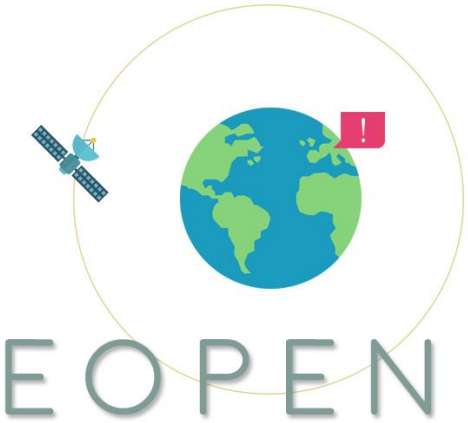

EOPEN

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

H2020-776019

D2.5: Joint Decision & Information Governance Architecture Framework

Dissemination level:	Confidential
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Abstract

This deliverable*, D2.5: Joint Decision & Information Governance Architecture Framework*; provides readers with the necessary knowledge to replicate the approach taken within the EOPEN project; towards eliciting and defining their own information governance and decision-making improvements, in their own services. This deliverable builds upon the findings from the previous deliverables *D2.3: Current Operating Decision-Making Models*; & *D2.4: Target Operating Decision-Making Models*; and is composed of 2 parts. Firstly, an overview of generic artefacts that were omitted in those previous deliverables; Secondly, a walkthrough of how to implement the approach and how to structure the information once elicited. Templates for use in replicating the approach can be found in the Appendix.

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History

Version	Date	Reason	Revised by	Approved By
0.1	03/09/2020	Initial Draft	T.Pettengell	n/a
0.2	30/10/2020	Final Draft	T.Pettengell	M. Gabriella Scarpino
1	30/10/2020	Version to be submitted	T.Pettengell	L. Marzell

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Executive Summary

This deliverable, *D2.5: Joint Decision & Information Governance Architecture Framework*, provides readers with the necessary knowledge to replicate the approach taken within the EOPEN project; towards eliciting and defining their own information governance and decision-making improvements, in their own services. This deliverable builds upon the findings from the previous deliverables *D2.3: Current Operating Decision-Making Models* & *D2.4: Target Operating Decision-Making Models* and is composed of 2 parts. Firstly, an overview of generic artefacts that were omitted in those previous deliverables; secondly, a walkthrough of how to implement the approach and how to structure the information once elicited. Templates for use in replicating the approach can be found in the Appendix

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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
PESTLE	Political, Economical, Social, Technological, Legal, Environmental

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1 JOINT DECISION & INFORMATION GOVERNANCE ARCHITECTURE

1.1 Overview

The Joint Decision & Information Governance Architecture (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. 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.

Data and/or Information comes in many different forms and the ability to capture and utilise any available strand , at any time, is critical for decision makers in Environmental Disaster Management such as those Use-Cases defined within EOPEN. But as data and the means to process it becomes cheaper and more accessible, gradually the complexity in understanding how to manage and best use it becomes more challenging too. With so much heterogeneous data sources and management software available, decisions on how best to invest or prioritise in the different associated capabilities also becomes a challenge.

The JDIG has been designed to address both these challenges, supporting decision makers understand their current capabilities to make these investment decisions. While supporting Engineers/Architects/Designers, understand what data they require to improve a service; and how to then re-design the service/system to prevent any blockages within the information journey. The figure below shows how these heterogenous data sources converge and the processes in the different layers that enable this information to flow through the journey.

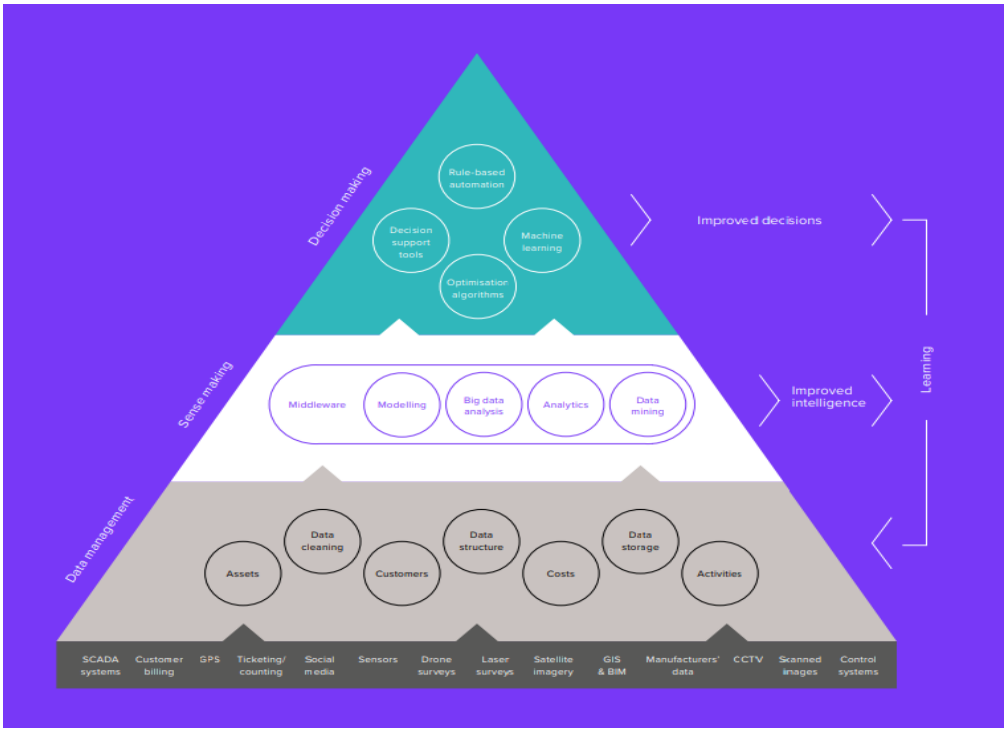

Figure 1: Decision-Making Pyramid

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1.2 JDIG Reference Architecture

At its core, the JDIG is about structuring information in a format that meets the needs of different stakeholders. To structure this information in a coherent and scalable format, it is necessary to create models, and metamodels to provide users with an understanding of how different components interact; and form part of the overall project, service, or system being developed. The following diagrams show these interactions down to the operational service level. Whilst the JDIG can support users down to the system level, this role was undertaken separately during the project; with the system level architecture shown in D6.1.

JDIG Metamodel

The below diagram represents the top-level metamodel for the JDIG, this shows the different layers of a project and how they interact, while showing the components within each layer. Only the interaction of components at a service level is shown as that was the lowest level of abstraction for EOPEN.

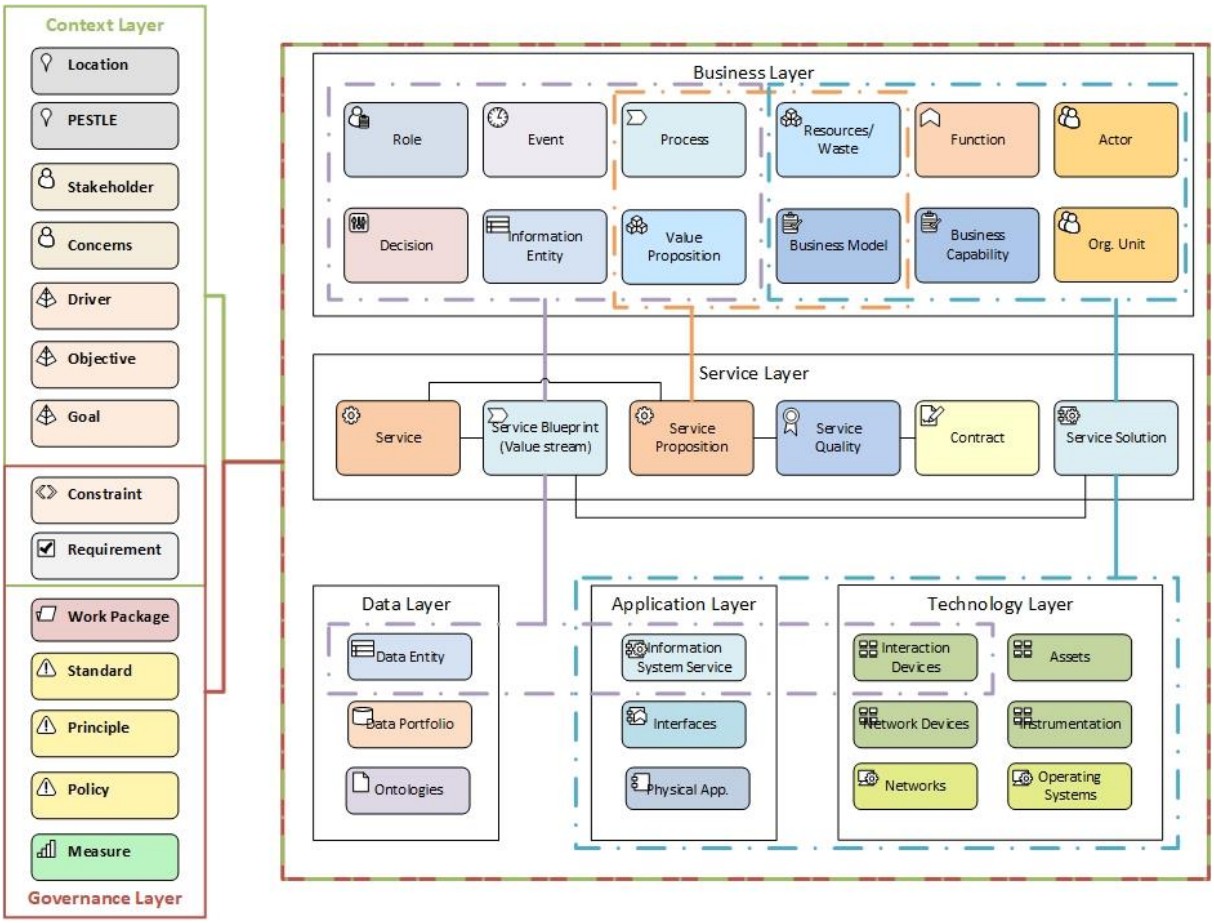

Figure 2: JDIG Metamodel

Contextual and Governance Layer Views

The building blocks and views that are generic and oversee the project are part of the Context and Governance Layers shown in the JDIG Metamodel. These layers are applicable to both Current (COM) and Target (TOM) Operating Decision-Making Models; and guide the development of the subsequent layers.

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Location Catalogue & PESTLE Analysis

This view provides users with an understanding of the different contextual factors that must be factored into the project, based upon the location. A PESTLE (Political, Economic, Social, Technological, Legal, Environmental) framework is used as the basis for this analysis as it provides the breadth of understanding required to make strategic decisions.

