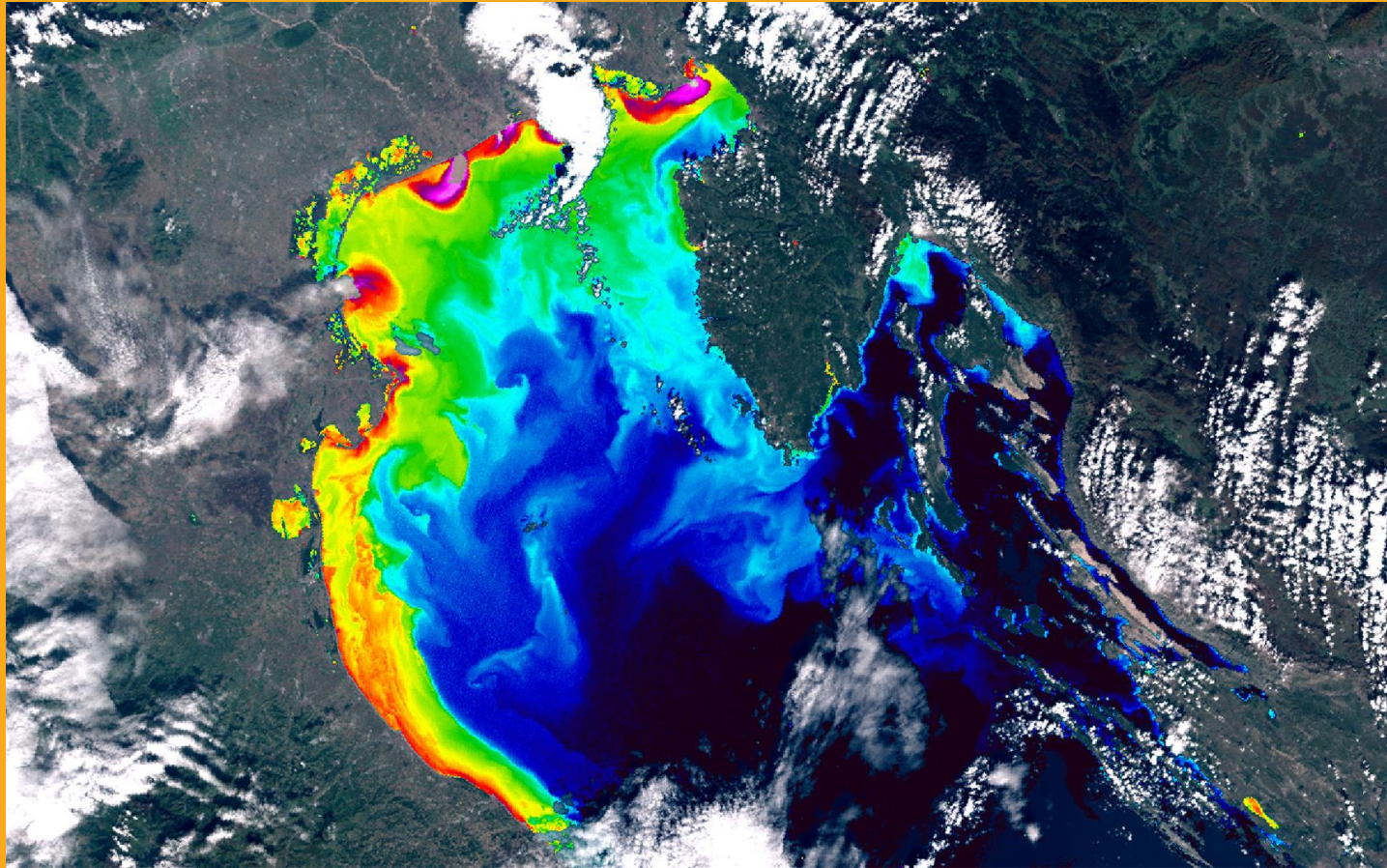


# Presentation of the Requirements Gathering Exercise with the Public Sector

Dr Michael Quinton, Space Unit Xjenza Malta





# Requirements Gathering Exercise: The Use of Satellite Data in Public Sector Departments



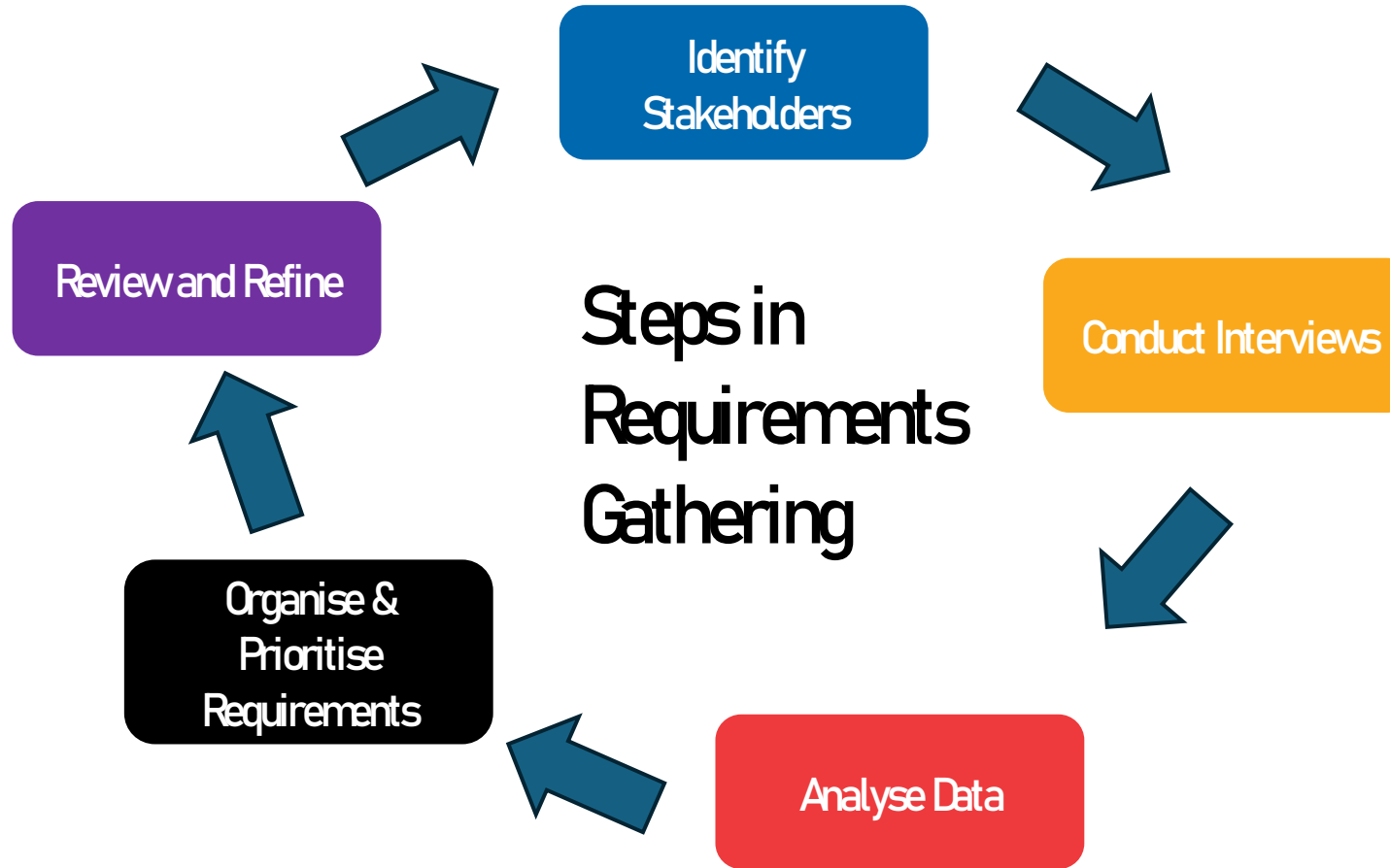
# Requirements Gathering Exercise:

## Scope

- Satellite data is becoming integrated into many services
- Satellite data offers continual and frequent updates
- Are these services being utilised in the Public Sector?
- How can Satellite data be used in Public Sector services?
- Are Public Sector Services equipped to utilise Satellite data in their daily use?



