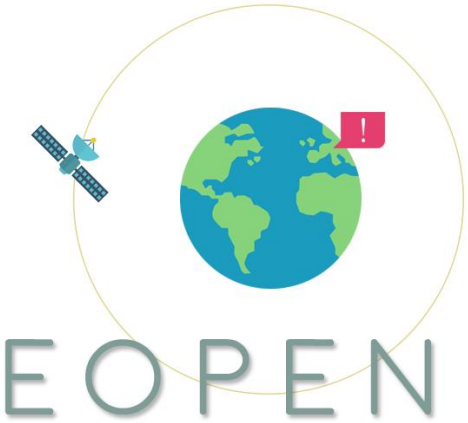


# EOPEN

opEn interOperable Platform for unified access and analysis of Earth observatioN data

H2020-776019

# D2.4

# Target Operating Decision-Making Model (TOM)

| | |
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**Abstract**

This deliverable, D2.4: Target Operating Decision-Making Model, is the second and final part of Task 2.3: Current & Target Operating Decision-Making Model. This report is a continuation of D2.3: Current Operating Decision-Making Model, identifying the functional improvements across the 3 Pilot Use Case's (PUC's) necessary to implement and maximise the benefit of the developed platform. The subsequent platform functionalities and the improvements it brings to the service value chains, previously identified as use-cases in D2.1: Use-Case Design are discussed. Along with recommendations to the PUC stakeholders for how to maximise the potential benefits at an organisational and partnership level.

The outputs of this report feed into the subsequent final deliverable for WP2; D2.5: Joint Decision & Information Governance Architecture.



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# Executive Summary

This deliverable, D2.4: Target Operating Decision-Making Model, is the second and final part of Task 2.3: Current & Target Operating Decision-Making Model. The purpose of this report is to identify the new functional configurations across the 3 Pilot Use Case's (PUC's) necessary to implement the developed platform, to provide tangible benefits to the service value chains. The scope, requirements and baseline for these PUC's to provide a clear vision of the progress made during the project have been developed and discussed in the previous WP2 deliverables D2.1; D2.2; & D2.3 respectively. These respective reports, including this, have been orchestrated through the use of the Joint Decision & Information Governance Architecture Framework (JDIG), an Enterprise Architecture Framework developed to support the development and configuration of complex system of system problems into repeatable services.

To address the aims and objectives of this task, this report is composed of 4 parts:

- Methodology & Approach
- PUC Target Operating Models
- Holistic Capability Assessment
- Recommendations & Conclusions

The Target Operating Models (TOM) and Capability Assessment have been designed collaboratively with project stakeholders; and synchronised with other pertinent deliverables within the project (D7.3, D7.4, D6.5). Ensuring a comprehensive and joined up approach throughout that delivers maximum value and effect to all parties.

**The outputs of this report feed into the subsequent final deliverable for WP2; D2.5: Joint Decision & Information Governance Architecture.**

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# Abbreviations and Acronyms

| | |
|---|---|
| **COM** | Current Operating Decision-Making Model |
| **TOM** | Target Operating Decision-Making Model |
| **JDIG** | Joint Decision & Information Governance Architecture |
| **PUC** | Pilot Use-Case |
| **WP** | Work Package |
| **CES** | Community Environmental Support |
| **NDVI** | Normalised Difference Vegetation Index |

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# Table of Contents

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# 1 INTRODUCTION

This deliverable sets out how EOPEN has developed the proposed Target Operating Decision-Making Models (TOM) for each Pilot Use-Case (PUC), based upon the Joint Decision & Information Governance Architecture Framework (JDIG). The JDIG has been developed specifically for EOPEN, however it has been designed to be agnostic and therefore useable for any form of service improvement where data and information is a key component.

This deliverable first describes the overall methodology and approach undertaken, which re-iterates some elements of the previous deliverable (D2.3), however it describes some alternative views that have been used for the TOM. Secondly it provides worked examples of these different views based upon the PUC's, to provide readers with case studies on how this works in practice; along with useful insight into how EOPEN impacts other service components. Thirdly, it provides an assessment for the impact EOPEN has (or can) have upon each PUC's decision and information management capabilities. While finally, it rounds up with additional future recommendations for each PUC to build upon, that have arisen as a result of EOPEN or were unable to be implemented at this time.

The Target Operating Models (TOM) and Capability Assessment have been designed collaboratively with project stakeholders; and synchronised with other pertinent deliverables within the project (D7.3, D7.4, D6.5). Ensuring a comprehensive and joined up approach throughout that delivers maximum value and effect to all parties.

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# 2 METHODOLOGY & APPROACH

## 2.1 Joint Decision & Information Governance Architecture (JDIG)

The JDIG is a tailored architecture approach with its roots in previous EU H2020 projects (UNITY & AUGGMED) and beyond. Based upon TOGAF 9.2 it is a method for mapping complexity at an enterprise level to bring a cohesive, scalable view to large system of systems. To successfully implement TOGAF, it must first be tailored to the scope and context of the situation through the architecture building blocks and views it will utilise to create the enterprise architecture. The collective output of this process in the context of EOPEN is the JDIG.

The JDIG is unique in that it gives special focus to the data and information that is exchanged between the different systems & actors; and is intended to be re-usable across any organisation. As such, it has been tailored for the TOM to include the architecture building blocks and views as described below.

Some Architecture building blocks and views are generic, realised in both Current & Target Operating Models (COM/TOM), such as Value Streams, locations and organisation/actors. Rather than duplicate effort, these generic items are being documented in the forthcoming deliverable; *D2.5: Joint Decision & Information Governance Architecture.*

### 2.1.1 Architecture Building Blocks

Architecture building blocks are the re-usable entity's that create a scalable architecture. As building blocks are re-used across views it shows the complexity and inter-relationships between other building blocks. Building Blocks that are re-used multiple times can be seen as critical to the use-case and therefore provides rationale to prioritise their improvement.

Building blocks can vary in abstraction either being a collection of smaller entities (such as a service or capability), or as individual entities (e.g. Actors). For the purpose of the JDIG the Individual Entities will be categorised as; **People** (Actors & Organisations), **Process** (Activities & Tasks), **Governance** (Decisions, Policies & Regulations), **Technology** (Physical and Logical systems) & **Information** (Data & Intelligence).

Architecture Building Blocks are typically captured in catalogues, and as such are primarily used for oversight and description. For the purpose of the JDIG, catalogues are focused on capturing the collective packaged building blocks such as Systems, Capabilities & Services. By themselves, the catalogues serve little additional value to stakeholders, as such they have been omitted from this deliverable, in favour of more comprehensive **Views**, as detailed below.

### 2.1.2 Views

Views are a way to present stakeholders the key information related to them in the most appropriate format. Tailoring of the architecture involves deciding which views will be most appropriate and will address the key needs for different stakeholder groups. For each PUC the following views were developed which best represented the TOM:

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**Event Diagrams**

Event Diagrams show stakeholders a high-level view of how key events and the related processes unfold. Event Diagrams were chosen as they represent key events that may be triggered by decisions, or may trigger decisions that trigger further processes, or even additional decisions. Event Diagrams were designed to explicitly follow the 3 key JDIG Value Streams, providing organizational context to the generic stages while also making them transposable, providing means for easy scalability at a later date.

**Process flows**

Process flows show stakeholders an increasingly granular view of activities that deliver value to a customer. Rather than map every single process that occurs within each PUC which would be unnecessary, it was decided to only map the key processes that lead to a decision, as well as any highlighted areas of improvement.

**Decision tables**

Decision tables show logical decision paths based upon certain metrics of data. Within the Scope of EOPEN and the TOM, decision tables are used to determine boundaries around a decision that can be created and matched within the platform to automate alerts and notifications. Matching the type of data and the source allows us to follow the 'information pathway' that shows where information goes and where it has an impact. Each decision table, maps directly to a Control Entity, which can be followed up into the Event or Process Diagram it resides within.

**Data/System Matrix**

A Data/System Matrix shows which system is used to gather or process each data component, helping determine whether certain systems can be removed as data is duplicated elsewhere, or vice-versa where a certain system is needed for critical data input.

**Training/Role Matrix**

The Training/Role Matrix determines what training is required for which role (in the context of EOPEN), though this can be further expanded to include operational training. This helps determine what type of training new users to EOPEN will require to use the platform effectively.

**Task/Information Matrix**

Duplicated in the COM, this matrix shows what information is required by which stakeholders and at what time, to perform their tasks effectively. This matrix is utilised within the TOM as a means of testing that the systems and processes are performed correctly, with the information reaching the correct stakeholders as expected.

**Decision/Information Matric**

Similar to the Task/Information Matrix, this matrix identifies which information impacts which decision, highlighting which information streams are critical to the optimal functioning of each service.

**Information/Source Matrix**

This matrix shows users where each of the information components originates from; be they from systems, people or objects. Supporting that 'Information Pathways' ensure all parties

have a clear understanding of where to go for certain information, or where changes to one of the sources may have an impact on another part of the overall system.

**Service Building Block Configuration**

To understand what elements, make up a service and therefore what is impacted by changes to it, a mapping of the component parts must take place. Component parts are categorised as detailed above in; People, Process, Governance, Technology & Information. This mapping is the accumulation of all other components within the TOM and therefore shows the complete configuration for each new service to be functional.

**Data Capability Assessment**

Data and information being the most critical aspect of the JDIG, this view is pulled out as a more detailed version of the overall Holistic Capability Assessment. This view shows the different data that is either collated or created; and performs an assessment against each type versus each stakeholder. Identifying which stakeholders have the data they need to perform their job satisfactorily, and where improvement is needed against each data type.

**Holistic Capability Assessment**

The Holistic Capability Assessment supports a baseline evaluation of each PUC. By pulling together all the collective information, and through the subjective 'What works/What doesn't work' analysis, a maturity assessment of the PUC can take place. The Capabilities described here are generic to ensure re-usability, with the various different services from different stakeholders mapped to the corresponding generic capability. As well as the Holistic Capability Assessment providing an assessment to support investment and prioritisation for improvements in an organisation or enterprise, it also provides a uniform template to compare the COM vs the TOM; enabling easy utilisation across any future organisations.