Location:	Municipality of Vicenza
Political (Include issues related to government policies, political pressures or regulations.)	Growing unrest from locals due to loss of property during recent floods - Pressure for authorities to be seen to making progress in prevention and improving response
Economic (Include issues related to inflation, interest rates, affluence of area)	Affluent area in close proximity to Venice, due to tourism - Less affluent further out and near the common locations of flooding up river - Large amount of money is spent and lost due to Flooding, both from government, businesses and residents
Social (Include issues around culture, education and demographics)	Few trained individuals for Earth Observation analysis - Locals are passionate about the impacts of flooding - locals are regularly involved in discussions and volunteer for civil protection activities
Technological (Include new developments, data access, condition of existing equipment)	Multiple actors using different databases - Data not up to date - Large legacy systems - No big data Capability - Lack of standards surrounding EO data - Lack of connectivity infrastructure across municipality
Legal (Include current or future legislation, labour, health or trade laws)	Regulations against large modifications to infrastructure due to environmental protections - Set procedures for civil protection activities recently agreed - Legal processes must be followed and adhered to in case of flooding and any resulting damage
Environmental (Include factors that impact the service based upon the environment, or that may impact the environment such as natural resources, terrain or pollution)	Area is highly susceptible to flooding - Flooding has happened more regularly in past decade and been more severe -Protected land and world heritage sites in close proximity so difficult to make alterations to infrastructure

Table 1: PESTLE Analysis PUC1 Example

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Stakeholder Catalogue

This Catalogue is used to keep track of all the Stakeholders within a scenario and any additional pertinent information.

Stakeholders					
Name	**Description**	**Organisation Unit**	**#FTEs**	**Stakeholder Goal**	**Associated Tasks**
Prefect	Prefect of Vicenza	Provincial government	1	Monitoring of emergency	Responsable for emergency at provincial level
Mayor	Mayor of Vicenza	Local Government	1	Monitoring of emergency	Responsable for emergency at local level
Civil protection Agency: Local	The civil protection actors that work on a local scale, identifying risk, notifying stakeholders, supporting volunteers, cohordinate emergencies and manging local operations.	Local Government	3	Monitoring of emergency and management	management of emergency at local scale
Civil Protection Volunteers (Vicenza)	Civile protection volunteers	Local Government	20+	Monitoring of emergency and management	management of emergency
Fire Brigade (VVF)	Fire Brigade	Provincial Governament	20+	Monitoring of emergency and management	management of emergency
Municipal Police	Municipal police of Vicenza	Local Government	20+	Monitoring of emergency and management	management of emergency
Veneto Region Soil Defence office	Office responsable for land use, water management and environmental issues	Regional Government	20+	Monitoring of emergency and management	management of environment and land use
Municipal Technicians	Technicians of Vicenza responsible for thecnical services, emergencies and land use planning	Local Government	20+	Monitoring of emergency and management	management of emergency and technical services
Genio Civile di Vicenza	Veneto region office responsable for river maintance	Regional Government	20+	Monitoring of emergency and management	management of local rivers (major rivers)
Vicenza company for multi-utility services	Multiutility company responsable for water, energy and waste management	Local Government	20+	Monitoring of emergency	water, waste and energy management
Social workers	assist citizens to prepare for emergency and provide support during emergency.	Local Government	20+	Safety and emergency management	help citizen
Environmental agency (ARPAV)	Provide continuous precipitation, temperature, humidity and wind data, used for AMICO system.	Regional Government	20+	Monitoring of emergency	manage the environmental variable (responsable for sensors) and weather provider (with CFD)
Civil protection forecasting Service (CFD)	Proving forecasting of meterological events. Provides the raw information used to determine the potential for and level of an expected emergency and emergency bulletin.	Regional Government	20+	Monitoring of emergency	Weather forecast and allert bulletin
Serenissima Meteo	Local meteo service provider (SME)	SME	20+	datas from EOPEN to develope meteo forecsats	Meteo service provider
Civil Protection Agency: Regional	The civil protection actors that work on a regional scale, identifying risk, notifying stakeholders, supporting provinical emergencies and manging regional operations.	Regional Government	20+	Monitoring of emergency	management of emergency at regional scale
Civil Protection Agency: Provincial	The civil protection actors that work on a provincial scale, identifying risk, notifying stakeholders, supporting local emergencies and manging provincial operations.	Provincial government	4	Monitoring of emergency	management of emergency at provincial scale
Consorzio di Bonifica Brenta (Land reclamation authority)	Land reclamation authority of Bacchigione tributary basin, responsable for the minor hydrographic net	Local Government	20+	Flooded area and river status acquisition	management of local rivers (minor rivers)
Alto Adriatico Water Authority (AAWA)	Alto Adriatico Water Authority	National Governament	20+	Monitoring of emergency and management	planning of hydraulic emergency and management of water resources (all rivers)
ConIT – Consorzio Stabile Innovazione Tecnologica	SME	SME	unknown	create tools EOPEN compatible	software house for some public bodies
Citizen	Local citizens in the effected municipality	Local Government	20+	own Safety	

Figure 3: Stakeholder Catalogue PUC1 Example

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Stakeholder Mapping

Stakeholder Mapping is used to identify the different stakeholders that are impacted by any given event or scenario in the project, and to guide communication activities. These Stakeholder Mapping techniques are common practice within project management, the map on this left is used to help group different actors together, based upon criteria set out by the architect, in this case location was used. The second on the right, is used to map the relative interest vs power the stakeholders have in the project, with different strategies used to keep different groups engaged. The example used if for demonstration purposes and though it is based upon PUC1, it does not necessarily replicate that used by the project.

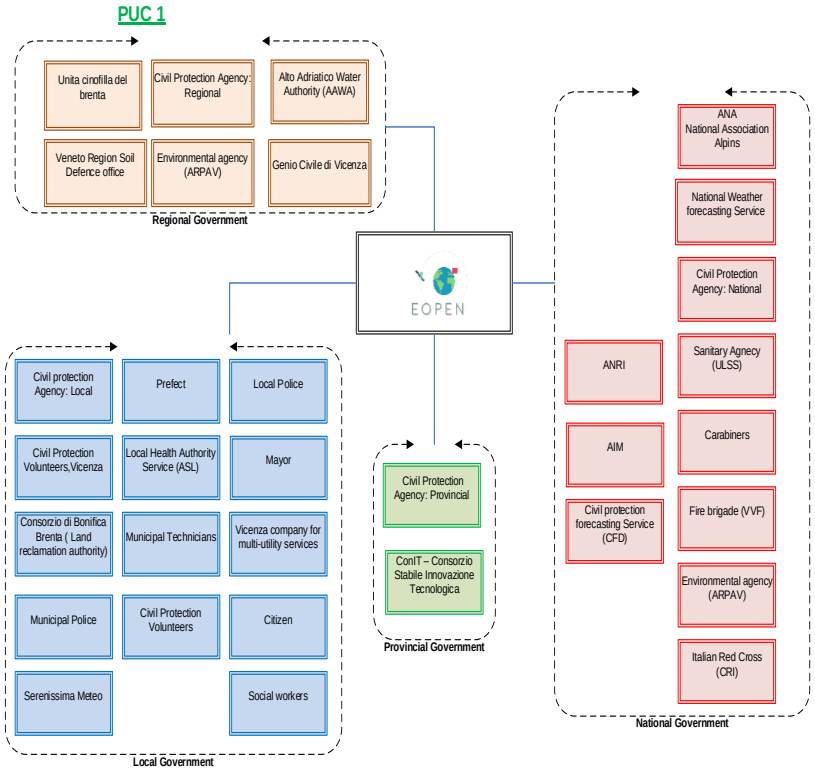

Figure 4: Stakeholder Map

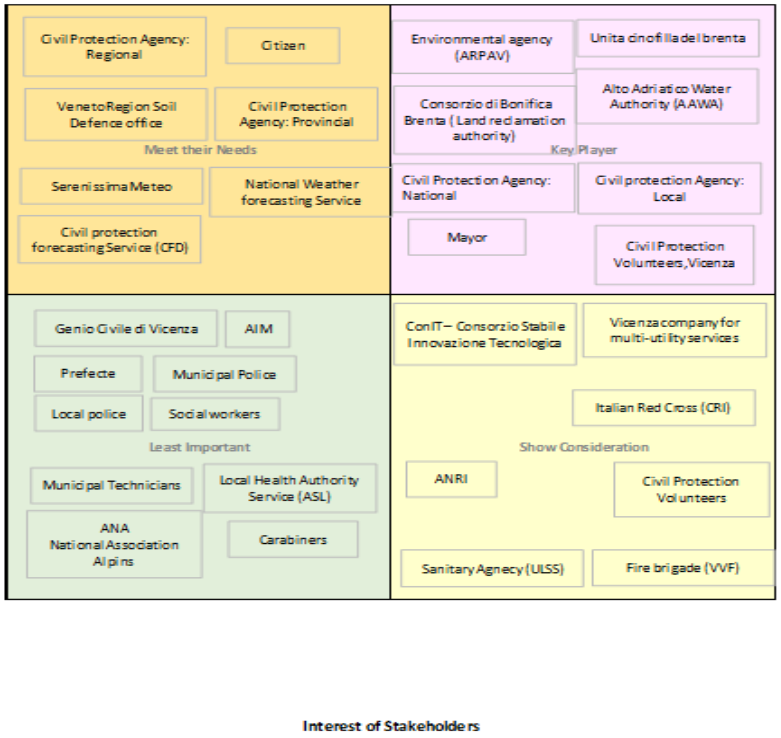

Figure 5: Stakeholder Power/Interest Map

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Stakeholder Engagement plan

The Stakeholder engagement plan is linked to the previous power/interest map and adds any concerns they may have in the project, which in turn provides rationale for the views and communication methods to be provided. Concerns are gathered through interaction with the stakeholders and are not static, therefore need updating periodically throughout a project. The example below is for demonstration purposes and though it is based upon the same stakeholders it does not reflect that used within the project, due to the sensitive nature of this work.

