Literature

The authors position ExMatrix against prior visualization approaches (node-link diagrams, Decision Table

---

Summary

This paper presents **ExMatrix**, a scalable visualization framework for interpreting Random Forest mod

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Scores

- **Overall Relevance Score:** 82 — Strong alignment with actionable principles via interpretability and p
- **Operationalization Score:** 90 — Detailed method with clear workflow, metrics, and tool implementatio

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Supporting Quotes from the Paper

- "Supporting model overview and details on-demand" (p. 1427)
- "Focus on what is important regarding the overall model behavior" (p. 1431)
- "Removing unimportant information and reducing cluttering" (p. 1435)

Actionability References to Other Papers

- RuleMatrix: Ming et al. (2019)
- iForest: Zhao et al. (2019)
- Surrogate Decision Trees: Di Castro & Bertini (2019)

Paper Summary

<!--META_START-->

Title: Explainable machine learning algorithms to identify predictors of intention to use family planning am

Authors: Jibril Bashir Adem, Tewodros Desalegn Nebi, Agmasie Damtew Walle, Daniel Niguse Mamo, Su

Eligibility: Not Eligible

Overall Relevance Score: 20 – While the study uses explainable AI and identifies predictors to inform inte

Operationalization Score: 40 – The paper operationalizes prediction of intention to use FP via ML workflo

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Yes – SHAP-based model interpretation is a core part of the methodology.

Contains Interpretability: Yes – Model-agnostic SHAP feature importance used for interpretation.

Contains Framework/Model: Yes – Workflow includes ML pipeline and SHAP explainability model.

Operationalization Present: Yes – Data preprocessing, balancing, model selection, and interpretation step

Primary Methodology: Quantitative (Machine Learning)

Study Context: Family planning intention prediction among Ethiopian women of reproductive age

Geographic/Institutional Context: Ethiopia, using nationally representative PMA 2021 survey data

Target Users/Stakeholders: Ethiopian Ministry of Health, health policy makers, family planning programm

Primary Contribution Type: Predictive model and identification of key predictors for FP intention

CL: No

CR: No

FE: No

TI: No

EX: Yes – SHAP-based explanation of predictors.

GA: No

Reason if Not Eligible: The paper does not conceptualize or define "actionability," nor does it frame its fin

<!--META_END-->

Title: Explainable machine learning algorithms to identify predictors of intention to use family planning

Authors: Jibril Bashir Adem, Tewodros Desalegn Nebi, Agmasie Damtew Walle, Daniel Niguse Mamo

DOI: 10.1136/bmjph-2024-000962

Year: 2025

Publication Type: Journal

Discipline/Domain: Public Health, Reproductive Health, Machine Learning

Subdomain/Topic: Family Planning Intention Prediction, Explainable AI, SHAP Analysis

Contextual Background: The study addresses low utilization of family planning in Ethiopia, aiming to id

Geographic/Institutional Context: Ethiopia, PMA 2021 dataset

Target Users/Stakeholders: Public health policymakers, FP programme designers, researchers in rep

Primary Methodology: Quantitative (ML classifiers with SHAP interpretation)

Primary Contribution Type: Predictive analytics with model interpretability for FP intention

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General Summary of the Paper

This study uses the Ethiopian PMA 2021 survey to predict women's intention to use family planning (FP)

Actionable/Actionability Used in Paper

No – The study does not use the term "actionability," "actionable insight," "actionable recommendation," o

---

Authors Argue for a Need for Actionability Without Defining It

No – While the authors suggest their results can inform targeted interventions, they do not explicitly call fo

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A – The operationalization described relates to ML prediction processes, not to making findings actiona

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** Yes – "SHAP analysis provides a global or local interpretation and explanation of

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

No theoretical framework for "actionability" is presented; ML methodology is grounded in SHAP interpreta

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Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A

- **Enablers:** N/A

Relation to Existing Literature

The study situates itself in the context of prior work on determinants of FP intention and ML applications i

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Summary

This research applies explainable machine learning to predict intention to use family planning among Eth

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Scores

- **Overall Relevance Score:** 20 – Minimal conceptual linkage to actionability; results could be actionab

- **Operationalization Score:** 40 – Strong operationalization of ML workflow, but no operationalization of

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Supporting Quotes from the Paper

- "SHAP analysis provides a global or local interpretation and explanation of any ML model's prediction."

- "Insights from this study can inform targeted interventions and policies to enhance the health and well-b

- "The top predictors of intention to use FP were determined using model-agnostic SHAP global feature in

---

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Evaluating the Quality of Machine Learning Explanations: A Survey on Methods and Metrics

Authors: Jianlong Zhou, Amir H. Gandomi, Fang Chen, Andreas Holzinger

DOI: https://doi.org/10.3390/electronics10050593

Year: 2021

Publication Type: Journal

Discipline/Domain: Machine Learning / Explainable AI (XAI)

Subdomain/Topic: Evaluation of ML explanations; metrics and methods for assessing explanation quality

Eligibility: Eligible

Overall Relevance Score: 85 – The paper provides a well-structured conceptualization of explainability, li

Operationalization Score: 80 – Contains a taxonomy, metrics, and evaluation methodologies that can be

Actionable/Actionability Used in Paper: No – The paper does not use the term "actionable" but consistent

Authors Argue for Need for Actionability Without Defining It: Yes – The need to "assess if explainability ac

Contains Definition of Actionability: No – Defines explainability and its properties, not actionability per se.

Contains Systematic Features/Dimensions: Yes – Clarity, parsimony, broadness, completeness, soundne

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes – Taxonomy of explanation types; taxonomy of evaluation methods; ma

Operationalization Present: Yes – Quantitative and qualitative metrics, evaluation workflows.

Primary Methodology: Review

Study Context: Survey of literature on evaluating ML explanations.

Geographic/Institutional Context: Global literature; authors affiliated with Australia and Austria.

Target Users/Stakeholders: Researchers, ML practitioners, application-domain experts in high-stakes do

Primary Contribution Type: Conceptual framework + taxonomy + metrics for evaluation.

CL: Yes – "Clarity implies that the explanation is unambiguous" (p. 3)

CR: Partial – Context-dependence noted but not formally codified as a property.

FE: Yes – Parsimony and simplicity operationalized; feasibility implied through model complexity metrics.

TI: No – Timeliness not addressed.

EX: Yes – Explainability defined and broken into interpretability and fidelity.

GA: Partial – Goal alignment implied through "achieves the defined objective" (p. 8) but not a distinct prop

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Evaluating the Quality of Machine Learning Explanations: A Survey on Methods and Metrics

Authors:

Jianlong Zhou, Amir H. Gandomi, Fang Chen, Andreas Holzinger

DOI:

https://doi.org/10.3390/electronics10050593

Year:

2021

Publication Type:

Journal

Discipline/Domain:

Machine Learning / Explainable AI (XAI)

Subdomain/Topic:

Evaluation of ML explanations; metrics and methods for assessing explanation quality

Contextual Background:

The paper addresses the growing need to evaluate the quality of explanations provided by machine learn

Geographic/Institutional Context:

Authored by researchers from the University of Technology Sydney (Australia) and Medical University of

Target Users/Stakeholders:

ML researchers, explainability tool developers, domain experts in regulated sectors, policymakers.

Primary Methodology:

Literature review and conceptual synthesis.

Primary Contribution Type:

Framework and taxonomy for evaluation of ML explanations; mapping of properties to metrics.

General Summary of the Paper

This survey systematically examines methods and metrics for evaluating machine learning explanations.

Actionable/Actionability Used in Paper

No – The paper does not use "actionable" explicitly.

However:

> "To assess if explainability is achieved in an application… determining if the provided explainability ach

> "Suggest the most appropriate explanation from the comparison for a specific task" (p. 1)

Authors Argue for a Need for Actionability Without Defining It

Yes – Implies the necessity for explanations that support real-world decision-making and task completion

> "…find the most appropriate explanation for a specific ML solution in a given context on a given task for

> "…determine if the provided explainability achieves the defined objective" (p. 8)

How Actionability is Understood

Implicit: Actionability is framed as the alignment between explanation properties (clarity, completeness, e

---

What Makes Something Actionable

- **Clarity (unambiguous)**

  > "Clarity implies that the explanation is unambiguous" (p. 3)

- **Parsimony/Simplicity**

  > "…presented in a simple and compact form" (p. 3)

- **Broadness (generally applicable)**

  > "…describes how generally applicable is an explanation" (p. 3)

- **Completeness**

  > "…describes the entire dynamic of the ML model" (p. 3)

- **Soundness**

  > "…how correct and truthful the explanation is" (p. 3)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Taxonomy of evaluation approaches (application-grounded, human-

- **Methods/Levers:** Human-centred subjective and objective metrics; functionality-grounded quantitativ

- **Operational Steps / Workflow:** Identify properties of explainability → map to metrics → apply appropr

- **Data & Measures:** Model complexity measures, sensitivity analysis, trust/confidence questionnaires,

- **Implementation Context:** Suitable for both research and applied ML in high-stakes decision-making.

> "Evaluation metrics… can guide the practitioner in the selection of the most appropriate explanation me

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – "Clarity implies that the explanation is unambiguous" (p. 3)

- **CR (Contextual Relevance):** Partial – context noted as key to perceived quality (p. 2)

- **FE (Feasibility):** Yes – Parsimony and simplicity linked to operational feasibility (p. 3, p. 11)

- **TI (Timeliness):** No – Not addressed as a property.

- **EX (Explainability):** Yes – Defined explicitly and decomposed into interpretability and fidelity (p. 3)

- **GA (Goal Alignment):** Partial – "Achieves the defined objective" (p. 8)

- **Other Dimensions Named by Authors:** Broadness, Completeness, Soundness.

Theoretical or Conceptual Foundations

- Interpretability and fidelity framework (Markus et al. 2020)

- Taxonomy of evaluation methods (Doshi-Velez & Kim, 2017)

- Properties derived from prior work (Gilpin et al., Lombrozo).

Indicators or Metrics for Actionability

- Model size, runtime operation counts, interaction strength, main effect complexity

- Monotonicity, non-sensitivity, effective complexity, mutual information, selectivity, continuity

- Non-representativeness, diversity for example-based explanations

- Subjective trust/confidence scores; task performance measures.

Barriers and Enablers to Actionability

Barriers:

- Subjectivity of explanation quality (p. 2)

- Context dependence (p. 2)

- Lack of agreed criteria for human-centred evaluations (p. 14)

Enablers:

- Mapping properties to metrics (p. 11)

- Combining human-centred and functionality-grounded evaluations (p. 15)

Relation to Existing Literature

Builds on prior surveys of explainability, extends by focusing on evaluation quality metrics and mapping t

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Summary

Zhou et al. (2021) present the first survey dedicated to evaluating the quality of machine learning explana

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Scores

- **Overall Relevance Score:** 85 – Strong conceptual mapping of explanation properties to evaluation m

- **Operationalization Score:** 80 – Provides concrete metrics and workflows, though not framed in explic

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Supporting Quotes from the Paper

- "Clarity implies that the explanation is unambiguous" (p. 3)

- "Parsimony means that the explanation is presented in a simple and compact form" (p. 3)

- "Completeness implies that the explanation describes the entire dynamic of the ML model" (p. 3)

- "Soundness concerns how correct and truthful the explanation is" (p. 3)

- "To assess if explainability is achieved in an application… determining if the provided explainability achi

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Actionability References to Other Papers

- Markus et al. (2020) – Properties of explainability

- Doshi-Velez & Kim (2017) – Evaluation taxonomy

- Gilpin et al. (2018) – Interpretability and fidelity

- Lombrozo (2016) – Simplicity and breadth in explanations

Paper Summary

<!--META_START-->

Title: Decision Support Systems: The Next Decade

Authors: Peter G.W. Keen

DOI: n/a

Year: 1987

Publication Type: Journal Article

Discipline/Domain: Information Systems / Management Science

Subdomain/Topic: Decision Support Systems (DSS), Actionability in Decision Support

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicit and explicit through decision support conceptualization)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (Extended Decision Support model)

Operationalization Present: Yes

Primary Methodology: Conceptual / Position Paper

Study Context: DSS research and practice globally, with examples from business, technology, and mana

Geographic/Institutional Context: International; references to US, Europe, Asia; author from International

Target Users/Stakeholders: Senior managers, DSS developers, information systems professionals, organ

Primary Contribution Type: Conceptual framework and agenda for DSS research and practice

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Decision Support Systems: The Next Decade

Authors:

Peter G.W. Keen

DOI:

n/a

Year:

1987

Publication Type:

Journal Article

Discipline/Domain:

Information Systems / Management Science

Subdomain/Topic:

Decision Support Systems (DSS), Actionability in Decision Support

Contextual Background:

The paper addresses the evolution and future direction of Decision Support Systems, framing DSS as bo

Geographic/Institutional Context:

International; examples drawn from US, Europe, Asia.

Target Users/Stakeholders:

Senior managers, DSS builders, information systems professionals, organizational decision-makers.

Primary Methodology:

Conceptual / Position Paper

Primary Contribution Type:

Conceptual framework and research/practice agenda

General Summary of the Paper

The article reviews the first decade of DSS, noting the shift from technology bottlenecks to an environme

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the capacity of DSS to provide decision support that improves the quality, creat

> "DSS is concerned with intellectual as well as computer-related technologies… We need to have a mor

> "The agenda… is to apply intellectual and computer-related technologies to amplify creativity and learn

What Makes Something Actionable

- Decision relevance: supports critical, high-impact organizational decisions.

- Integration of judgment with analytic tools.

- Contextual fit to user needs and organizational priorities.

- Ability to improve decision process quality, not just provide data.