## 2.2 Approach

For the purpose of this deliverable we are focussed on the methods to gather information prevalent to the TOM. In Figure 1 below, a high-level overview of the inputs/outputs and approach for the TOM creation can be seen. Those elements highlighted in Yellow are not included in this deliverable as they either catalogues or are duplicated in the COM. Those highlighted in dark blue are included but only to the degree that is necessary to show EOPEN's interaction/implications on the operating model. For example, in the training/role matrix, the training required for using the different functionalities of EOPEN is included, to indicate the changes in training required to use the EOPEN platform; but general training for each of the tasks or decisions is not, as this should be covered by the stakeholders own policies. An overview of the JDIG methodology is available in *D2.1: Use-Case Design.*

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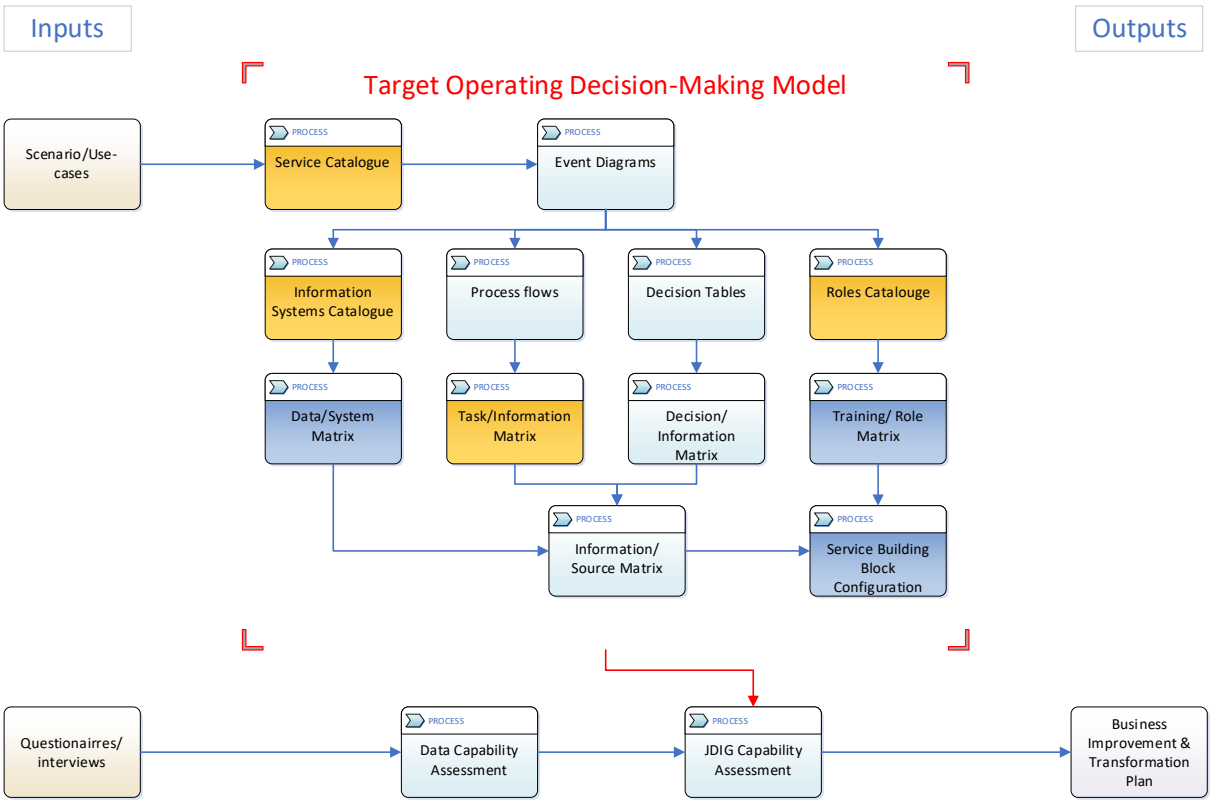


Figure 1: TOM Approach Overview

### 2.2.1 Target Operating Decision-Making Models

**Event Generation**

From the CES scenarios developed by each PUC, the key event/value streams were pulled out through a combination of joint analysis and iterative dialogue with the PUC leads and their stakeholders. Generation of events were bounded by being explicitly related to the value proposition of EOPEN. For example, in PUC2, stakeholders gather information related to international grain supply, as well as for domestic but for EOPEN, we are only focused on the domestic data. The Event Diagram is therefore focused on the Domestic data gathering rather than international.

**Process Generation**

Building upon highlighted areas of improvement within stages of the Event Diagrams, Process diagrams were drawn up iteratively from the scenarios developed in deliverable, *D2.1: Use-case Design*; and updated following stakeholders' feedback. As they are a decomposition of the stages of the event diagrams, event diagrams themselves being a top-level process diagram, they are used sparingly to identify any specific changes due to the introduction of EOPEN into the TOM.

**Decision Table Creation**

Based upon the Event Diagrams for each PUC, each 'Decision Making' event has a corresponding decision table. These have been updated to include the parameters to be set within EOPEN, to co-ordinate with automated alerts for different environmental events.

**Data/System Matrix**

This matrix has been developed by identifying which data is to be collated through the final version of EOPEN (detailed in D6.5) and which data will still be collated by current or legacy systems within each PUC.

**Training/Role Matrix**

This matrix is developed by matching the different training requirements (described within deliverable D7.3), with the different stakeholder roles identified within their CES scenario. Roles are preferred over actors as a single actor may take up different roles within each CES scenario, for example civil protection officers in PUC1 may either be part of the Command and Control, Maintenance, Rescue or Monitoring teams.

**Decision/Information Matrix**

Similar to the Task/Information Matrix, this matrix is created by defining the parameters needed to make a particular decision.

**Information/Source Matrix**

This matrix is developed by combining the 3 separate matrices (Data/System, Task/Information, Decision/Information) into one single view.

**Service Building Block Configuration**

The services within this matrix relate to either a singular event diagram developed above or a combination of 2 or more depending upon the complexity of the service. The corresponding data gathered through the templates is then mapped to one of the 5 corresponding building block areas. **People**, referring to actors and organisations; **Process**, being activities and tasks; **Governance**, refers to decisions and policies; **Technology**, includes communication channels and computer systems; & **Information**, either data or intelligence. The level of detail for building blocks is based upon what provides the greatest value vs time/effort, which depends on the scope and complexity of the project. For EOPEN the abstraction level is fairly high, as the purpose is to test a concept rather than fine-tune existing services.

### 2.2.2 Capability Assessments

**Data Capability Assessment**

The data entities used for this assessment correlate to the data tables that were described in deliverable, D2.3. The assessment is based upon the evaluation work undertaken by each individual PUC and the feedback they have received, which will be formally detailed in the forthcoming deliverable, D7.4.

Each data entity is given a Red, Amber, Green (RAG) status rating based upon every stakeholder's concerns for said entity. This is then scored, and an average is taken to determine the overall data capability rating.

**Holistic Capability Assessment**

The Holistic Capability Assessment maps the combined information from the scenario, what works/what doesn't analysis, and additional stakeholder feedback against the generic JDIG Capability Model. Information is analysed and categorised into the relevant tier 2 capabilities, from which a subjective assessment is conducted. Capabilities are marked as follows:

- Where little or no information is available, capabilities are marked in **BLACK**;

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- Where major concerns are raised about performance these are marked in **RED;**
- Where improvements to performance or efficiency are identified but do not produce major concerns these are marked in AMBER;
- Where performance is good these are marked in GREEN.

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# 3 TARGET OPERATING DECISION-MAKING MODELS

The JDIG has been developed to map how information flows through from its initial capture, to the decisions, services and tasks it supports. Through this journey the information is converted into different formats, with different communication methods which may cause information to be added, changed or removed. It is at these points that information can either become more valuable or less valuable for the desired end recipient. By mapping out the full journey it is possible to identify these points; and whether improvements in communication, technology, governance or process design, may improve the flow of information; to support better decision making; or improve the desired outcome & effectiveness of these tasks or services. Alternatively, and in the context of EOPEN, this also allows identification of new information sources or types of information, and where these might fit within the desired decision-making or service design structure.

The Target Operating Decision-Making Models are the accumulation of improvements brought about through the project by incorporating the EOPEN platform into stakeholder operations. To incorporate EOPEN into physical operations there must of course be some adaptation to accommodate its use (such as training), while on the other hand there are some changes that occur due to its use (positive and/or negative depending on your viewpoint). The JDIG is simply a means of mapping these changes in a transposable and scalable format so that stakeholders are aware of the implications and changes needed. For some these have been physically tested in a real working environment (PUC1) for others (PUC2 & PUC3) this has been achieved through simulation and feedback.

As this deliverable follows on from the previous deliverable (D2.3) it builds upon and re-uses a lot of the previously elicited information, as the overall services in the TOM compared to the COM remain relatively unchanged. It is the finer detail where EOPEN provides additional value to each of the different stakeholders, that is honed and expanded upon to build that clearer picture.

The TOM supports 2 key outputs; firstly, it contextualises the operating environment the solution (EOPEN) works within, allowing users to understand what, where, how and why EOPEN will be used and the benefits it can provide. Secondly, it supports a comparison between the future state with EOPEN and the previous state as documented in the COM (D2.3). Examples of these outputs can be seen below in the following chapters; *3.1 TOM Examples, 3.2 Capability Impact Assessment*.

Although the JDIG has been developed to support EOPEN, and the examples below are taken from the PUC's of EOPEN, the same approach is easily utilised elsewhere. Such as  where improvements in decision making or information flow are required. As such the JDIG is positioned as a re-usable service design methodology.

## 3.1 TOM Improvements

The tables below provide an overview of how the different functionalities developed within the EOPEN platform have provided improvements to the specific services within each PUC. This list is not exhaustive but relates to those requirements from *D2.2: User Requirements*, that were identified and have been met by the project, as to be shown in the forthcoming *D7.4: Evaluation of the final system and field demonstrations*.

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### 3.1.1 TOM Improvements PUC1:

| EOPEN Functionality | Service Improvement |
|---|---|
| Automated water level Alerts | Automates Flood warnings through AMICO system |
| Faster EO data processing speed | Reduces 2dimension mapping update frequency |
| Historical data collation and analysis | Highlights at risk areas to prioritise evacuation and flood defences. Also identifies which areas are safe. |
| Real-time Water level Monitoring | Though the AMICO system it reduces the need for as many physical water monitors around the location |
| Real-time EO Mapping | Provides Mission control with up-to-date maps for the situation on the ground |
| Picture Upload | Provides greater detail of situation when combined with mapping data |
| Auto-collation and archiving of data | Reduces risk of lost data, reduces need for stakeholders to collate data, therefore provides extra focus on their activities. Data is more easily accessible for review. |
| Flood damage estimation | Reduces insurance claim submissions from days to hours |
| Social-Media feed | Provides real-time and historic data to support response and recovery operations |
| Event Detection Module | Provides automated notifications of any pre-determined parameters being met, or changes that are materially different to normal conditions. |

### 3.1.2 TOM Improvements PUC2:

| EOPEN Functionality | Service Improvement |
|---|---|
| Rice Paddy Extent Mapping | Very high accuracy, with greater detail to identify anomalies. Reduces reliance on ground truth data. |
| Rice Status Indicator | Provides more regular updates on rice status. Reduces reliance on ground truth data. |
| Biomass & Yield Indicator | Provides greater accuracy to yield estimates. |
| EO data acquisition at a Parcel level | Provides greater accuracy for all services and the possibility to monitor more densely populated crop types. |
| Seamless Integration with other systems | Automates collation and analysis of data from a variety of sources, reducing the need to manually collate and analyse. |

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| | |
|---|---|
| Dashboard & Workflow Sharing | Instantly share dashboard and workflow configurations with colleagues/stakeholders, making it simpler to verify the data. |
| Auto-collation and archiving of data | Reduces the risk of lost data, reduces need for stakeholders to collate data manually. Data is more easily accessible for review. |
| Social-Media feed | Provides real-time and historic data to support response and prevention operations. |
| Historical data collation and analysis | Provides historical trends and predictions to support Food Security prevention activities and indicate potential future shortfalls. |
| Event Detection Module | Provides automated notifications of any pre-determined parameters being met, or changes that are materially different to normal conditions. |

### 3.1.3 TOM Improvements PUC3:

| EOPEN Functionality | Service Improvement |
|---|---|
| Soil/Land Quality Assessment | Provides a detailed view of current soil/land conditions, determining soil/land density, moisture and whether it has frozen even underneath snow conditions. Supports the planning of remedial actions. |
| Lower Class Road Monitoring | Provides detailed observation at a mapping level sufficient to monitor smaller, less-used roads. Reduces need for manual observations and checks. |
| Climate Trend Analysis Tool | Provides detailed analysis of climatic conditions. Identifying trends and predictions in climate patterns to support preventive operations. |
| Road Blockage Assessment | Identifies and notifies stakeholders which roads to avoid, or which need maintenance |
| Event Detection Module | Provides automated notifications of any pre-determined parameters being met, or changes that are materially different to normal conditions. |
| Seamless Integration with other systems | Automates collation and analysis of data from a variety of sources, reducing the need to manually collate and analyse. |
| Dashboard & Workflow Sharing | Instantly share dashboard and workflow configurations with colleagues/stakeholders, making it simpler to verify the data. |

| | |
|---|---|
| Auto-collation and archiving of data | Reduces the risk of lost data, reduces need for stakeholders to collate data manually. Data is more easily accessible for review. |
| Social-Media feed | Provides real-time and historic data to support response, recovery and prevention operations. |
| Historical data collation and analysis | Provides historical trends and predictions to indicate trends and support future planning. |

## 3.2 TOM Examples

The following examples are taken collectively across the 3 EOPEN PUC's to highlight the transposable nature of the JDIG.

