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STATAMAP: Spatialisation and Dissemination of Statistics: A Background Technical Report
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Title of the Project:	**STATAMAP: Spatialisation and Dissemination of Statistics**

Name of Contracting Organisation:	**National Statistics Office, Malta**

NATIONAL STATISTICS OFFICE • MALTA

Contents

Introduction

This project's thrust is to review the Malta National Statistics Office's capacity for GIS spatial data creation, generate the first maps and to disseminate the data through its website. The concept is to create a working model of the full datacycle (data sourcing, gathering, cleaning, analysis, conversion and dissemination). The final stage centers on the investigation of the best methods that enable dissemination of the data in interactive spatial format.

The main aim is to study, record and distribute the data gathering-structuring-spatialisation and disseminating process employing lineage recording and geo-server technologies. The study will take up the LAU2 spatial level as base level as it includes administrative areas and active communities that can use the data for their day-to-day requirements. The project will identify the main datasets, mainly from Census 2011 and other key datasets, create a transposition process, map the datasets and identify the best technology for online and media dissemination employing INSPIRE data specifications, metadata, and geoserver technologies.

The research component, entitled "STATAMAP: Spatialisation and Dissemination of Statistics: A Background Technical Report " has been carried out in order to depict an understanding of the technical issues that impinge on the creation of spatial data within a statistical organisation. The report provides the background analysis for the Geographical and local information theme (THEME: 5.05) as based on the project scope for Merging statistics and geospatial information in Member States. This was designated through Regional statistics and geographical information initiative by EUROSTAT unit: E.4 under the EUROSTAT Grant for 2012. As the Maltese National Statistics Office is responsible for the development, production and dissemination of European statistics according to Article 5 of Regulation N°223/2009 of the European Parliament and of the Council of 11/03/2009 on European Statistics, this project fits within the parameters for the investigation into the spatialisation and dissemination of statistics, which model could serve as a basis for other agencies to enhance upon.

The research component of the Malta initiative is based on an analysis of a series of prior initiatives and current activities in which the Maltese National Statistics Office was involved or is currently active in both on a national level as well as an international level. The scope for reviewing the legacy and current activities is aimed at creating an understanding of the status quo in Malta as well as creating the basis for post-project continuity.

The report reviews the base analysis of spatial data over the past decades as well as the current situational structure. This step was taken to analyse what such initiatives were, how they were driven and also to analyse barriers to such information and dissemination in terms of the spatial scenario. The data issue is also analysed to depict the current state of affairs and analyses the

steps taken to enable the spread of spatial information and how NSO could be the fulcrum for its spread.

The research then looks at its initiatives in other projects related to spatial data and how it has benefitted from or been instrumental in the national and international activities and legislative measures such as INSPIRE, SEIS and Aarhus. The current project also investigated the stakeholders' feedback/reactions to spatial data take-up.

This scope of this study was reached through the provision of expert advice on the current situation, the definition of an enhanced/new skills development process and the identification of themes for the implementation of the dissemination of a GIS-based approach to data dissemination, which is managed through internal courses at NSO and the creation of a dissemination tool for the stakeholders and the general public. The project consultants also drafted and monitored the required courses and lineages/walkthroughs for the training and the web-based solutions.

Objectives

The action was implemented in the Maltese Islands with the main work carried out at the National Statistics Office in Valletta.

The action aimed to create tool/s that enable the National Statistics Office to spatialise, standardise and in turn disseminate data in an interactive online map format. This was carried out through the implementation of various phases summarised in:

i) the identification of the datasets to be used;
ii) the tool creation and;
iii) the dissemination processing.

The action also resulted in the creation of a mindmap of the data creation status, a review the relative legislative instuments, the carrying out a data mining exercise, the creation of lineage documentation and creation of the spatial data, the review of and development of dissemination technologies and finally the enablement of processes to enable continuity through the setting up of capacity within NSO and the setting up a monitoring network.

This project aimed to create a working model of the full datacycle targeting the ultimate dissemination of data in interactive spatial format. The main objective is to identify the main datasets, mainly from Census 2011 and other key datasets employed by NSO, which wikll in turn be integrated into the GI system through a transposition process employing INSPIRE data specifications, metadata, and geoserver technologies.

The project's objectives are aimed to:

- study, record and distribute the data gathering-structuring-spatialisation and disseminating process employing lineage recording and geo-server technologies;
- develop a datacycle analysis of the current methods;
- carry out research on the initiatives already taken up;
- evaluate the current support systems available to NSO in terms of GIS information;
- identify the GI skills development courses required;
- develop course/s on the creation of GI data and its updating;
- create lineages that allow the creation of such datasets; and
- develop a web-based GI dissemination service; aimed at developing a series of step-by-step approaches to the course delivery and dissemination.

Methodology

The project is based on a socio-technic research approach. It will initially create a mindmap of the status of data creation to dissemination process. An initial desk-based study will review the available legislative and operational documentation to ascertain data management, dissemination modes and lacunae. This phase also analyses what officials and the general public percieve as the ideal data dissemination mode and how they use maps and other visual aids (Work Package (WP) 1).

The outputs cover:

i) This mindmapping exercise of the status of data creation to dissemination process covers the data management and legislative documentation on how data flows for each of the units and especially on the units that provided the data for this project. Such – to includes the data sourcing, gathering, management, dissemination and what the officers perceive as the main lacunae/problems they have.

ii) General public perception on their ideal data dissemination mode and how they use maps and other visual aids: this phase will be tackled at a later stage as part of the Perception Survey.

The next phase was set to be based on a data mining exercise that identified those datasets to be used for the interactive map applications using hi-end technologies as spatial information systems in line with the relative data specifications identified by international protocols as is INSPIRE and the relative Eurostat/JRC/EEA/DGEnv SEIS initiative. This phase will create lineage documentation on the process, create the spatial data in addition to walkthroughs and train staff to employ the process (WP2).

The training was split in two phases:

i) the first phase was set up through a training aspect based on a 3-day introduction to GIS
   a. Day 1 - intro to GIS
   b. Day 2 - first maps in GIS
   c. Day 3: strategy on how best to go about this issue: metadata, spatial data, basics and future trends

ii) the second phase was set up through a training aspect based on a 3-day introduction to GIS
   a. Day 1 - intro to GIS
   b. Day 2 - first maps in GIS
   c. Day 3: strategy on how best to go about this issue: metadata, spatial data, basics and future trends

The final phase of the project develops dissemination technologies using geoserver and standalone technologies for the public providing a service for those with access to and/or non-access to online technologies in an interactive and animated medium as well as create a training manual for NSO staff to maintain the system (WP3).

The project will also ensure continuity through the setting up of capacity within NSO in conjunction with other data creators aimed at the setting up of a network of excellence that ensures reliable data dissemination to the public (WP4).

The launching and dissemination process will facilitate the project closure inclusive of a media-train to different LAUs, educational entities and public/private agencies (WP5).

Expected Results

The project is expected to deliver an implementation-oriented document based on the datacyle lineage structure. The results will create a series of visual and analytical data aids for the general public, an interactive mapping tool allowing users to choose areas of interest. The results will create a knowledge-based guidance document highlighting the best datasets to employ in such a system through the delivery of:

a) the creation of a GIS-based system in the NSO and training;
b) an animated guidance that visually depicts statistics in a friendly-manner;
c) a series of process lineages, implementation manuals and training sessions; and
d) online geoserver and standalone tools.