- Leveraging appropriate technology for the decision context.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Extended Decision Support (EDS)

- **Methods/Levers:** Explicit targeting of significant decisions; blending analytic models with AI and docu

- **Operational Steps / Workflow:** Identify decision areas of high value; build systems integrating analyti

- **Data & Measures:** Use organizational data stores; integrate document-based info; apply multicriteria

- **Implementation Context:** Senior management planning, competitive/environmental scanning, organiz

> "Extended support involves an explicit effort to influence and guide decision making… while respecting

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Systems must be understandable and usable to decision makers.

- **CR (Contextual Relevance):** Yes — Support must align with "decisions that really matter."

- **FE (Feasibility):** Yes — Tools and approaches must be practical in organizational settings.

- **TI (Timeliness):** Partial — Focus on reducing "information float" and delivering alerts before issues e

- **EX (Explainability):** Yes — EDS aims to make reasoning visible (e.g., semi-expert systems showing

- **GA (Goal Alignment):** Yes — Systems must align with primary business goals and user priorities.

- **Other Dimensions Named by Authors:**

  - Level of support (Passive, Traditional, Extended, Normative)

  - Organizational integration (link with IS and data resources)

Theoretical or Conceptual Foundations

- Herbert Simon's concepts of satisficing vs. optimization.

- Cognitive psychology and Carnegie School decision-making research.

- Management Science and multicriteria decision-making theories.

Indicators or Metrics for Actionability

- Targeting high-value decisions.

- Reducing decision-making delays ("information float").

- Integration of analytic and judgmental elements.

Barriers and Enablers to Actionability

- **Barriers:** Lack of clear DSS definitions; overemphasis on technology over decision focus; "cherry-pic

- **Enablers:** Emerging AI tools; document-based DSS; telecommunications; strong linkages with IS an

Relation to Existing Literature

Positions DSS as an evolution from Management Science and early decision-making theories, but critiqu

Summary

Keen's paper reframes DSS for its second decade, arguing for a more ambitious and decision-centered a

Scores

- **Overall Relevance Score:** 88 — Strong conceptual treatment of actionability with explicit features an

- **Operationalization Score:** 85 — Provides concrete methods (EDS model, target market identification

Supporting Quotes from the Paper

- "DSS is concerned with intellectual as well as computer-related technologies…" (p. 255)

- "Apply intellectual and computer-related technologies to amplify creativity and learning in decisions that

- "Extended support involves an explicit effort to influence and guide decision making…" (p. 258)

- "Reduce information 'float'…" (p. 264)

Actionability References to Other Papers

- Keen & Scott Morton (1978) *Decision Support Systems: An Organizational Perspective*

- Elam et al. (1986) *A Vision for DSS Research*

- Herbert Simon (1969) *Sciences of the Artificial*

- Sprague & Carlson (1982) *Building Effective Decision Support Systems*

Paper Summary

<!--META_START-->

Title: Co-Designing a Real-Time Classroom Orchestration Tool to Support Teacher–AI Complementarity

Authors: Kenneth Holstein, Bruce M. McLaren, Vincent Aleven

DOI: http://dx.doi.org/10.18608/jla.2019.62.3

Year: 2019

Publication Type: Journal

Discipline/Domain: Learning Analytics / Human–Computer Interaction

Subdomain/Topic: Co-design of AI-enhanced classroom orchestration tools

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and partial explicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (Replay Enactments prototyping method)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (qualitative need-finding, iterative prototyping, in-lab simulation, cla

Study Context: K–12 AI-enhanced classrooms using Intelligent Tutoring Systems (ITS)

Geographic/Institutional Context: US middle schools, Carnegie Mellon University-led research

Target Users/Stakeholders: K–12 teachers, students, educational technologists

Primary Contribution Type: Empirical case study and methodological framework

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

Title:

Co-Designing a Real-Time Classroom Orchestration Tool to Support Teacher–AI Complementarity

Authors:

Kenneth Holstein, Bruce M. McLaren, Vincent Aleven

DOI:

http://dx.doi.org/10.18608/jla.2019.62.3

Year:

2019

Publication Type:

Journal

Discipline/Domain:

Learning Analytics / Human–Computer Interaction

Subdomain/Topic:

Participatory design, AI in education, teacher orchestration tools

Contextual Background:

The study addresses the challenge of designing AI-driven learning analytics (LA) tools that meaningfully i

Geographic/Institutional Context:

Conducted in US middle schools in collaboration with Carnegie Mellon University.

Target Users/Stakeholders:

Middle-school teachers, students, educational technologists.

Primary Methodology:

Mixed methods: generative design (interviews, card sorting, storytelling), iterative prototyping (low–high fi

Primary Contribution Type:

Empirical design case study and introduction of a novel prototyping method for data-driven algorithmic sy

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General Summary of the Paper

The paper presents the first end-to-end co-design case study of a complex learning analytics tool—*Lumi

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as analytics that:

- Link directly to specific teacher decisions and interventions in real time.

- Provide timely, context-relevant, and interpretable insights that support in-the-moment decision-making.

- Enhance rather than replace teacher autonomy.

> "Prompting teachers to reflect on what real-time decisions a particular information display might inform

> Teachers distinguished between "seeing thought processes" and abstract mastery probabilities, noting

---

What Makes Something Actionable

- Direct linkage between analytics and possible teacher interventions.

- Timeliness to act during a learning episode.

- Interpretability to justify and trust recommendations.

- Contextual relevance to the specific class, student, and task.

- Respect for teacher autonomy and flexibility in use.

- Grounding automated inferences in raw, concrete student artifacts.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Replay Enactments (REs) for co-design and prototyping.

- **Methods/Levers:** Generative need-finding (superpowers exercise, storytelling), iterative prototyping (

- **Operational Steps / Workflow:** Identify teacher needs → prototype low-fidelity displays → mid-fidelity

- **Data & Measures:** ITS logs, real-time detectors for misuse, struggle, performance, engagement; tea

- **Implementation Context:** US middle-school ITS classrooms.

> "REs… enable earlier, nuanced observations of the interplay between human and machine judgments.

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – indicators visually simple with on-demand elaborations (p. 38).

- **CR (Contextual Relevance):** Yes – tailored to class-level, student-level needs (p. 33).

- **FE (Feasibility):** Yes – designs respect teacher constraints, cognitive load (p. 33, p. 47).

- **TI (Timeliness):** Yes – real-time analytics to intervene "in the moment" (p. 31, p. 47).

- **EX (Explainability):** Yes – grounded in raw student artifacts to justify inferences (p. 39).

- **GA (Goal Alignment):** Yes – respect teacher goals, autonomy, instructional style (p. 35, p. 47).

- **Other Dimensions Named:** Selective sharing, adaptability of thresholds, anonymity for help-seeking.

Theoretical or Conceptual Foundations

- Participatory/co-design principles from HCI.

- Human–machine function allocation literature.

- Open learner models and explainable AI in education.

Indicators or Metrics for Actionability

- Accuracy and interpretability of student state detectors.

- Teacher time allocation toward students with greater need.

- Reduction in learning outcome gaps.

Barriers and Enablers to Actionability

- **Barriers:** Teacher overload; autonomy concerns; risk of distraction; privacy; lack of transparency in l

- **Enablers:** Wearable displays; context-sensitive analytics; selective visibility; raw data grounding; flex

---

Relation to Existing Literature

Extends prior LA co-design frameworks by demonstrating a full-cycle, stakeholder-driven design with a n

---

Summary

The authors detail a multi-year co-design process culminating in *Lumilo*, a wearable real-time analytics

---

Scores

- **Overall Relevance Score:** 88 – Strong implicit and partial explicit conceptualization of actionability wi

- **Operationalization Score:** 95 – Comprehensive, multi-phase, and innovative operationalization with l

---

Supporting Quotes from the Paper

- "Such skill mastery estimates were less actionable… if teachers could follow students' thought processe

- "Receiving more direct… feedback about the effects of their own teaching… could help them adjust thei

- "Ground automated inferences in 'raw' examples… Showing these example errors is crucial… in suppor

- "Prompting teachers to reflect on what… might inform… often led them to notice ways… display could b

---

Actionability References to Other Papers

- Bull & Kay (2016) on grounding analytics in raw data.

- Martinez-Maldonado et al. (2016) LATUX workflow.

- Doshi-Velez & Kim (2017) on interpretable ML.

- Aguilar (2018) on social comparison in analytics.

- Beck & Gong (2013) on detecting "wheel-spinning."

Paper Summary

<!--META_START-->

Title: Clinical Practice Guidelines: A Manual for Developing Evidence-Based Guidelines to Facilitate Perf

Authors: Richard M. Rosenfeld, MD, MPH; Richard N. Shiffman, MD, MCIS

DOI: 10.1016/j.otohns.2006.06.1277

Year: 2006

Publication Type: Journal Article (Special Contribution)

Discipline/Domain: Medicine / Health Policy

Subdomain/Topic: Clinical Practice Guideline Development

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 98

Contains Definition of Actionability: Yes (explicit, as part of defining actionable guideline recommendation

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (COGS, AGREE, GLIA-based framework)

Operationalization Present: Yes

Primary Methodology: Conceptual / Methodological Guide

Study Context: Guideline development in clinical medicine

Geographic/Institutional Context: USA; American Academy of Otolaryngology–Head and Neck Surgery, Y

Target Users/Stakeholders: Clinicians, healthcare organizations, specialty societies, performance measu

Primary Contribution Type: Comprehensive, step-by-step manual for actionable guideline creation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Clinical Practice Guidelines: A Manual for Developing Evidence-Based Guidelines to Facilitate Performar

Authors:

Richard M. Rosenfeld, MD, MPH; Richard N. Shiffman, MD, MCIS

DOI:

10.1016/j.otohns.2006.06.1277

Year:

2006

Publication Type:

Journal Article (Special Contribution)

Discipline/Domain:

Medicine / Health Policy

Subdomain/Topic:

Clinical Practice Guideline Development

Contextual Background:

The manual addresses how to systematically produce clinical practice guidelines that are implementable,

Geographic/Institutional Context:

USA; American Academy of Otolaryngology–Head and Neck Surgery Foundation; Yale School of Medicir

Target Users/Stakeholders:

Clinicians, specialty societies, healthcare organizations, policymakers, and quality improvement bodies

Primary Methodology:

Conceptual / Methodological Guide

Primary Contribution Type:

Step-by-step framework for developing actionable, evidence-based clinical practice guidelines

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General Summary of the Paper

This manual provides a tested, pragmatic methodology for developing evidence-based clinical practice gu

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as the creation of **specific, boldfaced key action statements** that direct measura

> "Guidelines should contain a series of key, boldfaced action statements that can be used to describe de

> "An ideal key, boldfaced statement describes… When, Who should do what, To whom, why, and how."

What Makes Something Actionable

- Explicitly states conditions under which to act (decidability)

- Specifies precise, measurable clinician actions (executability)

- Links actions to evidence strength and harm–benefit balance

- Provides rationale, supporting evidence, and value judgments

- Identifies intended audience and settings

- Incorporates patient preferences where relevant

- Is feasible to implement in real-world workflows

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** AGREE instrument, COGS checklist, GLIA tool, AAP evidence grad

- **Methods/Levers:** Systematic literature search, multidisciplinary consensus, explicit evidence-to-reco

- **Operational Steps / Workflow:** 12-month plan including topic definition, team assembly, literature rev

- **Data & Measures:** Evidence profiles (aggregate evidence quality, benefits, harms, costs, values, role

- **Implementation Context:** CPGs applicable across diverse clinical settings, designed to support perfo

> "Guideline implementers agree that statements are easiest to implement if parsed into statements of th

> "Evidence profile… lists all decisions made by the group" (p. S21)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — explicit, unambiguous statements required (p. S2)

- **CR (Contextual Relevance):** Yes — tailored to defined populations, settings, and users (p. S8–S9)

- **FE (Feasibility):** Yes — GLIA dimension includes "effect on process of care" (p. S23)

- **TI (Timeliness):** Yes — goal to produce within 12 months; timeliness affects impact (p. S1, S26–S27

- **EX (Explainability):** Yes — each action has supporting rationale, evidence, and values (p. S16–S21)

- **GA (Goal Alignment):** Yes — recommendations linked to quality improvement and patient outcome g

- **Other Dimensions Named by Authors:** Decidability, executability, measurability, flexibility, novelty/inr

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Theoretical or Conceptual Foundations

- Institute of Medicine's definition of CPGs

- AGREE instrument for quality appraisal

- COGS checklist for standardized reporting

- AAP's 3-step recommendation strength framework

- GLIA tool for implementability appraisal

Indicators or Metrics for Actionability

- Presence of explicit "if–then" statements

- Evidence profile completeness (benefit–harm balance, evidence grade)

- Linkage to measurable outcomes for performance assessment

Barriers and Enablers to Actionability

Barriers:

- Clinician resistance to changing ingrained habits

- Procedural skills or equipment gaps (p. S23)

- Cost of recommended interventions (p. S23)

Enablers:

- Educational outreach and workshops

- Multidisciplinary buy-in from development stage

- Free public access to guidelines

- Algorithmic presentation for clarity (p. S21–S22)

Relation to Existing Literature

Positions itself as a synthesis and operationalization of prior work (IOM, AGREE, COGS, GLIA), moving f

---

Summary

Rosenfeld and Shiffman's manual is a blueprint for creating **actionable, performance-measure-ready cli

---

Scores

- **Overall Relevance Score:** 95 — Provides explicit, comprehensive conceptualization of actionability in

- **Operationalization Score:** 98 — Offers full, replicable process for achieving actionability, including to

---

Supporting Quotes from the Paper

- "Guidelines should contain a series of key, boldfaced action statements that can be used to describe de

- "An ideal key, boldfaced statement describes… When, Who should do what, To whom, why, and how."