Stakeholder	Stakeholder Group	Concerns	Related View	Method of Engagement	Frequency	Responsibility
Mayor	Key Player	Project progress and the ability to improve existing services	Capability Model; Demonstrations	Physical meeting	Quarterly	AAWA
AAWA	Key Player	Alignment of EOPEN solution with AAWA services	Solution Footprint; Service Blueprint	Teleconference	Weekly till solution definition; periodically thereafter	SERCO
Civil Protection: Local	Key Player	Access and data distribution via internal services	System Architecture	Teleconference	At Solution Definition Stage; Prior to any new version	AAWA/ SpaceApps
ARPAV	Key Player	Use of data	Information/Task Matrix; System Architecture	Physical Meeting	At solution definition stage; Any change in data usage	AAWA
CONiT	Show Consideration	Bandwidth Requirements	System Architecture	Teleconference	At Solution Definition Stage; Prior to any new version	AAWA
Civil Protection Volunteers	Show Consideration	Operational use of proposed solution	Event/Process Diagram; Training Matrix	Physical Meeting	At solution definition stage; Prior to testing & Evaluation	AAWA

Table 2: Stakeholder Engagement Plan

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Stakeholders/Driver/Goals/Objective Matrix

This Matrix links the stakeholders from each scenario to the drivers/goals and objectives that relate to them. This shows how different stakeholders share similar goals and can also be used to show conflicts in objectives, if applicable.

			Objectives								
Stakeholders	**Drivers**	**Goals**	**Improve Meteo Forecasts**	**Identify flooded area and river aqcusition**	**Ability to create Compatible tools for EOPEN**	**Improve flood prediction software**	**Improve collation of information during a flood**	**Improve collation of information after a flood**	**Simplify Flood damage estimation process**	**Receive accurate and timely flood communications**	**Improve tasking and decision making procedures**
Prefect	Wants to reduce overall risk and improve safety for citizens and property	Improved safety to people and property through better information flow and Flood management processes	Y	Y		Y	Y	Y	Y	Y	Y
Mayor			Y	Y		Y	Y	Y	Y	Y	Y
Civil protection Agency: Local	Wants to receive more accurate and timely information to improve flood management process		Y	Y	Y	Y	Y	Y	Y	Y	Y
Civil Protection Volunteers (Vicenza)			Y	Y		Y	Y	Y	Y	Y	Y
Fire Brigade (VVF)			Y	Y		Y				Y	Y
Municipal Police			Y	Y		Y				Y	Y
Veneto Region Soil Defence office			Y	Y		Y				Y	Y
Municipal Technicians			Y	Y		Y			Y	Y	Y
Genio Civile di Vicenza			Y	Y		Y				Y	Y
Vicenza company for multi-utility services			Y	Y		Y				Y	Y
Social workers			Y	Y		Y				Y	Y
Environmental agency (ARPAV)			Y	Y		Y				Y	Y
Civil protection forecasting Service (CFD)	Wants to produce more accurate and timely information	Improve information flow to support flood management processes	Y		Y						
Serenissima Meteo			Y		Y						
Civil Protection Agency: Regional	Wants to produce and receive more accurate and timely information		Y		Y	Y	Y	Y		Y	
Civil Protection Agency: Provincial			Y		Y	Y	Y	Y		Y	
Consorzio di Bonifica Brenta (Land reclamation authority)			Y	Y	Y	Y	Y	Y		Y	
Alto Adriatico Water Authority (AAWA)			Y	Y	Y	Y	Y	Y		Y	
ConIT – Consorzio Stabile Innovazione Tecnologica	Wants to improve communication channels during a flood				Y					Y	
Citizen	Wants to receive more accurate and timely information	To keep themselves and their property safe	Y	Y		Y			Y	Y	

Figure 6: Stakeholder/Driver/Goal/Objective Matrix

Work Package/Objective/Measure Matrix

This Matrix links the objectives from the previous Matrix to the project work packages, with measures created to provide criteria that need to be met to show that the project has met the objectives set out. The corresponding tasks within each work package have been identified to streamline accountability for delivering each measure and objective.

		Work Packages/ Tasks						
Objectives	**Measures**	WP2	WP3	WP4	WP5	WP6	WP7	WP8
Improve Meteo Forecasts	Meteo Forecasts updated every 6 hours		T3.3	T4.2 & T4.4	T5.1 & T5.2	T6.3 & T6.4	T7.2 & T7.3	T8.3
Identify flooded area and river aqcusition	80+% accuracy for real-time monitoring		T3.1	T4.1 - T4.4	T5.3	T6.3 & T6.4	T7.2 & T7.3	T8.3
Ability to create Compatible tools for EOPEN	Open Standards used throughout				T5.1	T6.1 & T6.2		
Improve flood prediction software	<10% Error Rate		All	T4.1 - T4.4	All	All	T7.2 & T7.3	T8.3
Improve collation of information during a flood	Automate Collation and visualisation of Meteo, EO & Social Media within 5 minutes of aqcuistion	T2.4	All	All	T5.2	All	T7.2 & T7.3	T8.3
Improve collation of information after a flood	Automate Collation and storage of all defined data source within 24hrs	T2.4	All	All	T5.2	All	T7.2 & T7.3	T8.3
Simplify Flood damage estimation process	Automate collation of data and send for approval within 24hrs	T2.4	T3.1	T4.1		All	T7.2 & T7.3	T8.3
Receive accurate and timely flood communications	Within 10 minutes of flood prediction being recorded	T2.4		T4.1		All	T7.2 & T7.3	
Improve tasking and decision making procedures	Reduce waste (in time spent) by 10%	T2.4			T5.3	T6.4	T7.2 & T7.3	

Figure 7: Work Package/Objective/Measure Matrix

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Functional & Non-Functional Requirements Catalogue

Methods for capturing and managing requirements vary depending upon the nature and scope of the project, there is no fixed correct option, rather it being up to the team managing the project to decide which is most appropriate. For EOPEN, the SAFe 5.0 requirements management approach was used, the reasons and means of approaching this is to be described in more detail later in this deliverable in chapter 3.1 . As requirements have been extensively documented in both deliverables D2.2 and D2.3, a snapshot is shown below just to demonstrate the means of structuring used within EOPEN. Non-functional Requirements are also referred to as constraints within the metamodel.

ID	As A...	I Want....	So that...	Satisfaction criteria	NFR? (Y/N)	MoSCoW	Dependent on	Requirement Source	Version History (Updated on)	Acceptance Test	Notes
US_V_01	Member of AAWA	To accurately and quickly predict the likelihood of flooding and notify stakeholders (EWS)	I can warn decision makers of a potential flooding hazard	Amico will run faster (less than 1 hour) Prediction system to utilise satellite imagery for increased accuracy	N	M	US_V_08	PUC1_GA5	V2 (11/07) updated Satisfaction criteria & added data source	Flood Simulation Test	Accuracy and speed will depend upon more precise forecast and infrastructure (Computers) and information on soil moisture and temperature
US_V_01a	Member of AAWA	to accurately predict that no area will be flooded	I can provide accurate information to decision makers	Error Less than 10%	N	M		Scenario Analysis	V2 (11/07) added data source	Flood Simulation Test	Accuracy will depend on more precise geometry (DEM 1 m)
US_V_01b	Member of AAWA	to accurately predict the area that will be flooded	I can provide accurate information to decision makers	Error Less than 10%	N	M		Scenario Analysis	V2 (11/07) added data source	Flood Simulation Test	Accuracy will depend on more precise geometry (DEM 1 m)
US_V_01b1	Member of AAWA	to accurately predict the extent that the area will be flooded	I can provide accurate information to decision makers	Error Less than 10%	N	M		Scenario analysis	V2 (11/07) added data source	Flood Simulation Test	Accuracy will depend on more precise geometry (DEM 1 m)
US_V_01b2	Member of AAWA	to accurately predict when the area will be flooded	I can provide accurate information to decision makers	Error Less than 10%	N	M		Scenario analysis	V2 (11/07) added data source	Flood Simulation Test	Accuracy will depend on more precise geometry (DEM 1 m)
US_V_01c	Member of AAWA	To automatically send out warning level based upon flood prediction	The time taken for partners to receive warning is reduced	Within 10 minute of flood prediction being recorded	N	S	US_V_01b	Scenario analysis	V1	Flood Simulation Test	
US_V_02	Civil protection Decision Maker	To view current flooding situation	I can monitor flood levels by location in real-time and make informed decisions	Real-time updates Visual interpretation	N	M		PUC1_GA3	V1	Flood Simulation Test	
US_V_02a	Civil protection Decision Maker	To view public comments from Social Media on flooding situation	I can monitor flood levels by location and make decisions	Location and time, stamped to comment Include pictures if applicable Real-time (<1 minute response)	N	M		PUC1_GA2	V2 (03/07) updated 'i want' criteria and 'satisfaction criteria' V3 (11/07) added Data source	Social Media Crawler Test	Which Social media platform is used to gather this data is not of concern, users simply want 'a view' of public perception
US_V_02a1	Civil protection Decision Maker	To view public comments From Social Media overlaid onto situation map	I can monitor flood levels by location and make decisions	Location and time, stamped to comment Include Pictures if applicable Comments overlaid onto flooding situation map	N	M	US_V_02b	Scenario analysis	V2 (03/07) updated 'i want' criteria and 'satisfaction criteria' V3 (11/07) added Data source	Social Media Crawler Test	
US_V_02a2	Civil protection Decision Maker	To be able to filter public comments from Social Media to only those relevant to me	I only see comments relevant to the current situation	Filtration system by: date/time, location, keywords, Semantic analysis or picture attached	N	S	US_V_02a4	Scenario analysis	V2 (03/07) updated 'i want' criteria and 'satisfaction criteria' V3 (11/07) added Data source	Social Media Crawler Test	
US_V_02a3	Civil Protection Decision Maker	To be able to visually analyse public comments from social media	I can group together similar comments into topics	Content within topics is similar	N	S	US_V_02a4	Technical comments	V1 (03/07) new V2 (11/07) added data source	Social Media Crawler Test	

Figure 8: Requirements Capture Catalogue

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Policy, Standards & Principles Catalogue

This catalogue should hold all available policies, standards and principles that relate to the project; each policy, standard or principle should have a related template as shown on the right hand side below, to capture the detail and implications of each of these governing objects. While the left shows an example of a Principle, these are taken directly from TOGAF 9.2 with slight amendments.

Principle 11: Data is Shared

Statement:

Users have access to the data necessary to perform their duties; therefore, data is shared across enterprise functions and organizations.

Rationale:

Timely access to accurate data is essential to improving the quality and efficiency of enterprise decision-making. It is less costly to maintain timely, accurate data in a single application, and then share it, than it is to maintain duplicative data in multiple applications. Current data is stored in hundreds of incompatible databases. The speed of data collection, creation, transfer, and assimilation is driven by the ability of the organization to efficiently share these islands of data across the organization.

