**TM Forum Introductory Guide**

**IG1238 AI Canvas**

**IG1238**

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|  |  |
| --- | --- |
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# Executive Summary

TM Forum best practices have been using Business Model Canvases in various guises for the past five years as an early method of ideation. These canvases form an integral part of most of the Catalysts projects and help socialize specific Use Case templates and allow various stakeholders to understand the issues they are addressing and their inter-departmental/functional dependencies in a simple single canvas.

The AI Governance group are proposing to implement a variation of this Canvas though this paper to allow a similar methodology of examination within the AI Domain.

The primary aim of the document is to provide an environment to explore and validate problems and hence form a basis for further examination to find appropriate solutions and areas within the AI domain where the identified problem is worthy of exploring a solution. Supplementary output of these early examinations will allow participant to assess risk related to a potential AI project at an early stage, both in terms of governance, costs, and performance goals (is a 95% confidence in the output good enough? Does the output meet our explainability and accountability thresholds etc.)?

The Canvas is a prescriptive template to guide the targeted audience on how the AI solution to their problem would perform in a production environment. It should be noted that there is a presumption that use cases developed/evaluated by this AI Canvas are fit for AI, however the question of the applicability of AI within the use case can be continuously evaluated and considered during the construction/evaluation of the Canvas whilst in flight.

Diagram

Description automatically generated

Figure 1. Logical Flow AI Canvas (Paul Morrissey, BolgiaTen)

# AI Generic - Use Case Template

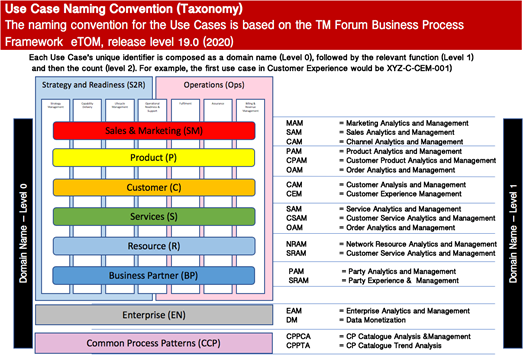


Figure 2. AI Canvas Taxonomy Naming Convention (Paul Morrissey, BolgiaTen)

Mapping the Use Case to areas identified in the eTOM model will allow users to center their problems around key themes and operational areas and allow for the deconstruction of functions to be analyzed and address for instance in the exposure of associated data types etc.

This methodology will allow CSP’s to maintain a library of Use Cases which can be used within a knowledge base. It is important to log all Use Cases, both ones which are taken forward into execution but also a list of Use Cases which were not approved and fully articulating the reasons why they were not approved.

Many Use Cases will not be approved for specific reasons which may be time dependent such as regulation risks, the lack of internal expertise etc.

As the business landscape changes it may be worth re-examining these Use Cases again and so it is recommended that they should be added to a ‘not yet’ list rather than a ‘never’ list.

It may also be useful to continually monitor the ‘not yet’ attributes to detect a change of status and possible re-examination.

## An example use-case number scheme

Use Case Name:     Home Monitoring Using AI

Use Case Number: CPAM #001

# Definitions and Assumptions

Definition:

Try to define all the items you are using here including but not limited to Data Types, Model Types etc.

Assumption:

Try to list all Assumption you have made in the construction of this Use Case including but not limited to; Acceptable confidence levels, Influence of Bias, Deviation from standards (Internal and external)

# Business Problem and Benchmark Assessment

A key concern here is that the underlying business problem is correctly identified so that when we attempt to address it (with an AI solution) the output is something that can be consumed by the business and delivers true value.

With the underlying business problem in mind, this section of the AI Canvas encourages early exploration of the performance goals that the solution would have to achieve to deliver a net benefit. This may help establish benchmark goals for ‘accuracy’ of the AI system and support assessment of whether these can realistically be achieved. This section may also help to identify the business variables whose values need further refinement to tighten the limits on AI model performance. These same variables might also be things that need to be monitored during the operational life of an AI model to ensure its environment remains consistent with design assumptions.