The results will enable the NSO to build a spatial-based capacity and the general public to access data in a visual dimension.

Outputs

The project's output includes a survey of the officials' and public's perception of spatial information, documentation on developing GIS capacity, data identification and cornversion to spatial format, relative training, the creation of an online mapping system employing geoservers and standalone tools and an animated interactive website bringing spatial dimension to the public.

Deliverables (Work Packages)

WP1

- A mindmap of the status of data creation to dissemination process
- A desk-based study on legislative and operational documentation to ascertain data management, dissemination modes and lacunae, inclusive of INSPIRE, SEIS and other initiatives
- A survey of officials' and the general public's perception on data dissemination modes and usage of maps and other visual aids.
- Indictors: Status indicators on current usage, documentation listing and officials'/public usage of current tools and maps
- Impacts: Identification of lacunae, introduction of spatial-related legislation and technology awareness

WP2

- A data mining exercise identifying the datasets that will be used for the interactive map applications
- Introduction and implementation of a GIS system in line with the relative data specifications identified by international protocols as is INSPIRE, SEIS and other initiatives.
- Creation of the relative spatial datasets inclusive of Census and other key datasets
- Drafting of lineage documentation on the process, creation of walkthroughs
- Training of staff to ensure continuity
- Indictors: Number of datasets that can be used for this exercise, lineage documentation forms, number of gis layers created, staff numbers trained,
- Impacts: first GIS datasets created, knowledge of lineage documents drafting, staff trained in the process

WP3

- Development of dissemination technologies using geoserver and standalone technologies
- Launching and testing of prototype with feedback cycle and final version creation/uploading
- Development of a series of informative animated media (animations, walkthroughs) illustrating the visualisation of statistics
- Drafting of a training manual for NSO staff to maintain the system
- Indictors: number of maps integrated into the geoserver and in standalone formats, level of feedback on system's usage, media uptake by users, staff trained in process
- Impacts: spread of knowledge of maps interaction. Staff trained in the process

WP4

- Setting up of a network of excellence including NSO partners
- Indictors: number of organisations and experts involved the the network
- Impacts: spread of knowledge, network links creation, increased interest and drive to identify key datasets in the diverse partner entities to add their data to the system

WP5

- Launching of dissemination process and distribution of informational material
- Launching of media-train to different LAUs, educational entities and public/private agencies
- Conference
- Indictors: number of partners involved in participating, feedback from media train, usage statistics on usability
- Impacts: increased usage of statistics by the experts and by the general public

Project Maintenance and Continuity

The project implementation process was structured to ensure maintainance on diverse levels:

Logistical

The projects logistics was maintained through the establishment of the network which ensured that the outputs have a lifetime beyond the actual closure of the project. The network setup will post-project also ensure that new datasets emanating from diverse organisations will be integrated and that the range of key datasets can be widened.

Technological

The technological outputs from this project will be maintained inhouse through the rendereing of simple-to-use instruction manuals and the the lineage process. The software will be upgraded as per need to ensure compatibility with new technologies as well as ensure such through the training of inhouse personnel.

Dissemination

The NSO will ensure that the project is sustained through its structures and through the launching of a series of Memoranda of Understanding between the wider-organisational network partners and through the establishment of a media-train.

1 Legacy and GI Systems in the Maltese Islands

1.1 The status of spatial information in the Maltese Islands

Early studies in spatial patterning of crime and criminality were carried out in the pre-computing era of the early nineteenth century work by Adolphe Quetelet (1796-1874)[1] and Andre Michel Guerry (1802-1866)[2]. These two studies, together with another two unique cases detailed below, proved the power of spatial studies and visualisation whether applied correctly or used inappropriately. Though not strictly employing GIS, these studies employed systematic geographical analysis that was conducted many decades before the invention of computers.

Such was the case of Dr. John Snow in 1854[3] who identified the cause of an outbreak of cholera in Soho London. This was an exemplary case of the use of a pre-computing spatial analysis where a disease was stopped due to the correct identification of a water pump as the main conveyor for the disease. On the other hand, the first abuse of spatial analysis can be attributed to a Governor Elbridge Gerry[4] who in 1812 was accused of redistricting voting aggregations in Massachusetts with the result that the map containing the shrunken-electable concentration of people living in his opponent's support base formed the crude shape of a salamander. From this episode, the word *gerrymandering* was coined to reflect his name and the salamander shape. Interestingly, a case of criminal activity had to be one of the first cases of GI mapping, albeit
non-digital.

1.4 GIS and Social Sciences

Mapping is a successful tool that can be used for a wide range of functions including policy-making, implementation and monitoring interventions. This can be done through real-time and updated systems that allow thematic aspects to be mapped and displayed either on an intranet or on the internet. The latter, through Web-GIS

[1] http://www.mrs.umn.edu/~sungurea/introstat/history/w98/Quetelet.html
[2] http://library.tnstate.edu/MARION/ACK-5229
[3] http://www.ph.ucla.edu/epi/snow/snowmap1_1854.html
[4] http://12.164.81.10/declaration/signers/gerry.htm

functionality has enabled users to view

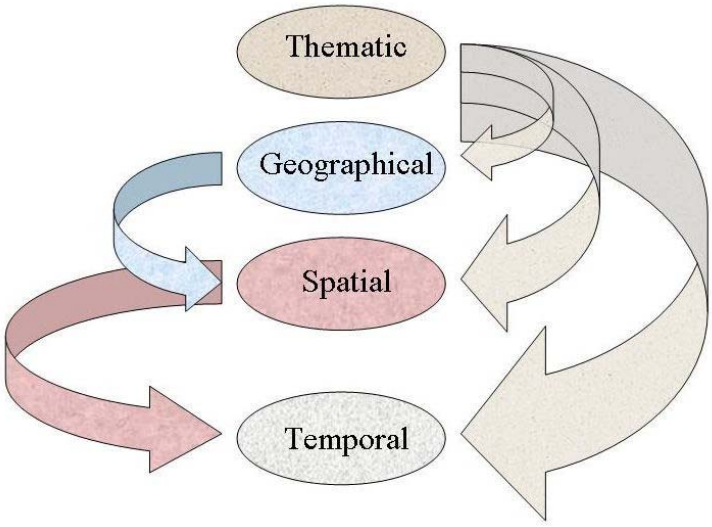
The ability of GIS to form an analysis based on a what, why, who, when, where, why not and how phenomena (W6H) outlined by CMAP has helped one specific theme and which can be transposed to other themes. GIS analysts seek to investigate each of the W6H pivots to identify patterns to reach conclusions on whether correlations exist or not. The six pivots can be investigated as follows (CMAP, 2002):

- **What** categories of activity were committed? What routines can be identified (category analysis)? What relationships are there between activities and other variables?
- **Why** did an activity occur? Why did the offender partake in the activity (commonalities of a pattern – root cause of an activity problem)?
- **Who** carried out the activity? Who witnessed the activity? Who was the victim (offender and target profiling)?
- **When** did an activity occur (temporal analysis)?
- **Where** did the activity occur? (geographic analysis – environmental analysis)
- **How** did a activity occur (deductive approach - classification and modus operandi analysis)?
- **Why not** investigate unrelated variables to elicit if some type of relationship exists (correlation between data layers)?