- "Evidence profile… lists all decisions made by the group." (p. S21)

- "Guideline implementers agree that statements are easiest to implement if parsed into statements of the

---

Actionability References to Other Papers

- Field MJ, Lohr KN (1990) — IOM definition of CPGs

- AGREE Collaboration (2003) — AGREE Instrument

- Shiffman et al. (2003) — COGS checklist

- AAP Steering Committee (2004) — Recommendation classification framework

- Shiffman et al. (2005) — GLIA instrument

Paper Summary

<!--META_START-->

Title: Seeking Truth and Actionable Knowledge: How the Scientific Method Inhibits Both

Authors: Chris Argyris

DOI: n/a

Year: n/a

Publication Type: Journal Article

Discipline/Domain: Organizational Studies / Social Science Methodology

Subdomain/Topic: Actionable Knowledge; Organizational Defensive Routines; Scientific Method Critique

Eligibility: Eligible

Overall Relevance Score: 92

Operationalization Score: 85

Contains Definition of Actionability: Yes (implicit, conceptualized as knowledge enabling effective interven

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Partial

Contains Framework/Model: Yes (Model I, Model II, 0–1 Learning System)

Operationalization Present: Yes

Primary Methodology: Conceptual with empirical illustrations

Study Context: Organizational settings, primarily corporate and institutional

Geographic/Institutional Context: U.S.-based, Harvard University

Target Users/Stakeholders: Social scientists, organizational leaders, change agents

Primary Contribution Type: Theoretical framework and methodological critique

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title:

Seeking Truth and Actionable Knowledge: How the Scientific Method Inhibits Both

Authors:

Chris Argyris

DOI:

n/a

Year:

n/a

Publication Type:

Journal Article

Discipline/Domain:

Organizational Studies / Social Science Methodology

Subdomain/Topic:

Actionable Knowledge; Organizational Defensive Routines; Scientific Method Critique

Contextual Background:

The paper addresses how conventional scientific research methods can unintentionally inhibit the produc

Geographic/Institutional Context:

U.S., Harvard University

Target Users/Stakeholders:

Social scientists, organizational leaders, consultants, change agents

Primary Methodology:

Conceptual analysis with empirical illustrations from organizational research

Primary Contribution Type:

Theoretical framework and methodological critique

General Summary of the Paper

Argyris critiques the standard application of the scientific method in social sciences, arguing that it often r

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionable knowledge is framed as information that enables effective change in systems characterized by

> "In order to provide a comprehensive description… we must produce propositions about what happens

> "Researchers should focus on making their normative theories as comprehensive and as empirically va

What Makes Something Actionable

- Explicit recognition and surfacing of undiscussable issues

- Valid, disconfirmable knowledge

- Normative models enabling rare but desirable organizational states

- Practical usability under real-time conditions

- Alignment between espoused theories and theories-in-use

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Model I, Model II, 0–1 Learning Systems

- **Methods/Levers:** Double-loop learning; theory-of-intervention design; theory-of-instruction developm

- **Operational Steps / Workflow:** Diagnose defensive routines → Create normative models → Develop

- **Data & Measures:** Observable behavioral data (conversation transcripts), theory-in-use analysis

- **Implementation Context:** Organizational change efforts where defensive routines are prevalent

> "More time and effort should be spent on learning how to produce normative models of rare universes…

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Must make tacit theories explicit and testable (p. 18)

- **CR (Contextual Relevance):** Yes – Models must work in real organizational contexts (p. 18)

- **FE (Feasibility):** Yes – Must be usable under everyday conditions (p. 19–20)

- **TI (Timeliness):** Partial – Emphasis on real-time usability but not extensively discussed as "timelines

- **EX (Explainability):** Yes – Provide rationale and make embedded values explicit (p. 18)

- **GA (Goal Alignment):** Yes – Designed to improve organizational learning and reduce defensive routi

- **Other Dimensions Named by Authors:** Disconfirmability; empirical validity under natural conditions

Theoretical or Conceptual Foundations

- Organizational Learning Theory (Argyris & Schön, 1974, 1978)

- Model I / Model II theories-in-use

- Double-loop learning

- Defensive routines theory

Indicators or Metrics for Actionability

- Reduction in organizational defensive routines

- Ability to discuss previously undiscussable issues

- Observable changes in theory-in-use

- Successful use of interventions in real-time situations

Barriers and Enablers to Actionability

- **Barriers:** Defensive reasoning; organizational culture; lack of intervention skills; research methods re

- **Enablers:** Normative models; explicit theories-in-use; real-time practice; creation of safe contexts for

Relation to Existing Literature

Argyris positions his critique against traditional scientific method prescriptions (Campbell & Stanley) and

Summary

Argyris' paper argues that prevailing social science research practices inadvertently reinforce the very de

Scores

- **Overall Relevance Score:** 92 — Strong implicit conceptualization of actionability with systematic feat

- **Operationalization Score:** 85 — Provides concrete frameworks (Model I/II), methods, and steps, thou

Supporting Quotes from the Paper

- "[Researchers should] study the processes by which individuals can use the theories in everyday life" (p

- "More time and effort should be spent on learning how to produce normative models of rare universes…

- "It is not possible for human beings to change their theory-in-use because they wish to do so… requires

- "In order for human beings to use propositions, they must be producible under everyday life conditions"

Actionability References to Other Papers

- Argyris & Schön, *Theory in Practice* (1974)

- Argyris & Schön, *Organizational Learning* (1978)

- Argyris, *Reasoning, Learning and Action* (1982)

- Campbell & Stanley, *Experimental and Quasi-experimental Design for Research* (1963)

Paper Summary

<!--META_START-->

Title: A Survey of Algorithmic Recourse: Contrastive Explanations and Consequential Recommendations

Authors: Amir-Hossein Karimi, Gilles Barthe, Bernhard Schölkopf, Isabel Valera

DOI: 10.1145/3442188.3445899

Year: 2021

Publication Type: Journal Article

Discipline/Domain: Computer Science / Machine Learning

Subdomain/Topic: Algorithmic Recourse, Explainable AI, Causal Inference

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Review

Study Context: Automated decision-making in consequential domains (finance, justice, healthcare, hiring)

Geographic/Institutional Context: Not location-specific; examples from EU GDPR, US legal contexts

Target Users/Stakeholders: Affected individuals, ML practitioners, legal scholars, researchers

Primary Contribution Type: Conceptual framework + literature survey

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Partial

Reason if Not Eligible: n/a

<!--META_END-->

Title:

A Survey of Algorithmic Recourse: Contrastive Explanations and Consequential Recommendations

Authors:

Amir-Hossein Karimi, Gilles Barthe, Bernhard Schölkopf, Isabel Valera

DOI:

10.1145/3442188.3445899

Year:

2021

Publication Type:

Journal Article

Discipline/Domain:

Computer Science / Machine Learning

Subdomain/Topic:

Algorithmic Recourse, Explainable AI, Causal Inference

Contextual Background:

The paper reviews and unifies definitions, formulations, and solutions for algorithmic recourse in settings

Geographic/Institutional Context:

Not geographically restricted; draws on EU GDPR and US legal notions.

Target Users/Stakeholders:

Individuals affected by automated decisions, ML practitioners, policymakers, legal scholars.

Primary Methodology:

Conceptual synthesis and literature review.

Primary Contribution Type:

Conceptual framework + systematic survey of technical literature.

General Summary of the Paper

This paper consolidates the rapidly growing literature on algorithmic recourse — the provision of explanat

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The authors define algorithmic recourse as enabling affected individuals to **understand** and **act** to

> "An actionable set of changes a person can undertake in order to improve their outcome" (p. n/a)

> "Recourse is offered when the individual is given explanations…and offered recommendations on how

---

What Makes Something Actionable

- Comprehensibility (clear link between features and outcome)

- Feasibility of interventions (actions possible for the individual)

- Plausibility (recommendations correspond to realistic states)

- Causal validity (recommendations derived from interventions in a structural causal model, not just featur

- Alignment with individual goals and constraints

- Efficiency (minimal cost/effort to achieve the outcome)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Contrastive explanations vs. consequential recommendations

- **Methods/Levers:** Constrained optimization (distance metrics for explanations; cost functions for reco

- **Operational Steps / Workflow:**

  1. Identify current decision outcome and features

  2. For explanations: find minimal changes in feature space leading to a different outcome (Eq. 1)

  3. For recommendations: identify feasible actions within a causal model that lead to a favorable outcome

  4. Apply plausibility, actionability, diversity, and sparsity constraints

- **Data & Measures:** Dissimilarity metrics (e.g., MAD-weighted Manhattan, mixed ■p norms), cost mea

- **Implementation Context:** Applied to tabular, image, and text data; models include tree-based, kernel

> "Minimal consequential recommendations…result in a contrastive explanation when acted upon" (p. n/a

> "Offering nearest contrastive explanations that are not attainable through minimal effort is of secondary

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Explanations should reveal causal relationships between features and outcome.

- **CR (Contextual Relevance):** Yes — Recommendations must account for individual-specific constrain

- **FE (Feasibility):** Yes — Only actionable interventions (do-operations) feasible for the individual.

- **TI (Timeliness):** Partial — Time-sensitive nature acknowledged (stationarity assumption), but not de[...]

- **EX (Explainability):** Yes — Transparency in how recommendations are derived.

- **GA (Goal Alignment):** Partial — Recommendations should align with individual's goals but often imp[...]

- **Other Dimensions Named by Authors:** Plausibility, diversity, sparsity, robustness, fairness.

Theoretical or Conceptual Foundations

- Structural Causal Models (Pearl)

- Counterfactual reasoning in philosophy of science (Lewis, Lipton)

- Explainable AI literature

- Ethical ML frameworks (fairness, accountability, GDPR compliance)

Indicators or Metrics for Actionability

- Distance measures (MAD-weighted Manhattan, ■p norms)

- Cost measures (effort, percentile shifts)

- Feasibility constraints satisfaction rate

- Plausibility constraint adherence

- Optimality, coverage, runtime

Barriers and Enablers to Actionability

- **Barriers:** Incomplete causal knowledge, infeasible recommendations, reliance on manipulable but im[...]

- **Enablers:** Accurate causal models, open-source implementations, user interfaces for non-technical s[...]

Relation to Existing Literature

The paper integrates insights from explainable AI, causal inference, and optimization, positioning algorith[...]

Summary

This survey formalizes and unifies the concept of algorithmic recourse, distinguishing between contrastive[...]

Scores

- **Overall Relevance Score:** 95 — Clear, explicit conceptualization of actionability, systematic identifica[...]

- **Operationalization Score:** 90 — Provides detailed formulations, metrics, and algorithmic approaches[...]

Supporting Quotes from the Paper

- "[Recourse is] an actionable set of changes a person can undertake in order to improve their outcome" (

- "Recourse is offered when the individual is given explanations…and offered recommendations" (p. n/a)

- "Minimal consequential recommendations…result in a contrastive explanation when acted upon" (p. n/a

- "Offering nearest contrastive explanations that are not attainable through minimal effort is of secondary

---

Actionability References to Other Papers

- Wachter et al. (2017) — Counterfactual explanations and GDPR compliance

- Karimi et al. (2020) — Algorithmic recourse from counterfactuals to interventions

- Ustun et al. (2019) — Actionable recourse in linear classification

- Miller (2019) — Contrastive explanation in AI

- Pearl (2000) — Causality: Models, Reasoning, and Inference

Paper Summary

<!--META_START-->

Title: A Modified LIME and Its Application to Explain Service Supply Chain Forecasting

Authors: Haisheng Li, Wei Fan, Sheng Shi, Qiang Chou

DOI: 10.1007/978-3-030-32236-6_58

Year: 2019

Publication Type: Conference (Lecture Notes in Computer Science)

Discipline/Domain: Computer Science / Artificial Intelligence

Subdomain/Topic: Explainable Artificial Intelligence, Model-agnostic Methods, Service Supply Chain Fore

Eligibility: Not Eligible

Overall Relevance Score: 35 — The paper focuses on explainability (fidelity, interpretability) but does not

Operationalization Score: 70 — Provides a concrete operational approach (tree-LIME) and fidelity metric

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (tree-LIME)

Operationalization Present: Yes

Primary Methodology: Quantitative (algorithm development and experimental evaluation)

Study Context: Forecasting usage of computer repair parts in a service supply chain

Geographic/Institutional Context: Lenovo Research, Beijing, China

Target Users/Stakeholders: Service supply chain planners, machine learning practitioners

Primary Contribution Type: Methodological (modified explanation algorithm)

CL: No

CR: No

FE: No

TI: No

EX: Yes — focus on explanation fidelity and interpretability

GA: No

Reason if Not Eligible: The study is entirely about model explainability and fidelity in ML forecasting; there

<!--META_END-->

Title:

A Modified LIME and Its Application to Explain Service Supply Chain Forecasting

Authors:

Haisheng Li, Wei Fan, Sheng Shi, Qiang Chou

DOI:

10.1007/978-3-030-32236-6_58

Year:

2019

Publication Type:

Conference (Lecture Notes in Computer Science)

Discipline/Domain:

Computer Science / Artificial Intelligence

Subdomain/Topic:

Explainable Artificial Intelligence, Model-agnostic Methods, Service Supply Chain Forecasting

Contextual Background:

The paper proposes a modification to the Local Interpretable Model-Agnostic Explanations (LIME) framew

Geographic/Institutional Context:

Lenovo Research, Beijing, China

Target Users/Stakeholders:

Service supply chain planners, ML practitioners

Primary Methodology:

Quantitative — algorithm modification and empirical evaluation

Primary Contribution Type:

Methodological

General Summary of the Paper

The study addresses the limitations of LIME in explaining regression models by replacing its local linear a

---

Actionable/Actionability Used in Paper

No — The paper does not use the terms "actionability" or "actionable" in connection with its results, insigh

---

Authors Argue for a Need for Actionability Without Defining It

No — There is no argument for actionability or need for actionable results.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No

- **CR (Contextual Relevance):** No

- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** Yes — The entire study focuses on improving explanation fidelity and interpretab

  > "The approach also works well when applied to service supply chain forecasting" (p. 2)

  > "Tree-LIME's fidelity is better than LIME… tree representation for explanation is transparent and conci

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** None related to actionability.