# Requirements Gathering Exercise: Steps



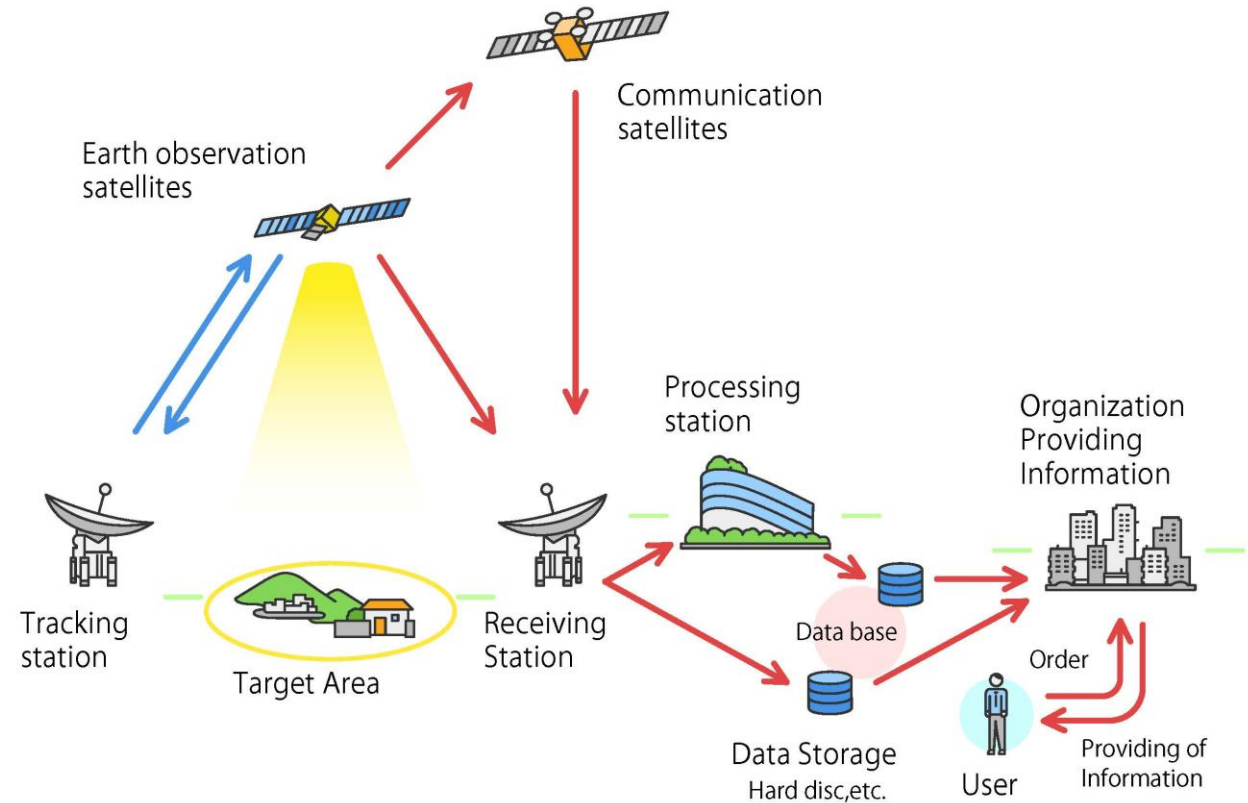
# Interviews with the Public Sector

- 14 Public Sector Entities
- 1 Private Sector Entity (Meteorological Department MIA)
- Interviews semi-structured (Method used in UI design)
- In person and recorded
- Results have been transcribed
- Data analysis uses Grounded Theory as analysis method



# Interviews Questions

- The work & data used by the entity
- Use of Satellite Data – Yes or No
- Knowledge of satellite data products
- Hardware & Software Requirements
- Expertise, knowledge & Training
- Budget & Communication with higher authority
- Potential sustainable use of satellite data
- Data processing techniques of satellite data





## Satellite Data Use

\* In-situ measurements & drone imagery are used to improve resolution & increase data points