GIS has facilitated the use of any data using both space and time as a way of producing verifiable information on the patterning and links between the variables. As indicated in the W6H structure any data that has a link to a geocoded system can be analysed. In this way GIS has brought to the fore situations where previously non-spatial data (attributes) can now be linked to a spatial dataset and that same data would be integrated into a new GIS layer. Such a structure enables the evolution of thematic data to geographical data (locational data based on points on the earth) to a spatial construct (relationship between entities based on the earth) and across a temporal dimension. Figure 1 depicts the different types of analysis that can occur between these four constructs.

Thus GIS has helped the different disciplines due to its versatility in that theories are readily given the opportunity to be validated or refuted through the creation of previously unavailable data.

Figure 1: Analytical Constructs and Dimensions



Source: Formosa (2007)

1.5 A S.W.O.T. analysis on the USE of GIS for the mapping research exercise

Before one can decide to employ GIS as the main tool in data analysis, a SWOT (Strengths, Weaknesses, Opportunities and Threats) exercise was necessarily carried out to enable the reader to understand the issues in implementing such a mapping system that does away with the rose-tinted glasses perspective of a one-solution product. GIS has its positive and negative aspects of the technology and its service in a statistics office construct. The SWOT analysis helps to clarify these issues.

Each part of the process is analysed for its technical, policy-social-environmental and, marketing-economic functions (Table 1).

Table 1: SWOT Analysis of the use of GIS for Statistical entities

SWOT Analysis of the USE of GIS for Statistical Entities: Strengths, Weaknesses, Opportunities, and Threats	
Strengths	***Weaknesses***
Technical • Immediate availability of data to analysts • Queries are automated and pre-formulated letters sent to police chiefs/policy makers • Attribute data available on one single keyboard stroke linked to a map • Routines automate queries and instructions through cross-referencing • Use of Common Database (CDb) eliminating need for redundancy in police databases • Use of buffering analysis and zonal searches can be carried out within single-theme data layers as well as multi-theme layers. **Policy, Social and Environmental** • Faster analysis of trouble calls • Determination of the effects different data types have on different physical and socio-economics variables • Analysis results can be utilized by a number of disciplines and activities such as real estate estimation, fraud, security companies and social services suppliers • Integration of data from different sources, leading to improvement in rapid reaction delivery and projections based on trends **Marketing and Economic** • Real-time mobile input can be easily updated and defaulters acted upon • Incentives for data-related organisations to invest in new technologies • Reduction of data entry errors and overhead costs	**Technical** • Potential bias by employees in favour of older non-technological systems • Confidentiality issues • Inputting, updating and reading rights are not always adequate - wide access • Distribution of data to a large number of people: staff • Incompatibility with older datasets/systems • Prone to rare but possible data theft or sabotage particularly by "rogue officers" **Policy, Social and Environmental** • Data is viewed as being the domain of the organisations rather than social scientists/general public in general – data is kept at a distance through a series of barriers to access the data • Limited support from management and non-technological-oriented chiefs • Lack of understanding by policy makers of the process to mine and analyse data for analysis • Lack of skills in information technology and information systems by social science students and practitioners **Marketing and Economic** • Policy makers take time to realize the utility of GIS • High initial cost of hardware and software plus cost of training, cost of managing the GI system, costs of updating the data and costs of answering queries and

for field-based and office work	requests for information • There is no 'monetary' profit in these activities and hence refusal to see profit against reduction in staff time to analyse data

SWOT Analysis of the USE of GIS for Statistical Entities: Strengths, Weaknesses, Opportunities, and Threats	
Opportunities	***Threats***
Technical • Link to international datasets such as EuroStat, EEA • National and International quick analytical function • Need for the setting up of systems compatible with the mapping agency's GIS allowing future exchange of data	**Technical** • Inputted data is not updated regularly • Changes in categorizations can lead to incomparable results • New hardware can make whole systems obsolete • Project stoppage midway through completion
Policy, Social and Environmental • Identification of specific areas of analysis at the diverse LAU/NUTS levels • Provide progressive training in the analytical approach • Work towards inter-agency data sharing • Identification of potential needs by other agencies/individuals for interoperable approaches to data structuring	**Policy, Social and Environmental** • Political and economic uncertainty impede investment • Poor timing of decision making • Assumptions can be "mistaken" leading to wrong and costly decisions
Marketing and Economic • More GI-aware statisticians allowing more efficient and effective analysis and visualisation outputs • Wide availability of data to other entities • Spin-offs of the attribute section of data • Allows time-scheduling - third parties are better served	**Marketing and Economic** • Data sold/bought at exorbitant prices by other agencies impede mapping of systems. Prices requested do not reflect reality (includes social data) • Real-time analysis needs real-time updated 3rd-party data exchanges that reflect the ground-truth such as new development, new transport

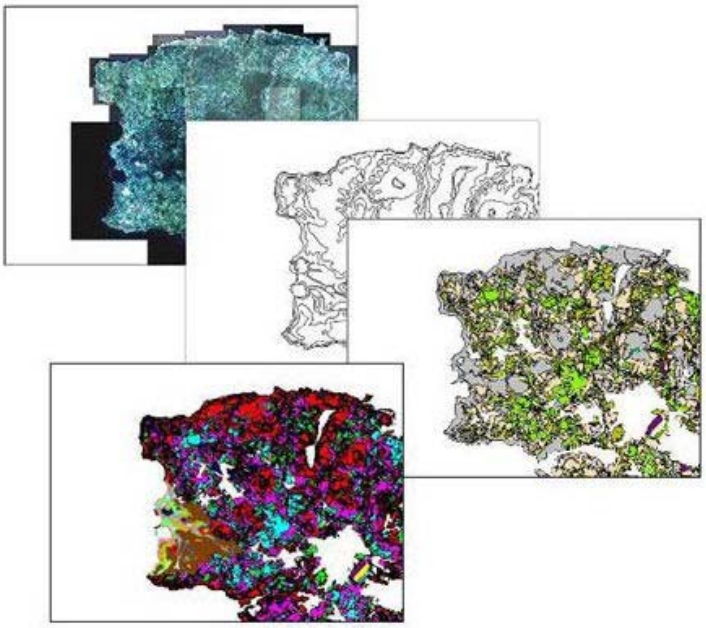
	routes

This analysis shows that there is no sure-fire way to develop a foolproof GIS mapping system. As with other processes it strives on as well as suffers from the functional, analytical, administrative and human-related issues as experienced by other software-applications. However, as listed in the Strengths and Opportunities, the pros far outweigh the cons, thus enriching the whole spectrum of crime-related functionality.