Implications:

- To enable data sharing we must develop and abide by a common set of policies, procedures, and standards governing data management and access for both the short and the long term
- For the short term, to preserve our significant investment in legacy systems, we must invest in software capable of migrating legacy system data into a shared data environment
- We will also need to develop standard data models, data elements, and other metadata that defines this shared environment and develop a repository system for storing this metadata to make it accessible
- For both the short term and the long term we must adopt common methods and tools for creating, maintaining, and accessing the data shared across the enterprise
- Data sharing will require a significant cultural change
- This principle of data sharing will continually "bump up against" the principle of data security - under no circumstances will the data sharing principle cause confidential data to be compromised
- Data made available for sharing will have to be relied upon by all users to execute their respective tasks - This will ensure that only the most accurate and timely data is relied upon for decision-making. Shared data will become the enterprise-wide "virtual single source" of data.

Name	Should both represent the essence of the rule as well as be easy to remember. Specific technology platforms should not be mentioned in the name or statement of a principle. Avoid ambiguous words in the Name and in the Statement such as: "support", "open", "consider", and for lack of good measure the word "avoid", itself, be careful with "manage(ment)", and look for unnecessary adjectives and adverbs (fluff).
Statement	Should succinctly and unambiguously communicate the fundamental rule. For the most part, the principles statements for managing information are similar from one organization to the next. It is vital that the principles statement is unambiguous.
Rationale	Should highlight the business benefits of adhering to the principle, using business terminology. Point to the similarity of information and technology principles to the principles governing business operations. Also describe the relationship to other principles, and the intentions regarding a balanced interpretation. Describe situations where one principle would be given precedence or carry more weight than another for making a decision.
Implications	Should highlight the requirements, both for the business and IT, for carrying out the principle - in terms of resources, costs, and activities/tasks. It will often be apparent that current systems, standards, or practices would be incongruent with the principle upon adoption. The impact to the business and consequences of adopting a principle should be clearly stated. The reader should readily discern the answer to: "How does this affect me?". It is important not to oversimplify, trivialize, or judge the merit of the impact. Some of the implications will be identified as potential impacts only; and may be speculative rather than fully analysed.

Table 3: Governance Template

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Service Layer Views

The following views relate to the service layer in the JDIG Metamodel. These views are here to provide a high-level overview of how the new service or system will operate.

Service/Value Stream Catalogue

This catalogue shows how each of the individual services being investigated as part of the project relates to certain aspects of the JDIG Journey & Value Streams.

Service	Description	JDIG Value Stream
NAS - Agricultural Intelligence	NAS gathers and extracts essential agricultural information on behalf of RDA	Data Transition
RDA - Agriculture Project Effectiveness Decision	RDA utilises the agricultural intelligence provided by NAS, to evaluate the effectiveness of their on-going agrucultural development projects	Decision Making
MAFRA - Policy Change Decision	Based upon the outlook and reccomendations from KREI, plus the on-going development of innovative agricultural practices from RDA. MAFRA implements new policy and directives for food security at a national level.	Decision Making
CJ - Grain Production Outlook	CJ gathers agricultural data to predict domestic grain production	Data Transition
CJ - Severe Weather Forecast	CJ monitors meteorological forecasts, and risk asesses them to predict potential severe events	Data Transition
CJ - Import/Export Values	CJ combines domestic and international crop monitoring and predictions, with predicted severe weather events, to set import and export values for crops within Korea	Decision Making
CJ - Purchase/Sell Grain	Based upon the predicted information and import/export values, CJ purchases or sells grain to maximise profits.	Task Fulfilment
KREI - Domestic Crop Monitoring	KREI collates domestic agricultural information to view the current status of all crops on a monthly basis	Data Transition
KREI - Crop Yield Estimation	KREI collates domestic agricultural information to estimate the annual crop yield on a quarterly basis	Data Transition
KREI - Food Sustainability Early Warning Decision	Based upon current Domestic and International crop monitoring. KREI provide a food sustinability Early Warning Index. Early warning system is monitored daily, while reports are prepared monthly.	Decision Making
KREI - Economic Early Warning Decision	Based upon current domestic crop monitoring and yield predictions, combined with economic indices. KREI provide a quartely Economic report on Domestic Food Security	Decision Making
KREI - Food Security Assessment	Based upon current and historic domestic annual yield predictions, and global agricultural pressures. KREI provide a food Security Assessment to the Korean Government and General Public.	Decision Making
KREI - Food Policy Development	Based upon the annual food security assessment, KREI propose agriculture policy changes to the Korean government for the coming year.	Task Fulfilment
KREI - Crisis Mitigation planning	Based upon the Economic intelligence KREI develop on a quarterly basis, they propose countermeasures for the Korean government to ensure sustainability.	Task Fulfilment

Figure 9: Service/Value Stream Catalogue

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Service Proposition

The Service Proposition details the value that EOPEN, or whichever system you are developing can provide to your stakeholders. This value is mapped against a problem statement, and details which service and process it relates too. These Service Propositions are then further refined and combined into a Business Improvement & Transformation Plan at a later stage to group improvements together for easier management. In this instance of designing a service proposition for EOPEN, resources relate to the existing products that partners have brought into the project, while business models aren't applicable as this is being provided as a free service as part of the project.

Stakeholder	KREI	KREI	KREI	KREI	NAS	NAS	CJ	CJ
Service	Domestic Crop Monitoring	Domestic Crop Monitoring	Crop Yield Estimates	Crop Yield Estimates	Agricultural Intelligence	Agricultural Intelligence	Grain Production Outlook	Grain Production Outlook
Value Stream	Data Transition	Data Transition	Data Transition	Data Transition	Data Transition	Data Transition	Data Transition	Data Transition
Process	Data Collection	Data Analysis	Data Collection	Data Analysis	Data Collection	Data analysis	Data Collection	Data Analysis
Problem Statement	Low resolution remote sensing data	NDVI data doesn't differentiate between closely packed crops	Lots of different data sources and platforms	Crop yield estimates are done manually	Currently only have MODIS remote sensing data	Lack of AI and Machine Learning Knowledge	Current remote sensing data is very low resolution	Data analysis is done manually
Value Proposition	EOPEN can provide sentiel data which can provide up to very high resolution data	EOPEN can provide a mix of different EO data sources and choose the best data source option for the task at hand, or combine multiple layers to further enhance visualisations	EOPEN can merge EO and Non-EO data within a single Interface	EOPEN can automate workflows and processes, both locally and/or within the HPC infrastructure to expedite analysis tasks	EOPEN can provide a mix of different EO data sources and choose the best data source option for the task at hand, or combine multiple layers to further enhance visualisations	EOPEN provides ready made AI and machine learning algorithms to make programming more accessible	EOPEN can provide sentiel data which can provide up to very high resolution data	EOPEN can automate workflows and processes, both locally and/or within the HPC infrastructure to expedite analysis tasks
Resources/ Waste	Sentinel Umbrella	Sentinel Umbrella	Cloud Computing Infrastructure	HPC Enviornment	Sentinel Umbrella	AI Recipe List	Sentinel Umbrella	HPC Enviornment
Business Model	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Figure 10: Service Proposition

Service Blueprint

The Service Blueprint provides a snapshot of all the important components the whole service operates. Traditionally this would involve showcasing the interactions between service users, front facing actors and back-end processes. In the case of EOPEN as the focus was on developing the EOPEN platform as a standalone service rather than developing each stakeholder's individual service, the blueprint has been adapted to focus on the core interactions between the User, the front-end of the platform and the back-end.

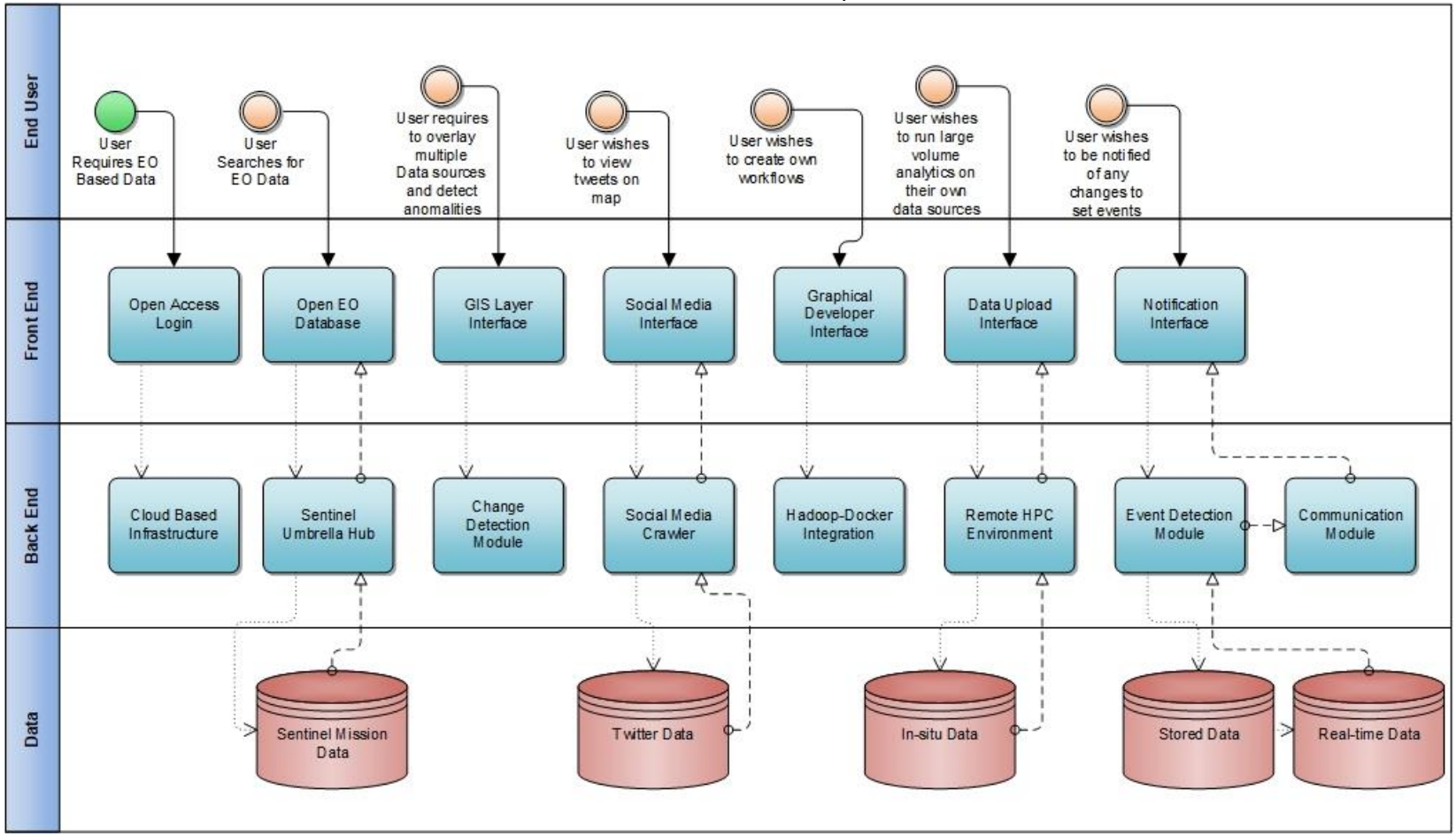

Figure 11: Service Blueprint

Solution Footprint Diagram

This diagram represents an overview of the proposed solution, the key components that inform the new service and how the capabilities map to the goals for each stakeholder.