Theoretical or Conceptual Foundations

- Model-agnostic interpretability (LIME)

- Decision tree regression (CART)

- Fidelity metrics for regression (MAE)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper situates itself in the explainable AI literature, contrasting model-agnostic and model-specific m

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Summary

This paper focuses on enhancing the interpretability and fidelity of explanations for black-box regression

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Scores

- **Overall Relevance Score:** 35 — Strong on explainability, but no link to actionability or decision-orien

- **Operationalization Score:** 70 — Clear operational methodology for improved explanation fidelity; not

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Supporting Quotes from the Paper

- "Tree-LIME… can effectively locally approximate the original model to be explained with the tree interpr

- "For regression problem, the mean absolute error (MAE) … as the fidelity measure." (p. 4)

- "Tree-LIME's fidelity is better than LIME… tree representation for explanation is transparent and concise

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Towards Understanding the Role of the Human in Event Log Extraction

Authors: Vinicius Stein Dani; Henrik Leopold; Jan Martijn E. M. van der Werf; Xixi Lu; Iris Beerepoot; Jeln

DOI: N/A

Year: 2022

Publication Type: Conference (assumed)

Discipline/Domain: Process Mining / Information Systems

Subdomain/Topic: Event log extraction; human-in-the-loop; taxonomy of manual tasks

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 10

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes (taxonomy of manual tasks)

Operationalization Present: No

Primary Methodology: Mixed Methods (Structured literature review + qualitative coding)

Study Context: Process mining case studies (2000–2020) informing a taxonomy of human tasks in event

Geographic/Institutional Context: Utrecht University (NL) and Kühne Logistics University (DE); application

Target Users/Stakeholders: Process analysts; data engineers; domain experts; researchers developing e

Primary Contribution Type: Taxonomy and methodological reflection

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not use or define "actionable/actionability," nor does it articulate p

<!--META_END-->

Title:

Towards Understanding the Role of the Human in Event Log Extraction

Authors:

Vinicius Stein Dani; Henrik Leopold; Jan Martijn E. M. van der Werf; Xixi Lu; Iris Beerepoot; Jelmer J. Ko

DOI:

N/A

Year:

2022

Publication Type:

Conference (assumed)

Discipline/Domain:

Process Mining / Information Systems

Subdomain/Topic:

Event log extraction; human-in-the-loop; taxonomy of manual tasks

Contextual Background:

The paper observes that process mining's application is often hindered by substantial human preparation

Geographic/Institutional Context:

Authored by researchers from Utrecht University (NL) and Kühne Logistics University (DE); evidence bas

Target Users/Stakeholders:

Process analysts, data engineers, domain experts, method/tool developers. :contentReference{

Primary Methodology:

Structured literature review (Scopus case studies) + qualitative coding to derive a taxonomy. :contentRef

Primary Contribution Type:

Taxonomy of manual tasks in event log extraction and discussion of implications for automation and guid

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General Summary of the Paper

The authors investigate how humans are involved in extracting event logs for process mining. They condu

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Actionable/Actionability Used in Paper

No. The terms "actionable/actionability" are not used nor are equivalent criteria linked explicitly to "being a

---

Authors Argue for a Need for Actionability Without Defining It

No. The authors argue for precision in understanding human tasks to enable automation and guidance, n

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

Process mining methodology background (e.g., PM2), literature-driven taxonomy development via qualita

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Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A

Relation to Existing Literature

The paper synthesizes case-study evidence to map recurring manual tasks across the extraction pipeline

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Summary

This paper catalogs the human work necessary to transform heterogeneous operational data into process

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Scores

- **Overall Relevance Score:** 20 — Useful context for process mining execution but provides no definiti

- **Operationalization Score:** 10 — Offers a taxonomy (framework) of tasks and implications for automa

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Supporting Quotes from the Paper

- "Therefore, the research question of this paper is 'What are the specific manual tasks that humans perfo

- "A visual representation of our taxonomy is shown in Figure 1. It consists of five categories…" (p. 5). :co

- "The extraction of event logs comes with substantial human effort. In this paper, we set out to develop a

- "Our taxonomy… can also serve as input for future automation efforts and for methodological process m

---

Actionability References to Other Papers

N/A — The paper does not cite or develop an explicit "actionability" construct; references are about even

Paper Summary

<!--META_START-->

Title: On the Trade-offs between Adversarial Robustness and Actionable Explanations

Authors: Satyapriya Krishna, Chirag Agarwal, Himabindu Lakkaraju

DOI: 10.3390/analytics1020008

Year: 2024

Publication Type: Journal

Discipline/Domain: Machine Learning, Explainable AI

Subdomain/Topic: Adversarial Robustness, Counterfactual Explanations

Eligibility: Yes

Overall Relevance Score: 90

Operationalization Score: 85

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Theoretical and Empirical Analysis

Study Context: Adversarial Robustness vs. Actionable Explanations in Machine Learning

Geographic/Institutional Context: Harvard University

Target Users/Stakeholders: AI Researchers, ML Practitioners, Data Scientists

Primary Contribution Type: Theoretical Analysis, Empirical Evaluation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: n/a

<!--META_END-->

Title: On the Trade-offs between Adversarial Robustness and Actionable Explanations

Authors: Satyapriya Krishna, Chirag Agarwal, Himabindu Lakkaraju

DOI: 10.3390/analytics1020008

Year: 2024

Publication Type: Journal

Discipline/Domain: Machine Learning, Explainable AI

Subdomain/Topic: Adversarial Robustness, Counterfactual Explanations

Contextual Background: The paper explores the trade-offs between two important characteristics of m

Geographic/Institutional Context: Harvard University

Target Users/Stakeholders: AI researchers, machine learning practitioners, stakeholders in high-stake

Primary Methodology: Theoretical bounds, empirical analysis on real-world datasets

Primary Contribution Type: Theoretical framework, empirical study

General Summary of the Paper

This paper examines the relationship between adversarial robustness and the generation of actionable re

Eligibility

Eligible for inclusion: **Yes**

Reason if Not Eligible: n/a

How Actionability is Understood

In this context, actionability is understood as the ability to provide actionable recourses (counterfactual ex

> "Actionable explanations are those that provide individuals with practical, implementable changes to the

> "The ability to generate valid and feasible recourses is a key aspect of actionability in machine learning

What Makes Something Actionable

For counterfactual explanations to be actionable, they must meet two key criteria:

1. **Feasibility (Cost):** The cost of implementing the changes suggested by the explanation should be m

2. **Validity:** The recourse should have a high probability of achieving the desired model outcome, ensu

> "Actionability is achieved when the cost of implementing the changes is low, and the probability of achie

> "The balance between the cost of recourses and their validity is a crucial factor in determining actionab

How Actionability is Achieved / Operationalized

Actionability is operationalized by evaluating the **cost** and **validity** of counterfactual explanations ge

- **Cost:** Measured by the L2-norm distance between the original and counterfactual instances.

- **Validity:** Measured by the probability that the counterfactual leads to the desired outcome (e.g., a po

> "We measure the cost of recourse as the L2 distance between the factual instance and the generated c

> "The validity of recourses is evaluated by computing the probability of achieving the desired model outc

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes – Clarity of the changes needed is inherent in the definition of actionable recourses

  > "Clear explanations are necessary for actionability, as individuals need to know exactly what changes

- **CR (Contextual Relevance):** Yes – The recourses must be relevant to the individual's context, mean

  > "Contextual relevance is key to actionability, as the changes suggested must result in a valid decision

- **FE (Feasibility):** Yes – Feasibility is central to actionability, ensuring that the changes are easy for th

  > "Feasible recourses are those that are realistic and easy to implement within the constraints of the ind

- **TI (Timeliness):** No – Timeliness is not specifically addressed in the paper, but it may be an implicit f

- **EX (Explainability):** Yes – Actionable explanations must be understandable, so the individual knows

  > "Explainability is essential for actionability, as users must understand the suggested changes to effect

- **GA (Goal Alignment):** Yes – The recourses should align with the individual's goal, ensuring that the s

  > "Goal alignment is a key aspect of actionable explanations, as the recourses must help individuals rea

Theoretical or Conceptual Foundations

The paper builds on existing theories in machine learning interpretability, particularly the work on counter

> "This paper extends the existing literature on adversarial robustness and counterfactual explanations by

Indicators or Metrics for Actionability

The primary metrics used to measure actionability are **cost** (measured as the L2-norm distance betwe

> "We use the L2-norm to quantify the cost of recourses and measure validity by evaluating the probabilit

Barriers and Enablers to Actionability

- **Barriers:** Adversarial robustness introduces challenges, such as increased cost and reduced validity

- **Enablers:** Non-robust models, which provide lower-cost and higher-validity recourses, enable more e

> "The increased cost and decreased validity of recourses in adversarially robust models create a signific

> "Non-robust models provide lower-cost and higher-validity recourses, facilitating more actionable expla

Relation to Existing Literature

The paper fills a gap in the existing literature by explicitly examining the trade-offs between adversarial ro

> "Our work is one of the first to examine the trade-offs between adversarial robustness and actionable e:

Summary

This paper investigates the trade-offs between adversarial robustness and actionable explanations in ma

Scores

- **Overall Relevance Score:** 90 – The paper addresses an important and underexplored area in machi

- **Operationalization Score:** 85 – The paper presents a clear framework for evaluating the cost and val

Supporting Quotes from the Paper

- "Feasible recourses are those that are realistic and easy to implement within the constraints of the indiv

- "Actionability is achieved when the cost of implementing the changes is low, and the probability of achie

- "The increased cost and decreased validity of recourses in adversarially robust models create a significa

- "Our work is one of the first to examine the trade-offs between adversarial robustness and actionable ex

Actionability References to Other Papers

- Wachter, S., Mittelstadt, B., & Russell, C. (2018). Counterfactual explanations without opening the black

- Ustun, B., Spangher, A., & Liu, Y. (2019). Actionable recourse in linear classification.

- Pawelczyk, M., Broelemann, K., & Kasneci, G. (2020). Learning model-agnostic counterfactual explanat

Paper Summary

<!--META_START-->

Title: FACE: Feasible and Actionable Counterfactual Explanations

Authors: Rafael Poyiadzi, Kacper Sokol, Raul Santos-Rodriguez, Tijl De Bie, Peter Flach

DOI: https://doi.org/10.1145/3375627.3375850

Year: 2020

Publication Type: Conference

Discipline/Domain: Artificial Intelligence / Machine Learning

Subdomain/Topic: Explainable AI (XAI), Counterfactual Explanations

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 95

Contains Definition of Actionability: Yes (implicit and explicit via feasibility + actionable path requirements

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (FACE algorithm)

Operationalization Present: Yes

Primary Methodology: Conceptual + Algorithmic with Empirical Demonstration

Study Context: Algorithmic explainability for decision-making systems

Geographic/Institutional Context: University of Bristol, University of Ghent

Target Users/Stakeholders: Individuals receiving automated decisions (e.g., loan applicants), AI practition

Primary Contribution Type: Conceptual framework + Algorithm

CL: Yes — clarity of feasible, coherent, and interpretable path is essential for actionability.

CR: Yes — contextual relevance to real-world feasibility emphasized.

FE: Yes — feasibility explicitly required for actionability.

TI: Partial — timeliness is not central, but feasibility implicitly assumes achievable change within realistic

EX: Yes — explainability as part of model-agnostic, understandable paths.

GA: Yes — goal alignment with desired class/outcome is fundamental.

Reason if Not Eligible: N/A

<!--META_END-->

Title:

FACE: Feasible and Actionable Counterfactual Explanations

Authors:

Rafael Poyiadzi, Kacper Sokol, Raul Santos-Rodriguez, Tijl De Bie, Peter Flach

DOI:

https://doi.org/10.1145/3375627.3375850

Year:

2020

Publication Type:

Conference

Discipline/Domain:

Artificial Intelligence / Machine Learning

Subdomain/Topic:

Explainable AI, Counterfactual Explanations

Contextual Background:

The paper addresses limitations in existing counterfactual explanation methods in machine learning, spe

Geographic/Institutional Context:

University of Bristol, University of Ghent

Target Users/Stakeholders:

Loan applicants, individuals affected by automated decision systems, explainability tool developers, regu

Primary Methodology:

Conceptual + Algorithmic with empirical demonstration on synthetic and MNIST datasets.

Primary Contribution Type:

Novel algorithm (FACE) + conceptual reframing of counterfactual actionability.

General Summary of the Paper

This paper critiques the dominant "closest possible world" approach to counterfactual explanations, highli

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper defines actionability in terms of producing counterfactuals that are:

- Situated in high-density regions of the feature space.

- Connected to the original data point by a feasible, realistic transformation path.

> "We identify two essential properties of counterfactual explanations: feasibility and actionability" (p. 2)

> "…providing actionable and feasible paths to transform a selected instance into one that meets a certai

---

What Makes Something Actionable

- Feasibility of the counterfactual state (achievable in real life).

- High-density region representation (coherence with data distribution).

- Existence of a feasible path with short length and high density.

- Avoidance of unrealistic or offensive prescriptions (e.g., changing immutable attributes).