Spatial analysis and its impact on social research

Spatial analysis takes up different forms, from physical pin charting to use of textual documentation to use of tabular data and eventually to the use of statistical tools. Social-scientific research to date has depended on textual and tabular data that is rarely analysed in a spatio-temporal setting. The use of spatial and temporal analysis of data has enabled analysts to combine different resources stored in various formats into a coherent system. With GIS technology, analyses that were not possible in the traditional sense can be identified due to 'its ability to compare multiple geographic factors and investigate geographic correlations' and identify the root cause of a problem (Bruce, 2002: 25). It also has the ability to unravel a complex issue that may be too difficult to investigate using conventional or paper-based methods. GIS aids researchers to generate new knowledge through the use of cross-data analysis such as land zoning and offence location through the concept of layering (connected by a common frame of reference system known as x/y coordinates) (Figure 2).

Figure 2: Layering Concept



Source: MEPA, 2012 - layers depict from bottom to top: aerial imagery, geology, agriculture and habitats

Problems with very large datasets can be overcome through the concept of multiple layering and distributed access to data. The layering issue brings together multi-source data such as, for example, the visual analysis of poverty concentrations based on an analysis of economic data such as income and dilapidated dwellings, burglary and street lighting, drugs partaking and bars, thefts and egg-roll carts drug-cover schemes (Woodby, 2003). Better still, this analysis can be carried out in a time-series process to create a spatio-temporal output, effectively identifying trends and helps in recommending policy change.

Need for information systems: where was the need for GIS highlighted

Way back from the 19th Century of Quetelet, the need for information systems that cater for specific areas of study has long been felt, particularly in the attempts to identify patterns through the use of wall maps and coloured pins. Even before the advent of computing, researchers identified that the main point of contention with this methodology was that few persons could effectively identify trends based on variables such as crime type, time and relationship to other crime locations. The technology was very basic and limited and progressively needed other methods such as flash card, catalogues, calculators, spreadsheets or databases to cater for the research demands. This brought about a need to develop digital spatial information systems, better known as GIS.

- Integration of GIS and statistical tools

Major improvements in the analysis area have occurred during the last few years and tools have been developed that carry out statistical research in a spatial construct. These software include such examples as CrimeStat[5] (Levine, 2002). These software, together

[5] '*CrimeStat*® is a spatial statistics program for the analysis of crime incident locations, developed by Ned Levine & Associates under grants from the National Institute of Justice (grants 1997-IJ-CX-0040 and 1999-IJ-CX-0044). CrimeStat allows the analysis of standard deviation maps, attribute analysis, journey to crime, hotspot analysis and a series of spatial statistical measures – http://www.icpsr.umich.edu/NACJD/crimestat.html

with other specialised tools such as SPSS and SAS help users to create new information that aids in the verification or refutation of hypotheses.

In addition, specialised tools have been developed by major software companies providing evidence that the commercial sector has seen ways to profit from the advances in the technologies. Tools in the private and public domain include ESRI products, MapInfo, MapWindow, Vertical Mapper, and related products.

In their study on Sheffield, building up on the earlier 1990s studies by Bottoms and Wiles, Craglia *et al* (2000) used SAGE[6] and STAC[7] programmes. They used the software for the analysis of socio-demographic data, building up on the earlier practice of analysis using spreadsheets and databases together with street-level data (Rich, 1995).

- Interpretation measures

Although primarily GIS was developed as a physical discipline analysis tool it is being used as an analysis tool in the social science arenas. Helms (2002, 8-9) identified that analysis cannot happen without a wide-ranging overview of the components of an activity: space, time, behaviour, target and offender. Each of these contributes to both a physical as well as a sociological/psychological construct. Whilst each can to a certain extent be analysed through GIS, it is imperative that researchers delve deep into the relationships between all these to dissect the issue at hand.

[6] SAGE (Spatial Analysis in a Geographical Environment) was produced under ESRC research grant R000234471 'Developing spatial statistical software for the analysis of area-based health data linked to a GIS' (Craglia *et al*, 2000) - ftp://ftp.shef.ac.uk/pub/uni/academic/D-H/g/sage/sagehtm/sage.htm

[7] STAC – Space and Temporal Analysis of Crime software was developed by the Illinois Criminal Justice Information Authority (ICJIA). A users manual is available: Users Manual and Technical Manual, (1996), Chicago, IL: ICJIA

Summary

Locational analysis underwent a rapid evolution through the introduction of GIS technology and the spatio-temporal techniques it launched due to its versatility in handling large-volume and diverse datasets spread across multi-disciplinary areas.

The use of specific statistical tools integrated within GIS or as an add-on module has indicated that crime-analysis can go beyond mere mapping of hotspots towards an in-depth analysis of the spatial and temporal aspects of crime. This can be carried out through an understanding of the spatial components of an area, the landuse parameters the data operates in, the social issues involved and finally understanding how the crime aspect can be interpreted against each of these, either through cross-sectional or longitudinal studies.

Finally, GIS has enabled dissemination of data to a wider audience, through web-enabled crime- mapping, even though this technology is still in its infancy.

This chapter outlined the development of GIS and crime-mapping and how it can be used to gather data, analyse and deliver results leading to an understanding of crime issues. The next chapter explores the scene within which the crime and GIS research will operate; that of the Maltese Islands.

1.2 Building blocks for GI and Spatio-Temporal Data Dearths in the Socio-technic environment

In a rapidly developing world where the introduction of massive online information systems has enabled both the scientist and the general public to interact with remotely-located data from across the globe, the reality of access to data and eventually to information is slowly bringing forth the realisation that decades-old barriers to access to data still need to be overcome. Whilst the massive volumes of data at hand can easily lead one to acquire a perception that there is everything one could require at the touch of a button, reality speaks with another voice; the data is there, the issue of reliability and free access speaks otherwise.

The fundamentals of research lie in the availability of reliable data, a phenomenon that has left disciplines struggling with issues of repeatability of scientific outcomes. Whilst technology and legislative measures have caught up with the realities facing researchers, access to that data through interactive interfaces is still limited.

Data availability suffers from a plethora of scourges that have left entire countries with a dearth of reliable baseline information, particularly small states which have limited human capacity to manage the whole datacycle in the physical, social and environmental domains. Whilst the main limitations include the fact that there are few homogeneous structures in operation, other limitations included a governance situation where data is not made available or is charged at unsustainable rates. The latter has been tackled through the Aarhus Convention and the Freedom of Information Act, whilst others require initiatives that generate tools which gather, analyse and disseminate the data for free, an exercise sought in the European Regional Development Fund described herein.

Other more technical issues include the fact that there are too many standards to follow, data is not dynamic (gathered ad hoc as a one-off and not real-time), data is not quality assured/controlled, queries are not organised and recorded, data is not secured – ('illegal' use of storage on personal storage devices and other digital media) and that versioning is not practiced.

In addition, even where the data is available, there is an upsurge in requests for access to such data which has increased drastically since Tim Berners-Lee's (1989) world wide web (WWW) proposal changed society as never before. The WWW changed a medium that was at best techno-centric to one that is now essentially socio-technic. Increasing requirements for bandwidth has resulted in a need for a reanalysis of Dahrendorff's (1990) access issue in contemporary worlds, both real and virtual, where not all society has access to the information through on-line services. This lack of access is leading to a situation where a new type of poverty is being created: that related to information drought, with users lacking internet-access losing out on progress in the various socio-economic themes. This is already being seen in the North-South divide across European countries in terms of access to the medium that transports this data, where internet access disparities range from 33% in Greece to 88% in Iceland (NSO, 2009).