### 3.2.1 Event Diagrams

The Event diagrams below are taken from PUC2, the food security use-case, these have been updated from the previous deliverable (D2.3) to indicate how EOPEN could impact these different services each event diagram represents. The examples shown are from KREI, the key stakeholders for food security monitoring in South-Korea. The overall service process remains the same throughout these, as the intention is to use EOPEN as a straight replacement or comparator, the value lies in the improvements EOPEN provides which are annotated in these diagrams.

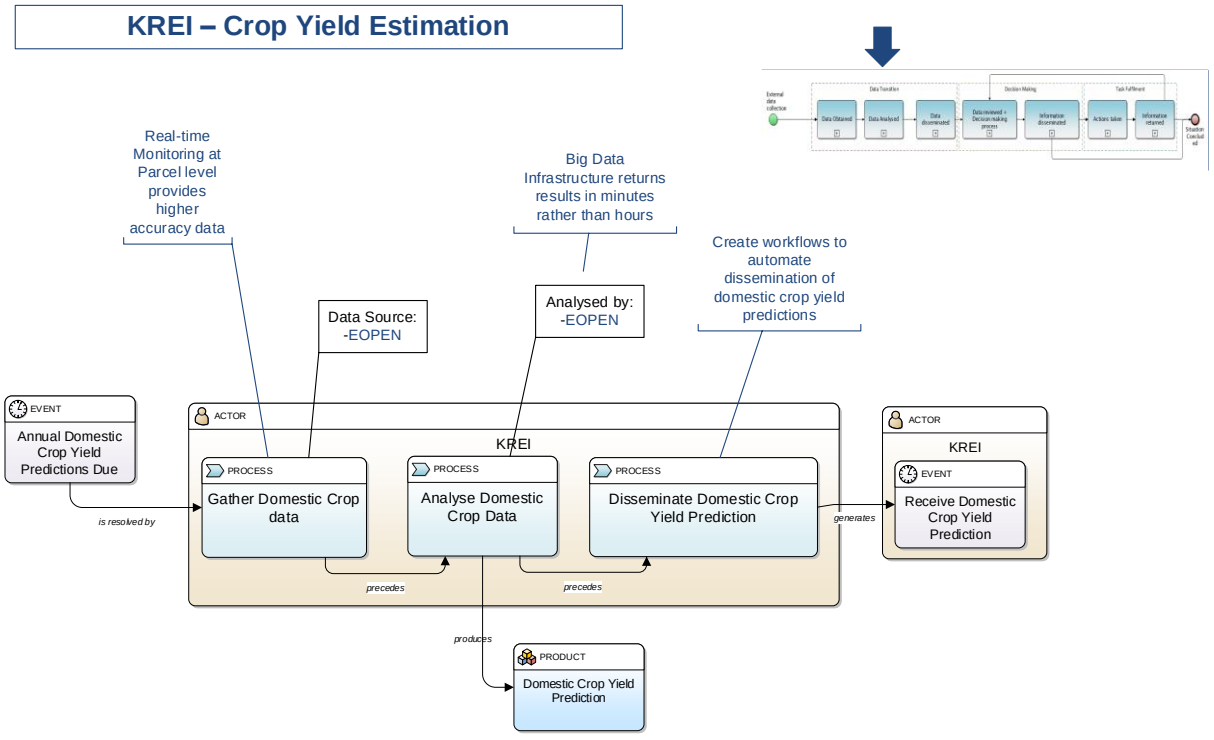


Figure 2: PUC2 TOM Event Diagram Example (1/3)

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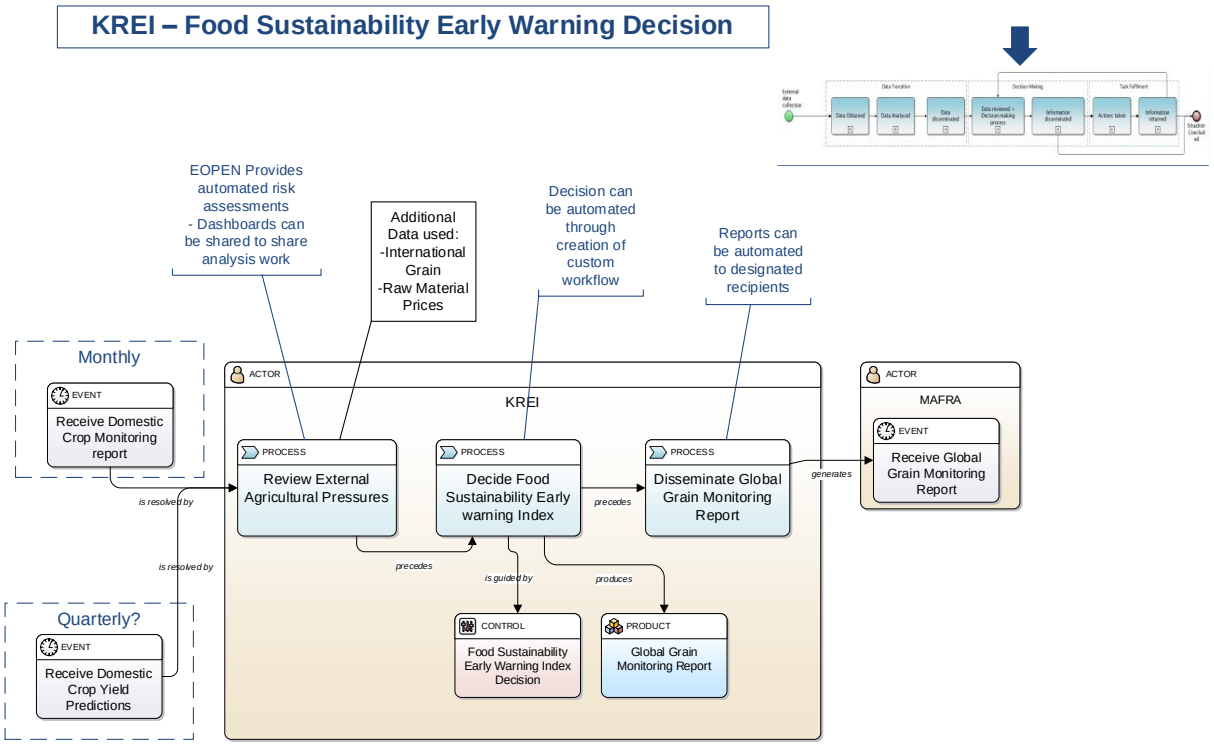


Figure 3: PUC2 TOM Event Diagram Example (2/3)

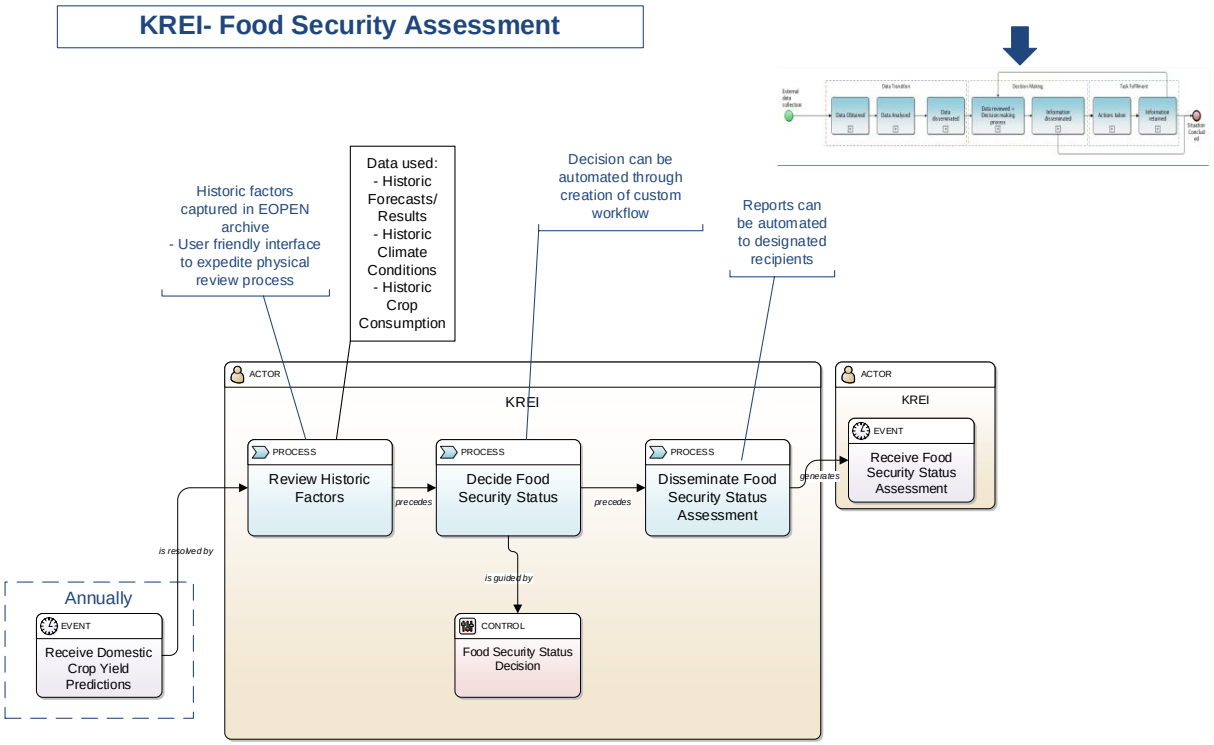


Figure 4: PUC2 TOM Event Diagram Example (3/3)

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### 3.2.2 Process Diagrams

The process diagram below is taken from PUC1 and is based upon the process each stakeholder undertakes once a flood first breaches the river in the municipality. In this process it is envisioned that EOPEN provides both the initial notification to stakeholders of the flood event occurring, as well as providing the real-time operational view of what areas are currently underwater and which are close to, to support recovery and evacuation activities. This process is a proposed more granular detailed view of the 'Alarm stage' Event, breaking out the interactions between different actors (systems and people).

