

The SIntegraM Stairway to Integrative Spatialisation: Removing the Barriers to Access and Harmonisation

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Abstract: Data integration is a complex construct to enact, and spatial data posits further barriers to be overcome. The Maltese case study that culminated in the SIntegraM project depicts such an effort aimed at changing an entire country's data structures, basemapping and analytical processes. The transition from a hoarding reality to an open and big data structure is seen as positing an example for spatial data integration and operational implementation.

Keywords: GIS, spatial data integration, nsdi, SIntegraM, LiDAR, harmonisation of geodata

1 Introduction

Due to the various national/EU data creation obligations, Malta is committed to upgrading the national spatial data capacity, which is currently not integrated and does not follow a coherent process, but is based on an approach where each organisation has built its own systems that do not communicate with other entities' systems.

This project aims to develop and implement a national spatial data infrastructure and enhance the capacity of geo-spatial/GIS technology expertise for Malta. The project constitutes the creation of a strategic approach to spatial data, creation of critical base datasets, as well as enabling a legislative and shift in mentality in terms of exchange and access to data. The project ensures that the underlying aerial, terrestrial and bathymetric infrastructures and knowledge gain are made available to all government entities to deliver the relevant analytical framework as per national, EU and other international obligations and requirements. The infrastructure and range of systems, equipment, analytical and dissemination tools will also be geared to enable inter-governmental data dissemination, knowledge gain and an integrated approach towards information foresight.

The Maltese spatial data realities sit on a veritable tightrope where most data is held by individual entities with little or no data collaboration between the different entities or even the datasets themselves. Efforts have been made over time as detailed in CASSAR & FORMOSA (2013), BUTTIGIEG, FORMOSA & SLADDEN (2015), and FORMOSA (2017). The data exists, it is in a non-earth format with its own projection. However, it is blind to external datasets and cannot talk to other datasets within an integrated core. Spatial Infrastructure is also hampered by an old base map, non-earth data, ancient technology, a persistent silo-effect that keeps data from being shared, governmental entities charging each other for data, lack of integration, and limited human resources and training.

2 Processes and Methods

2.1 Issues Pertaining to Isolationist Scenarios

This is especially true due to a lack of a cohesive approach that ensures that the baseline data is common to all and that the current problems emanate from the difficulty of agreeing on a national data structure that is based on a reliable locational approach. Figure 1 depicts the different regions employed within the Maltese Islands where each entity decides upon its own regions and hence on a national scale coordination of incidents of operational activities becomes practically impossible to achieve. Data harmonisation is sought to ensure the reduction of such incompatibilities.

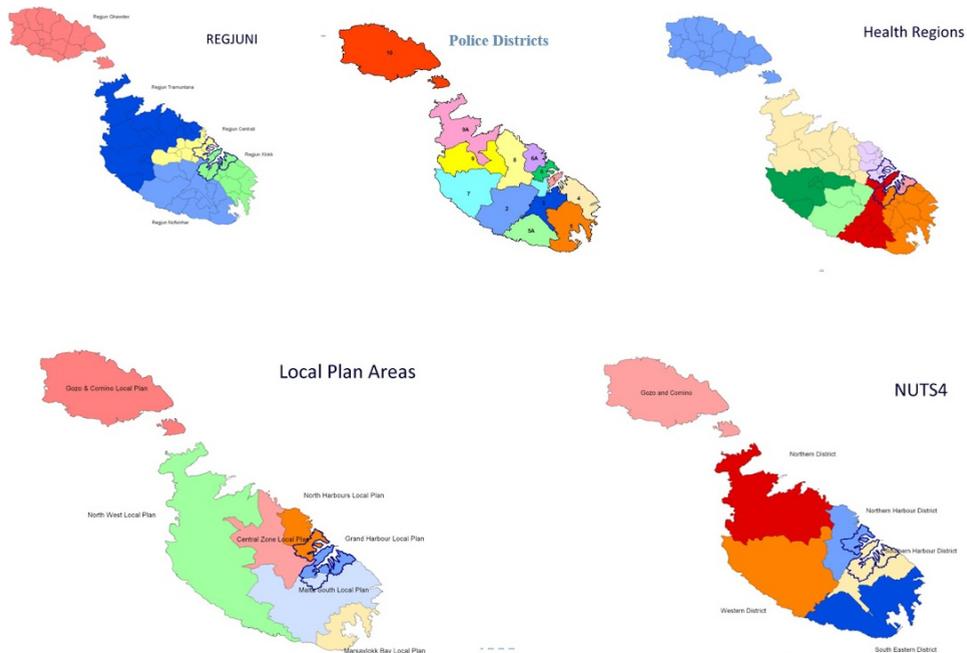


Fig. 1: Incongruence between the different regions: Regjuni 2009, Police Districts, Health Regions, Local Plan Areas and NUTS4