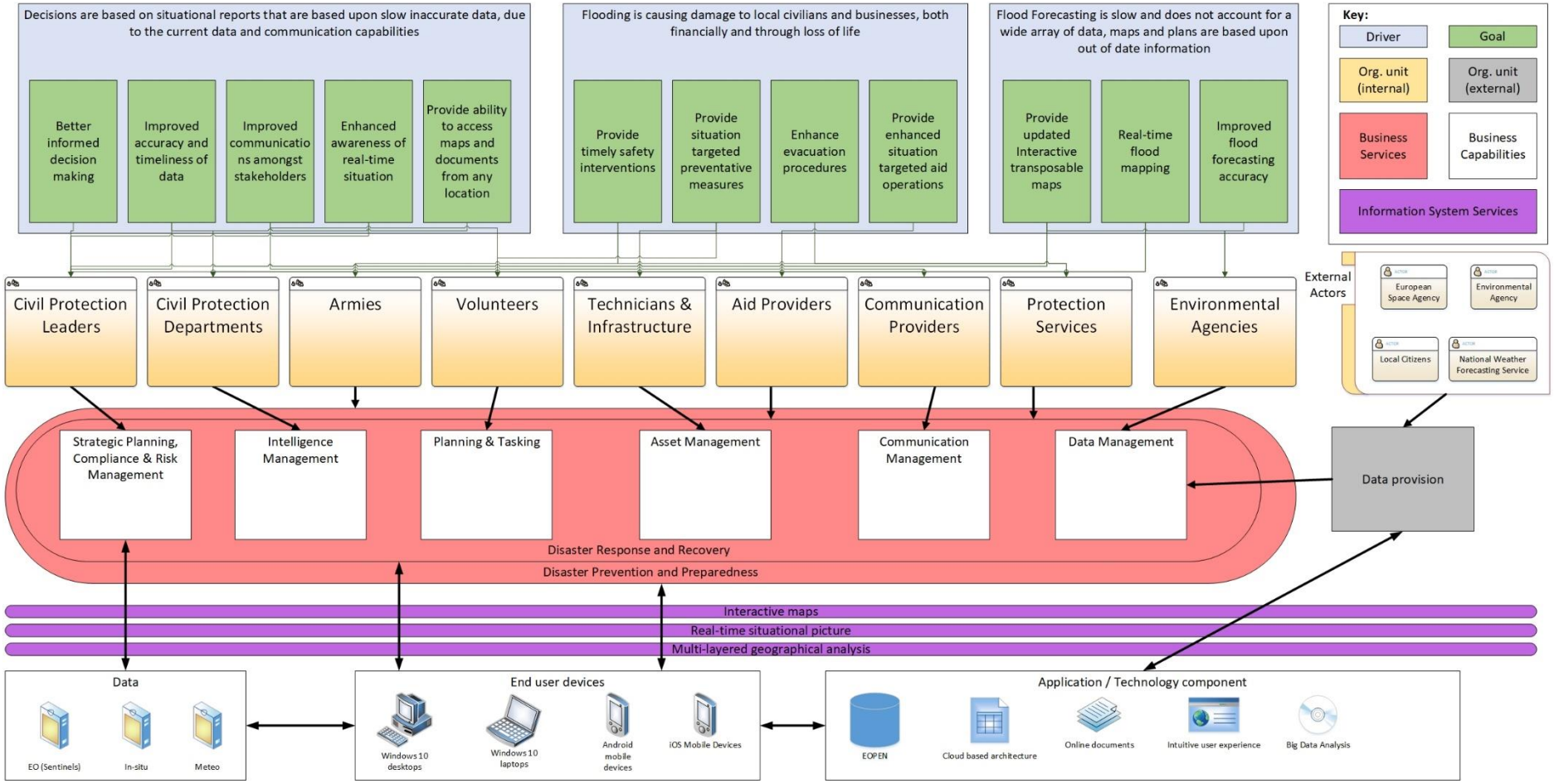

Figure 12: Solution Footprint

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2 CONCEPT OF OPERATIONS

This Chapter details the process used to design a new service using the JDIG architecture. Detailed within is an overview of the phases from research through to testing. As this was the furthest stage EOPEN reached, information on later stages is omitted.

2.1 JDIG Requirements Analysis Framework

Requirements Analysis as part of the JDIG is handled in two separate formats. Firstly, the use of SAFe 5.0 is utilised to identify and manage system level requirements, while a further bespoke framework is used to manage service level requirements. This approach provides a marriage of both fast-iterative system development, as well embedding the whole service within the complex ecosystem.

The rationale for this is that systems, and especially software development, have been proven to be more effective through the introduction of quick iterative cycles of development, following Agile principles. While on the other hand understanding what changes at an enterprise or organisational level, which are needed to adapt to that new service are often more time consuming. Following the traditional TOGAF approach of understanding the business requirements and mapping out in detail all the dependencies is time consuming and often the stakeholders are not aware of the changes that are required. In fact, more often than not they are constrained by what will be possible by the end solution anyway. This then leads to redevelopment of the system after already spending a large amount of time modelling all aspects, which impacts the time to market.

Using SAFe 5.0, at the early stages of a project to capture requirements, in this case by using User stories, helps provide a clear vision of the proposed service based upon the needs of the stakeholders. At this stage, the development team can take initiative and speedily create the new system, while the architects' piece together the greater detailed information to identify how that service will ultimately operate and be embedded into the ecosystem. The diagram below shows how this looks in action. Key to the success of this approach is ensuring regular communication and solution alignment meetings to fine-tune any irregularities. SAFe 5.0 is not discussed within this document and the author refers the reader to the SAFE 5.0[1] website for further details on this approach.

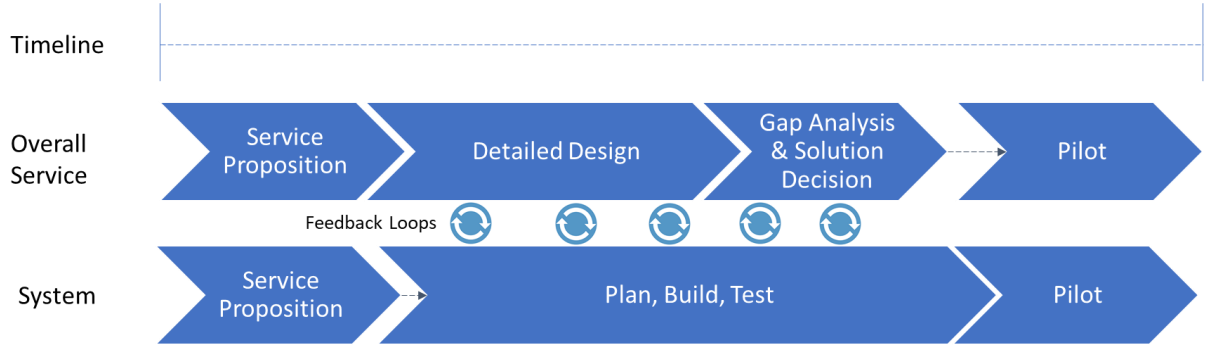

Figure 13: Parallel Requirements View

[1] SAFe 5.0: Requirements Model https://www.scaledagileframework.com/safe-requirements-model/

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JDIG Requirements Methodology

The JDIG Requirements methodology works by gradually decomposing the layers of the COM against the JDIG Journey to identify what within the current model works, what doesn't and the reasons behind that. This COM analysis is conducted through the use of templates (as seen in Annex 1), these templates are completed in collaboration with stakeholders on the ground and are based upon scenarios, developed to highlight the main problems current users face.

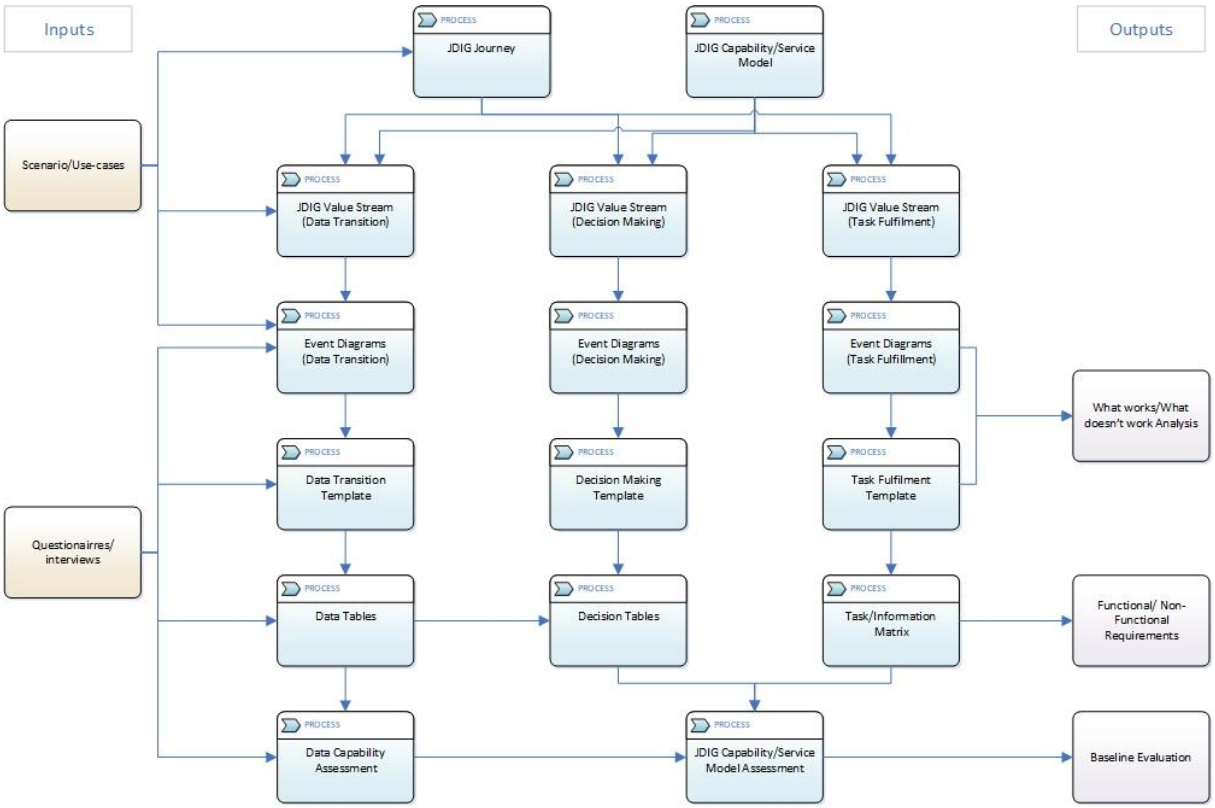

Figure 14: COM views towards requirements

The detail within these templates is then mapped to the appropriate diagram (as shown in figure 14). There is not necessarily a one-to-one relationship against value streams, as there can be multiple different variations of each. How these all map to the journey is shown in the diagrams below:

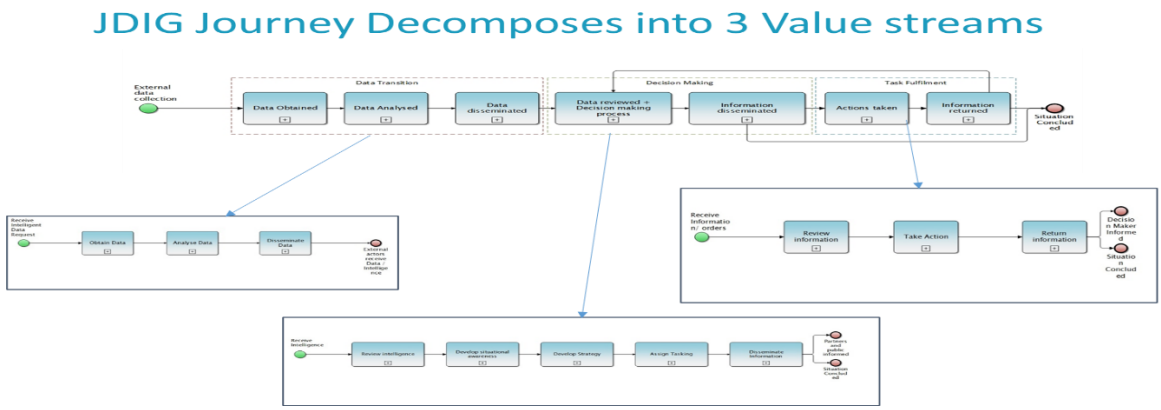

Figure 15: JDIG Journey to Value Streams

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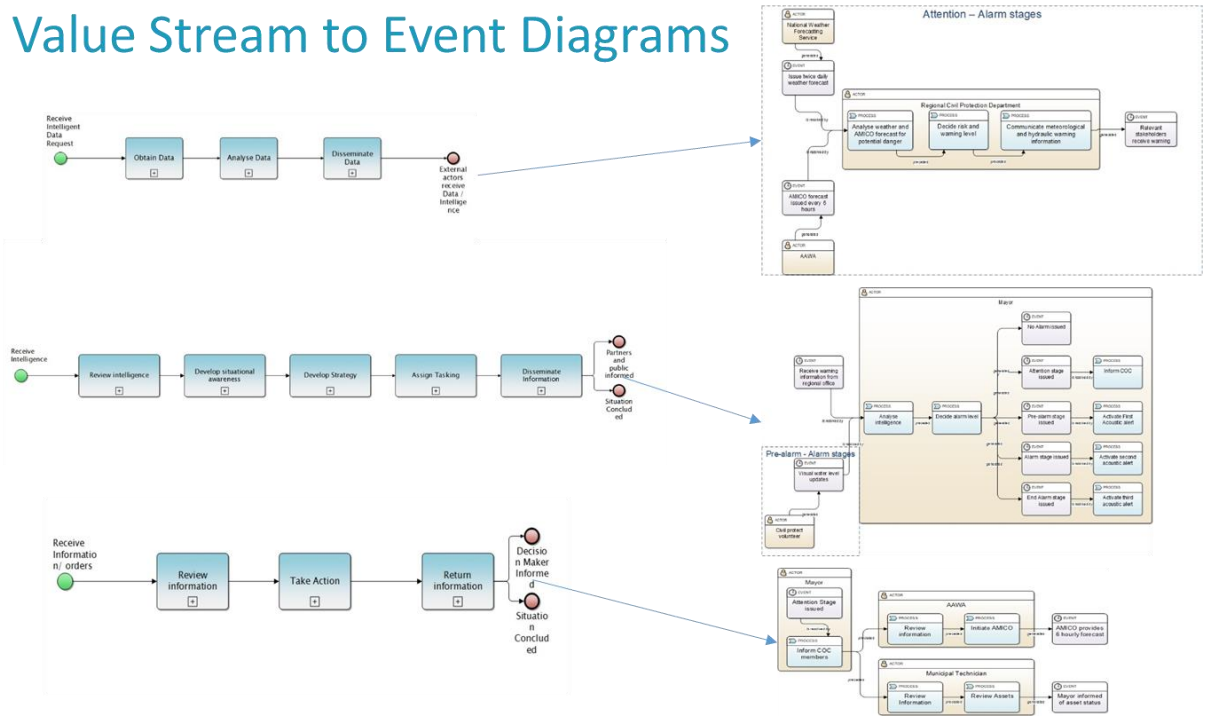

Figure 16: JDIG Value Streams to Event Diagrams

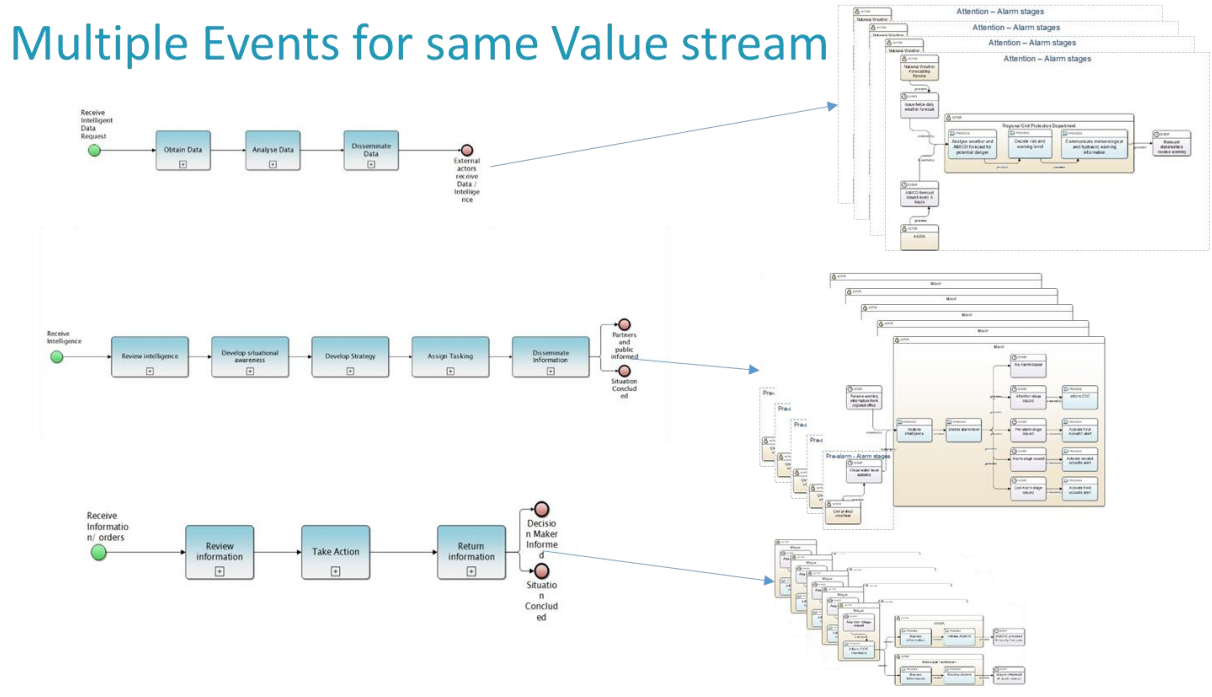

Figure 17: JDIG Value Streams to Event Diagrams (multiples)

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Detail captured through Templates

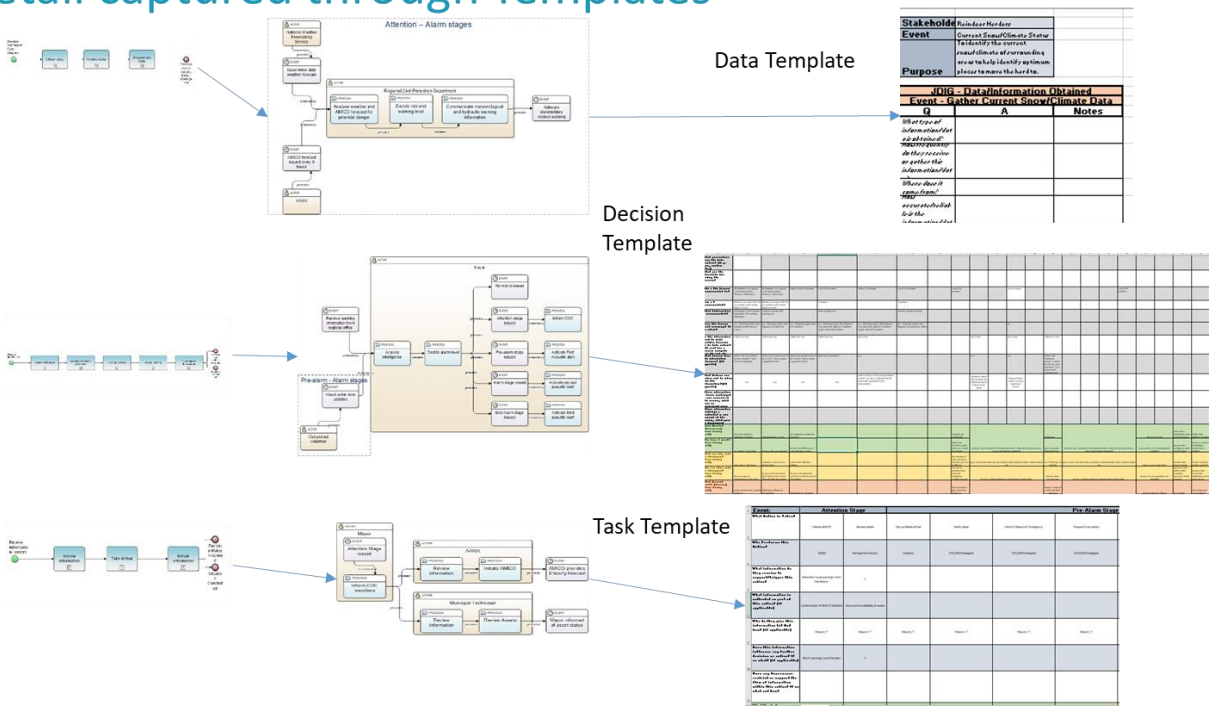
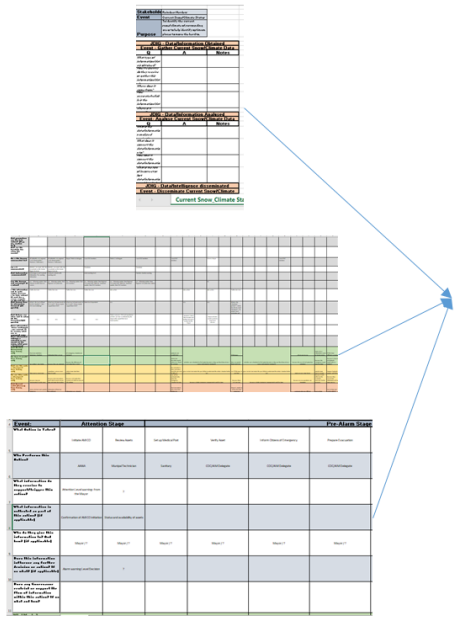