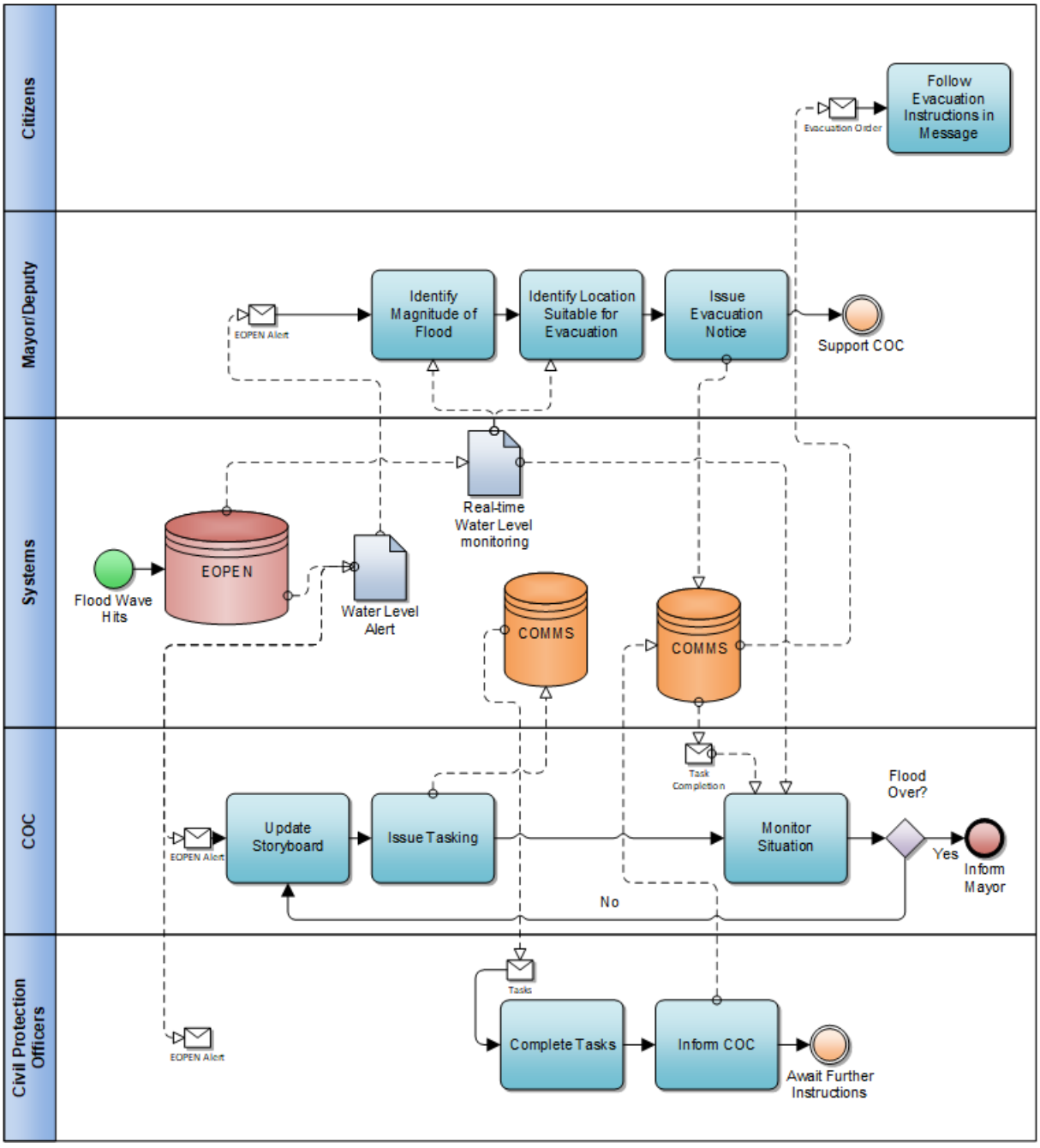


Figure 5: PUC1 TOM Process Diagram Example

### 3.2.3 Decision Tables

Decision tables utilise a binary (Y/N) or (T/F) combination against a matrix of questions to determine the different possible variations that may impact a decision, and the resulting decision. In the previous deliverable (D2.3) an example was shown for the Alarm Level decision to determine the potential for a flood event in the local municipality for PUC1. This single decision had a total of 9 variables with 80 different variations for 4 possible decisions: No Alarm, Attention, Pre-Alarm & Alarm. Even with this number of variables there were still issues surrounding the timing of alarms, the accuracy of the data behind these variables and the refresh rate of the main data source (AMICO) being 6 hours.

In the proposed TOM, as shown below in *Figure 6: PUC1 TOM Decision Table Example*, we have cut the number of variables to 5 with only 16 variations, dramatically cutting out the number of options and therefore simplifying the decision. This has been achieved through reducing the variables that had no significant impact on the decision, while providing improved accuracy for the AMICO system through its synchronization with EOPEN. The decision point for the final AMICO prediction has also been raised to within 3 hours to reduce the risk of a false negative result having a detrimental impact on the flood preparation activities. Safeguards have also been added by utilising the upstream and local area water level monitoring through EOPEN, where if both of these are triggered it escalates to the next alarm level, to counteract the possibility of an error through the AMICO system.

| | |
|---|---|
| Context | Geographical area with high flood risk |
| Role/Actor | Civil protection Leader / Mayor or nominated deputy |
| Responsibilities | Ensure the protection of local people and buildings |
| Decision | What alarm level needs to be raised |
| Location | Local municipality |
| Assumptions | Questions are based upon the most relevant regional/local data |

| Data threshold | Predicted precipation above 200mm | Amico prediction | Amico prediction | Pre-determined water levels | Pre-determined water levels | |
|---|---|---|---|---|---|---|
| Data source | National Forecasting Service / EOPEN | AAWA / EOPEN | AAWA EOPEN | EOPEN | EOPEN | |
| Questions | Predicted high risk weather within 2 da | River predicted to over run embankments within 24 hours | River predicted to over run embankments within 3 hours | Upstream Water level above alert point | Water level near to overcoming dikes | Decision outcom |
| Option 1 | N | N | N | N | N | No Alarm needed |
| Option 2 | N | N | N | N | Y | No Alarm needed |
| Option 3 | N | N | N | Y | N | No Alarm needed |
| Option 4 | N | N | N | Y | Y | Attention |
| Option 5 | Y | N | N | N | N | Attention |
| Option 6 | Y | N | N | N | Y | Attention |
| Option 7 | Y | N | N | Y | N | Attention |
| Option 8 | Y | N | N | Y | Y | Pre-alarm |
| Option 9 | Y | Y | N | N | N | Pre-alarm |
| Option 10 | Y | Y | N | N | Y | Pre-alarm |
| Option 11 | Y | Y | N | Y | N | Pre-alarm |
| Option 12 | Y | Y | N | Y | Y | Alarm |
| Option 13 | Y | Y | Y | N | N | Alarm |
| Option 14 | Y | Y | Y | N | Y | Alarm |
| Option 15 | Y | Y | Y | Y | N | Alarm |
| Option 16 | Y | Y | Y | Y | Y | Alarm |

Figure 6: PUC1 TOM Decision Table Example

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### 3.2.4 Data/System Matrix

The Data/System Matrix below is taken from PUC1 and maps the key data points to the systems that provide it. While not a system in a traditional sense, Visuals were still included as they are a key part of the overall 'information system'.

| Data | System | | | | |
|---|---|---|---|---|---|
| | EOPEN | National Forecasting | AMICO | ARPAVA | Visuals |
| Precipitation | x | x | | | |
| Current Water Level | x | | | x | x |
| Historic Water Levels | x | | | x | |
| Flood Prediction | | | x | | |
| Historic Flood | x | | x | | |
| Flood Damage | x | | | | x |
| EO Mapping | x | | | | |

Figure 7: PUC1 TOM Data/System Matrix Example

### 3.2.5 Training/Role Matrix

The below Training/Role Matrix is taken from PUC3 and splits out the different roles within the stakeholder organisations, matched to the EOPEN training. The training components on the left are from the deliverables D6.5 (General, Admin, Developer) & D7.3 (Developer, PUC3 Specific).

| Org. Unit | | FTA | | | | Reindeer Herders | | |
|---|---|---|---|---|---|---|---|---|
| Role | | Data Analyst | Software Developer | Engineer | Manager | Herders | Group Leaders | Researchers |
| General Usage | Login | x | x | x | x | x | x | x |
| | Navigation | x | x | x | x | x | x | x |
| | Dashboards | x | x | x | x | x | x | x |
| | Managing Layers | x | x | x | x | x | x | x |
| | Notifications | x | x | x | x | x | x | x |
| | Sharing | x | x | x | x | x | x | x |
| | Storage | x | x | x | x | x | x | x |
| Admin | Manage Users | | | | x | | x | |
| | Manage Storage | | | | x | | x | |
| | Manage Security | | | | x | | x | |
| | Manage Li nkages | | | | x | | x | |
| Developer | Login | | x | | | | | x |
| | Navigation | | x | | | | | x |
| | Process Creation | | x | | | | | x |
| | Workflow Creation | | x | | | | | x |
| | Implementation on HPDA | | x | | | | | x |
| | Data Augmentation | | x | | | | | x |
| | Model Training | | x | | | | | x |
| | Execution Report | | x | | | | | x |
| | Visualizations | | x | | | | | x |
| PUC3 Specific | FMI Open Data WFS & Workflow | x | | | x | x | x | x |
| | FMI Dashboard & Snow Tweets | x | | | x | x | x | x |
| | Snow Depth and temperature for reindeer disctricts | | | | | x | x | x |
| | Temperature time series for reindeer districts | | | | | x | x | x |
| | Animation of snow depth in Lapland | x | | | x | x | x | x |

Figure 8: PUC3 TOM Training/Role Matrix Example

### 3.2.6 Decision/Information Matrix

The Decision/Information Matrix below is taken from PUC1, this indicates what information each decision needs, to be made successfully. It should be noted that some decisions are dependent upon each other, such as ‘alarm level’ and ‘AMICO initiation’, where the initial alarm level decision is the main trigger for initiating AMICO, while AMICO then becomes the main trigger for the Alarm level decisions.

| | Information | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Decision | Alarm Level | High Risk Weather | Amico Prediction | Water level upstream | Water Level at dikes | Current Water Levels | Visuals | Emergency Calls | Historic Information | Damage Estimation | Road Blockage | Asset Review |
| Alarm Level | | x | x | x | x | | | | | | | |
| AMICO Initiation | x | x | | x | | | | | | | | |
| Evacuation Location | | | x | | | x | | | x | | x | |
| Tasking | x | | x | | | x | x | x | | | x | |
| Barrier Locations | | | x | | | | x | | x | | | |
| Flood Damage Estimate | | | | | | | x | | x | x | | x |
| End Alarm | x | x | x | x | x | x | x | | | | | |
| Maintenance/ Repair | | | | | | x | x | | | x | x | x |

Figure 9: PUC1 TOM Decision/Information Matrix Example

### 3.2.7 Information/Source Matrix

This final matrix combines the previous two matrices into one to show the different sources for the information. Note that decisions from the previous decision/information matrix have also become information in their own right as they are triggers for tasks.

| | | Source | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | EOPEN | National Forecasting | AAWA | ARPAVA | Mayor | COC - Civil protection | Citizens | Civil Protection |
| Information | Alarm Level | | | | | x | | | |
| | End Alarm | | | | | x | | | |
| | High Risk Weather | x | x | | | | | | |
| | Amico Prediction | | | x | | | | | |
| | Water level upstream | x | | | x | | | | |
| | Water Level at dikes | x | | | | | | | x |
| | Current Water Levels | x | | | | | | | |
| | Visuals | | | | | | | x | x |
| | Evacuation Location | | | | | x | x | | |
| | Tasks | | | | | x | x | | |
| | Emergency Calls | | | | | | x | x | |
| | Historic Information | x | | x | | | | | |
| | Damage Estimation | x | | | | | | x | x |
| | Road Blockage | x | | | | | | x | x |
| | Asset Review | | | | | | | | x |
| | Precipitation | x | x | | | | | | |
| | Current Water Level | x | | | | | | | |
| | Historic Water Levels | x | | x | | | | | |
| | Flood Prediction | | | x | | | | | |
| | Historic Flood | x | | x | | | | | |
| | Flood Damage | x | | | | | x | x | x |
| | EO Mapping | x | | | | | | | |