This approach will help the organization to establish meaningful performance targets for the AI system – targets which are directly related to the sought-after business benefit. They may also be an important input to other considerations, for example helping to establish an optimal ‘fairness-accuracy’ operating point.

|  |  |
| --- | --- |
| **Problem Statement** | A statement of the problem, without implying any specific solution. For example, ‘reduce customer churn’ is better than ‘predict customer churn’. |
| **Business Value** | How a solution to this problem might generate a real benefit to the business. Be specific and provide quantification where possible – e.g., regarding the financial scale of the opportunity. |
| **Measurable Goals with Direct Linkage to this Use Case** | What criteria are relevant for measuring the successful delivery of the solution? Aim to define goals with a direct bearing on value rather than proxy measures. |

| **What is the addressable business problem** | **How will the AI be deployed to address this?** | **What are the performance criteria for the model?** | **What’s the minimum performance required (include assumptions)?** |
| --- | --- | --- | --- |
| A tangible problem with one or more potential technical solutions. | Describe how an AI solution could address this problem. | Identify the AI performance criteria that will determine whether the solution provides a net benefit. | Estimate the performance the system will need to achieve in order to provide a net benefit and state the assumptions used to reach this result.  The assumptions may be single values, or ranges may be used to capture uncertainty. Large levels of uncertainty which in turn drive large variation in the required model performance suggest areas where further refinement of the assumed values would be beneficial. |

## Example

|  |  |
| --- | --- |
| **Problem Statement** | Diagnosis of faults in customer premises often requires accurate identification of the equipment involved – e.g., which version of master socket is installed, or which model and version of broadband hub is in use. Customers may have to be guided through this process |
| **Business Value** | Improving the time to identify equipment will have a direct impact on call center efficiency and reduce customer stress. Correct identification of equipment will allow for faster and more accurate fault diagnosis and repair.  Average of 1200 fault calls/day involving identification of CPE.  Average time to manually identify CPE = 2.5 minutes, which add £2 to call handling costs. |
| **Measurable Goals with Direct Linkage to this Use Case** | Call handling time, NPS, Time-to-fix, repeat calls. |

| **What is the addressable business problem** | **How will the AI be deployed to address this?** | **What are the performance criteria for the model?** | **What’s the minimum performance required (include assumptions)?** |
| --- | --- | --- | --- |
| Reduce agent time in correctly identifying customer premises equipment during fault diagnosis. | Customer uses smartphone app to image and identify the CPE and information sent electronically to the agent.  AI object classification model identifies the customer premises equipment – e.g., type and variant. | Average sensitivity across all classes of object – i.e., the proportion of customer premises equipment that are correctly identified. | *Fixed Assumptions*:   * Average cost saving of AI-driven CPE identification = £2 per call * Cost penalty of incorrect CPE classification = £5 per call   **Average sensitivity for neutral benefit = cost/(cost+saving) = 71%**  *Modeling uncertainty:*   * Average cost saving of AI-driven CPE identification = £1.50 to £2.50 (90%CI) * Cost penalty of incorrect CPE classification = £4.60 to £5.40 (90%CI) per call   **Average sensitivity for neutral benefit = 72%**  **Sensitivity range (90%CI): 66.3 to 77.1%** |

# User Story: Storyline Development

In keeping with other TM Forum standard documents, the development of the User Story is an important first step. In the AI Canvas, the User Story should be ‘a problem’ expressed in the first person singular (the problem initiator: see Section 9).

|  |  |
| --- | --- |
| **As a….** |  |
| **I need to…** |  |
| **So that I can…** |  |
| **To do this I need…** |  |

## Example: A Home Monitoring System

|  |  |
| --- | --- |
| **As a….** | Relative (care) of an elderly person who is showing signs of dementia but is determined to live in their own home and whom I am worried about their safety and security in their house whilst unaccompanied. |
| **I need to…** | Be able to monitor their safety whist living in their house |
| **So that I can…** | Feel confident that the person is safe and secure whilst I am remote from the scene |
| **To do this I need…** | Access to a system which monitors their movement and actions and allows me to be fully confident that they are safe |

# Use Case AI Life Cycle Methodology

The following section should be a vision of how the solution would perform in a true AI Ops environment during a E2E implementation (IG 1190). This should be conducted in addition to a mapping across the TM Forum AI Check Lists (GB1021) and consideration of the Chain of Custody journey.