Entity	Use of Satellite Data	Use Description
Planning Authority (PA)	Yes	Reporting to EEA, Part of Copernicus land monitoring, Purchased Hi Res satellite data to update basemap
Ambjent Malta	Used Temporarily	Satellite data used in a Space Research Fund project (MAARES) but not used beyond the fund
Transport Malta (TM)	Yes	Use Google Maps for Traffic data
Environment & Resources Authority (ERA)	Yes	Purchased Hi Res satellite data to update basemap
Energy & Water Agency (EWA)	Used Temporarily	Satellite data used in a Space Research Fund Project (WARM EO)
Malta Air Traffic Control	Yes	EGNOS used extensively. ECMWF data used Extensively & provided by the MET Offiice
MET Office	Yes	ECMWF data used Extensively
Lands Department	No	Allows the use of Google Maps for clients purchasing land
Public Works	Used Temporarily	Satellite data used in Space Research Fund Coastal Sage, using satellite data for training
Infrastructure Malta	No	There is great interest to implement Satellite data services
Malta Fisheries (MAFA)	Yes	Satellite Navigational data used for tracking of vessels & monitoring movement
Malta Communications Authority (MCA)	Yes	Use of Stereo imagery (Purchased) measures height, density of buildings
Malta Information Technology Agency (MITA)	N/A	MITA will not use satellite data but are trying to integrate it into government services - National Spatial Data Infrastructure (NSDI)
Civil Protection Department (CPD)	Yes	Galileo (early warning) & Copernicus (location information & detail)
Malta Resources Authority (MRA)	Yes	Report at EU and UN levels. Uses Copernicus Data. Not processed Internally

## Resolution Requirements

Entity	Resolution Required	Requirements
Planning Authority (PA)	4 to 5cm	2D & 3D applications, Intend to use Spectral data. Pushing for Radar data use (mm resolution in relation to ground motion)
Ambjent Malta	Resolution to the cm	Hi-res data required to distinguish trees from one another, width of water courses. Interest to use Multispectral Imagery especially with regards to chlorophyll levels or water content
Transport Malta (TM)	Resolution to the cm	Hi-res data for road condition surveys and road markings. Use of current drone data 2cm resolution
Environment & Resources Authority (ERA)	15cm	Purchased Hi Res (15cm) satellite data to update basemap
Energy & Water Agency (EWA)	Resolution to the cm	Hi-res required for detailed crop mapping.
Malta Air Traffic Control	EGNOS 1.5m positioning	Air traffic control operations EGNOS.
MET Office	ECMWF 0.25x0.25 degrees	ECMWF Integrated range Forecasting System (IFS) GRIB2 format, considering Spectra data use
Lands Department	Resolution to the cm	Monitor land in high definition with clear detail between one plot/ building & another
Public Works	Resolution in millimetres, optical imagery 0.5m	Monitoring Boulder movements, buildings and stability of buildings (Interferometry), High detail accuracy of the shoreline for Coastal monitoring
Infrastructure Malta	5 - 10 cm	Spot potholes, cracks in road surfaces, recognise differences in manholes, telephony services
Malta Fisheries (MAFA)	To the closest metre	Satellite Navigational data used for tracking of vessels & monitoring movement
Malta Communications Authority (MCA)	50cm resolution	Precision required to determine differences in building heights & distinctions between buildings - radiation levels & antennae - 2D and 3D data required
Malta Information Technology Agency (MITA)	N/A	MITA is looking into integrating satellite services into Public Sector domain



## Hardware & Software Requirements

\* Thanks to the ESRI agreement hardware & software across government departments are more harmonised