Figure 10: PUC1 TOM Information/Source Matrix Example

### 3.2.8 Service Building Block Configuration

The Service Building Block Configuration example below, is taken from PUC2, this has been updated from the COM to identify the changes through incorporating EOPEN. In this case the changes are relatively small as EOPEN acts as a 1-1 replacement or as a comparator for the previously used MODIS or NDVI data sources. What is not shown and is difficult to quantify in this table, as the processes remain the same throughout, is how the output and speed of these services can be improved through the remote sensing capabilities of EOPEN. For example, the first service 'NAS – Agricultural Monitoring', the monitoring and reporting of results was cumbersome as it required manually gathering data in the field, writing up the report and then sending them off. While through EOPEN the monitoring and reporting could be automated thus reducing timing to minutes instead of hours/days. In this case the process is still the same, it is just performed remotely as the accuracy through EOPEN is high enough that is does not require additional checks.

| PUC:2 | Building Blocks | | | | |
|---|---|---|---|---|---|
| **Service** | **People** | **Process** | **Governance** | **Technology** | **Information** |
| NAS - Agricultural Monitoring | NAS, RDA, Farmers, Statistics Korea | Identify baseline data, Monitor designated area remotely, Automate results reports | N/A | EOPEN | Domestic crop growth status, Domestic crop yield predictions |
| RDA - Agricultural Research | NAS, RDA, MAFRA | Identify research topic, Define Research Criteria, Conduct Test, Monitor Remotely, Evaluate results, Report results | Project Effectiveness Decision | EOPEN | Domestic crop growth status, Domestic crop yield predictions |
| MAFRA - Agricultural Policy Review | MAFRA, NAS, RDA, KREI, Congress of South Korea, CJ, Farmers | Review Agricultural Information, Review Agricultural Research, Review Expert Opinions, Decide Agricultural Policy Agenda, Disseminate Agricultural Policy Agenda, Review Agricultural Policy Agenda | Agricultural Policy Agenda Decision | N/A | Current/Previous Agricultural Policy, Results from current/past years plans, Research project results, Global Grain Monitoring Report, Agricultural and Rural Economic Trends report, Food Security Assessment |
| CJ - Agricultural Monitoring | CJ, Private Partners, Statistics Korea, USDA | Gather Domestic Grain Forecast, Gather International Grain Forecast, Monitor | N/A | Remote Monitoring (NDVI/ EOPEN) | Domestic crop growth status, Domestic crop yield predictions, International crop growth status, |

| | | | | | |
|---|---|---|---|---|---|
| | | Meteorological Conditions | | | International crop yield predictions, El Nino & La Nina Predictions, Global Sea temperature, Domestic Severe weather forecasts |
| CJ - Agricultural Trading | CJ, Private Partners, International Partners, Farmers, MAFRA, KREI, Statistics Korea, USDA | Gather Domestic Grain Forecast, Gather International Grain Forecast, Monitor Meteorological Conditions, Set Import/Export Values, Purchase/Sell Grain | Import/Export Value Decision, Agricultural Policy | Remote Monitoring (NDVI/ EOPEN) | Domestic crop outlook, Severe weather forecast, International grain estimates, Domestic grain price, International grain price, Raw material costs, Early Warning Index |
| KREI - Agricultural Monitoring | KREI, Statistics Korea, Farmers | Gather Crop Data, Analyse Damages, Perform Impact Assessment, Assess Anomalies, | N/A | USN, Drones, EOPEN | Domestic Crop status, Domestic Crop yield, Raw material price, International Crop status, International Crop Yield, Farm Sample Survey |
| KREI - Early Warning System | KREI, MAFRA | Review Agricultural Information, Compare Against Historic Trends, Decide Warning Level, Issue Warning | Food Sustainability Early Warning Decision, Economic Early Warning Decision, Agricultural Policy | EOPEN | Domestic Crop status, Domestic Crop yield, Raw material price, International Crop status, International Crop Yield, Farm Sample Survey |
| KREI - Food Security Assessment | KREI, MAFRA | Review Agricultural Information, Compare Against Historic Trends, Assess Self-Sufficiency Rate, Develop Food Policy, Issue Food Security Report | Food Security Status Decision, Agricultural Policy | N/A | Domestic Crop status, Domestic Crop yield, Raw material price, International Crop status, International Crop Yield, Farm Sample Survey, Agricultural Research, Historic Crop Yield |

| | | | | | |
|---|---|---|---|---|---|
| KREI - Crisis Mitigation planning | KREI, MAFRA | Review Agricultural Information, Compare Against Historic Trends, Review Agricultural Research, Develop Mitigation Activities, Inform Stakeholders, Review Mitigation Plans | Agricultural Policy, Risk Management Plans | N/A | Domestic Crop status, Domestic Crop yield, Raw material price, International Crop status, International Crop Yield, Farm Sample Survey, Food Security Assessment, Early Warning Index, Agricultural Research, Historic Mitigation Plans and Results |
| | | | | | |

Table 1: PUC2 - TOM Service Building Block Configuration Example

## 3.3 Capability Impact Assessment

### 3.3.1 Data Capability Assessment

As mentioned previously the Data Capability Assessment is pulled out specifically from the Holistic Capability Assessment, to provide a richer view on how this capability is assessed. This is due to the JDIG being focused heavily on the Data Management Capability, and the interactions it has on other capabilities.

Below is the data capability assessment for each PUC. Each data type corresponds to those described within the data tables as detailed in D2.3. Evaluation has been undertaken based upon the feedback received from stakeholders that is to be included in the forthcoming deliverable D7.4.

**PUC1**

| | Stakeholders | | |
|---|---|---|---|
| Data types | **Mayor/Deputy** | **AAWA** | **Civil Protection** |
| Data Collection | | | |
| Weather Monitoring | | | |
| EO Mapping | | | |
| Water Level Monitoring | | | |
| Historical Flood Data | | | |
| | | | |
| Data Analysis | | | |
| Flood Prediction | | | |
| Road Blockage | | | |
| Damage Estimation | | | |

| Key | Description | Scoring |
|---|---|---|
| | Satisfactory data | 3 |
| | Improvement needed | 2 |
| | No data or innaccurate | 1 |
| | Not Applicable | n/a |

| Data Capability assessment | |
|---|---|
| 1-1.5 | Red |
| 1.5-2.5 | Amber |
| 2.5-3 | Green |

| Data Capability Assessment | Mayor/Deputy | AAWA | Civil Protection | Total |
|---|---|---|---|---|
| Data Collection | 3 | 3 | 3 | 3 |
| Data Analytics | 3 | 3 | 3 | 3 |

Figure 11: PUC1 TOM Data Capability Assessment

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**PUC2**

| | Stakeholders | | | |
|---|---|---|---|---|
| Data types | KREI | CJ | NAS | RDA |
| Data Collection | | | | |
| Current crop status | | | | |
| Historic Crop Yield | | | | |
| Rice Paddy Mapping | | | | |
| | | | | |
| Data Analysis | | | | |
| Crop Growth | | | | |
| Crop Yield Prediction | | | | |
| Project Effectiveness | | | | |
| Damage Estimation | | | | |

| Key | Description | Scoring |
|---|---|---|
| | Satisfactory data | 3 |
| | Improvement needed | 2 |
| | No data or innaccurate | 1 |
| | Not Applicable | n/a |

| Data Capability assessment | |
|---|---|
| 1-1.5 | Red |
| 1.5-2.5 | Amber |
| 2.5-3 | Green |

| Data Capability Assessment | KREI | CJ | NAS | RDA | Total |
|---|---|---|---|---|---|
| Data Collection | 2.67 | 3.00 | 3.00 | N/A | 2.89 |
| Data Analytics | 2.67 | 2.67 | 2.67 | 2.67 | 2.67 |

Figure 12: PUC2 TOM Data Capability Assessment

**PUC3**

| | Stakeholders | | |
|---|---|---|---|
| Data types | R_Herders | R_Researchers | FTA |
| Data Collection | | | |
| Historical Snow data | | | |
| Current Snow data | | | |
| Predicted Snow data | | | |
| Historical Climate data | | | |
| Current Climate data | | | |
| Predicted Climate data | | | |
| Data Analytics | | | |
| Historical Impact of snow/climate on reindeers | | | |
| Historical Impact of snow/climate on road network | | | |
| Predicted Impact of snow/climate on reindeers | | | |
| Predicted Impact of snow/climate on road network | | | |
| Severe weather event probability | | | |
| Severe weather event exceptions | | | |

| Key | Description | Scoring |
|---|---|---|
| | Satisfactory data | 3 |
| | Improvement needed | 2 |
| | No data or innaccurate | 1 |
| | Not Applicable | n/a |

| Data Capability assessment | |
|---|---|
| 1 -1.5 | Red |
| 1.51 -2.5 | Amber |
| 2.51 -3 | Green |

| Data Capability Assessment | R_Herders | R_Researchers | FTA | Total |
|---|---|---|---|---|
| Data Collection | 2.67 | 2.67 | 2.67 | 2.67 |
| Data Analytics | 2.50 | 3.00 | 2.50 | 2.67 |

Figure 13: PUC3 TOM Data Capability Assessment

### 3.3.2 Holistic Capability Assessment

The following capability assessment is a follow up to that which was conducted in D2.3, where a baseline of current capability was undertaken to assess the individual PUC's current operating capacity. This updated version is based upon the evaluation undertaken by each individual PUC as detailed in the deliverable D7.4, using the JDIG Capability Model as the framework to assess progress in the capacity based upon the predicted Target Operating Model. The colour coding is as follows:

- Green – Optimal Functionality
- Amber – Satisfactory but can be improved
- Red – Improvement needed
- Black – Not applicable/ Not enough information provided

Both COM and TOM assessments have been included to show the comparison between the two, along with a rationale table detailing the reasons for improvement / no-improvement.