The initial consideration of this methodology and its implications within Operations dimension assesses and tries to envision the potential difficulties of AI-driven Operations activities related to business alignment, processes management, service lifecycle management, service operations management and governance of AI services in a dynamically evolving context.

The question to be answered here: Is your Operations AI-ready?

Are your Deployment and Production processes prepared to effectively and safely deploy, operate, control and maintain new AI components?

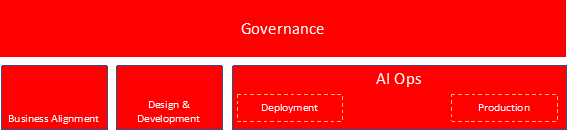


Figure 3. End-to-End Life Cycle Management (Paul Morrissey, BolgiaTen)

# AI Model Selection

The examination of the use of a model is vitally important at this stage and the use of IG1232 Model Data Sheets Specification and IG1184 AI Management Standards are encouraged at this stage of the evaluation.

The purpose of this section in the AI Canvas is to articulate any constraints or other considerations that might have a substantive impact on the choice of AI model used in the solution.

For example, it might be that regulation or an organization’s AI policy mandate that a ‘high-stakes’ model should be fully interpretable. This will obviously limit the available options when the data scientist considers model selection.

At this stage it is not necessary to be sure that any given constraint will have an impact on model choice. Rather, it is sufficient to suspect that it might be the case.

The table below provides a *non-exhaustive* list of areas from which relevant constraints might arise and some examples of potential considerations.

|  |  |
| --- | --- |
| **Model Procurement** | Is there is a requirement to maintain strict provenance traceability for the model and training data that might be difficult to meet for models procured from a third party? |
| **Environmental Impact** | Is the model’s environmental footprint a concern? |
| **Data** | Is there some property of the data that will preclude or favor particular model types, e.g., data quality? |
| **Transparency** | Does the application make specific demands on explainability or interpretability of the model? |
| **Implementation** | Are there limitations imposed by the environment the model will work within, e.g., AI will run on edge devices, or non-GPU infrastructure only? |
| **Safety** | Does the application make specific ‘safety’ demands that will influence model choice, e.g., high resistance to adversarial attack or privacy exposure? |
| **Ethics** | Are there ethical concerns that will influence model selection? These might arise from the type of data that is used, or indeed its sourcing – i.e., the desire to maintain an ethical supply chain. |
| **Policy** | Any other organizational policy implications on model selection. |
| **Legal / Regulatory** | Any other legal or regulatory implications for model selection. |

## A simple example of the AI canvas

A simple example for this section of the AI canvas is given below:

|  |  |
| --- | --- |
| **Data** | Training data is known to be highly imbalanced. |
| **Environmental Impact** | Environmental footprint to be minimized for training *and* inference.  Training carbon footprint must not exceed 500kg CO2eq |
| **Ethics** | Training data ‘X’ cannot be used due to concerns over the employment conditions of the laboring workforce. |

# Primary Actors

The Canvas calls for various stakeholders to participate at an early-stage examination and hence identify and articulate potential risks/issue to the whole group. These form the validation group that is an important step as we often see *‘pet project’* moving through to potential implementation without peer review, this step is intended to stop that happening but also to understand the true value of the proposition at an early stage. This group meets twice during the AI Canvas Life cycle, once at the beginning stages to validate early findings and give a provisional green light for the examination and once at the end before recommendation to the Business for formal approval of the Use Case.

Once completed Best Practice would see this Use Case being presented and approved by the corporation through an organizations formal multi-peer approval process.