Figure 18: JDIG Templates to Event Diagrams

Templates Inform Service Requirements



Stakeholder	Issue	Consequence	Solution
AAWA / Mayor / COC	AMICO flood forecast is only every 6 hours	Delay in decision making and resulting Civil protection activities	Use remote sensing and big data infrastructure to impro forecast frequency
AAWA / Mayor / COC	AMICO flood forecast has had some errors	Wrong decisions made	Use remote sensing and big data infrastructure to impro error rate
Volunteers	Not able to share pictures of flood status	Have to write down what happened during a flood	Shared Multimedia communication channel
Mayor	Damage estimation process takes a long time	Recovery process takes longer as it takes time to receive insurance compensation	Utilise Remote sensing for damage estimation
AAWA / Mayor / COC	Lots of information during a flood is lost	Damage estimation and planning/ prevention activities for next time become more difficult	Flood information automatically saved
COC / Mayor / Volunteers	Communication issues	Allocation and Task completion information is lost, resulting in tasks not being completed or not reported	Task Allocation and Completion software
Volunteers	Water monitoring is done manually	Labour intensive, hard to monitor all areas and get a complete picture	Utilise Remote Monitoring Sensors to monitor water levels

Figure 19: JDIG templates to Service Requirements

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Templates are also converted into tables and matrices

Figure 20: Templates to COM detailed design

Tables and matrices inform JDIG capability assessment

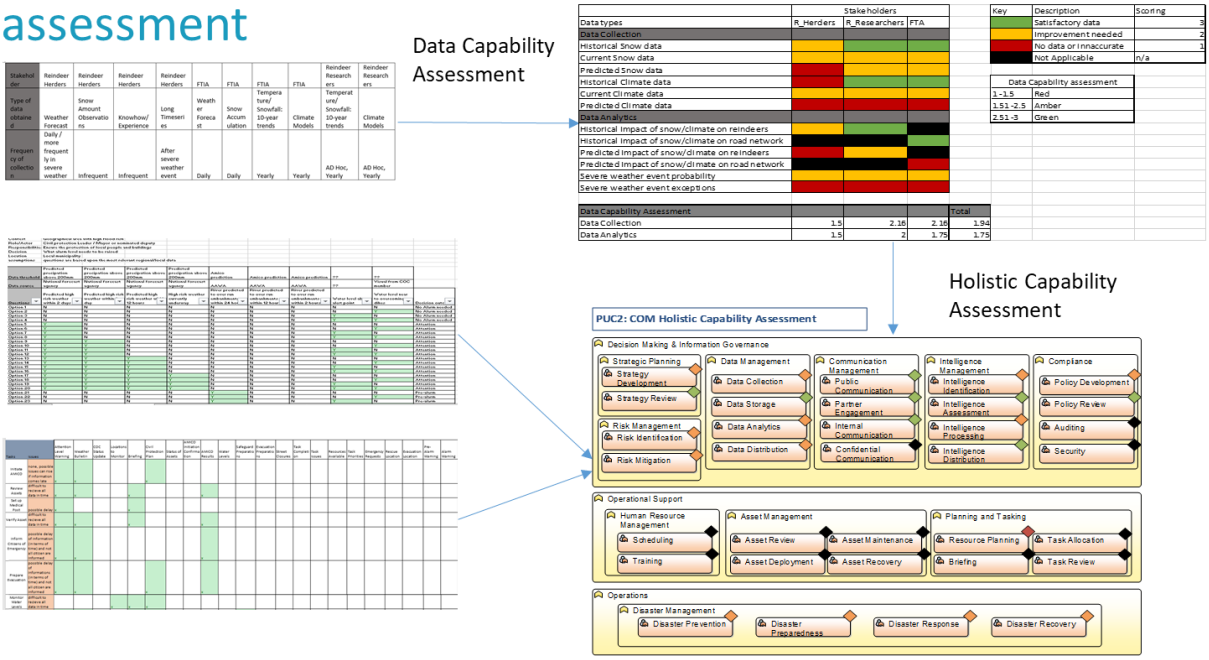

Figure 21: COM Detail to Capability Assessment

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2.2 JDIG Service Design Methodology

To build a new, or refine an existing service is a complex and challenging undertaking. The method described below is detailed to provide readers with an understanding of the approach taken within EOPEN. Figure 22, provides an overview of the full service design methodology. The design of which is based upon TOGAF 9.2; and aligns with the reference architecture detailed in the previous chapter.

Figure 22: JDIG Service Design Methodology

Research

This phase provides the initial knowledge to guide the project and the resulting information provides the core of the project, which interact and are iteratively updated within each resulting phase (as shown in the diagram). The artefacts captured here relate to those within the governance and context layers, as described in the previous chapter. The relationship is as follows:

- **Project Management** – Work Package/Objective/Measures Matrix; Policy/Standards/Principles Catalogue; Location & PESTLE Analysis Catalogue
- **Stakeholder Management** – Stakeholder Catalogue; Stakeholder Mapping, Stakeholder Engagement Plan; Stakeholder Drivers/Goals/Objectives Matrix
- **Requirements Management** – Functional/Non-Functional Requirements Catalogue

Aside from the requirements approach detailed above, the JDIG does not propose any specific means for conducting this research; users must choose the method and means most appropriate to their context.

Service Proposition

Once the initial requirements have been captured, through the use of the SAFe 5.0 Framework; and the templates provided. The project must define all the services that are to be impacted by the proposed change; and which stage of the JDIG journey they relate to within a **Service/Value Stream Catalogue**. From there a **Service Proposition** must be completed to define the value to each of these services the proposed solution will bring, and what resources are required. Next a **Service Blueprint** is created to define how this service will work in context, while lastly a **Solution Footprint** is defined to show how all the components of that service combine to meet the stakeholder needs. Examples of these are shown earlier in this deliverable in chapter 1.

As this framework uses SAFe 5.0 for the management of requirements and software development, unless there is a high level of complexity for the proposed system that needs mapping out, systems development moves straight to the plan, build, test phase.

Detailed Design

This provides a more granular level of detail of both the COM & TOM to describe the proposed solution. The level of granularity depends upon the scale and time available within the project. Rather than define the whole service system at once, this process is designed to be iterative and to break the solution into small use-cases based upon the user stories. As the high-level architecture for the solution has already been defined this allows for a modular approach to development. As described in phase 2, these steps are primarily used to map how the overall service will function once any new system is in place, as the system can be designed with more agility than the overall service. More often than not, the service is dependent upon any changes or blockages from the new system, rather then vice versa, if the high-level solution has been mapped correctly. This approach therefore streamlines the service development process and improves time-to-market.

In the first iteration this is used to map the COM to understand the constraints against the high-level solution detailed in the service proposition stage. This then moves onto the Gap Analysis and Solution Decision Phase, before returning to this phase for a second iteration to map out the proposed TOM. The deliverables D2.3 & D2.4; were the representation of this phase of the project and further detail for the artifacts used can be found within those documents.

Gap Analysis & Solution Decision

This phase identifies different options for the changes required from the current to the target state. As described before, at this stage for the first iteration, the COM is mapped in detail while the TOM is still kept high level. Once a decision has been made and the TOM is then mapped in detail, this stage is re-done to identify any further changes that may be necessary due to any adaptions made in the TOM. The means for capturing the gap analysis and decision is described within a Business Improvement and Transition Plan (BITP) as detailed below.

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Business Service	Crop Monitoring
What is the task or decision that could be improved?	Identifying current crop yield predictions
What information is needed?	Precision EO data down to parcel level
Why?	Current predictions have a high error rate
Desired Outcome	Crop predictions have <2% error rate
COM Constraints	
Information	Information is not available
Technology	Current HPC environment does not support high resolution EO products
People	N/a
Process	N/a
Governance	N/a
Requirements	
High Resolution EO database with remote HPC access	
Must run on existing Infrastructure	
Principles	
P1. Build Not Buy	
TOM Solutions	
Option A	Procure existing EO database
Option B*	Develop new EO product

Table 4: JDIG BITP Example

Plan, Build, Test

Following on from the SAFe 5.0 methodology, this stage is about rapid development and testing of new software or systems in iterative cycles. User Stories and the acceptance tests defined at an earlier stage are used as the basis for this rapid testing.