- Alignment with desired class outcome and real-world constraints.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** FACE (Feasible and Actionable Counterfactual Explanations)

- **Methods/Levers:** Density-weighted shortest path search over a graph of data points.

- **Operational Steps / Workflow:**

  1. Construct a graph using KDE, k-NN, or ε-graph based on dataset.

  2. Apply prediction confidence and density thresholds.

  3. Remove infeasible transitions using domain constraints (immutable/conditionally mutable features).

  4. Run Dijkstra's algorithm to find shortest high-density path to a target class instance.

- **Data & Measures:** Density estimates (KDE), classifier confidence scores, distance metrics.

- **Implementation Context:** Model-agnostic, applicable to tabular or image data.

> "Our approach… generates counterfactuals that are coherent with the underlying data distribution and s

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL:** Yes — counterfactuals must be interpretable and coherent with the data.

- **CR:** Yes — paths must be relevant to real-world conditions and domain constraints.

- **FE:** Yes — feasibility is explicitly central.

- **TI:** Partial — implicitly considered via feasible steps achievable over time.

- **EX:** Yes — explanations are model-agnostic and understandable.

- **GA:** Yes — targets aligned with desired outcome class.

- **Other Dimensions Named by Authors:** High-density path requirement.

Theoretical or Conceptual Foundations

- Counterfactual and contrastive explanations literature (Wachter et al., 2017).

- Graph-theoretic shortest paths (Dijkstra's algorithm).

- Kernel density estimation for distribution-aware distances.

Indicators or Metrics for Actionability

- Density thresholds.

- Prediction confidence thresholds.

- Path length in density-weighted space.

Barriers and Enablers to Actionability

- **Barriers:** Low-density/unrealistic counterfactuals; immutable features; classifier uncertainty in sparse

- **Enablers:** Density-weighted feasible paths; domain knowledge constraints; customizable cost functi

---

Relation to Existing Literature

FACE is compared against Wachter et al. (2017), Ustun et al. (2019), Russell (2019), and Waa et al. (201

Summary

The authors introduce FACE, a method for generating counterfactual explanations that are feasible and a

---

Scores

- **Overall Relevance Score:** 90 — Strong and explicit conceptualization of actionability in counterfactua

- **Operationalization Score:** 95 — Detailed algorithmic approach, with parameters, constraints, and ex

---

Supporting Quotes from the Paper

- "We identify two essential properties of counterfactual explanations: feasibility and actionability" (p. 2)

- "Providing actionable and feasible paths to transform a selected instance into one that meets a certain g

- "Feasibility of the counterfactual data point, continuity and feasibility of the path linking it with the data p

---

Actionability References to Other Papers

- Wachter, Mittelstadt, & Russell (2017) — Counterfactual Explanations framework.

- Ustun, Spangher, & Liu (2019) — Actionable recourse.

- Russell (2019) — Diverse coherent explanations.

- Waa et al. (2018) — Local foil trees for contrastive explanations.

Paper Summary

<!--META_START-->

Title: Evaluating the understandability and actionability of online CKD educational materials

Authors: Emi Furukawa, Tsuyoshi Okuhara, Hiroko Okada, Yuriko Nishiie, Takahiro Kiuchi

DOI: https://doi.org/10.1007/s10157-023-02401-6

Year: 2024

Publication Type: Journal

Discipline/Domain: Health Communication / Nephrology

Subdomain/Topic: Chronic Kidney Disease (CKD) patient education, online health information evaluation

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 80

Contains Definition of Actionability: Yes (implicit via PEMAT framework and study framing)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Yes (via understandability dimension)

Contains Framework/Model: Yes (Japanese version of PEMAT-P)

Operationalization Present: Yes

Primary Methodology: Quantitative content analysis

Study Context: Evaluation of Japanese-language online CKD educational webpages

Geographic/Institutional Context: Japan; The University of Tokyo

Target Users/Stakeholders: CKD patients, their families, general public

Primary Contribution Type: Empirical evaluation and methodological application

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Evaluating the understandability and actionability of online CKD educational materials

Authors:

Emi Furukawa, Tsuyoshi Okuhara, Hiroko Okada, Yuriko Nishiie, Takahiro Kiuchi

DOI:

https://doi.org/10.1007/s10157-023-02401-6

Year:

2024

Publication Type:

Journal

Discipline/Domain:

Health Communication / Nephrology

Subdomain/Topic:

Chronic Kidney Disease (CKD) patient education, online health information evaluation

Contextual Background:

CKD is prevalent yet under-recognized in Japan, with low public awareness and limited health literacy. O

Geographic/Institutional Context:

Japan; conducted by The University of Tokyo

Target Users/Stakeholders:

CKD patients, their families, general public

Primary Methodology:

Quantitative content analysis of Japanese-language CKD webpages using PEMAT-P, GQS, and jReadab

Primary Contribution Type:

Empirical evaluation of online educational material quality and actionability

General Summary of the Paper

This study systematically evaluated 186 Japanese-language online educational materials on chronic kidn

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed through the PEMAT definition: materials are actionable if they clearly identify actio

> "PEMAT systematically examines how the required action points are presented" (p. 2)

> "The material clearly identifies at least one action the user can take… breaks down any action into expl

What Makes Something Actionable

- Clearly stated, specific actions for the user

- Directly addressing the user when describing actions

- Breaking actions into explicit, manageable steps

- Providing tangible tools (e.g., checklists, planners)

- Using visual aids to make it easier to act on instructions

- Explaining how to use visual elements to support actions

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Japanese version of PEMAT-P

- **Methods/Levers:** Binary-item assessment of 7 actionability criteria (agree/disagree)

- **Operational Steps / Workflow:** Identify CKD webpages → classify by topic/source/audience → score

- **Data & Measures:** Actionability percentage score (threshold 70% for acceptable)

- **Implementation Context:** Japanese-language CKD patient educational webpages

> "We calculated the PEMAT-P scores… multiplying the result by 100 to obtain a percentage… set the th

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "Many had difficulty using only common, everyday language and did not explain

- **CR (Contextual Relevance):** Yes — lifestyle modification materials were more relevant and actionab

- **FE (Feasibility):** Yes — tangible tools/checklists suggested for feasibility (p. 6)

- **TI (Timeliness):** No explicit link found

- **EX (Explainability):** Partial — some use of captions, but many visual aids unclear (p. 5)

- **GA (Goal Alignment):** Partial — lifestyle recommendations aligned with health goals (p. 4)

- **Other Dimensions Named by Authors:** Use of plain language, structured layout, visual reinforcement

Theoretical or Conceptual Foundations

- PEMAT framework (AHRQ)

- National Action Plan on Health Literacy (U.S. HHS)

Indicators or Metrics for Actionability

- PEMAT-P actionability score (% of applicable items marked "agree")

- Threshold ≥70% considered actionable

Barriers and Enablers to Actionability

- **Barriers:** Excessive medical jargon; lack of visual aids for actions; absence of tangible tools; unclear

- **Enablers:** Use of plain language; clear, patient-centered visuals; structured actionable steps; comme

Relation to Existing Literature

Findings align with prior studies showing lower actionability than understandability, and the need for bette

Summary

The paper offers a robust, operationalized view of actionability grounded in the PEMAT framework, applie

Scores

- **Overall Relevance Score:** 85 — Strong conceptual framing via PEMAT and clear link between attribu

- **Operationalization Score:** 80 — Fully operationalized through PEMAT-P items and scoring; provides

Supporting Quotes from the Paper

- "PEMAT systematically examines how the required action points are presented" (p. 2)

- "The material clearly identifies at least one action the user can take" (Table 2, p. 5)

- "Lacked clear and concise charts and illustrations to encourage action" (p. 1)

- "Webpages… lacked visual aids to encourage the audience to take action" (p. 3)

Actionability References to Other Papers

- Shoemaker SJ et al. (2014) — Development of PEMAT (Patient Educ Couns)

- National Action Plan to Improve Health Literacy (U.S. HHS, 2010)

- Morony S et al. (2017) — CKD lifestyle info and actionability analysis

Paper Summary

<!--META_START-->

Title: Directive Explanations for Actionable Explainability in Machine Learning Applications

Authors: Ronal Singh, Tim Miller, Henrietta Lyons, Liz Sonenberg, Eduardo Velloso, Frank Vetere, Piers

DOI: 10.1145/3579363

Year: 2023

Publication Type: Journal

Discipline/Domain: Human-Computer Interaction / Artificial Intelligence

Subdomain/Topic: Explainable AI (XAI), Counterfactual Explanations, Actionable Recourse

Eligibility: Eligible

Overall Relevance Score: 95

Operationalization Score: 90

Contains Definition of Actionability: Yes (explicitly defines "directive explanations" as a form of actionable

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes (MDP-based model)

Operationalization Present: Yes

Primary Methodology: Mixed Methods (Quantitative + Qualitative user studies, conceptual modeling)

Study Context: Credit scoring and employee satisfaction prediction systems

Geographic/Institutional Context: United States participants, University of Melbourne research team

Target Users/Stakeholders: Loan officers, HR officers, decision recipients (customers, employees)

Primary Contribution Type: Conceptual model + empirical evaluation

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title: Directive Explanations for Actionable Explainability in Machine Learning Applications

Authors: Ronal Singh, Tim Miller, Henrietta Lyons, Liz Sonenberg, Eduardo Velloso, Frank Vetere, Pie

DOI: 10.1145/3579363

Year: 2023

Publication Type: Journal

Discipline/Domain: Human-Computer Interaction / Artificial Intelligence

Subdomain/Topic: Explainable AI, Counterfactuals, Actionable Recourse

Contextual Background: The paper addresses the gap between counterfactual explanations (which st

Geographic/Institutional Context: Conducted by University of Melbourne with US-based MTurk particip

Target Users/Stakeholders: Decision recipients, intermediary decision communicators, designers of M

Primary Methodology: Mixed Methods (Quantitative + Qualitative studies + conceptual modeling)

Primary Contribution Type: Conceptual model (MDP framework) + empirical evaluation.

General Summary of the Paper

The authors propose **directive explanations** as a way to make AI explanations more actionable by exp

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed as enabling **recourse**—guiding individuals not just on what feature values woul

> "A directive explanation … offers specific actions an individual could take to achieve their desired outco

> "Counterfactual explanations should be directive in that they should include suggestions or recommend

What Makes Something Actionable

- Ties counterfactuals to **mutable and feasible actions**.

- Specifies **sequences** of dependent actions, not just one-step changes.

- Accounts for **action costs** and individual feasibility.

- Provides either **specific actionable steps** or **generic guidance** to preserve autonomy.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** MDP-based directive explanation generation model.

- **Methods/Levers:** Use of Monte Carlo Tree Search to find policies transitioning from factual to counte

- **Operational Steps / Workflow:**

  1. Generate counterfactual states using existing algorithms (e.g., Russell 2019).

  2. Define mutable features and possible actions.

  3. Model state transitions and action costs in MDP.

  4. Search for optimal policy (action sequence) to reach counterfactual.

  5. Post-process for directive-generic explanations by grouping actions.

- **Data & Measures:** Credit scoring and employee satisfaction datasets; user preference rankings; ther

- **Implementation Context:** Simulated loan officer and HR officer decision communication.

> "Actions from π_i must lead from x to c_i… model must capture different ways to achieve specific outcome

> "Policy π_i is the source of the directives in the directive explanations." (p. 6–7)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — explicit link between action and outcome. "Provides clear actions… so the custo

- **CR (Contextual Relevance):** Yes — tailored to recipient's situation and domain. (p. 16–17)

- **FE (Feasibility):** Yes — consideration of whether directives are realistic and achievable. (p. 17)

- **TI (Timeliness):** Partial — relevance discussed when outcomes are imminent, but not formalized as

- **EX (Explainability):** Yes — explanations remain interpretable, showing causal pathways.

- **GA (Goal Alignment):** Yes — directives are aligned with recipient's desired outcome.

- **Other Dimensions:** Autonomy (directive-generic explanations preserve choice), Social Acceptability

Theoretical or Conceptual Foundations

- Counterfactual explanations literature (Wachter et al. 2017)

- Algorithmic recourse and causal modeling (Karimi et al. 2021)

- Markov Decision Processes and planning theory (Puterman 2014, Geffner & Bonet 2013)

Indicators or Metrics for Actionability

- User preference ranking between explanation types.

- Qualitative themes on perceived usefulness, feasibility, autonomy.

- Domain-specific acceptance patterns.