The Primary Actors should also form the Validation Committee. This list is provided as a guide and is not exhaustive. Various organizations would form this group in different constructs depending on the Use Case and their business strategy alignments.

| **Validation Group Candidates** | **Role** |
| --- | --- |
| The Problem Initiator | Somebody who proposed a difficult question for discussion or solution; a riddle; a scientific topic for investigation. Remember under the democratizing of AI these problems/potential Use Cases can come from various parts of the organization (and from external candidates and or partners) |
| The Business Analyst | A business analyst is a person who analyses an organization or business domain and documents its business, processes, or systems, assessing the business model or its integration with technology. Business Analyst helps in guiding businesses in improving processes, products, services, and software through data analysis. |
| The Data Scientist | A data scientist is a professional responsible for collecting, analyzing, and interpreting extremely large amounts of data |
| The Problem Broker | The problem broker is a role in which actors frame conditions such as public problems and work to make policy-makers accept these frames. The problem broker makes use of knowledge, values, and emotions in the framing of problems. Other important factors are persistence, access to policy-makers, credibility, and willingness. The AI Governance group recommend that this is the person who should ask the question 'is this an AI problem or can it be solved by other means. |
| The AI Governance and Ethics Voice | This role could be filled by somebody from the legal department who is particularly interested in regulation from the Marketing department who looks at Brand and reputation or the HR department who is interested in internal staff safety. Perhaps even a new role within a company ‘The Ethics Officer’ |
| The Financial Voice | This role should be concerned with looking at the short-term and long-term implications of the project from a budget perspective |
| IT Representative | Somebody from the Design & Development and system architecture function |
| AI Ops Representative | Somebody from the AI Ops function |

# Potential Measures, Metrics, and KPIs

Here we establish a view of the key measures that will define the success of the solution (in broad terms). Where known, priority of measures should be indicated as well as any relationships that exist between measures. For example, it might be understood that two measures are, to some extent, conflicting and that one may have to be compromised to meet the other. If stakeholder expectations are known for the target value of any of these measures, these should also be recorded.

|  |  |  |  |
| --- | --- | --- | --- |
| Priority | Measure/KPI Description | Target value/range *(if known)* | Relationship with other Measures/KPIs |
| Indicate if there is flexibility in meeting this measure/KPI | Description of the measure and its purpose. | Acceptable value/range for the measure. | Any known interaction with other measures. |

## Example

Home Monitoring Using AI

|  |  |  |  |
| --- | --- | --- | --- |
| Priority | Measure/KPI Description | Target value/range *(if known)* | Relationship with other Measures/KPIs |
| Mandatory | False alarm rate | < 1% | Must be achieved in conjunction with KPI for detection of genuine alert situations. |

# AI Data Sources

The purpose of this section of the canvas is to identify the data that will be required to take the project forward and to produce an initial view of any uncertainties around obtaining the data. It is common for teams to underestimate the difficulty and time taken to obtain access – both administratively and physically – to relevant data. Here we encourage consideration of the full range of AI-related activities that require data. These include, but are not limited to: problem understanding, model selection, training and validation, and safety evaluation (e.g., bias assessment, testing for generalization, testing for adversarial attack).

The purpose and potential source of each type of data should be identified. A simple risk level should then be assigned to indicate the uncertainty concerning the sourcing and use of the data entity. Data which is readily available with well understood cost and with known quality would be considered low risk. Data which is thought to exist but with largely unknown integration costs and which is suspected to have quality issues would be considered high risk.

Identification of significant risks for data that is central to success of the solution suggests that further analysis is warranted in order to reduce the associated uncertainties, whether they arise from the lack of an obvious source, knowledge around costs, concerns about quality or something else.

This basic assessment can be further developed (e.g., in the Cost portion of the LEAN Canvas).