Thus, the need was felt for a new initiative that targets strategic approaches to spatial information, data capture, data analysis, dissemination and data/hardware sharing innovations. This led to the SIntegraM activity aimed to develop and implement a national spatial data infrastructure and enhance the capacity of geo-spatial/GIS technology expertise for Malta. The project constitutes the creation of a strategic approach to spatial data, creation of critical base datasets, as well as enabling a legislative and mentality shift in exchange and access to data. The project will ensure that the underlying infrastructure and capacity are made available in order to deliver the relevant analytical framework as per national, EU and other international obligations and requirements.

Such is possible due to the focus on a specific but in turn generic target audience that includes all government entities conversant with spatial information, as well as those who aspire to create such data. The project has been presented to the Cabinet and subsequently Permanent Secretaries (PSs) who have taken the project on board.

The innovative aspect of such a project entails a series of services being offered inclusive of data being created and exchanged, the use of hardware and software across all entities; zero charging is envisaged where such is covered by a Cost Benefit Analysis.

2.2 The 5+1+2 Modelling Approach

The modelling approach is based on a 5:1:2 pivot structure where the main elements identified as needing change were split into infrastructure, capacity and protocols. The first 5 points relate to infrastructure requirements, the next refers to training whilst the last two cover the INSPIRE Directive and data exchange protocols.

The 5: Building the Infrastructure

- Developing a new Basemap for the Maltese Islands.
- Aligning all spatial data in a common projection (removing the current truncated data system).
- Drafting a Strategy for National Spatial Data Infrastructure.
- Building the necessary infrastructure to enable the entire data cycle (design-input-analysis-output-reporting) and for future preparedness.
- Creating an online dissemination and analysis spatial information system.

In terms of infrastructure, such as relates to hardware, software and content, Malta's main spatial data problem relates to its reliance on an old basemap from 1988. In addition, data is sold between entities, it is not homogenous and is gathered ad-hoc. It is imperative that Malta develops a new basemap for the Maltese Islands at various scales ranging from 1:10,000 to 1:1000, as well as aligning all spatial data in a common projection (removing the current truncated data system) and one that is used by the EU. In turn, the project builds the necessary infrastructure to enable the entire data cycle (design-input-analysis-output-reporting) – hardware, software and content. This leads to the acquisition of the necessary infrastructure for future preparedness (aerial, terrestrial and marine technologies) to reduce external reliance. Finally, the project will enable the creation of a national interactive geoportal for online dissemination and analysis.

Two such outputs that have already served as a launching pad for the dissemination technologies are SEISMALTA (www.seismalta.org.mt) and CLOUDLISLE (www.cloudisle.org). The former (Figure 2a) depicts realtime environmental data reporting, whilst cloudisle (Figure 2b) posits the 3D data of the entire nation state inclusive of one nautical mile data from the baseline coast. The project entailed the creation of .laz files that were converted to webgl for thin-client use by scientists and the general public.

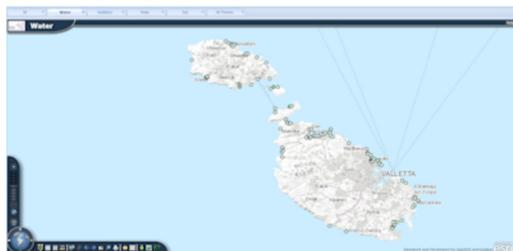


Fig. 2a: www.seismalta.org.mt

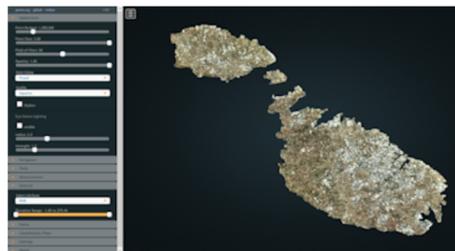


Fig. 2b: www.cloudisle.org

1: Human Capacity

- Building human capacity in the spatial themes across all governmental entities.

In terms of human capacity, the latter relates to knowledge of spatial information, where Malta's main spatial expertise is spread across the diverse entities with limited collaboration or exchange. Knowledge varies across the technical, administrative and professional levels.

It is imperative that Malta enhances its human capacity in the spatial themes across all governmental entities, through training of data gatherers and refiners, data analysts and reporters, information specialists, preparedness specialists and legal experts.