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## PUC1

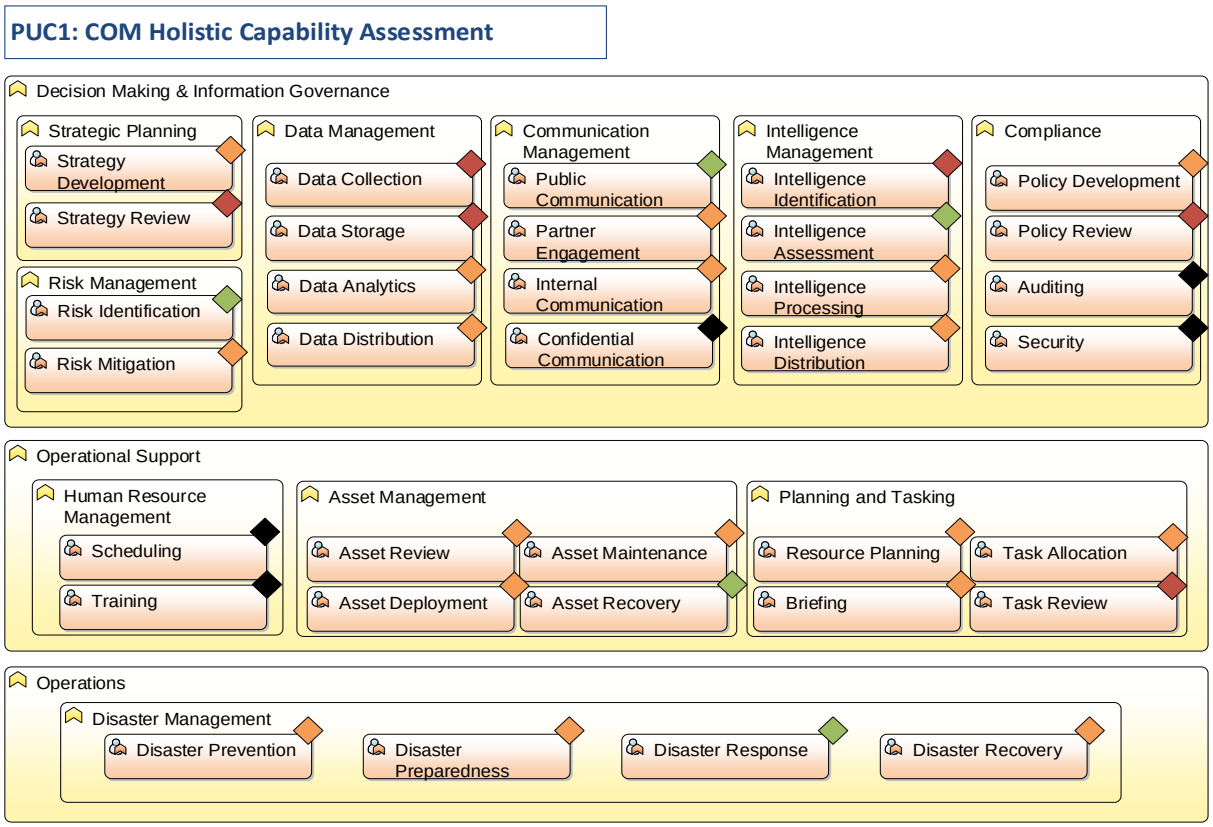


Figure 14: PUC1 - COM Holistic Capability Assessment

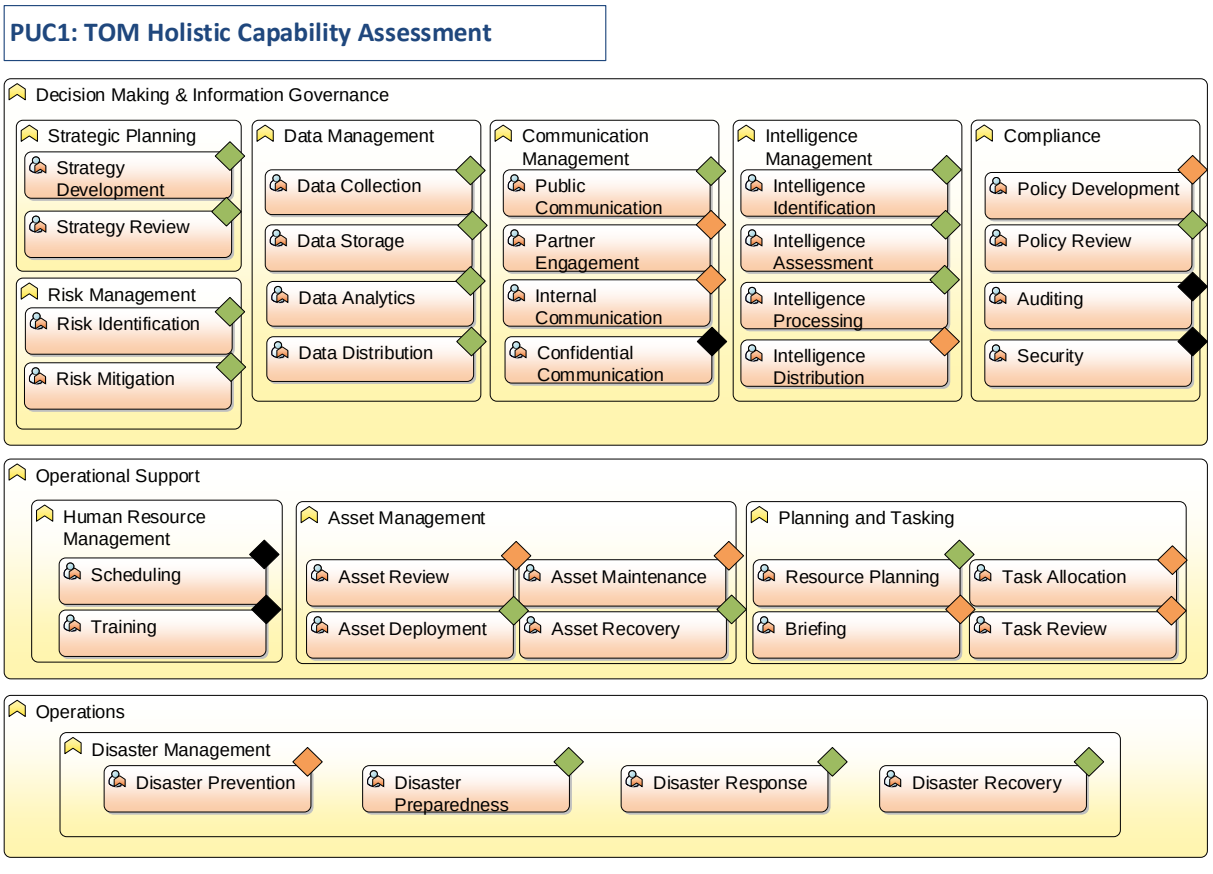

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Figure 15: PUC1 - TOM Holistic Capability Assessment

| Capability | COM RAG | TOM RAG | Rationale |
|---|---|---|---|
| Strategic Planning | | | |
| ¬Strategy Development | A | G | Real-time monitoring and improved historical information support more robust and directed strategies to provide a tailored approach to each event. Ensuring the best possible strategy is engaged for the particular event at hand. |
| ¬Strategy Review | R | G | Data collection and storage with EOPEN ensures information is easily retrievable to support strategy reviews. |
| Risk Management | | | |
| ¬Risk Identification | G | G | No Change – already satisfactory |
| ¬Risk Mitigation | A | G | Real-time monitoring and improved historical information support more robust and directed prevention and preparedness activities to mitigate both known risks and new risks as they emerge. |
| Data Management | | | |
| ¬Data Collection | R | G | EOPEN fuses multiple streams of data from both Earth observation and in-situ sources into a single source providing improved breadth, depth, and quality of data. |
| ¬Data Storage | R | G | Data from all sources are automatically collated and archived to be easily retrieved. Dashboards showing custom configurations of data can also be stored and shared with other users |
| ¬Data Analytics | A | G | Data is automatically analysed within EOPEN utilising the big data infrastructure and presented in a user-friendly format back to users |
| ¬Data Distribution | A | G | EOPEN successfully integrates with other systems within the PUC, particularly the AMICO system which pulls data from the EOPEN platform to speed up the flood predictions. Dashboards showing custom configurations of data can also be stored and shared with other users. |
| Communication Management | | | |
| ¬Public Communication | G | G | No Change – already satisfactory |
| ¬Partner Engagement | A | A | No Change – though EOPEN provides additional functionalities for sharing data before and after an event it is still reliant on the existing infrastructure where a lack of signal reduces its ability to be used in the field |
| ¬Internal Communication | A | A | No Change – though EOPEN provides additional functionalities for sharing data before and after an event, during one it is still reliant on the existing |

| | | | |
|---|---|---|---|
| | | | infrastructure where a lack of signal reduces its ability to be used in the field |
| ¬Confidential Communication | B | B | Not Applicable/ Not enough Information |
| Intelligence Management | | | |
| ¬Intelligence Identification | R | G | The various modules of EOPEN provide multiple sources of processed intelligence such as event detection and social media feeds. |
| ¬Intelligence Assessment | G | G | No Change – already satisfactory |
| ¬Intelligence Processing | A | G | Event and change detection modules, along with the big data infrastructure support the elicitation of higher value intelligence |
| ¬Intelligence Distribution | A | A | No Change – though EOPEN provides additional functionalities for sharing data before and after an event, during one it is still reliant on the existing infrastructure where a lack of signal reduces its ability to be used in the field |
| Compliance | | | |
| ¬Policy Development | A | A | No Change – EOPEN provides up to date maps and the historic date to support policy development, however the development itself is based upon a lot of extenuating factors out of the immediate stakeholders control |
| ¬Policy Review | R | G | EOPEN captures and retains historical data to support policy reviews |
| ¬Auditing | B | B | Not Applicable/ Not enough Information |
| ¬Security | B | B | Not Applicable/ Not enough Information |
| Human Resource Management | | | |
| ¬Scheduling | B | B | Not Applicable/ Not enough Information |
| ¬Training | B | B | Not Applicable/ Not enough Information |
| Asset Management | | | |
| ¬Asset Review | A | A | No Change – at this time EOPEN is not linked to any form of IoT to capture asset maintenance data |
| ¬Asset Maintenance | A | A | No Change – at this time EOPEN is not linked to any form of IoT to capture asset maintenance data |
| ¬Asset Deployment | A | G | EOPEN provides historical and predicted data to identify the highest priority areas for assets to be deployed |
| ¬Asset Recovery | G | G | No Change – already satisfactory |
| Planning and Tasking | | | |
| ¬Resource Planning | A | G | Historic data capture and current predictions through EOPEN provides more comprehensive information to base resource allocation upon. |
| ¬Task Allocation | A | A | No change – Data provided by EOPEN provides a small improvement over allocation of tasks, however during an event an explicit tasking system is required to allocate and make adjustments in real-time. |

| | | | |
|---|---|---|---|
| ¬Briefing | A | A | No change – Data provided by EOPEN provides a small improvement over task briefings, however during an event an explicit tasking system is required to allocate and make adjustments in real-time. |
| ¬Task Review | R | A | Information is collated automatically following a flood event, however without an integrated tasking system it is difficult to monitor exact activities |
| Disaster Management | | | |
| ¬Disaster Prevention | A | A | No Change – though EOPEN provides historical data to highlight inefficiencies, improvements require changes to physical infrastructure which is out of scope |
| ¬Disaster Preparedness | A | G | Flood prediction and outlining of flooded areas runs to a higher level of accuracy, improving both response time and allocation of resources |
| ¬Disaster Response | G | G | No Change – already satisfactory, real-time monitoring adds additional depth of detail and frees up manpower for more pertinent activities. |
| ¬Disaster Recovery | A | G | Reports are collated automatically, with flood damage estimates automated through the platform. Provides significant improvement over existing capability |