An example for a machine vision use case is given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Data** | **Purpose** | **Source** | **Risk level** |
|  | What is the nature of the data and what it is comprised of? | What purpose will this data serve in developing the AI model? | How will the data be sourced? Is it already known to be available, or will a new effort be required to obtain it? | What is the level of risk around obtaining the data? |

## Example

| **#** | **Data** | **Purpose** | **Source** | **Risk level** |
| --- | --- | --- | --- | --- |
| 1 | Labeled data - CPE imagery with class labels and bounding boxes. To include all broadband hub models, NTEs and set-top boxes. | Model training and performance evaluation | Internal project underway to source and label imagery. Toolset available to segment and classify images. | Medium – costs of obtaining sufficient volumes of imagery unquantified. |
| 2 | Challenge data – imagery of third-party products | Model robustness evaluation | Unknown – database doesn’t exist but plans in place to crowdsource labeled images. Tooling available to segment and label images. | High |
| 3 | Challenge data – low quality imagery | Model robustness evaluation | From data augmentation tools | Low – but dependent on (1) |

# AI Risks & Mitigations

This section provides the opportunity to prompt consideration of typical risks and issues that might arise in developing and operating the model. Ideally these prompts would be informed by a database of real-world ‘incidents’, e.g.,

<https://incidentdatabase.ai/>.

Different use cases may demand different levels of mitigation or response. In some cases, it may be appropriate for the business to simply accept the inherent risk.

|  |  |
| --- | --- |
| **Risk** | **Mitigation** |
| Ethical contravention | 1. Assess project against XYZ Ethical Framework (see section 13) 2. Review project with stakeholder forum |
| Model bias | 1. Review data sourcing and provenance 2. Convene diverse data review team 3. Ensure stakeholder groups represented in development team 4. Identify fairness/bias criteria and incorporate into model test plan |
| Shortcut learning:   * presence of confounding features in data | 1. Manual inspection of data for confounding features 2. Use data augmentation techniques on training data 3. Build test models to check for ability to predict suspected confounding features from data |
| Adversarial attack |  |
| Privacy exposure | 1. Build test protocol to check for model memorization of training data |
| User trust | 1. Prefer transparent model algorithms |
| Consumer trust | 1. Prefer transparent model algorithms 2. Support mechanism for external audit of in-life function |
| Operational risk – error in algorithmic trading may lead to uncontrolled losses | 1. Enforce model contract to limit authority of model to make unsupervised decisions |

# Ethics and Governance Compliance Statement

Many Organizations and NGOs around the world are developing Ethics and Governance frameworks which we should look to consider within this canvas such as they are applicable to the Telco Industry. We are looking at the following standard frameworks to help inform our thinking here, but they should absolutely include at a minimum AI Safety and some sort of sustainability components.

In considering this analysis of the Use Case certain background reading may be useful, a non-exhaustive list is set out below:

* [Green Algorithms](http://www.green-algorithms.org/)
* [MAIEI](https://montrealethics.ai/about/) Montreal AI Ethics Institute
* [The Association for the Advancement of Artificial Intelligence](https://aaai.org/Conferences/code-of-ethics-and-conduct.php) Code of Ethics
* What’s next for AI Ethics, Policy and Governance: a research paper
* [World Economic Forum white paper ‘A Framework for Responsible Limits on Facial Recognition Use Case](https://www.weforum.org/whitepapers/a-framework-for-responsible-limits-on-facial-recognition-use-case-flow-management)’
* The Global AI Agenda MIT
* [A Guide to Ethical Data Science](https://royalsocietypublishing.org/doi/pdf/10.1098/rsta.2018.0080) the Royal Statistical Society
* [Singapore Model Framework](https://www.pdpc.gov.sg/help-and-resources/2020/01/model-ai-governance-framework)
* [EU Guidelines on Ethical A](https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai)I
* [EU Proposal for regulation laying down harmonized rules for Artificial Intelligence](http://https//us02st1.zoom.us/web_client/f3jfhf/html/externalLinkPage.html?ref=https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonised-rules-artificial-intelligence)
* [OECD Principles](https://www.oecd.org/going-digital/ai/principles/)
* [Centre of Human Technology](https://www.humanetech.com/)
* [Ledged of Harms](https://ledger.humanetech.com/)
* China’s New Generation AI Governance Principles

In addition to the Ethical risks shared above various Governance standards should also be considered, including but not necessarily limited to:

* [GDPR](https://gdpr.eu/)
* [Singapore National Governance standards](https://www.pdpc.gov.sg/help-and-resources/2020/01/model-ai-governance-framework)
* [World Economic Forum Shaping the Future of Technology Governance: Data Policy](https://www.weforum.org/platforms/shaping-the-future-of-technology-governance-data-policy).