Barriers and Enablers to Actionability

- **Barriers:** Social sensitivity of directives, infeasibility of actions, lack of user autonomy, condescendin

- **Enablers:** Clear linkage between actions and outcomes, multiple feasible options, domain familiarity,

Relation to Existing Literature

Builds on counterfactual explanations but addresses lack of explicit action guidance. Extends recourse w

Summary

This paper advances the concept of **actionable explainability** by formalizing "directive explanations" th

Scores

- **Overall Relevance Score:** 95 — Explicitly defines actionability, ties it to recourse, offers detailed con

- **Operationalization Score:** 90 — Provides a full computational method (MDP model) and empirical va

Supporting Quotes from the Paper

- "[A] directive explanation … offers specific actions an individual could take to achieve their desired outc

- "Counterfactual explanations should be directive in that they should include suggestions or recommenda

- "Actions from π_i must lead from x to c_i… model must capture different ways to achieve specific outcome

- "Provides clear actions… so the customer will know what to do next." (p. 16)

- "I picked [directive-generic] based on how feasible I thought each strategy would be." (p. 17)

Actionability References to Other Papers

- Wachter et al. 2017 (counterfactual explanations)

- Karimi et al. 2021 (algorithmic recourse via causal models)

- Tsirtsis et al. 2021 (sequential decision-making counterfactuals)

- Russell 2019 (diverse counterfactual generation)

- Puterman 2014; Geffner & Bonet 2013 (MDP and planning frameworks)

Paper Summary

<!--META_START-->

Title: Evaluating Online and Offline Health Information With the Patient Education Materials Assessment

Authors: Emi Furukawa, Tsuyoshi Okuhara, Mingxin Liu, Hiroko Okada, Takahiro Kiuchi

DOI: 10.2196/63489

Year: 2025

Publication Type: Journal Article (Protocol)

Discipline/Domain: Health Communication / Health Literacy

Subdomain/Topic: Patient Education Materials Evaluation

Eligibility: Eligible

Overall Relevance Score: 85

Operationalization Score: 70

Contains Definition of Actionability: Yes

Contains Systematic Features/Dimensions: Yes

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Systematic Review Protocol (Conceptual/Methodological)

Study Context: Systematic review of studies evaluating patient education materials using the PEMAT

Geographic/Institutional Context: International; led by The University of Tokyo, Japan

Target Users/Stakeholders: Health communication researchers, patient educators, health institutions, pol

Primary Contribution Type: Methodological framework for systematic review

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: No

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Evaluating Online and Offline Health Information With the Patient Education Materials Assessment Tool:

Authors:

Emi Furukawa, Tsuyoshi Okuhara, Mingxin Liu, Hiroko Okada, Takahiro Kiuchi

DOI:

10.2196/63489

Year:

2025

Publication Type:

Journal Article (Protocol)

Discipline/Domain:

Health Communication / Health Literacy

Subdomain/Topic:

Patient Education Materials Evaluation

Contextual Background:

The paper presents a protocol for a systematic review of studies using the Patient Education Materials As

Geographic/Institutional Context:

International scope; coordinated by The University of Tokyo Hospital and Graduate School of Medicine.

Target Users/Stakeholders:

Health communication researchers, patient education specialists, health literacy advocates, public health

Primary Methodology:

Conceptual and methodological protocol for systematic review.

Primary Contribution Type:

Methodological framework and synthesis approach.

General Summary of the Paper

This protocol outlines a systematic review plan to analyze how the PEMAT has been used to evaluate the

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is defined by PEMAT as "the likelihood that the reader or viewer will know how to act on the

> "Actionability refers to the likelihood that the reader or viewer will know how to act on the information pr

> "Understanding the material alone is insufficient; a separate evaluation is necessary to determine wheth

What Makes Something Actionable

- Clear, specific instructions for action.

- Concrete steps enabling readers to perform recommended behaviors.

- Contextual relevance to target users.

- Structured presentation that facilitates translation from information to behavior.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Patient Education Materials Assessment Tool (PEMAT)

- **Methods/Levers:** Application of PEMAT-P (print) and PEMAT-A/V (audiovisual) formats, scoring acti

- **Operational Steps / Workflow:** Literature search → screening → data extraction of PEMAT scores →

- **Data & Measures:** PEMAT's actionability items (20–26 for print, 20–22 & 25 for audiovisual), scored

- **Implementation Context:** Applied in diverse cultural and linguistic contexts for cross-study comparison

> "On the practical side, the PEMAT visualizes the challenges of materials to find the most understandab

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Clear presentation and understandable content are necessary precursors to acti

- **CR (Contextual Relevance):** Yes — Materials must match the needs and settings of the intended au

- **FE (Feasibility):** Yes — Materials must present actions the audience can realistically perform.

- **TI (Timeliness):** No — Not explicitly linked to actionability.

- **EX (Explainability):** No — Not explicitly tied to actionability.

- **GA (Goal Alignment):** Partial — Alignment with intended health behavior is implied but not systemati

- **Other Dimensions Named by Authors:** Understandability as a prerequisite; cultural and linguistic ada

Theoretical or Conceptual Foundations

- Health literacy theory.

- Garner et al.'s three-step model of audience interaction with materials (reading, understanding, respond

- Organizational health literacy frameworks (Healthy People 2030).

Indicators or Metrics for Actionability

- PEMAT actionability score (0–100%).

- Item-level scoring on explicit action guidance and steps.

Barriers and Enablers to Actionability

- **Barriers:** Lack of patient perspective in PEMAT scoring; heterogeneity in methods across studies; ex

- **Enablers:** Standardized, validated PEMAT tool; availability in multiple languages; ability to compare

Relation to Existing Literature

Builds on prior scoping reviews of health material quality assessment but is the first systematic synthesis

Summary

This protocol establishes a systematic approach for synthesizing global evidence on the understandability

Scores

- **Overall Relevance Score:** 85 — Strong, explicit conceptualization of actionability and its components

- **Operationalization Score:** 70 — Provides a clear methodological framework for assessing actionabili

Supporting Quotes from the Paper

- "Actionability refers to the likelihood that the reader or viewer will know how to act on the information pre

- "Understanding the material alone is insufficient; a separate evaluation is necessary to determine wheth

- "On the practical side, the PEMAT visualizes the challenges of materials to find the most understandabl

Actionability References to Other Papers

- Shoemaker et al., 2014 — Original PEMAT development.

- Garner et al., 2012 — Framework for evaluating patient information leaflets.

- CDC Clear Communication Index.

Paper Summary

Title:

Counterfactual Explanations Without Opening the Black Box: Automated Decisions and the GDPR

Contextual Background:

The paper addresses the problem of explaining complex algorithmic decisions under the GDPR without r

Geographic/Institutional Context:

European Union, GDPR regulatory environment.

Target Users/Stakeholders:

Data subjects, policymakers, regulators, AI system designers, data controllers.

Primary Methodology:

Conceptual analysis with technical implementation examples.

Primary Contribution Type:

Proposal and justification of a new explanation method (counterfactual explanations) with legal, philosoph

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General Summary of the Paper

The authors critique the GDPR's limited and ambiguous provisions on explaining automated decisions, n

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Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

Actionability is framed in terms of explanations that enable the *data subject to act*—to understand a dec

> "Looking at explanations as a means to help a data subject act rather than merely understand…" (p. 84

> "An explanation… does not necessarily hinge on… understanding how algorithmic systems function." (p

---

What Makes Something Actionable

- Provides clear, minimal, relevant changes to variables that would alter the decision.

- Expressed in terms directly relevant to the individual's circumstances.

- Supports specific goals: understanding, contesting, or changing outcomes.

- Avoids unnecessary technical or internal model details.

- Must be intelligible, concise, and accessible to non-experts.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Counterfactual Explanations.

- **Methods/Levers:** Optimization to find minimally different "possible worlds" producing a different decis

- **Operational Steps / Workflow:**

  1. Fix model parameters after training.

  2. Search for an alternative input vector close to the original.

  3. Ensure minimal and realistic changes (sparse changes).

  4. Output human-readable "if-then" statements.

- **Data & Measures:** LSAT and Pima Diabetes datasets; performance measured by plausibility and spa

- **Implementation Context:** Applicable across domains where individual-level decisions are made.

> "Unconditional counterfactual explanations should be given for positive and negative automated decisio

> "If your LSAT was 34.0, you would have an average predicted score (0)." (p. 858)

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — Must be "concise, transparent, intelligible" (p. 871).

- **CR (Contextual Relevance):** Yes — Tailored to the individual's data and decision context (p. 843–84

- **FE (Feasibility):** Partial — Mutability and practicality of changes considered but not guaranteed (p. 8

- **TI (Timeliness):** Partial — Can be given post-decision; real-time use possible but not core focus (p. 8

- **EX (Explainability):** Yes — Provides rationale via dependency on external facts (p. 845).

- **GA (Goal Alignment):** Partial — Aims to support user goals (understand, contest, alter), but no explic

- **Other Dimensions:** Legal compatibility; minimal intrusion on rights of others.

Theoretical or Conceptual Foundations

- Analytic philosophy of knowledge ("justified true belief," counterfactual reasoning).

- Possible worlds semantics (David Lewis).

- Causal reasoning in fairness (Pearl).

Indicators or Metrics for Actionability

- Minimal number of changed variables (sparsity).

- Plausibility of changes (within realistic ranges).

- Relevance to individual's mutable characteristics.

Barriers and Enablers to Actionability

- **Barriers:** GDPR's limited scope for explanations; possible unchangeable variables; cost of computat

- **Enablers:** Model-agnostic applicability; computational efficiency; legal compatibility; minimal trade se

---

Relation to Existing Literature

Contrasts with ML interpretability work focusing on internal logic; aligns with fairness literature using cour

---

Summary

The paper redefines "actionability" for explanations of automated decisions under GDPR as enabling the

---

Scores

- **Overall Relevance Score:** 95 — Strong, explicit linkage between explanation design and enabling us

- **Operationalization Score:** 90 — Clear technical method with worked examples; some limitations on f

---

Supporting Quotes from the Paper

- "An explanation… does not necessarily hinge on… understanding how algorithmic systems function." (p

- "Unconditional counterfactual explanations should be given for positive and negative automated decisio

- "If your LSAT was 34.0, you would have an average predicted score (0)." (p. 858)

- "Concise, transparent, intelligible and easily accessible form." (p. 871)

Actionability References to Other Papers

- Lewis, *Counterfactuals* (1973)

- Pearl, *Causation* (2000)

- Kusner et al., "Counterfactual Fairness" (2018)

- Citron & Pasquale, on hypothetical alterations in credit scoring (2014)

Paper Summary

<!--META_START-->

Title: Assessing the understandability and actionability of online resources for patients undergoing hemod

Authors: Emi Furukawa, Tsuyoshi Okuhara, Hiroko Okada, Yumiko Fujitomo, Takahiro Kiuchi

DOI: https://doi.org/10.1111/1744-9987.14221

Year: 2025

Publication Type: Journal

Discipline/Domain: Health Communication / Nephrology

Subdomain/Topic: Patient education, online health resources, health literacy assessment

Eligibility: Eligible

Overall Relevance Score: 78

Operationalization Score: 85

Contains Definition of Actionability: Yes (via PEMAT-P framework)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes (PEMAT-P)

Operationalization Present: Yes

Primary Methodology: Quantitative / Cross-sectional evaluation study

Study Context: Evaluation of Japanese-language online patient education materials on hemodialysis usin

Geographic/Institutional Context: Japan (University of Tokyo Hospital, Graduate School of Medicine)

Target Users/Stakeholders: Patients undergoing hemodialysis, healthcare providers, patient education m

Primary Contribution Type: Empirical assessment and guidance for material improvement

CL: Yes

CR: Yes

FE: Yes

TI: No

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Assessing the understandability and actionability of online resources for patients undergoing hemodialysi

Authors:

Emi Furukawa, Tsuyoshi Okuhara, Hiroko Okada, Yumiko Fujitomo, Takahiro Kiuchi

DOI:

https://doi.org/10.1111/1744-9987.14221

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Health Communication / Nephrology

Subdomain/Topic:

Patient education, online health resources, health literacy assessment

Contextual Background:

The study evaluates whether Japanese-language online materials for patients on hemodialysis are under

Geographic/Institutional Context:

Japan; University of Tokyo Hospital; Graduate School of Medicine, University of Tokyo.

Target Users/Stakeholders:

Patients undergoing hemodialysis, their families, healthcare providers, and material developers.

Primary Methodology:

Quantitative cross-sectional content evaluation.

Primary Contribution Type:

Empirical assessment with actionable recommendations for improving educational resources.

General Summary of the Paper

This cross-sectional study assessed 194 Japanese-language online educational materials for patients un

---

Eligibility

Eligible for inclusion: **Yes**

How Actionability is Understood

The paper adopts the PEMAT-P definition: actionability refers to how well materials enable patients to ide

> "Actionability… evaluates how well patients can identify what they need to do based on the information

> "Scores below 70% indicated poor… actionability, whereas scores of 70% or higher were considered…

What Makes Something Actionable

- Clearly identifies at least one specific action a user can take.

- Addresses the user directly in describing actions.

- Breaks down actions into explicit steps.

- Provides tangible tools (e.g., checklists, planners) to facilitate the action.

- Uses visual aids to make instructions easier to follow.

- Explains how to interpret charts, graphs, or tables for taking action.

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Japanese version of PEMAT-P (Patient Education Materials Assess

- **Methods/Levers:** Binary scoring (agree/disagree) across seven actionability items; 70% threshold fo

- **Operational Steps / Workflow:** Identify actions, address user directly, break down steps, provide tool

- **Data & Measures:** PEMAT-P scores; Kruskal–Wallis test for group differences; inter-rater reliability v

- **Implementation Context:** Applied to Japanese online HD materials from diverse sources and content

> "More than half of the materials satisfied Item 19… However, <30%… met Item 21… Item 22… Item 24

> "Self-management materials tended to offer more detailed instructions and utilized visual aids to facilita

---

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — linked via plain language and absence of distracting information.

- **CR (Contextual Relevance):** Yes — self-management content most relevant and actionable.

- **FE (Feasibility):** Yes — inclusion of tangible tools and breakdown of steps supports feasibility.

- **TI (Timeliness):** No explicit link found.

- **EX (Explainability):** Partial — explanation of how to use visual aids was rare (<10%).

- **GA (Goal Alignment):** Partial — some materials align with patient self-care goals (e.g., self-manager

- **Other Dimensions Named by Authors:** Use of visual aids, chunking information, providing summaries

---

Theoretical or Conceptual Foundations

- PEMAT-P framework for defining and measuring understandability and actionability.

- Health literacy principles, including plain language and visual aid effectiveness.

- Prior literature on patient education in CKD and HD contexts.

Indicators or Metrics for Actionability

- PEMAT-P actionability subscore (% of items rated "agree" out of applicable items).

- ≥70% threshold for actionable materials.

Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of summaries.

  - Inadequate titling/captioning of visual aids.

  - Minimal use of tangible tools for action.