Entity	Hardware & Software Requirements
Planning Authority (PA)	Powerful computers and other hardware acquired through EU funding – 3D outputs using Terrestrial Land Scanners (TLS) – Software ESRI for GIS
Ambjent Malta	Developing an AI software to identify 5 flora species – ESRI Software for GIS – University of Malta can provide AI algorithms to Ambjent Malta
Transport Malta (TM)	ESRI for GIS and further tools can be acquired from MITA – Use of Google Maps for traffic data
Environment & Resources Authority (ERA)	Lack of knowledge on how to process hi-res satellite data and make best use of such products. Hardware is suitable to run ESRI ArcGIS. Use of sentinel products in courses and use of QGIS.
Energy & Water Agency (EWA)	ESRI for GIS. Working with the University on a project utilising satellite data for agriculture and water resource management.
Malta Air Traffic Control	Software and hardware are upgraded according to needs. Fully equipped to run EGNOS. 2018 awarded for pioneering satellite-based approaches on a particular runway.
<b>MET Office</b>	<b>All hardware &amp; software available for use of satellite data &amp; easy to update systems requirements</b>
Lands Department	Using Gaming Laptops running high level GPU for rendering use of ACAD and GIS applications. Application of Java programming for system functionalities. Cloud services from MITA for servers.
Public Works	Well-equipped hardware computer workstation with a strong processor. Software expensive licences and maintenance (SARPROZ) for SAR and InSAR applications
Infrastructure Malta	Use of ESRI for GIS. Also use software for road surface cost estimation and ACAD. Hardware available to run these systems
Malta Fisheries (MAFA)	Use of powerful laptops but still struggle when handling GPS data which uses 33 million nodes. More high tech required. Very large datasets run in GIS and frequent system crashes due to heavy datasets
Malta Communications Authority (MCA)	Use of ESRI for GIS, use of off the shelf satellite imaging products (purchased). Creating simulation software for forecasting with automation capabilities.
Malta Information Technology Agency (MITA)	MITA has provided ESRI ArcGIS software to Government Departments providing a homogeneous system. Computer upgrades had to be made in all involved departments to be able to host ArcGIS
Civil Protection Department (CPD)	Purchased an incident command unit which uses satellite data but not used often and outdated tech. Lack of dedicated personnel to run such systems and other

## Expertise, Knowledge & Training

\* In most cases it was mentioned that it is hard to find experts in the field. There aren't many and the few available go to the private sector since Public sector wages are unable to compete.

\*\* Hard to replace an expert who has left the place of work

Entity	Expertise, Knowledge & Training
Planning Authority (PA)	Finding people with expertise in GIS is a problem. The PA hosted various training workshops, but this was not continued. Plan to restart training programmes
Ambjent Malta	Finding experts in GIS is a problem. Not easy to employ people who have these skills since they usually find jobs in the private industry where wages are much better
Transport Malta (TM)	Running Business Process Engineering to integrate Geospatial elements into daily work. Participate in yearly ESRI training.
Environment & Resources Authority (ERA)	A lack of knowledge on the type of tools to use or make use of the appropriate products. Organised one day workshop with officials. In collaboration with MCAST a course was developed on satellite imagery and use of Sentinel products and their application in QGIS.
Energy & Water Agency (EWA)	Almost all staff are knowledgeable of GIS Spatial data. All staff had enrolled for training of ArcGIS. Further knowledge regarding Copernicus products would be helpful. Working with the University of Malta in the 'Subsequent Life' project which addresses satellite data use in agriculture and water resources management
Malta Air Traffic Control	Extended knowledge of other satellite data use would be required. Employment of expert in other satellite data use, temporary. Knowing more about satellite data use can open new possibilities.
<b>MET Office</b>	<b>Training offered upon entry. On the job training offered. Workers given refresher course every 5 years. Training for forecasters needed. Training on other satellite applications would be beneficial</b>
Lands Department	Training would be needed but has to be adapted so that it can be understood. Previous courses were hard to follow.
Public Works	Experienced learned using satellite data in SRF project Warm E0. Training continued internally with E0 59 courses of 10 modules using Cosmo-SkyMed data.
Infrastructure Malta	No person trained to use satellite data but once satellite data is integrated into ESRI internal experts in ESRI will be able to work with satellite data in the program
Malta Fisheries (MAFA)	Do not have the expertise in satellite data beyond the usual remit but can easily learn. Currently other satellite data use is not required. Plotting in ArcGIS & low-level coding using Python
Malta Communications Authority (MCA)	Training on Spatial data run by the PA provided theoretical & practical knowledge. Most staff are high level Masters graduates. Time & Commitment to engage in high level courses can only be considered in relevant fields.
Malta Information Technology Agency (MITA)	MITA has provided ESRI ArcGIS software to Government Departments providing a homogeneous system. Computer upgrades had to be made in all involved departments to be able to host ArcGIS