It should be noted that some of these standards are only just being agreed/approved and so constant monitoring of these should be part of this section.

|  |  |
| --- | --- |
| **Required** | Ethics, privacy & security-based considerations against the use case. |

# AI Worksheet

*This section is optional and can be completed as appropriate.*

Prior to full approval of the Use Case for further development a one-page collection of the steps may prove useful and an example of this is developed below. Organizations may have their own methodology for capturing these attributes and so this example below is offered as a template only.

## Example Business Model Canvas (LEAN Problem driven usual order of examination [x])

Only fill in the sections which are appropriate to the Business Problem (**Green** Optional)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Business Problem** | **Solution (Objective)** | **Unique Value Proposition** | | **Unfair Advantage** | **Customer Segments** |
| [1] Understanding of problem | [5] | [8] Example: First to Market | | [9] Example: we own the data | [3] Who will use the solution |
| **Existing Alternatives** | **Key Metrics (Key Results)** | **Channels** | **Early Adopters** |
| [2] List Alternatives | [6]  List KPI’s | [7] Examples: Direct, reseller, | [4] Who will validate the solution |
| **Cost Structure** | | | **Revenue Streams** | | |
| [10] Discussion ([Use Fermi estimate techniques](https://en.wikipedia.org/wiki/Fermi_problem)) | | | [10] Discussion ([Use Fermi estimate techniques](https://en.wikipedia.org/wiki/Fermi_problem)) | | |
| **Social Media/Brand Impact** | | | | |  |
| (11) List of social and brand attributes that can forum an opportunity or a threat to the business | | | | |  |

The Lean Start-up cycle consists of the Build-Measure-Learn feedback loop. Prototyping a solution and iterating until reaching the key metric is at the heart of any successful AI project. Thus, it is a natural fit to augment the Business Model Canvas (LEAN) for AI projects.

# Appendix: External References

|  |  |
| --- | --- |
| **External Reference 1** | IG1021 AI and DA Management Standards |
| **Dependency** |  |
| **Referenced Entity** |  |

|  |  |
| --- | --- |
| **External Reference 2** | IG 1190 AI-OP’s Service Management (TM Forum) |
| **Dependency** |  |
| **Referenced Entity** |  |

|  |  |
| --- | --- |
| **External Reference 3** | eTOM (Frameworx) |
| **Dependency** |  |
| **Referenced Entity** |  |

|  |  |
| --- | --- |
| **External Reference 4** | IG1232 AI and DA Management Standards |
| **Dependency** |  |
| **Referenced Entity** |  |

|  |  |
| --- | --- |
| **External Reference 5** | IG 1184 AI Management Standards |
| **Dependency** |  |
| **Referenced Entity** |  |

# Administrative Appendix

## Document History

### Version History

|  |  |  |  |
| --- | --- | --- | --- |
| Version Number | Date Modified | Modified by: | Description of changes |
| 1.0.0 | 26-May-2021 | Paul Morrisey | Initial release. |

### Release History

|  |  |  |  |
| --- | --- | --- | --- |
| **Release Status** | **Date Modified** | **Modified by:** | **Description of changes** |
| Pre-production | 26-May-2021 | Paul Morrisey | Initial release. |
| Production | 26-Jul-2021 | Adrienne Walcott | Updated to reflect TM Forum Approved Status |

## Acknowledgments

This document was prepared by the members of the TM Forum Data Governance Project team:

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