Table 2: PUC1 - TOM Holistic Capability Assessment Rationale

**PUC2**

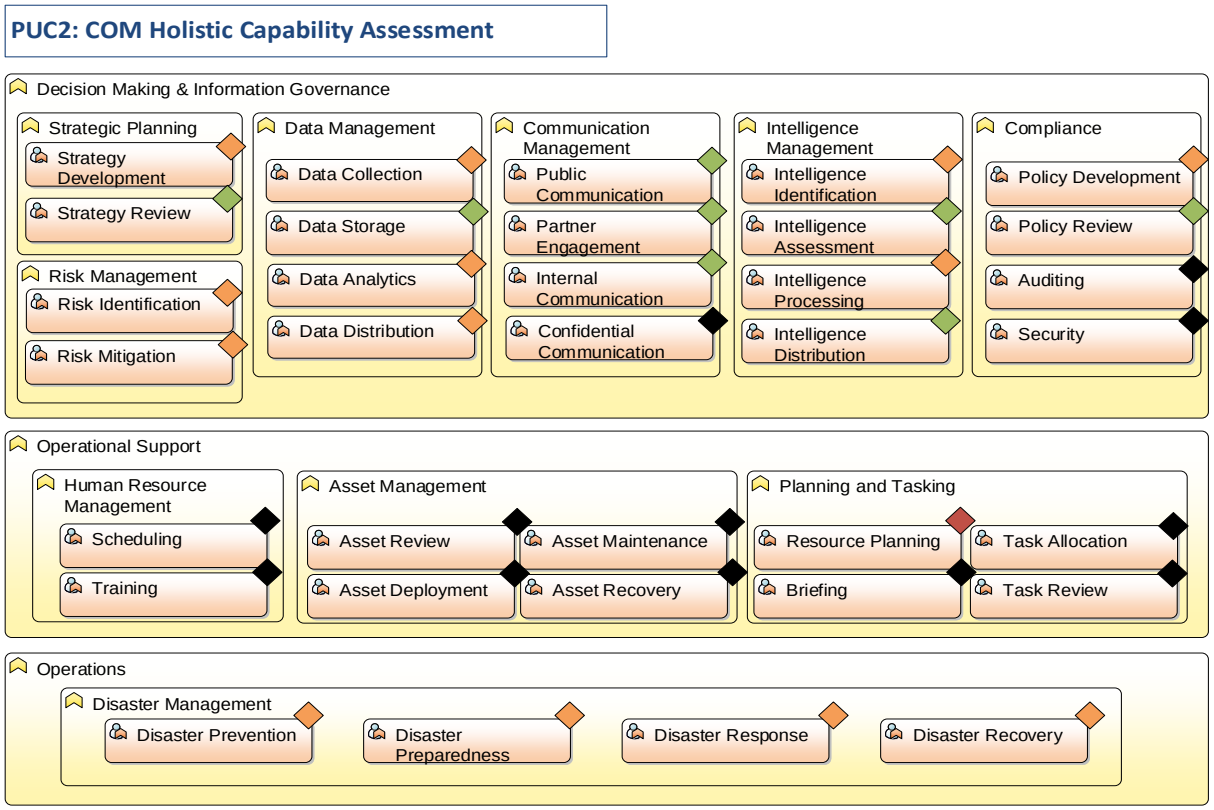


Figure 16: PUC2 - COM Holistic Capability Assessment

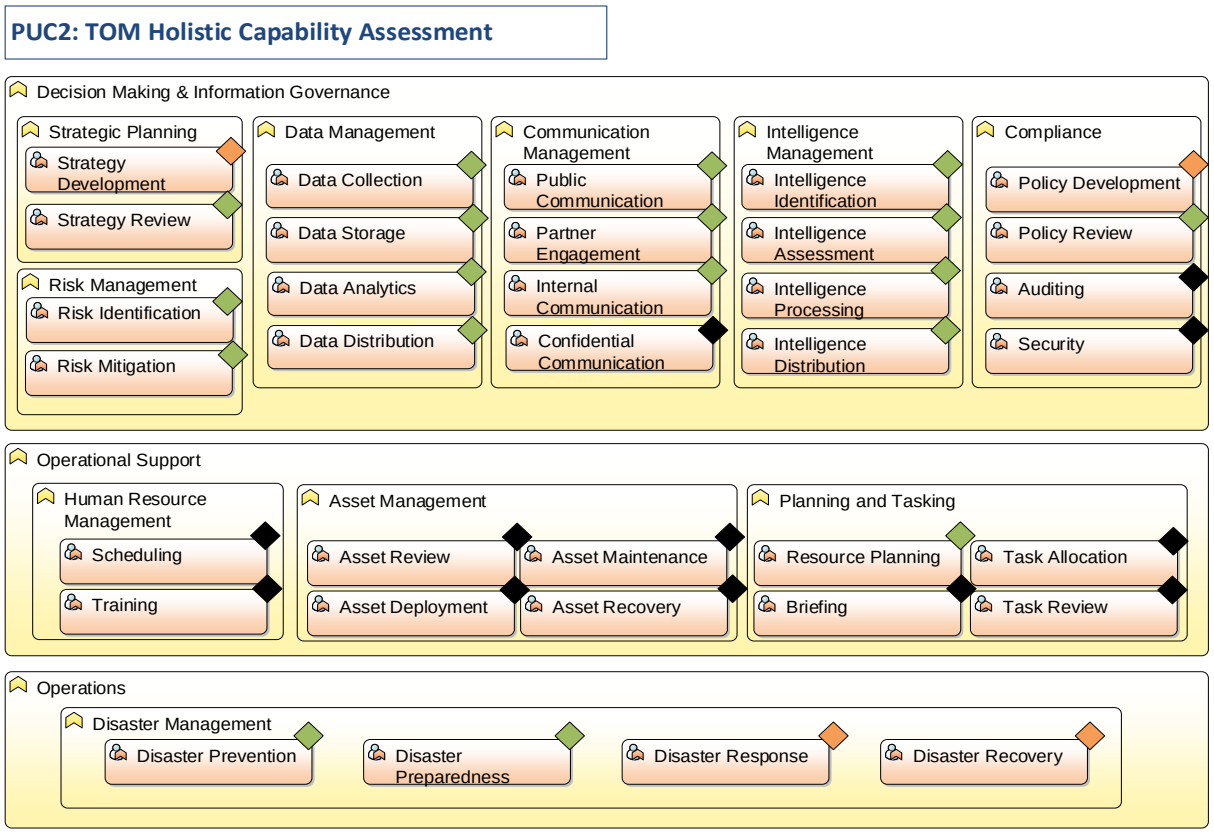


Figure 17: PUC2 - TOM Holistic Capability Assessment

| Capability | COM RAG | TOM RAG | Rationale |
|---|---|---|---|
| Strategic Planning | | | |
| ¬Strategy Development | A | A | No Change - EOPEN provides greater breath, depth and quality of data to base strategic decisions upon, however while some stakeholders find the accuracy % to be sufficient, others have little margin for error therefore reducing the total effectiveness of the data to be used in strategic decision making on its own. |
| ¬Strategy Review | G | G | No Change – Satisfactory already |
| Risk Management | | | |
| ¬Risk Identification | A | G | EOPEN provides automated risk identification through its change detection module, supported by faster processing speeds to provide real-time monitoring and identification of risks. |
| ¬Risk Mitigation | A | G | EOPEN provides higher accuracy data to base mitigation activities upon along with historic trends to analyse previous decisions and the consequences. |
| Data Management | | | |
| ¬Data Collection | A | G | EOPEN fuses multiple streams of data from both Earth observation and in-situ sources into a single source providing improved breadth, depth, and quality of data. |

| | | | |
|---|---|---|---|
| ¬Data Storage | G | G | No Change – Satisfactory already |
| ¬Data Analytics | A | G | Data is automatically analysed within EOPEN utilising the big data infrastructure and presented in a user-friendly format back to users |
| ¬Data Distribution | A | G | EOPEN successfully integrates with other systems within the PUC, streamlining distribution activities. |
| Communication Management | | | |
| ¬Public Communication | G | G | No Change – Satisfactory already |
| ¬Partner Engagement | G | G | No Change – Satisfactory already |
| ¬Internal Communication | G | G | No Change – Satisfactory already |
| ¬Confidential Communication | B | B | Not Applicable/ Not enough Information |
| Intelligence Management | | | |
| ¬Intelligence Identification | A | G | EOPEN fuses data from multiple streams to elicit more tangible intelligence. |
| ¬Intelligence Assessment | G | G | No Change – Satisfactory already |
| ¬Intelligence Processing | A | G | EOPEN's big data infrastructure provides greater processing speed and possibilities when combining and interrogating the gathered intelligence. |
| ¬Intelligence Distribution | G | G | No Change – Satisfactory already |
| Compliance | | | |
| ¬Policy Development | A | A | No Change – EOPEN provides greater breath, depth and quality of data to base policy decisions upon, however the margin for error for policy decisions is so low that even with the increases it is still below the threshold. |
| ¬Policy Review | G | G | No Change – Satisfactory already |
| ¬Auditing | B | B | Not Applicable/ Not enough Information |
| ¬Security | B | B | Not Applicable/ Not enough Information |
| Human Resource Management | | | |
| ¬Scheduling | B | B | Not Applicable/ Not enough Information |
| ¬Training | B | B | Not Applicable/ Not enough Information |
| Asset Management | | | |
| ¬Asset Review | B | B | Not Applicable/ Not enough Information |
| ¬Asset Maintenance | B | B | Not Applicable/ Not enough Information |
| ¬Asset Deployment | B | B | Not Applicable/ Not enough Information |
| ¬Asset Recovery | B | B | Not Applicable/ Not enough Information |
| Planning and Tasking | | | |
| ¬Resource Planning | R | G | Forward looking predictions, accurate rice paddy mapping and monitoring of current rice growth at a national level provides significant improvement in planning activities |
| ¬Task Allocation | B | B | Not Applicable/ Not enough Information |
| ¬Briefing | B | B | Not Applicable/ Not enough Information |
| ¬Task Review | B | B | Not Applicable/ Not enough Information |

| Disaster Management | | | |
|---|---|---|---|
| ¬Disaster Prevention | A | G | Rice Paddy Mapping provides an accurate understanding of what areas have been fully utilised for farming, ensuring maximum utilisation to prevent potential shortfalls. Historical data also highlights trends and indicates when climatic conditions may require changes to the farming season. |
| ¬Disaster Preparedness | A | G | Crop Growth monitoring and yield estimates provide an early indication of potential food security issues |
| ¬Disaster Response | A | A | No Change – Though EOPEN provides near real-time crop monitoring it does not account for soil conditions currently which would provide an earlier indication of potential issues that need resolving |
| ¬Disaster Recovery | A | A | No Change – Though changes to yield are monitored these are not regular and are based upon visible loss of crops, while damage and loss of growth will take significantly longer to materialise visibly through EO data. |

Table 3: PUC2 - TOM Holistic Capability Assessment Rationale

## PUC3

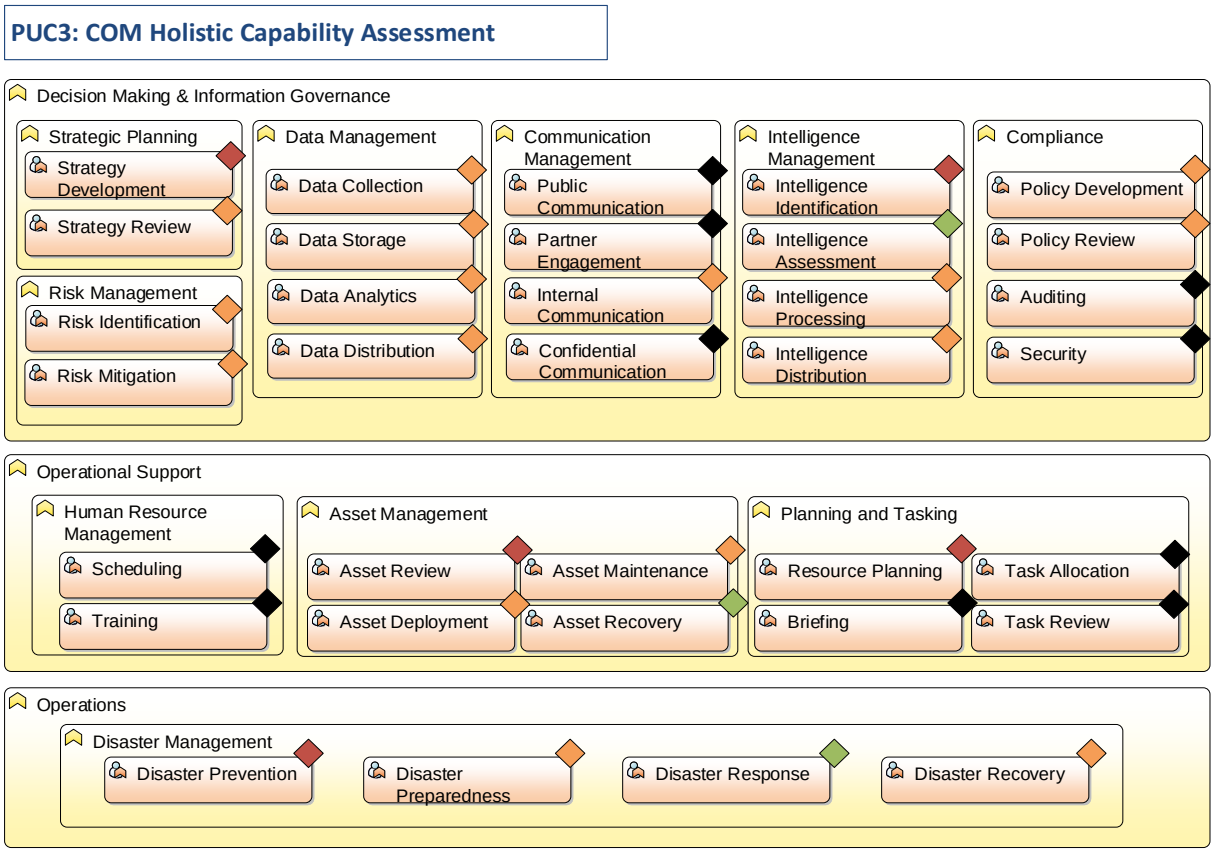


Figure 18: PUC3 - COM Holistic Capability Assessment

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**PUC3: TOM Holistic Capability Assessment**