The other most important issue relates to access to standardised processes for information-creation which though not targeted exclusively for one domain, is being tackled from various legislative loci such as the Data Protection Act (OJ, 1995), the Århus Convention (OJ, 2003a;

OJ 2003b), the Freedom of Information Act (OJ, 2003c) and the INSPIRE Directive (OJ, 2007), as well as other guidance documents that are targeted to enable the smooth and free flow of effective information.

1.3 The Information Dilemma - Tower of Babel or Valhalla?

Research methodology is currently facing a period unprecedented in history, where a data-rich but information poor scenario is the norm but which situation risks resulting into a Tower of Babel re-enactment.

The issue of access to data is spread across diverse realities covering the real world – real world data, real-virtual and virtual-virtual. Dahrendorff's (1990) argument that information has become a social issue where users are confronted with various barriers to access that data becomes a reality when power is viewed from an access point of view. The method of accessing data in analogue format in order to analyse exclusively in analogue format is not a throwback to decades past but a shocking reality in various fields of study, mainly the social sciences and the arts. Though many tools are available in proprietary and open-source formats, they may not be enough to bring the schools into the modern era where researchers use high-end technology; such needs a cultural and generational change. This is the trumpet call for a veritable plethora of potentially society-changing themes as data needs to be depicted as a real-time scenario, not something that can be gathered ad hoc.

The second case where researchers do take up the digital data option and convert analogue data into digital form for analysis is growing, however the fear of data itself is not a reality that one can ignore, particularly where that analysis requires comparison with data from a virtual reality and where the data being reviewed sits in a distributed database. The latter could be located somewhere in another country where the source is not clearly defined, due to the lack of knowledge and availability of metadata.

The third concept is one where all data sources are virtual and users may not have access to such dissemination services and thus experience a new form of poverty called the digital divide. This is a reality that proponents of fully-digital systems can rarely afford to ignore and need to cater for through easily understandable tools such online databases and visual mapservers with help files. The spate of technologies that have been created over the past decade has been mind-numbing to the effect that users are lost for choice: the first webmap technologies which included the early XEROX PARC Map Viewer (Note 1) (launched June 1993) were primitive but today's access to real-time data download and access to information

will leave all those who have yet to make the jump on the wayside. Thus it is important that all users are accounted for and that technology is unobtrusive enough to ensure that those not adept to the virtual worlds do not feel alien to their own thematic domain as it develops in another reality.

1.4 Identifying the ills of data access and inaccessibility

The state of affairs in information management and dissemination is peppered with both success stories and uphill struggles. Users plodding through the data-information-knowledge-action process experience various barriers to access to data, high costs, archaic mapping, baurocratic procedures and aged data the currency of which is unusable in a rapidly changing world. Various initiatives have enabled users to partake to the process with the onus placed on the national agencies. Such initiatives such as the Aarhus Convention, the INSPIRE Directive and the Shared Environmental Information System initiative have laid the proverbial carpet to ensure that the process is eased. Though the legislative aspects have been instrumental in enabling the academic and scientific field to be aware of the availability of data for further analysis, the general public lagged in the understanding of the use to which such data could be employed at governance and locality levels.

The Malta case study sought to analyse the situation on the ground as at 2006 most datasets were disparate, basemaps were dated as at 1988, environmental data capture was ad hoc and the dissemination, a mapserver was available with a date tag of 2000 and data were available to the public on a request basis.

The idea to bring all the aspects of baseline information, a comprehensive nation-wide digital terrain and bathymetric model, environmental and spatial data into an interactive medium was brought to the fore with the eventual application for ERDF funding. This was aimed at the eventual dissemination of all information for free through an INSPIRE compliant online tool. This sequence of events brought to the fore the need for a speedy approach to implement the changes to ensure compliance with the legislative requirements.

2. Creating a Methodological Case for Techno-Centric and Socio-Technic approaches

Data analysis in the diverse domains has traversed a path that evolved from a scenario employing purely techno-centric approaches based on the concentration of technology as the fulcrum for research to one that is gathering pace towards the implementation of such technologies as a tool for the social sciences (socio-technic).

The socio-technic approach took off due to the initiation of the analysis process outlined by CMAP (2002) in their criminological process which was based on the concept of creating information based on the analysis of social interactivity (the what, why, who, when, where, why not and how phenomena (W6H)). Such data phenomena has helped users to build a real or virtual structure that pushes the data remit away from the pure technology to one where focus is on what actually constitutes the data remit. The assumption was that once data became available, the technologies would follow suit.

Analysts seek to investigate each of the W6H pivots to identify patterns to reach conclusions whether correlations between the thematic variables exist or not (CMAP, 2002).

The steps Malta took to initiate the process to ensure that W6H base data is made available to all comprised the setting-up of a series of data-management processes that ensured that data can be verified and used across the thematic domains. This data collection process was carried out over a period of twenty-five years from 1985 to 2010 and included such agencies as the National Mapping Agency, the Planning Authority, the Local Councils, the Land Registry, Transport Authority, Resources Authority, National Statistics Office, the Common Database Agencies and the utilities (water, electricity, infrastructure-roads, cable TV, telecoms and posts). This phase was followed by a series of application-based processes that enables information to take a new road towards data dissemination and dataflows. These processes include the implementation of development planning at strategic and local levels, the issue of dataflows to the EU which gave an impetus to the implementation of this phase such as the implementation of the Environmental Acquis, the creation of mapservers, the establishment of an Environmental Impact Assessment regime, the implementation of legislation based on access to data and datacycle management (data design, gathering, inputting, cleaning, analysis and output). This was carried out in conjunction with membership in such activities as ESPON, GMES, GEOSS, EIONET, CLC, amongst others.

The main factors that were taken up to ensure that the social and geographical domains were given space for integration are depicted in the following series of steps:

2.1 Data input and verification

This initial step looked at the availability of data and the requirement for data acquisition issues and included the implementation of a package of different technologies such as scanning, digitisation, manual data capture and use of manual and automated tools to capture such data from remotely sensed imagery. Such data acquisition also required users to verify sources, remove errors, and carry out essential quality control exercises.

2.2 Data storage and database management

Essentially concerned with hardware constraints and the need for more storage space, this step saw users going beyond the physical issues and identified methods to store data in reliable and easily accessible formats. This major process involves the building up of such entities as are datasets where users can access data in a variety of forms and designs. However, care needs to be taken to ensure that the correct structures are used, with the implementation of protocols such as the INSPIRE implementation rules. The main advantage of such databases is the ability to access attributes within different databases situated in remote sites, facilitating the access to data across networks such as national and global internet, through so-called distributed databases.

2.3 Data analysis and modelling

Data models helped to create a system of information processes such as layering, cross-dataset linkages and integration of internal and external datasets. Analysis took the form of querying functions through languages supporting the data. Structured Query Language (SQL) is a useful tool, though even more rudimentary tools such as functions within Excel and other base software can help achieve good results. Other software such as Statistical Package for the Social Sciences (SPSS) helped in the analysis of socio-economic data, though SQL and spatial options within SQL help environmental scientists to carrying out multi-dimensional analysis: such as in the case of spatio-temporal analysis of habitat change and the effect of human activities on these habitats. Modelling is important at this stage as it aids the researcher to build up a functional model that could also be dynamic and deliver automated analysis for eventual report development. Interestingly, whilst various models exist for environmental monitoring such as the SIMO (Briguglio & Portelli, 2002) initiative and the EEA environmental models, there are few socio-spatial models that are being considered except for those related to the impacts of climate change on the coastal areas. Such models require further study for their impact on displacement, social

upheaval and unrest, something evidenced in the aftermath of hurricane Katrina in 2005 and the 2004 Indonesian Tsunami as examples.