2: Legislative and Mentality Shift

- Adhering to the INSPIRE Directive and relevant legislation.
- Creating a series of protocols that enable the free exchange of data and knowledge across the entities as well as ensuring **Data SECURITY and Data Protection** within the DPA, FOI, INSPIRE and other Acts/Directives.

The final but highly critical pivot relates to data exchange and protection. The 2 pivot relates to adherence to legislation and the inclusion of the concept of FREE exchange of data and information and Cost-Sharing through a Secure Structure. Malta has limited data resource and the exchange of data that needs to be paid for is limiting progress and creating obstacles to progress, particularly when data is already paid for by the same government. Thus, the time is ripe for a shift in mentality across all entities where data is gathered once and used by many: a free exchange data across the governmental entities and that it is governed by a common structure. It is imperative that Malta adheres to the INSPIRE Directive and relevant data legislation, that it creates a series of protocols that enable the free exchange of data and knowledge across the entities, and that it introduces cost-sharing solutions.

3 Raison d'Etre

This project fits within the requirements of regional development funding, as it posits an initiative that sets the groundwork within the "National Digital Strategy" in line with the aims of the new National ICT strategy (Government of Malta, 2014) that states that the Government plans to build a competitive digitally enabled economy which will foster an entrepreneurial spirit to promote investment in technologies and leverage value-added economic

opportunities. This project fulfils the objective that “Government aims to increase the use of e-government services to improve people’s quality of life by simplifying the interface between government, citizens and the business community and the provision of faster and simpler services”. It particularly targets the implementation of the SO where “Government will also improve the inter-departmental efficiency services through ICT, including through measures such as the setting-up of adequate ICT infrastructure, data management and open data systems, cloud computing and network development”.

In effect, SIntegraM will enable the implementation of an integrated process where the interface between government, citizens and the business community would be able to use updated information in real time, and where the information is reliable and verifiable. At the same time, it would offer the latest spatial data updates, consolidate information, free exchange of data and enhance informed policy-making and decision-making through knowledge gain. In addition, the inter-governmental efficiency issue will be fully taken-up as this project will ensure that all government ministries and entities will be able to participate in the project, create new information through a gather-once / use-any system, drastically reducing data redundancies and multiplicity of information, eliminating data and information duplication, while recalibrating non-aligned information which causes hundreds of man-hours being lost when reporting spatial information to the EU and other national or international entities. Ensuring the elimination of unreliable data sourcing, as well as reversing the practice where each entity hoards its data in isolation to the exclusion of the rest, are also aims of this project.

The project will also ensure that a mentality shift is achieved through the process where data is shared between all entities through secure data protection legislative and operational measures, information is rich and that knowledge gained by one entity is transferred to all entities. In addition, hardware, software and data emanating from the project will be shared amongst all entities leading to an operational shift where there is a collective approach to project implementation and execution at a national level, as opposed to a single entity level where the entity acquiring or managing the project retains a sole use over the proceeds from the project.

The SIntegraM’s outcomes are larger than the sum of its parts as it will enable government entities to start thinking in spatial terms, brings together policy-makers, on the ground experts and academics which process will eventually enable an evidence-based approach to policy making and eventual decision-taking.

This process requires a mentality shift which takes a generation to achieve, and which is why the time is ripe to effect such a project, the process of which being initiated in 1995 through the Structure Plan Monitoring Programme (PLANNING AUTHORITY 1997), the Data Protection Act (OJ 1995), the Freedom of Information Act (FOI) (OJ 2003a), the Public Service Initiative (PSI) (OJ 2003b), the Aarhus Directive (OJ 2003c), the INSPIRE Directive (OJ 2007), the SEIS Initiative (MARTIRANO, BONAZOUNTAS, FORMOSA, NOLLE, SCIBERRAS & VINCI 2012), and other such legislative and implementation tools such as the ERDF156 (MEPA 2009).

The SIntegraM will ensure a holistic approach to e-governance, the integration of data services, an increase in national spatial knowledge, as well as ensure that expertise is shared between all entities and that in turn data is made available to all. The project will enable a seamless DIKA transition from “Data to Information to Knowledge to Action” that will benefit government entities and in turn enhance e-services, data access and technological expertise as achieved through collaboration based on a unified approach.

3.1 Does It Work?

The implementation of an integrated GIS is an ongoing process that has yet to be evaluated. Primarily, the initial process, that of bringing together the entire governmental entities to participate in an EU funded project, was deemed a feat in itself. The integrative data concept taken up by the entities as a launching pad for the implementation of a nationwide process delivers on many levels.