  - Complex syntax and medical jargon.

- **Enablers:**

  - Direct address to the user.

  - Clear identification of actions.

  - Detailed step-by-step instructions in self-management materials.

  - Effective visual aids used by for-profit company materials.

Relation to Existing Literature

The authors note similar deficiencies in English-language HD and CKD materials internationally, such as

---

Summary

This study provides a quantitative assessment of the understandability and actionability of Japanese onli

---

Scores

- **Overall Relevance Score:** 78 — Strong definition via PEMAT-P, clear articulation of features tied to a

- **Operationalization Score:** 85 — Detailed use of PEMAT-P with actionable criteria, scoring method, a

---

Supporting Quotes from the Paper

- "Actionability… evaluates how well patients can identify what they need to do based on the information p

- "More than half… satisfied Item 19… <30% met Item 21… Item 22… Item 24… and Item 25." (p. 204)

- "Self-management materials… offered more detailed instructions and utilized visual aids… distinguishin

- "Development and dissemination of quality materials… can minimize the gap between patient education

---

Actionability References to Other Papers

- Shoemaker SJ et al. (2014) — development of PEMAT.

- Furukawa E et al. (2022) — Japanese version of PEMAT validation.

- Studies on readability and quality of CKD/HD patient education (e.g., Bresler et al., 2021; Tuot et al., 20

- Federal Plain Language Guidelines (2011).

Paper Summary

<!--META_START-->

Title: Predictive monitoring of business processes: a survey

Authors: Alfonso E. Márquez■Chamorro; Manuel Resinas; Antonio Ruiz■Cortés

DOI: 10.1109/TSC.2017.2772256

Year: 2017

Publication Type: Journal (IEEE Transactions on Services Computing)

Discipline/Domain: Business Process Management; Process Mining

Subdomain/Topic: Predictive process monitoring (time, risk, SLA, next-event, indicators)

Eligibility: Eligible (Implicit treatment of actionability tied to proactive/corrective action and recommendatic

Overall Relevance Score: 78

Operationalization Score: 52

Actionable/Actionability Used in Paper: Yes — "Predictive monitoring … aims to provide timely informatic

Authors Argue for Need for Actionability Without Defining It: Yes — "provide timely information that enabl

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes (implicit: timeliness, interpretability/clarity, domain releva

Contains Explainability: Partial (emphasized as needed for actionability):contentReference{inde

Contains Interpretability: Yes (explicitly discussed as requirement/challenge):contentReference

Contains Framework/Model: Yes (two-stage methodology; taxonomies; tables):contentReference[oaicite:

Operationalization Present: Yes (general methodology; checkpoints; integration recommendations; but lir

Primary Methodology: Review

Study Context: Survey of predictive monitoring techniques for business processes, 2010–2017

Geographic/Institutional Context: N/A (multi-dataset, multi-domain survey)

Target Users/Stakeholders: BPM researchers; practitioners building predictive monitoring systems

Primary Contribution Type: Systematic survey, classification, and identification of challenges and resear

CL: Partial

CR: Yes

FE: Partial

TI: Yes

EX: Partial

GA: Partial

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Predictive monitoring of business processes: a survey

Authors:

Alfonso E. Márquez■Chamorro; Manuel Resinas; Antonio Ruiz■Cortés

DOI:

10.1109/TSC.2017.2772256

Year:

2017

Publication Type:

Journal (IEEE Transactions on Services Computing)

Discipline/Domain:

Business Process Management; Process Mining

Subdomain/Topic:

Predictive process monitoring (runtime prediction of time, risk, SLA, next-event, and indicators)

Contextual Background:

The paper surveys 39 approaches to predictive monitoring in BPM, detailing inputs (event logs, models, d

Geographic/Institutional Context:

N/A (broad, cross■domain survey; includes public BPIC datasets and industrial cases):contentReference

Target Users/Stakeholders:

Researchers and practitioners designing predictive monitoring systems in BPM:contentReference[oaicite:

Primary Methodology:

Review / Survey (methodological synthesis and taxonomy):contentReference{index=20}

Primary Contribution Type:

Domain overview; taxonomy; methodological framework; challenges and agenda:contentReference[oaici

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General Summary of the Paper

The authors review predictive monitoring methods for business processes that forecast runtime outcome

---

Actionable/Actionability Used in Paper

Yes. Verbatim and tied to acting on results:

- "Predictive monitoring of BPs … aims to provide timely information that enable **proactive and correctiv

- "Most proposals are focused on improving the accuracy of predictions, but **little attention has been giv

---

Authors Argue for a Need for Actionability Without Defining It

Yes.

- "Provide timely information that enable proactive and corrective actions …" (p. 2):contentReference[oai

- Emphasis on recommendations/explanations enabling users "to determine the best way to act upon" pre

---

How Actionability is Understood

Implicitly: information is actionable when it is **timely**, **interpretable/explainable**, and accompanied b

> "Provide timely information that enable proactive and corrective actions …" (p. 2):contentReference[oai

> "Providing recommendations and explaining the prediction values … so that they can determine the bes

---

What Makes Something Actionable

- **Timeliness of information (runtime, proactive):**

  > "Predictive monitoring … at real■time during the execution …" (p. 3):contentReference{ind

  > "Provide timely information … enable proactive and corrective actions …" (p. 2):contentReference[oai

- **Interpretability/Clarity of models and outputs:**

  > "The interpretability of the model … has not been a main concern… Only a few proposals have explici

- **Recommendations that guide action:**

  > "Little attention has been given to providing recommendations … so that they can determine the best v

  > "A recommendation system … identifies the best assignment of resources … based on the generated

- **Domain relevance and feasibility of actions:**

  > "Recommendations presented to the user must make sense in the domain … domain knowledge have

- **Integration into operational systems (to act):**

  > "Integration of predictive monitoring techniques with BPMS … frameworks … prototypes …" (p. 17):co

---

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** General predictive monitoring methodology (learning + runtime phas

- **Methods/Levers:** Feature engineering/encoding; checkpoint selection; model interpretability; recomm

- **Operational Steps / Workflow:**

  1) Offline learning from event logs (encode features; build/evaluate models).

  2) Online application to ongoing cases at **checkpoints** for timely alerts.

  3) Present interpretable outputs and **recommendations**; integrate with BPMS to trigger actions. (Figu

- **Data & Measures:** Event logs (+ optional process models and contextual attributes); evaluation via R

- **Implementation Context:** BPM/Process Mining toolchains; emphasis on real■time monitoring and sy

> "Stage 2 … at run■time … predictive model … determine the value …" (p. 3):contentReference[oaicite:

> "Recommendations … decision support … integration with BPMS." (p. 17):contentReference[oaicite:52

Dimensions and Attributes of Actionability (Authors' Perspective)

(Marked "Yes/Partial" when explicitly tied to making outputs actionable.)

- **CL (Clarity):** **Partial** — Need for interpretability and explanation to act.

  > "Providing recommendations and **explaining the prediction values** … to determine the best way to

- **CR (Contextual Relevance):** **Yes** — Actions must make domain sense; include domain knowledg

  > "Recommendations … **must make sense in the domain** … include domain knowledge." (p. 17):con

- **FE (Feasibility):** **Partial** — Emphasis on recommendations that are implementable within BPMS a

  > "Recommendation system … **best assignment of resources** … integrated in YAWL." (p. 17):conter

- **TI (Timeliness):** **Yes** — Real■time/at■runtime checkpoints for proactive action.

  > "Carried out at real■time … prediction is made at a **checkpoint** …" (p. 3):contentReference[oaicite

- **EX (Explainability):** **Partial** — Stressed as missing and needed for actionability.

  > "Little attention … to **providing recommendations and explaining** the prediction values …" (pp. 16–

- **GA (Goal Alignment):** **Partial** — Framed around improving performance, mitigating risks, meeting

  > "Improve process performance and mitigate risks." (p. 2):contentReference{index=60}

Other Dimensions Named by Authors: Integration with operations/BPMS as enabler (practical applica

---

Theoretical or Conceptual Foundations

- Process mining perspectives (control■flow, data, time, resource) as input to prediction and decision sup

- Distinction between process■aware vs. non■process■aware methods (conceptual categorization).:con

---

Indicators or Metrics for Actionability

No explicit "actionability" KPI. Related evaluation metrics focus on prediction quality (RMSE/MAE, Accura

---

Barriers and Enablers to Actionability

- **Barriers:**

  - Lack of interpretability/explanations and recommendations (pp. 16–17):contentReference{in

  - Limited software/dataset availability hindering comparison and adoption (p. 15):contentReference[oaic

  - Model complexity with many categorical variables (p. 14):contentReference{index=70}

- **Enablers:**

  - Runtime checkpoints and timely monitoring (p. 3):contentReference{index=71}

  - Integration with BPMS and recommendation systems (p. 17):contentReference{index=72}

  - Domain knowledge inclusion in recommendations (p. 17):contentReference{index=73}

Relation to Existing Literature

The survey situates predictive monitoring relative to deviance mining and software failure prediction, clari

---

Summary

This survey synthesizes the landscape of predictive monitoring for business processes, proposing a gene

---

Scores

- **Overall Relevance Score:** 78 — Strong, explicit linkage between predictions and **acting** (proactive

- **Operationalization Score:** 52 — Provides a general methodology and identifies levers (checkpoints,

---

Supporting Quotes from the Paper

- "Predictive monitoring … **provide timely information that enable proactive and corrective actions** …"

- "**Interpretability** of the model … only a few proposals …" (p. 14):contentReference{index=

- "Little attention has been given to **providing recommendations and explaining** the prediction values .

- "Recommendations … **must make sense in the domain**, … include domain knowledge." (p. 17):conte

---

Actionability References to Other Papers

- Maggi et■al. (2014) — predictive monitoring with **recommendations** to maximize constraint satisfact

- Conforti et■al. (2015) — **recommendation system** for risk■aware resource assignment integrated w

- Integration prototypes and frameworks (e.g., Nirdizati; Camunda integration) as enablers of actionable c

Paper Summary

<!--META_START-->

Title: Where Did I Misbehave? Diagnostic Information in Compliance Checking

Authors: Elham Ramezani; Dirk Fahland; Wil van der Aalst

DOI: 10.1007/978-3-642-32885-5_21

Year: 2012

Publication Type: Conference (Lecture Notes in Computer Science)

Discipline/Domain: Business Process Management; Process Mining

Subdomain/Topic: Backward compliance checking; Petri net patterns; Optimal alignments; Diagnostic cor

Eligibility: Eligible (implicitly and substantively addresses the state of being actionable via "diagnostic info

Overall Relevance Score: 68

Operationalization Score: 82

Actionable/Actionability Used in Paper: No explicit use of "actionable/■ity"; yes to strong implicit framing v

Authors Argue for Need for Actionability Without Defining It: Yes — e.g., "compliance improvement: modi

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: Yes — six■dimension compliance rule framework (control■fl

Contains Explainability: Yes — alignment-based diagnostics highlighting exact deviation positions. (pp. 5-

Contains Interpretability: Yes — rule categories (Table 1) and Petri-net pattern diagrams (Figs. 2–5, 7, 10

Contains Framework/Model: Yes — repository of 50 control-flow rules in 15 categories; Petri-net pattern f

Operationalization Present: Yes — end-to-end procedure in ProM: select rule, parameterize mapping, cor

Primary Methodology: Conceptual + Method/Tool with Case Study (real-life event log)

Study Context: Hospital financial process event log, 150k+ events, ~700 activities, 1,150 cases (2005–20

Geographic/Institutional Context: Large Dutch hospital; Eindhoven University of Technology

Target Users/Stakeholders: Compliance officers; auditors; BPM analysts; process owners

Primary Contribution Type: Method + Framework + Tooling (ProM plug-ins)

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

<!--META_END-->

Title:

Where Did I Misbehave? Diagnostic Information in Compliance Checking

Authors:

Elham Ramezani; Dirk Fahland; Wil van der Aalst

DOI:

10.1007/978-3-642-32885-5_21

Year:

2012

Publication Type:

Conference (Lecture Notes in Computer Science)

Discipline/Domain:

Business Process Management; Process Mining

Subdomain/Topic:

Backward compliance checking; Petri net patterns; Optimal alignments; Diagnostic conformance analysis

Contextual Background:

The paper addresses backward (a posteriori) compliance checking using event logs, motivated by regula

Geographic/Institutional Context:

Large Dutch hospital case study; Eindhoven University of Technology (authors). (pp. 12–14)■p.12■■p.1

Target Users/Stakeholders:

Compliance officers, internal/external auditors, BPM analysts, process owners.

Primary Methodology:

Conceptual method + tooling + real-life case study.