2.4 Data display and outputs

The final aspect of the data process concerns the issue of data display and output. This can take a variety of forms: histograms, tables, maps and interactive maps. On the dissemination side there are a variety of technologies that help users to publish their research results, ranging from on-line html reports to dynamic web-mapping services to fully-fledged GIS mapservers. In Malta this has evolved to the dissemination of data through dedicated sites such as CrimeMalta (2012) that distribute crime data in spatial format for various variables. This initiative is being developed to disseminate social data from the Census (NSO, 2012) and a full SEIS-compliant system that will enable all environmental data to be disseminated for free.

3. Resultant Steps: The International Imposition: A Trauma or Heaven-Sent?

The resultant data structures emanating from the above mentioned process called for the setting up of various data management functions which were based on a three-pronged approach: the data-function, the GI-function, and the research function. The data function included the setting up of a series of data and information processes that sought to lay the foundation for dissemination protocols inclusive of data protection, which were followed by the integration of standards for data management. This process included the integration of the physical sciences data together with the socio-related data thereby ensuring data interactivity and synergies through the integration of both tabular and spatial processes. In turn, the functionality could integrate such processes as the Geographical Information (GI) function which took the data to a new level, mainly that employing visualisation methodology. This data resulted in the setting up of a series of information systems that allowed for spatial and geo statistical analysis through an integrative function targeted at ensuring scientific analytical functionality and reporting streamlining. It was only when Malta became an EU member state in 2004 and more specifically a member of the European Environment Agency (EEA) that the structures began to take form. Thus, the impetus to create such structures resulted from the need to submit data to the EEA and the EU which data required the necessity to conform to international standards on such issues as metadata, common protocols, common projections and calibration methodologies. Something, that unfortunately is not yet fully structured for social data but has served as the launching pad for the same disciplines.

The process was enabled through a number of organizational setups and legislative tools that helped initiate the process to deliver data at the national level and also at the international level. In effect this was due to the collaboration with the EEA, EUROSTAT, Joint Research Centre and the various EU Directorates General as well as being signatory to a number of UN Conventions. Legislative tools such as the Data Protection Act, the Freedom of Information Act, the Aarhus Convention, and the INSPIRE Directive were essential for the resultant preparedness. Whilst the first three have had a major impact on how one can access information through formal procedures and thus have a heavier socio-technic outcome, the INSPIRE Directive took up a more techno-centric role, directing the countries to implement a series of protocols to ensure that data is created in a homogenous manner that allows for analysis across the different states. Such protocols called implementation rules have resulted in the setting up of a smoother process to disseminate data in both visual and tabular formats. Data can now be created following a structure enabling analysis across the different disciplines. This said, INSPIRE caters for spatial data but being a small country, Malta has taken up the initiative to use the metadata forms both for spatial and non-spatial data, thus ensuring that for the first time social, economic and other non physical data can be structured through the same process as the spatial one. The relatively low expert capacity has led these few experts to effectively create the metadata reports for both spatial and non-spatial without

major requirements for organisational and business restructuring. Dissemination has also been helped through the implementation of the Aarhus Convention which ensures the free dissemination of data related to the environment to users, which in effect has broken the data hoarding and access-limitation that had been imposed on an ad hoc basis by the respective agencies (Note 3).

The following section describes the input that the different international process had on the access to data and creation of the tools in the Maltese Islands serving as the building blocks for spatial analysis.

3.1 The conveyor: EIONET

The European Environment Agency's EIONET (expert network) has managed to bring together experts in the different countries (EU member states and other neighbouring countries) through the setting up of National Focal Points, European Topic Centres, National Reference Centres, and Main Component Elements. The EIONET resulted in the setting up of an excellence network that discussed datacycles and dataflows which eventually laid the ground for quicker take-up of the main Aarhus Directives and the implementation of the INSPIRE Directive, apart from ensuring that all data is sent on a yearly basis to the CDR (Common Data Repository) which served and still serves as the repository for all countries, but which benefitted the small states such as Malta and Cyprus in that there was no need to replicate the CDR on a local CIRCA (Note 4) server and thus compliance for such state was quicker than for those who decided to install their own networks, hardware and software systems as well as dataflow methodologies.

The main impact that the EEA had on the Maltese dataflow process was through the identification and reporting of data for priority data flows on an annual basis. The process enabled the experts to ensure that data hoarding is no longer the case, that data is sourced and gaps identified, that formats are identified and that information is updated and validated, something that was not necessarily the case due to the lack of protocols on calibration and validation. Finally the EEA required the data to be consolidated and eventually submitted respecting target dates and deadlines, the latter especially imposing a regime that ensures data dissemination to the EEA and through its website to the general public.

The main impetus in this international process was the setting up of an expert network that enabled data to flow to a common source for easy download by users as well as ensuring a timely delivery of the relevant datasets. This resulted in the setting up of a network of geographical and social scientists who had access to knowledge streams.

3.2 The instrument: Århus Convention

Malta is party to the Århus Convention with its requirements for Access to information, Access to justice and Public participation. The Convention's Article 4 covers Access to Environmental Information which relates to how public authorities must make information available in the form requested unless such requests are unreasonable or where the information already exists in another form. The Convention also mentions specific deadlines for submission of such information emphasizing that data must be submitted by one month and two if such data request comprises a complex issue.

What is very interesting in the requirements of the Århus Convention is the fact that it outlines the cases where refusal is recommended, striving to limit the cases of refusal which should be only entertained if the requested information not held, it is manifestly unreasonable or too general and that it concerns material that has yet to be finalised and also that relating to internal communications.

In terms of collection and dissemination of information, the Convention (Article 5) states that public authorities need to create and update environmental information relevant to their function as well as establish systems that ensure the smooth flow of information about existing and proposed activities and also to inform the public in case of imminent threats.

Finally, the main impact that the Convention had on Maltese data processes concerned the requirement to ensure that each country needs to make its information accessible through free cataloguing and dissemination services in a transparent manner employing electronic databases.

The main impetus emanating from the Århus Convention was the setting up of a requirement for free data which could be disseminated using the EIONET CDR conveyor. The second component was thus established for the spatial and non-spatial domains.

3.3 The techno-centic protocol: INSPIRE

The need was subsequently felt for a technical instrument that would enable GIS users to create their data in a standardized structure for cross-thematic analysis. The INSPIRE Directive is the most robust Directive that has enabled data processing to be taken to a higher level as it encompasses the networks of the EIONET and the dissemination issues of the Århus Convention with the added functionality of creating a technical base for the data ensuring that it conforms to standardization and that any spatial data can be compared across the different themes.