Entity	Availability & Accessibility
Planning Authority (PA)	Budgets for satellite data procurement comes from funding. Business plan required for acquisitions of services & resources. EU finding for enhancing hardware, computers, servers.
Ambjent Malta	Budget limited & satellite data is usually obtained through ERA. Budget focuses on implementing projects. Finding received from MITA where person was employed to map drone images. Funding was acquired for the MAARES project through the Space Research Fund (SRF)
Transport Malta (TM)	Not easy to acquire funds for satellite data due to the complexity of the procurement process. Having contracts like the MITA ESRI agreement will speed up the procurement process tenfold.
Environment & Resources Authority (ERA)	To justify spending on satellite data & related infrastructure convincing management would be required to justify the expenditure. Higher management lack awareness concerning satellite data potential.
Energy & Water Agency (EWA)	Integrating satellite data into the EWA eco system should not be a problem. Procurement processes are challenging
Malta Air Traffic Control	Expenditure has to be justified, & the case made for expenditure
<b>MET Office</b>	<b>Open to Investment which is justifiable &amp; easy to obtain funding for such initiatives &amp; hardware and software upgrades. Financing to sustain projects &amp; ensure completion.</b>
Lands Department	Internal Budgets for IT. Currently no budget for satellite data purchasing. Take time to get larger budgets & happens at a higher level.
Public Works	No specific Vote for funding. Want to purchase software for satellite data processing. Need to purchase satellite data (less than €10,000 per annum) for one year of data with weekly frequency. Data is in raw format. Top management needs strong commitment from employees to pay for training & data use. Strong business plans required to justify spending.
Infrastructure Malta	Higher Management will push for higher budgets to provide for needs. Purchasing satellite data might be cheaper than paying for a drone survey.
Malta Fisheries (MAFA)	Internal requests for expenditure on hardware & software take a long time & it is a lengthy process.
Malta Communications Authority (MCA)	Funds to purchase satellite data are available & purchased. Data prices vary according to its type.
Malta Information Technology Agency (MITA)	Procurement of ESRI licences centrally controlled by MITA. Spending emphasises the harmonisation of Public Sector digital services.
Civil Protection Department	Need to service the budget for what is needed even in terms of employing more staff

## Sustainable use of Satellite data

\* All participants from the public sector that the establishment of a central data provision hub would be required to purchase satellite data that can be used by all government departments

Entity	Sustainable use of Satellite Data
Planning Authority (PA)	Plan to integrate satellite data but hi-res satellite data is required for sustainable use. More regular use of satellite data & more added value added to processing satellite imagery for value added data.
Ambjent Malta	To introduce a system which can provide weather conditions, water content, fire risks & other useable data which would be relevant for various end-users. High resolution data required for sustainable use of satellite data
Transport Malta (TM)	Interested in the sustained use & integration of satellite data into TM practices to take advantage of frequent turnover updating of data & the need for satellite data middleware to improve resolution. Drawing private industry into the sector to provide satellite middleware services.
Environment & Resources Authority (ERA)	Optimising resources in relation to reporting obligations. With improved satellite imagery it could ease and alleviate resources & monitoring functions which are increasing & making data available to the general public
Energy & Water Agency (EWA)	Data turnover frequency, high resolution intended for an end-user. Use of satellite data in agriculture, water resource management. Bringing up wages of employees to ensure that people don't leave for another sector.
Malta Air Traffic Control	Already using extensive EGNOS services & Google Maps but would look into other forms of photogrammetry if it aids in any way to improve obstacle detection & remains within the framework of current safety protocols.
<b>MET Office</b>	<b>Systems are in place, new software, set service level agreements so that software use is maintained. All procedures are taken to ensure the lifespan of the project year after year.</b>
Lands Department	Satellite data would have to be of hi-res to be integrated into Lands Department practices. There should be a main authority that provides satellite data to all government departments.
Public Works	Five key Sustainability goals SDG Coastal climate risk protection, energy performance in buildings, stormwater management, sustainable urban environments, nature-based solutions. Satellite data could be used in all 5 of these contexts. Training, expertise and knowledge are required to sustain the system
Infrastructure Malta	Satellite data use will be sustained if integrated into daily practice. Human resources & knowledge are essential
Malta Fisheries (MAFA)	Working on long term project to develop a system which integrates satellite data requiring substantial investment in infrastructure for fish tagging. Want to use satellite data related to sea surface temperature, wave height. Hi res data required for sustainable satellite data usage
Malta Communications Authority	To create automated data ingestion tasks & some analysis tasks