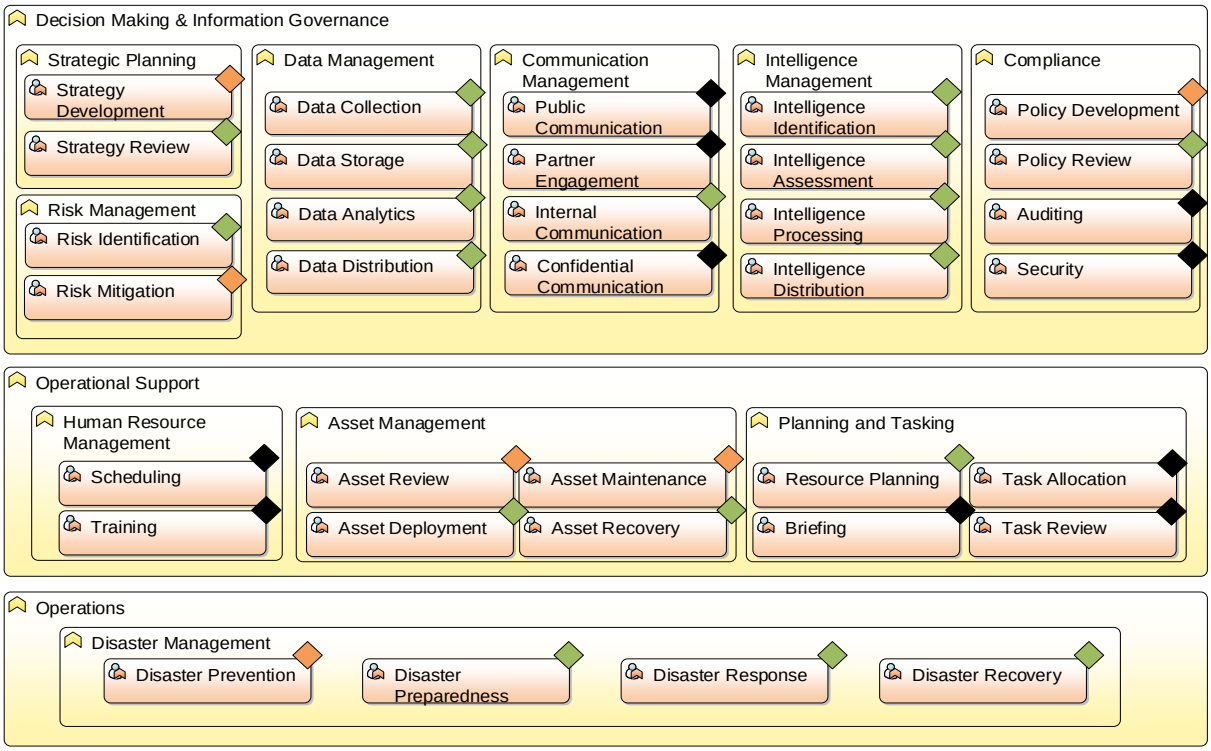


Figure 19: PUC3 - TOM Holistic Capability Assessment

| Capability | COM RAG | TOM RAG | Rationale |
|---|---|---|---|
| Strategic Planning | | | |
| ¬Strategy Development | R | A | Event detection and remote monitoring allow for greater preparedness for strategy developers in the short-term, however empowered climate projections analysis tools would provide the ability to test long term strategies more effectively |
| ¬Strategy Review | A | G | EOPEN's archive of historical climate data makes it easier to review the impact different strategies have had and to compare previous conditions to current to inform decisions. |
| Risk Management | | | |
| ¬Risk Identification | A | G | Real-time monitoring and short-term predictions, combined with event and change detection modules provides significant improvement by automating alerts for users |
| ¬Risk Mitigation | A | A | No Change – improved Climate projections would provide the ability to test mitigation activities before implementing, current datasets are considered out-of-date. |
| Data Management | | | |
| ¬Data Collection | A | G | Lack of climate and severe event detection data |
| ¬Data Storage | A | G | Not enough long time series data stored for comparisons |
| ¬Data Analytics | A | G | Analysing data is currently difficult and time consuming, lack of long-time series analysis |

| | | | |
|---|---|---|---|
| ¬Data Distribution | A | G | Data is distributed well but can be complex and lacking in visuals to support more efficient comparisons for decision making |
| Communication Management | | | |
| ¬Public Communication | B | B | Not Applicable/ Not enough Information |
| ¬Partner Engagement | B | B | Not Applicable/ Not enough Information |
| ¬Internal Communication | A | G | EOPEN can act as a single source of truth for internal configurations, supported by sharing dashboards and workflows to ensure colleagues are aligned. |
| ¬Confidential Communication | B | B | Not Applicable/ Not enough Information |
| Intelligence Management | | | |
| ¬Intelligence Identification | R | G | Event and change detection modules automate the identification of intelligence for users, allowing significantly more valuable information to be elicited in a shorter time frame |
| ¬Intelligence Assessment | G | G | No Change – Satisfactory already |
| ¬Intelligence Processing | A | G | Big data infrastructure makes it significantly quicker to process higher value intelligence from the data |
| ¬Intelligence Distribution | A | G | Archiving and sharing of data/dashboards provide much simpler communication methods for intelligence sharing |
| Compliance | | | |
| ¬Policy Development | A | A | No Change – more detailed and configurable climate projections are required to test policy decisions. |
| ¬Policy Review | A | G | EOPEN's archive of historical climate data make it easier to review the impact different policies have had or will have. |
| ¬Auditing | B | B | Not Applicable/ Not enough Information |
| ¬Security | B | B | Not Applicable/ Not enough Information |
| Human Resource Management | | | |
| ¬Scheduling | B | B | Not Applicable/ Not enough Information |
| ¬Training | B | B | Not Applicable/ Not enough Information |
| Asset Management | | | |
| ¬Asset Review | R | A | Remote monitoring at a much greater resolution and refresh rate allows much more comprehensive reviews of assets, especially for B-class roads. Even greater clarity or additional data sources would be required to identify minor maintenance issues |
| ¬Asset Maintenance | A | A | No Change – though Remote monitoring through EOPEN is significantly more detailed then previous sources used by stakeholders, even greater clarity or additional data sources would be required to identify minor maintenance issues |

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|---|---|---|---|
| ¬Asset Deployment | A | G | Real-time Monitoring through EOPEN supports better informed deployment decisions, allowing greater prioritisation |
| ¬Asset Recovery | G | G | No Change – Satisfactory already |
| Planning and Tasking | | | |
| ¬Resource Planning | R | G | Short-term predictions, historical data archives and real-time monitoring provide a significant improvement to planning activities. |
| ¬Task Allocation | B | B | Not Applicable/ Not enough Information |
| ¬Briefing | B | B | Not Applicable/ Not enough Information |
| ¬Task Review | B | B | Not Applicable/ Not enough Information |
| Disaster Management | | | |
| ¬Disaster Prevention | R | A | Historical climate data and real-time monitoring ensures near-term prevention activities are significantly improved through EOPEN, though long-term and configurable improved climate projections and empowered analysis tools would be beneficial for additional prevention activities. |
| ¬Disaster Preparedness | A | G | Monitoring of real-time and short-term predictions within EOPEN provides stakeholders a sound basis to develop preparedness activities |
| ¬Disaster Response | G | G | No Change – Satisfactory already |
| ¬Disaster Recovery | A | G | Historic climate analysis and extreme event detection provide stakeholders with the necessary data to identify suitable recovery activities and manage insurance claims |

Table 4: PUC3 - TOM Holistic Capability Assessment Rationale

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# 4 RECOMMENDATIONS & CONCLUSIONS

## 4.1 Recommendations

**PUC1**

As seen by the assessment in the previous chapter, incorporating EOPEN into the operations of PUC1 can have a significant improvement in their capabilities, especially around the capture and review of data; and the associated planning and review actions around flood management. To further enhance the PUC, it would be beneficial to incorporate a tasking and communication system that can help capture and overlay information within EOPEN, thus providing a single command and control functionality. This along with some structured improvements to the communication infrastructure would help further refine the operational capacity within PUC1.

**PUC2**

Though EOPEN has yet to provide specific dashboards for PUC2, early feedback has indicated that EOPEN can provide stakeholders within PUC2 with a much greater breadth, depth and quality to their data management capabilities. Though stakeholders have varying needs, as highlighted within the evaluation, EOPEN can still provide significant improvements to each individual need all within the one system. Further improvement would be in refining the error rate when viewing data at a national scale, due to the risk appetite for different stakeholders; especially at a policy level when accuracy is paramount. The addition of a soil quality and damage estimation module would also be beneficial to provide some early feedback to farmers and decision makers if conditions will cause significant damage to crops and to the amount of crops that will be needed to make up the shortfall.

**PUC3**

EOPEN has overall provided more detailed and larger data streams, in an easily digestible format to meet the stakeholder needs. The big data infrastructure has supported superior processing and retrieval of higher value intelligence, exceeding current capabilities. To further enhance the PUC, it would be beneficial to merge a dedicated climate trend analysis tool mixed with in-situ or IoT data that can provide even greater detail and the ability to assess the impact of different events upon assets.

## 4.2 Conclusion

The initial scope and development of the Target Operating Decision-Making Model (TOM) that has been carried out to date in EOPEN and seen here in this D2.4 deliverable, based upon the development of the PUC's, has provided a sound basis from which to scope, the operational view of EOPEN. In particular, the interactions and interfaces of information and the channels of communication, with stakeholders and organisations, has provided a firm foundation to support how EOPEN shows its value through the PUCs.

The overall goals of this TOM and the subsequent JDIG that flows from it, is to improve information sharing and flow and ultimately, support better informed decision-making. Therefore, the outputs from the scenario-based pilot exercises, along with this deliverable aim to provide readers with an understanding of how EOPEN and the JDIG can support decision-makers / service users to refine their current service offerings.