The main tenets of the INSPIRE Directive include the requirement for member states' public authorities to provide datasets and services that can be used for policy making, reporting and eventual monitoring. Though requiring only public bodies to comply, in actual fact this will result

in a ripple effect since most private entities engage in work with the public sector and any creation, analysis and subsequent transfer of data needs to comply with the public authorities' structures, thus in effect ensuring that all sectors comply with the legislation.

In terms of access, datasets need to be made accessible through readily-accessible interfaces that would be capable of being discovered, viewed, and downloaded. Another requirement is related to the need to create metadata (data about data which allows users to acquire knowledge of which datasets exist and what they hold prior to acquiring such datasets). Malta is highly advanced in the implementation of the metadata process through its employments of a two-pronged approach based on an Excel-based input tools and the use of the JRC online editor that creates an xml-based tool and is available also non social research.

The main impetus of INSPIRE is set at removing obstacles to access as well as making data that is currently used by only a few GI specialists, available to the general public. In fact, this process was hastened with such developments as Google Map and the related services that have pushed such data in the hands of the public even to the extent that it is transmitted in real-time should a researcher own a dedicated GPS handheld or even a smartphone, an exercise easily handled by traffic wardens, field surveyors, security agents and other enforcement officers.

3.4 The disseminator: SEIS

The set up of a high-level EU group entitled G4 as composed by the EEA, JRC, DG-Env and EUROSTAT, took over the initiative to consolidate the diverse information-related activities in order to enable the setting-up of a common information system. This was called the Shared Environment Information System (SEIS). Though not legislation, such a process enabled the groups to bring together the various datacycle initiatives and tools in order to propose the best way forward for the reduction of redundancy and multiple-reporting, employing the gather-once/use-many dictum.

The G4 calls for the need for certified standards, the need for data-exchange, the need for an expertise audit of data, the take-up of the Århus EU-wide access standards and the integration of the INSPIRE as the integrative tool for SEIS implementation.

The SEIS initiative led to an integrated framework that has been expanded to the wider geographical, environmental, physical, social and economic data enabling a reliable base for data analysis across the different thematic disciplines. The Malta SEIS initiative took off as a prototype for the development of an integrated system that spans the physical and social domains.

3.5 The socio-technic tool: ERDF for spatial and social sciences

Whilst Malta has experienced various access hiccups and limitations to data creation and access to data, the above four international activities have enabled it to set-up legislative and implementation procedures that ensure that data is reliable, consistently produced, validated and disseminated.

The resultant step was to integrate the requirements of the international activities and prepare a physical structure for data collection, input, storage, analysis and dissemination. Such was created through an ERDF project entitled "Developing National Environmental Monitoring Infrastructure and Capacity", which initiative complies with the requirements of EEA dataflows due to its remit to establish monitoring networks in line with EIONET requirements. This process ensures the free data dissemination to the public inclusive of spatial, environmental and physical data through Åarhus requirements, builds its structures through the Implementation Rules of the INSPIRE Directive and creates its own shared information system. The initiative was based on the concept that the thematic disciplines would have available a comprehensive infrastructure that enables NGOs, academia and the general public to download/upload thematic data and carry out cross-thematic analysis without the need to create their own systems.

4. Malta Case Study Discussion: The CRISOLA Outcomes and a tool to integrate Thematic, Social and Physical Themes

The setting up of the procedural structures enabled the author to investigate the potential for the creation of a SEIS based on a criminological construct relative to environmental criminology theory also known as urban ecology. As a case study to investigate the integration of data from the various themes into one integrated system, the CRISOLA (crime, social, landuse) model (Formosa, 2007) was implemented based on the SEIS design. The model reviews the different urban, social and crime data and integrates them into a spatial structure which delivered some interesting cross-thematic results. It integrates both spatial and temporal crime, whilst linking social and environmental statistics to such information layers, inclusive of development and urban use, and zoning activities, which context enables researchers to visualise a social construct such as crime in the space it occurred in.

4.1 The initial maps and dissemination tools: The case for Maltese cross-thematic structures

The CRISOLA output was based on a ten-year process that saw various activities aimed at the setting up of baseline data for social analysis which process led to the creation of various web-maps that serve as the eventual structures identified in the processes identified in the international requirements for data creation and dissemination.

The results included the creation of various datasets and maps required for each of the pivots of the model with the physical landuse maps being the first created, followed by the social maps and finally the crime-related maps. Figures 3 to 5 depict base maps created for each theme respectively: landuse map (figure 3), social (unemployment) map (figure 4) and reported crime (figure 5).

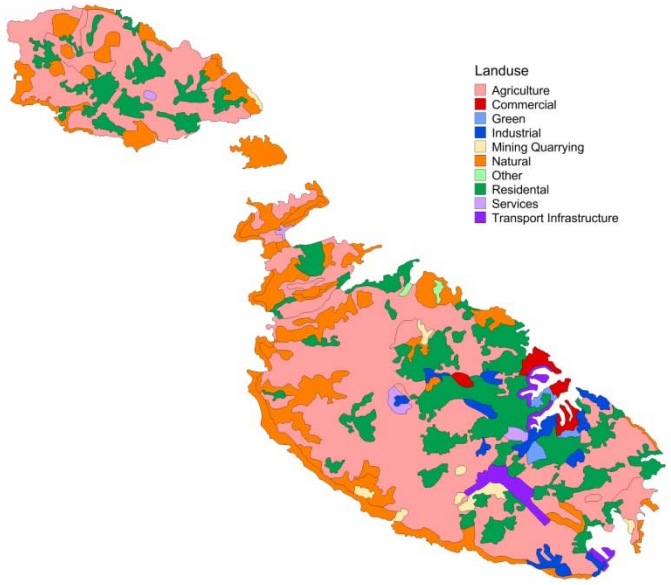


Figure 3. Landuse Map

Figure depicts the landuse categories in polygon format

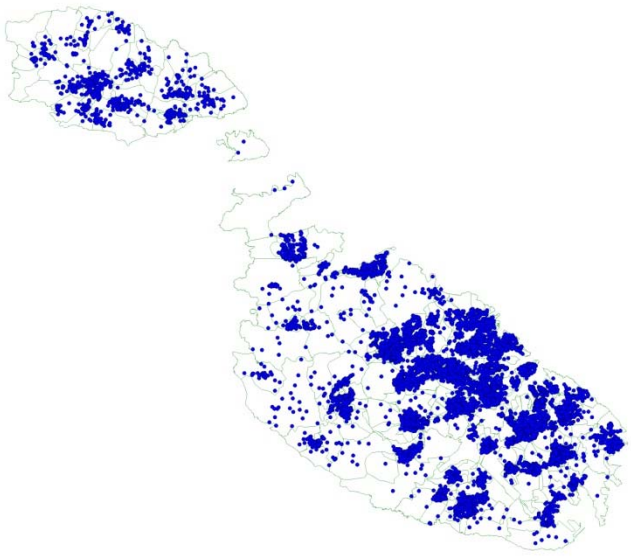


Figure 4. Unemployment Map

The figure depicts the incidence of unemployed persons at street level in point format

Figure 5. Crime Map

The figure depicts reported offences in point format

The resultant cross-thematic spatial analysis rendered correlations between poverty areas and dilapidated zones, poverty and offender residence zones (figure 6), retail and offence hotspots (figure 7), and other geostatistical outputs.