Testing at this stage should be in the form of both DevOps, to identify and mitigate any bugs within the system/software. As well as User Experience, to fine tune the look and feel of the proposed system. This dual pronged approach helps prevent any additional challenges before any live testing as part of the overall service. Further detail on these approaches are not part of this deliverable, and readers are referred to the corresponding literature for SAFe 5.0; DevOps; & User Experience Testing

Pilot

The Pilot Stage is the last to be described within this deliverable as that was the culmination in the phases achieved by the project upon completion. This stage is where the systems and service development combine into a single whole service. Approaches to piloting can take on many forms, either through tabletop exercises, live demonstrations, or Living Labs. The approach taken is down to those implementing and testing the service at the time. The ultimate goal here is to understand whether the proposed new service works within a real-life environment, using real actors. The aim is to be as close to real-life as possible, to allow identification of any issues and improvements required. This stage should end in an evaluation of the proposed new system/service, by the stakeholders, to ultimately make the decision on whether to implement this new system/service, whether it needs more refinement or whether it needs to be scrapped as it did not meet the expected needs.

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3 CONCLUSIONS

This deliverable provides the conclusion to WP2 and the JDIG Architecture Framework. As a result of the learning from this project the JDIG has been refined to provide readers with an accessible method of improving their information critical services. This scalable architecture can be used within any context, to provide decision makers with more clarity when making decisions on investing in new products or systems in enhancing their intelligence and decision-making capabilities.

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4 APPENDIX

4.1 Requirement Analysis Templates

Data Transition Blueprint

Stakeholder	
Event	
Purpose	

JDIG - Data/Information Obtained		
Event -		
Q	**A**	**Notes**
What type of information/data is obtained?		
How frequently do they receive or gather this information/data?		
Where does it come from?		
How accurate/reliable is the information/data?		
Where is it stored?		
JDIG - Data/Information Analysed		
Event -		
Q	**A**	**Notes**
What is the data/information analysed against?		
What does it convert the data/information to?		
How does it convert the data/information?		
What is the risk of incorrect or lost data/information at this point?		
JDIG - Data/Intelligence disseminated		
Event -		
Q	**A**	**Notes**
What data/intelligence is disseminated?		
Who is the data/intelligence disseminated to?		
How is the data/intelligence transmitted?		
What is the timeframe?		
Is there any governance supporting or restricting the dissemination of this data/intelligence? If so what and how?		
Analysis		
Q	*A*	*Notes*
What Works? [Successes]		
Why does it work?		
What are the risks or challenges?		
Why are they risks or challenges?		
What Doesn't work? [Issues]		
Why Doesn't it work? [The Underlaying causes]		
What is the consequence of this not working? [Failures]		

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Decision Making Blueprint

Location:	
Scenario:	

Q	Example	Decision 1	Decision 2	Decision 3	Decision 4
What Decision needs to be made?	Does weather forecast pose a potential dangerous situation for the Region?				
Why does this decision need to be made?	To inform citizens of a dangerous situation/ to support preventative action decision making.				
What are the possible decision outcomes?	Yes/no				
Who is responsible for making the decision?	Regional department of civil protection				
What type of information/data/Intelligence is used to inform the decision?	Meterological and Hydraulic information				
Where is this information/ data/ intelligence from?	National weather forecasting service				
What parameters does the information/data/intelligence contain? (E.g. time, location etc.)	Time, Location, Predicted precipitation				
What are the threshold's for making the decision?	Predicted Precipation over 200mm within a 36 hour period				
Who is the decision communicated to?	All Authorities at a regional scale (Municipalities, Provinces, Prefectures)				
How is it communicated?	Bulletin's via email, SMS, fax or available on the Veneto Region Website				
What Information is communicated?	Meterological and Hydraulic information. Plus warning information				
Does the decision need reviewing? If so when/how often?	yes - following updates from national weather forecast service				
What decision does this information influence? (If applicable)	What is the level of flood risk for situation? / Does COC need notifying?				
What Actions are taken and by whom with this information?(If applicable)	n/a				
Where information is freely exchanged in any element of this column, what policy or framework allow's this? And how?					
Where information exchange is restricted in any element of this column, what policy or framework restricts this? And how?					
What Works? [Successes]	Prevision underlines dangerous situations				
Why does it work?	are emitted 1 day before				
What are the risks or challenges?	More precise previsions				
Why are they risks or challenges?	because now are implemented in wide areas				
What Doesn't work? [Issues]	meteo alert tren and spatially imprecise				
Why Doesn't it work? [The Underlying causes]	because meteo models mesh is too wide and forecast are not always updated				
What is the consequence of this not working? [Failures]	bulletin are not so precise				

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Task Fulfilment Blueprint

Location:	
Scenario:	

What Action is Taken?					
Who Performs this Action?					
What information do they receive to support this action?					
What information is collected as part of this action? (if applicable)					
Who do they give this information to? And how? (if applicable)					
Does this information influence any further decision or action? If so what? (if applicable)					
Does any Governance restrict or support the flow of information within this action? If so what and how?					
What Works? [Successes]					
Why does it work?					
What are the risks or challenges?					
Why are they risks or challenges?					
What Doesn't work? [Issues]					
Why Doesn't it work? [The Underlaying causes]					
What is the consequence of this not working? [Failures]					

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Requirements Capture Template

ID	As A...	I Want....	So that...	Satisfaction criteria	NFR? (Y/N)	MoSCoW	Dependent on	Requirement Source	Version History (Updated on)	Use-Case Diagram	Notes
Id is the Unique requirement code for reference	This represents the role or type of user that the requirement is for	this represents the requried functionality users want	this represents why users want the functionality	This includes the performance or more detailed functions the user expects to accept the functionality	Is this a non-functional requirement (or Constraint)	this represents priority rating (Must, Should, Could, Won't)	This column shows what other requirement (by ID) this requirement is dependent on	This column shows where the requirement originates from	This column is to track changes to requirements	This Column Indicates how this requirement will be proven to be working (1 test may be used for multiple requirements)	This area is for additional notes
											Initiative
											User Story
											Epic
											User Story
											User Story
											User Story
											Epic
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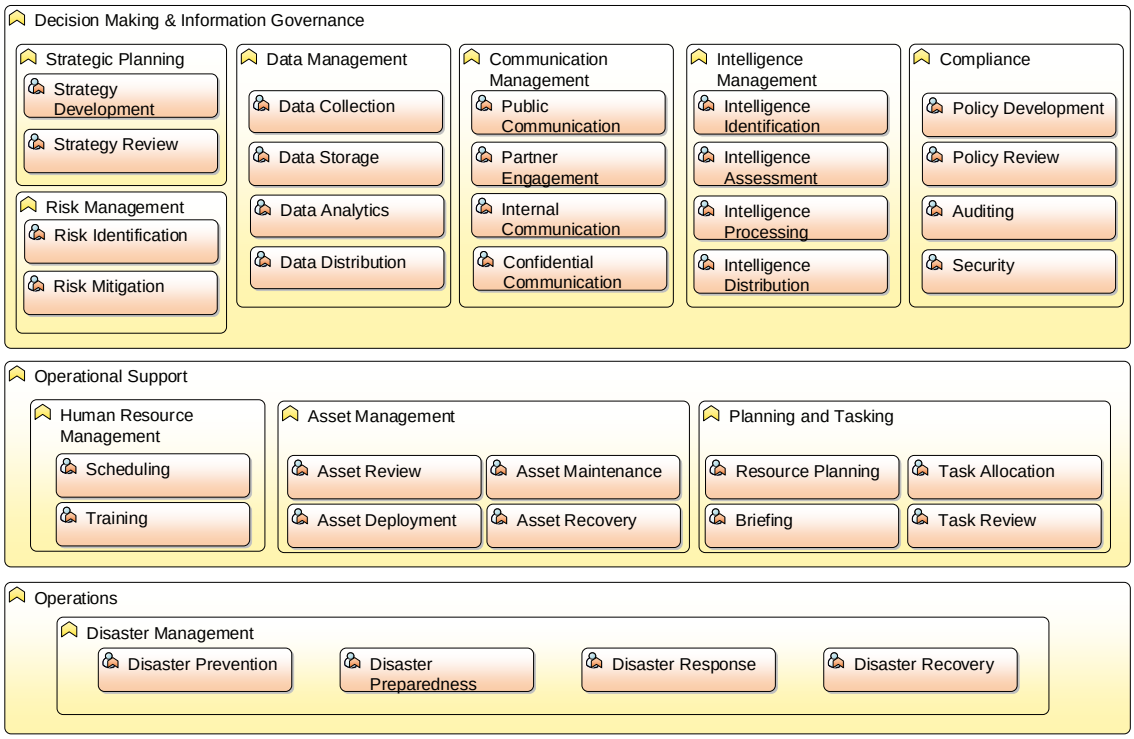
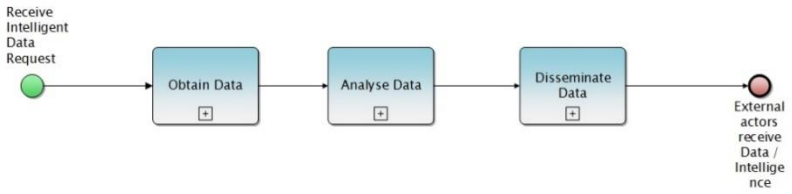
JDIG Capability Model

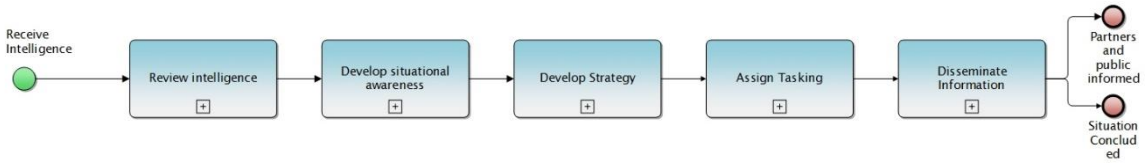


JDIG Value Streams

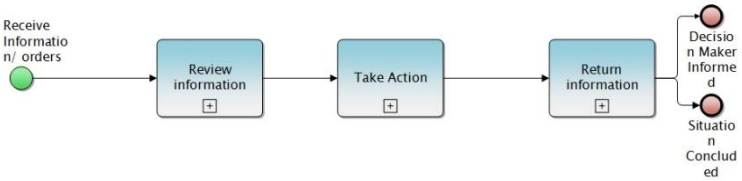
Data Transition



Decision Making



Task Fulfilment



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JDIG Business Improvement & Transformation Plan

Business Service	
What is the task or decision that could be improved?	
What information is needed?	
Why?	
Desired Outcome	
COM Constraints	
Information	I.e. is the information available within the organisation (Y/N)
Technology	i.e. Does the technology prevent this information from being transferred
People	i.e. is it a cultural or training issue
Process	i.e. does the process not exist or dilute the information
Governance	i.e. does governance prevent this information being transferred
Requirements	
Principles	
TOM Solutions	
Option A	
Option B	
Option C	