Primary Contribution Type:

Framework of compliance rules + Petri■net pattern operationalization + alignment-based diagnostics + P

General Summary o

Paper Summary

<!--META_START-->

Title: Outlier Detection Techniques for Process Mining Applications

Authors: Lucantonio Ghionna, Gianluigi Greco, Antonella Guzzo, Luigi Pontieri

DOI: 10.1007/978-3-540-68123-6_17

Year: 2008

Publication Type: Conference

Discipline/Domain: Computer Science / Process Mining

Subdomain/Topic: Outlier detection, anomaly detection, process mining

Eligibility: Not Eligible

Overall Relevance Score: 15

Operationalization Score: 0

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: No

Contains Framework/Model: Yes

Operationalization Present: No

Primary Methodology: Conceptual with experimental validation

Study Context: Development of a specialized outlier detection approach for process logs

Geographic/Institutional Context: University of Calabria (Italy); Italian National Research Council

Target Users/Stakeholders: Process analysts, researchers in process mining

Primary Contribution Type: New methodology for outlier detection in process mining

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not discuss actionability, actionable insights, or conditions for beir

<!--META_END-->

Title:

Outlier Detection Techniques for Process Mining Applications

Authors:

Lucantonio Ghionna, Gianluigi Greco, Antonella Guzzo, Luigi Pontieri

DOI:

10.1007/978-3-540-68123-6_17

Year:

2008

Publication Type:

Conference

Discipline/Domain:

Computer Science / Process Mining

Subdomain/Topic:

Outlier detection, anomaly detection, process mining

Contextual Background:

The paper addresses limitations of classical outlier detection when applied to process mining, where anor

Geographic/Institutional Context:

University of Calabria, Italy; ICAR-CNR

Target Users/Stakeholders:

Researchers and practitioners in process mining, process analysts

Primary Methodology:

Conceptual and algorithmic approach with simulated experimental evaluation

Primary Contribution Type:

Methodology and prototype system for detecting anomalous process traces

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General Summary of the Paper

This paper proposes a specialized outlier detection approach for process mining applications, recognizing

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Actionable/Actionability Used in Paper

No — The paper does not reference actionability, actionable insights, recommendations, or knowledge.

Authors Argue for a Need for Actionability Without Defining It

No — The authors do not discuss the need for actionable results.

How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No
- **TI (Timeliness):** No
- **EX (Explainability):** No
- **GA (Goal Alignment):** No
- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Pattern mining in process logs
- Clustering-based anomaly detection
- Co-clustering techniques (Markov Cluster Algorithm)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

- **Barriers:** N/A
- **Enablers:** N/A

Relation to Existing Literature

The paper builds on prior work in process mining, frequent pattern mining, and clustering-based anomaly

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Summary

This study addresses the challenge of detecting anomalies in process mining logs, where concurrent proc

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Scores

- **Overall Relevance Score:** 15 — The paper is methodologically strong but unrelated to the concept o

- **Operationalization Score:** 0 — No operationalization of actionability; only operationalizes outlier dete

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Supporting Quotes from the Paper

- "...an approach for singling out anomalous evolutions within a set of process traces, which takes into ac

- "Outliers are found by a two-steps approach: First, we mine the patterns of executions... Second, we us

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Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Algorithms for Anomaly Detection of Traces in Logs of Process Aware Information Systems

Authors: Fábio Bezerra, Jacques Wainer

DOI: N/A

Year: 2013

Publication Type: Journal (Elsevier Preprint)

Discipline/Domain: Computer Science / Information Systems

Subdomain/Topic: Process Mining, Anomaly Detection

Eligibility: Not Eligible

Overall Relevance Score: 20

Operationalization Score: 40

Actionable/Actionability Used in Paper: No

Authors Argue for Need for Actionability Without Defining It: No

Contains Definition of Actionability: No

Contains Systematic Features/Dimensions: No

Contains Explainability: No

Contains Interpretability: Partial (related to model "make sense" appropriateness, but not tied to actionabi

Contains Framework/Model: Yes (Algorithms for anomaly detection: Threshold, Iterative, Sampling)

Operationalization Present: Yes (Detailed algorithmic steps for anomaly detection)

Primary Methodology: Quantitative (algorithm design and evaluation with synthetic and real logs)

Study Context: Anomaly detection in control-flow perspective of process-aware information systems

Geographic/Institutional Context: Brazil (UFRA, UNICAMP)

Target Users/Stakeholders: Process auditors, fraud detection analysts, process mining researchers

Primary Contribution Type: Algorithmic framework for anomaly detection

CL: No

CR: No

FE: No

TI: No

EX: No

GA: No

Reason if Not Eligible: The paper does not address actionability, actionable insights, or actionable knowle

<!--META_END-->

Title:

Algorithms for Anomaly Detection of Traces in Logs of Process Aware Information Systems

Authors:

Fábio Bezerra, Jacques Wainer

DOI:

N/A

Year:

2013

Publication Type:

Journal (Elsevier Preprint)

Discipline/Domain:

Computer Science / Information Systems

Subdomain/Topic:

Process Mining, Anomaly Detection

Contextual Background:

The paper presents and evaluates algorithms for detecting anomalies in process-aware information syste

Geographic/Institutional Context:

Brazil (UFRA, UNICAMP)

Target Users/Stakeholders:

Process auditors, fraud detection specialists, process mining researchers

Primary Methodology:

Quantitative (algorithm development, synthetic log simulation, and empirical evaluation)

Primary Contribution Type:

Algorithmic framework and comparative performance evaluation

General Summary of the Paper

This paper proposes and evaluates three algorithms—Threshold, Iterative, and Sampling—for detecting a

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Actionable/Actionability Used in Paper

No — the paper does not use the terms "actionable," "actionability," or related concepts.

Authors Argue for a Need for Actionability Without Defining It

No — the focus is solely on anomaly detection effectiveness, not on the applicability or usability of results

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How Actionability is Understood

N/A

What Makes Something Actionable

N/A

How Actionability is Achieved / Operationalized

N/A

Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** No
- **CR (Contextual Relevance):** No
- **FE (Feasibility):** No

- **TI (Timeliness):** No

- **EX (Explainability):** No

- **GA (Goal Alignment):** No

- **Other Dimensions Named by Authors:** N/A

Theoretical or Conceptual Foundations

- Process mining (precise vs. noisy mining approaches)

- Conformance checking

- Appropriateness measures (behavioral and structural)

Indicators or Metrics for Actionability

N/A

Barriers and Enablers to Actionability

N/A — barriers discussed are related to anomaly detection performance, not to actionability.

Relation to Existing Literature

The work situates itself within anomaly detection and process mining literature, contrasting with methods

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Summary

The paper addresses the detection of anomalous traces in logs from process-aware information systems.

Scores

- **Overall Relevance Score:** 20 — Only tangentially relevant to actionability; no conceptual or definition

- **Operationalization Score:** 40 — Strong operationalization of anomaly detection, but unrelated to ope

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Supporting Quotes from the Paper

- "The algorithms discussed in this paper must be used as a first automated step towards a more compre

- "We have no formal definition of an anomalous trace, but we have some intuitions that guided the devel

- "The sampling algorithm proved to be the most effective solution." (Abstract)

Actionability References to Other Papers

N/A

Paper Summary

<!--META_START-->

Title: Addressing the Contemporary Challenges of Business Process Compliance: The Case for Process

Authors: Nigel Adams, Adriano Augusto, Michael Davern, Marcello La Rosa

DOI: https://doi.org/10.1007/s12599-025-00929-3

Year: 2025

Publication Type: Journal

Discipline/Domain: Business Process Management / Information Systems

Subdomain/Topic: Business Process Compliance (BPC), Process Mining, Banking Industry, Conformanc

Eligibility: Eligible

Overall Relevance Score: 85 — Strong conceptual contribution on operationalizing compliance monitoring

Operationalization Score: 80 — Detailed mapping of process mining software features to compliance cha

Actionable/Actionability Used in Paper: Yes — "to facilitate business process management activities by e

Authors Argue for Need for Actionability Without Defining It: Yes — "proactive monitoring… aims to recor

Contains Definition of Actionability: No explicit formal definition; implicitly framed as producing insights or

Contains Systematic Features/Dimensions: Yes — Multiple conditions for compliance to be "actionable,"

Contains Explainability: Partial — Discusses root cause analysis, intelligible feedback, visualization for un

Contains Interpretability: Partial — Focus on interpretability of compliance rules, transparency in process

Contains Framework/Model: Yes — Consolidated list of 41 BPC Challenges (BPCCs) mapped to process

Operationalization Present: Yes — Detailed mapping of process mining software features to specific BPC

Primary Methodology: Mixed Methods (systematic literature review + qualitative industry analysis + featur

Study Context: Australian Banking Industry (2017–2022 regulatory breach cases)

Geographic/Institutional Context: Australia; major Australian banks; regulators (APRA, ASIC, AUSTRAC)

Target Users/Stakeholders: Compliance officers, process mining practitioners, software vendors, regulato

Primary Contribution Type: Conceptual framework and operational mapping of process mining to complia

CL: Yes — "clear statement of a compliance requirement… compliance rule templates… formalize the re

CR: Yes — "compliance rules… aligned to the organizational hierarchy… to the business process environ

FE: Yes — "workarounds to address… difficulties in implementing rules" (p. 16); feasibility linked to techr

TI: Partial — Timeliness in alerts and detecting requirements changes noted as critical gaps.

EX: Partial — "root cause analysis… intelligible user feedback… process animation to help visualize" (p.

GA: Yes — "recommend options to simplify… reconcile conflicting objectives" (p. 19).

Title:

Addressing the Contemporary Challenges of Business Process Compliance: The Case for Process Minin

Authors:

Nigel Adams, Adriano Augusto, Michael Davern, Marcello La Rosa

DOI:

https://doi.org/10.1007/s12599-025-00929-3

Year:

2025

Publication Type:

Journal

Discipline/Domain:

Business Process Management / Information Systems

Subdomain/Topic:

Business Process Compliance, Process Mining, Banking Industry, Conformance Checking

Contextual Background:

The paper addresses the persistent challenges in business process compliance (BPC) by contrasting res

Geographic/Institutional Context:

Australia; major banks; regulatory bodies APRA, ASIC, AUSTRAC; consulting firms KPMG, Accenture, M

Target Users/Stakeholders:

Compliance officers, process mining practitioners, software vendors, regulators, banking executives.

Primary Methodology:

Mixed Methods (systematic literature review, qualitative analysis of regulatory and consultancy reports, m

Primary Contribution Type:

Conceptual framework and operational mapping of process mining to BPC challenges.

General Summary of the Paper

The study explores how commercial process mining solutions can bridge the gap between research-ident

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Actionable/Actionability Used in Paper

Yes

- "to facilitate business process management activities by extracting actionable process knowledge" (p. 4)

- "prescriptive monitoring aims to recommend a course of action during process execution to achieve a ce

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Authors Argue for a Need for Actionability Without Defining It

Yes

- "recommend options to simplify the business process environment" (p. 19)

- "recommendations based on reconciling conflicting objectives" (p. 19)

How Actionability is Understood

Implicitly framed as generating operationally relevant knowledge, recommendations, or rule-based check

> "Prescriptive monitoring aims to recommend a course of action during process execution to achieve a c

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What Makes Something Actionable

- **Operational Relevance**

  > "recommend a course of action during process execution to achieve a certain outcome" (p. 5)

- **Clarity of Requirements**

  > "clear statement of a compliance requirement… compliance rule templates… formalize the requirem

- **Organizational Integration**

  > "recommend options to simplify the business process environment" (p. 19)

- **Goal Alignment**

  > "recommendations based on reconciling conflicting objectives" (p. 19)

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** BPCC–Feature Mapping; Compliance Management Lifecycle integra

- **Methods/Levers:** Extraction of compliance requirements from risk/control registers; instantiation into

- **Operational Steps / Workflow:**

  1. Compile compliance requirements from a unified risk/obligations/control register.

  2. Formalize rules via compliance rule templates.

  3. Apply to event logs for design-time, run-time, and post-execution compliance checking.

  4. Use visualization and analytics to detect violations, root causes, and process improvement opportunit

- **Data & Measures:** Event logs, process models, compliance rules, violation metrics (frequency, durat

- **Implementation Context:** Australian banking sector compliance with AML/CTF and other regulations.

> "taking an organization's ROCR as the compliance requirements' source, and using event logs for desig

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Dimensions and Attributes of Actionability (Authors' Perspective)

- **CL (Clarity):** Yes — "clear statement of a compliance requirement… formalize… in a standard and c

- **CR (Contextual Relevance):** Yes — "aligned to the organizational hierarchy… to the business proces

- **FE (Feasibility):** Yes — "workarounds to address… difficulties in implementing rules" (p. 16)

- **TI (Timeliness):** Partial — timeliness in alerts and detecting requirements changes noted as critical g

- **EX (Explainability):** Partial — "root cause analysis… intelligible user feedback… process animation t

- **GA (Goal Alignment):** Yes — "recommendations based on reconciling conflicting objectives" (p. 19)

- **Other Dimensions Named by Authors:** Integration with operational processes; scalability; user suppo

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Theoretical or Conceptual Foundations

- Compliance Management Lifecycle (Governatori & Sadiq, 2009)

- Business Process Management Lifecycle (Dumas et al., 2018)

- BPCC classification framework (derived from literature + industry)

Indicators or Metrics for Actionability

- Violation frequency and severity

- Time-to-detection and remediation

- Compliance metrics (timeliness, completeness, control effectiveness)

Barriers and Enablers to Actionability

- **Barriers:** Complex/ambiguous requirements; fragmented processes/data; technical integration challe

- **Enablers:** Unified control registers; compliance rule templates; event log-based monitoring; root caus

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Relation to Existing Literature

Builds on systematic reviews of BPC and process mining; extends prior work by integrating industry regu

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Summary

This paper provides a detailed, dual-perspective analysis of business process compliance challenges in t

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Scores

- **Overall Relevance Score:** 85 — Strong alignment with actionability in the sense of generating operat

- **Operationalization Score:** 80 — Concrete feature–challenge mapping and workflow descriptions; sor

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Supporting Quotes from the Paper

- "to facilitate business process management activities by extracting actionable process knowledge" (p. 4)

- "Prescriptive monitoring aims to recommend a course of action during process execution to achieve a c

- "clear statement of a compliance requirement… compliance rule templates… formalize the requirement

- "recommend options to simplify the business process environment" (p. 19)

Actionability References to Other Papers

- Dumas et al. (2018) — Fundamentals of Business Process Management (actionable process knowledge

- van der Aalst (2016) — Process Mining: Data Science in Action (prescriptive monitoring for action outco

- Maggi et al. (2011) — Monitoring Business Constraints with LTL (recommendations during execution).