# Results

## Data Processing

Entity	Data Processing
Planning Authority (PA)	AI can be utilised for data processing in ArcGIS. Outsourcing to the University of Malta & MCAST to process the data
Ambjent Malta	AI can be utilised for data processing in ArcGIS. Outsourcing to the University of Malta and MCAST to process the data
Transport Malta (TM)	AI can be utilised for data processing in ArcGIS. Processing can be done internally & training given to personnel. Any additional tools are requested from MITA
Environment & Resources Authority (ERA)	AI can be utilised for data processing in ArcGIS. Discussions with MCAST to process the data
Energy & Water Agency (EWA)	Machine learning was used to improve resolution. This project could not be continued due to lack of resources. Discussions with the University of Malta to improve satellite resolution for use in agriculture & water management
Malta Air Traffic Control	Being a highly regulated domain anything new that is introduced needs to be compliant with all safety standards & protocols.
<b>MET Office</b>	<b>Raw data processing is subcontracted to third parties (private sector) who work in meteorology &amp; who develop software.</b>
Lands Department	Lands has their own software which has been developed over the years. AI processing should be done by a central authority that provides data to authorities
Public Works	Currently training internally to learn how to process data using Machine learning.
Infrastructure Malta	Not currently capable of using AI but would like to have the capacity to process the data internally. In contact with MITA to see about hi-res datasets and services that can be utilised for more effective data processing.
Malta Fisheries (MAFA)	Working with the University of Malta to improve data processing using AI to parse the necessary data for different scenarios
Malta Communications Authority (MCA)	Data would need to be procured through an SME or company rather than processing it internally.
Malta Information Technology Agency (MITA)	Willing to explore the use of AI stitching to enhance satellite resolution. Work is done with the AI department at the University of Malta
Civil Protection Department (CPD)	Tried to outsource to private companies to improve satellite resolution but private companies were charging very high prices to provide these services. Only one person working on GIS.
Malta Resources Authority (MRA)	Processing is outsourced to MCAST who improve satellite resolution for the MRA

# General Results

- Harmonised GIS system (ESRI ArcGIS) throughout all government departments
- Hardware has been upgraded to support ESRI ArcGIS
- Hi-Res satellite imagery required for detailed images & minute characteristics
- Purchase of satellite data varies in cost according to requirements
- Finding qualified staff is a problem
- Government wages do not compete with private sector
- No university courses to train people in full capacity GIS usage
- A central hub is being requested for satellite data distribution similar to the current MITA ESRI initiative



# Other Considerations

- Use of Copernicus Satellite products beyond imagery is not being considered
- Awareness of Copernicus Satellite products & other EUSPA and ESA services is essential
- Continuous training on Satellite data services & products is essential
- Formation of an Action Committee is required to successfully integrate satellite data use into Public sector practices
- Dialogue with Academia & the Private Sector are needed to provide specific user needs to the public sector
- Public sector infrastructure to support & sustain a satellite data ecosystem requires change in current modus operandi (revising wage scales, duties, training)



# Panel Discussion

## Panel Speakers:

- Dr Michael Schembri – Energy & Water Agency
- Mr Kurt Bonnici – Lands Department
- Mr Daniel Fenech – Public Works Department

## Discussion Points:

- The use or non-use of satellite data in your department
- Limitations related to the use of satellite data in your department
- Possible solutions, if any, regarding the potential use of satellite data in your department.

