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 ir

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 mapp

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.