The project has managed to link to the expected results through its focus on inter-departmental/inter-entity drive. These include a unified approach to spatial information, ICT and technologies being delivered through the inter-entity review, analysis and development of a Strategy for NSDI, inter-linked Legislative Drivers review and changes, and the identification of inter-entity spatial data flows.

The project's main pivot ensures that all entities are brought on board, a process initiated over the past years and through which the letters of intent were developed, which ensure that bureaucratic issues and information-barriers are reduced or eliminated through an integrated drafting of Protocols for data and information exchange based on a common approach to the data cycle. Such include the drafting of policies for the free exchange of data across the governmental entities, knowledge again, access to ICT knowledge and ICT technologies as well as a national process enabling one unified and integrated information structure'.

All government entities are envisaged to have access to the national basemap at zero cost as opposed to the current system where each department would have to acquire a licence and in turn cross-charge the mapping agency for other services rendered. The creation of the basemap, which also includes data acquisition of imagery, LiDAR data, oblique imagery, infrared data and other technologies, reduces the need for multiple data capture and expenditure by different departments as well as disseminates the resultant knowledge to all other entities, ensuring a smooth upgrading of both the effectivity and efficiency with regards to information and implementation processes. The project ensures that time wastage and process redundancies are eliminated through the activity that target the re-projection of all spatial data from the current 1988-induced non-Earth projection that is slowing down the data process as well as causing major capacity issues through a cross-departmental process to re-project all datasets to a real world map.

In addition, the services rendered through the project that encompass all entities detailed with spatial information are delivered through the acquisition of systems covering the management of spatial data (basic and advanced software tools) as well as the acquisition of highly advanced analytical tools targeted for real-time systems and real-life investigation. This is made possible through the setting up of a collective system of processes, software and hardware that ensure that entities are equipped with predictive tools, analytical models as well as immersive environments, already underway through memoranda of understanding and data sharing agreements. The latter functionality equips inter-departmental and inter-disciplinary focus teams to interact in real and virtual worlds ensuring that instant decision-taking is made possible through scenario building or instant access to streaming information (a case could be the immersion of a crisis group of specialists who can remotely view a developing situation such as a fireworks factory explosion and direct paramedics, CPD personnel, detour traffic, manage data capture drones, monitor dust/chemical plumes from a remote site, amongst other inter-connective activities).

The project in turn helps improve interdepartmental efficiency services through ICT as it delivers a rolling out of dissemination tools for the distribution and reporting of data to the public, scientific domains and EU/international reporting structures. In turn, this eases pressure on interdepartmental work as information would be instantly available through online and mobile systems both for the public but even importantly for service personnel who would be carrying out fieldwork, data capture through to the implementation of services on-the-ground and remote sites.

One issue that ensconces the new concept that is paramount in this project and which aimed to reduce public spending whilst ensuring a national approach to interdepartmental efficiency relates to the acquisition, installation, commissioning and testing of equipment that will be used by ALL entities through a time-slotted triage-like process, which process ensure that high-priority activities such as emergency services would be given precedence to ongoing projects or ad hoc initiatives. Such systems include ICT infrastructure that include immersive environment technologies, aerial-based technologies such as drones and specialised cameras (IR, thermal, LiDAR, rgb), terrestrial-based technologies that aim to scan streets, infrastructure, buildings and underground facilities, land survey and GNSS/GPS/GPR technologies as well as marine-based technologies.

4 Conclusions and Outlook

In conclusion, this phase of the work will entail a veritable restricting of the operational aspects of spatial information in the Maltese Islands. The initial conceptual models that have been built into the planning agency through lineages and information protocols, will be spread through the nation in stepped approaches. The latter include the wider-spectrum of spatial data infrastructure, basemap creation, hardware and software acquisitions as well as training at the diverse undergrad and post-grad levels. The project will result in the various entities changing their information in one single cross domain integrated system.

SIntegraM will entail the introduction of an integrated GIS, as opposed to the current simplified and isolated information systems structure. The technology will enable the digital processing of geographic spatial data that will enable users to analyse the spatial data contained in various data layers. SIntegraM will therefore aim to instill a shift in mentality across all Government entities to ensure that data is gathered once and used by multiple entities with data being exchanged freely by all entities. Specifically, the project will consist of transforming the infrastructure into an integrated system to cater to the procurement of the required hardware and software enabling such an infrastructural change. It will create a basemap, which is a detailed map of Malta and Gozo, in digitalised form, and allow for the layering of multiple data layers over the base map with user-friendly accessibility to the system for analytical and reporting mechanisms.

What ERDF156 brought to the fore in terms of data sharing and dissemination through SEIS and Cloudisle, SIntegraM scopes the entire nation in its striving for preparedness both in terms of knowledge and also in terms of capacity.

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