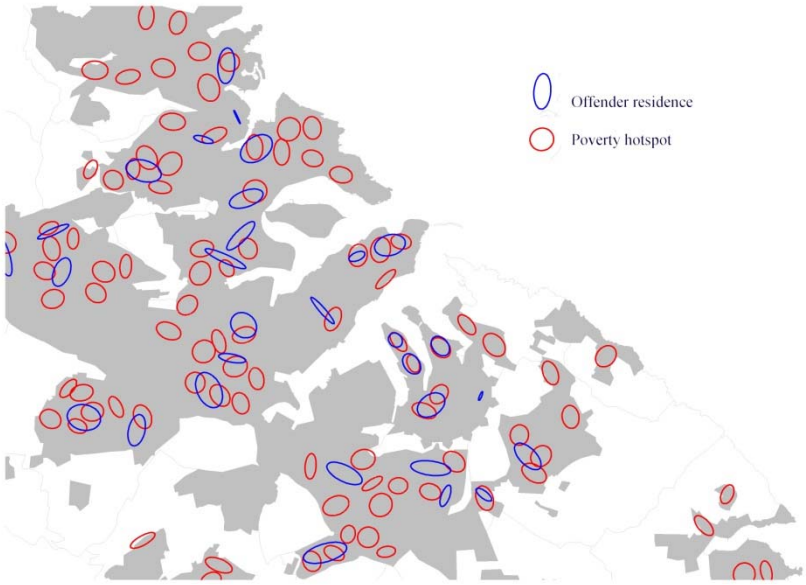


Figure 6. Poverty and Offender residence overlay

The figure depicts the correlated themes as standard deviational ellipsoids (SDE)

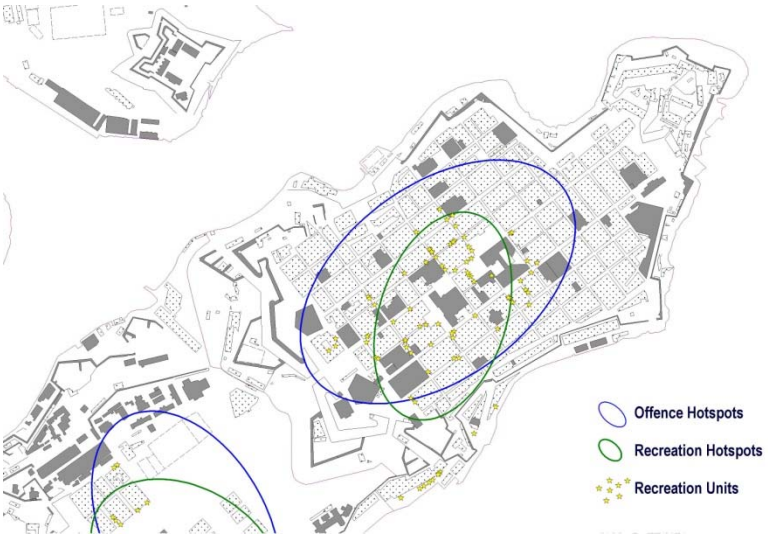


Figure 7. Crime Map

The figure depicts the offence and retail hotspots as standard deviational ellipsoids (SDE) overlaid on the point retail locations

The integetration of the three CRISOLA themes enabled the creation of other maps through an interactive online map (Figure 8) that employed the use of flash technology (precursor to a full SEIS), which enables users to view the Malta map at enumeration area levels (small spatial units comprising 150 households as based on Malta Census designations). Other tools experimented upon as conveyors for dissemination include a geoserver structure that is being reviewed for its client-based interactivity (Note 5).

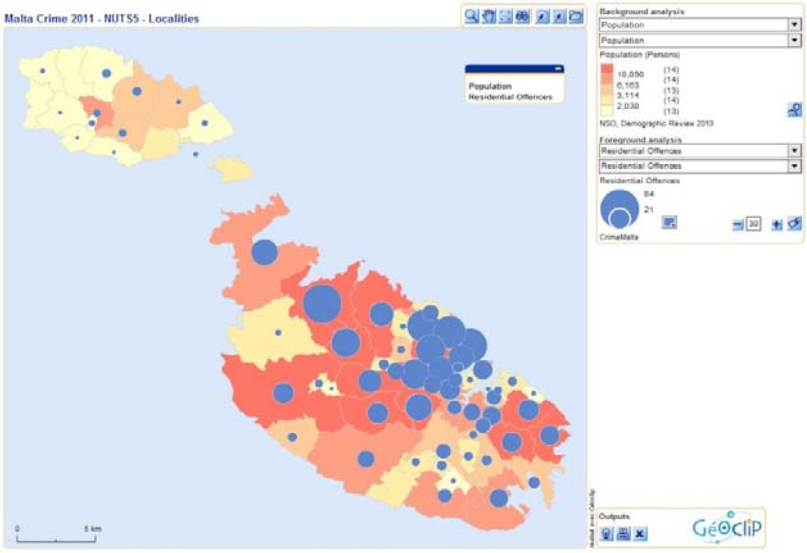


Figure 8. Interactive Crimemap

The figure depicts an online interactive mapping tool, available at www.crimemalta.com

4.2 The Next Steps for Data and Webmap Access in the Maltese Islands: Employing SEIS

The usefulness of the cross-thematic approach has been successful due to the adherence to and implementation of the various data creation protocols. The next phase is aimed at webmapping and dissemination and is currently being developed as part of the ERDF project which entails the integration of physical, social and environmental data within a comprehensive Shared Environmental Information System structure.

In summary, the next phases will be based on the outcomes of the process employed in this study in order to encompass a number of operational and implementation changes that will lead to the dissemination of and access to a very wide range of information. These changes may require further legislation updates through the reviewing of current legislation and the publishing of new legislative outcomes. Data Management and dissemination have taken the path of no-return; the legislative and technological advancements have ensured that access to data takes pole-position in the research process, where data reliability is ensured through a system of verifiable processes. Such will be enhanced through updates to GI layers, the creation of a full metadata list and the installation of triggering alerting systems that inform researchers when specific information points to an increase or displacement of an activity, irrespective of domain; physical or social.

5 State of Affairs: a 20-Year Approach

5.1 State of Play: the Spatial Irony

Malta has a strong GIS background with developments in the field dating back since the colonial period (pre-1964) with various progressive steps being taken that culminated in the most recent drive to digitize the legacy and to be prepared for the rapid changes that were brought about due to the improvements in visualization and rapid data transfer [6].

A brief overview of the history of geographic information systems (GIS) reveals a rapid (post-1985) pace of development in this arena. Figure 9 below depicts that the two main phases of the process were based on i) the Digital Mapping/ data collection phase and ii) the GI application phase pertaining to Phase i).

Whilst the process entailed the setting up of a national mapping agency in 1988 with a remit to digitize the basemap, the transition to a fully digital secenario required the implementation of GIS between 1994 and 1998, which was brought to the fore for public consumption in 2000 through the launching of a mapserver [7].

Whilst the first phase concentrated on the national implementation of hardware/software installations as infrastructural activities across the different social and physical agencies, phase two took on a legalistic and strategic trust aimed at ensuring that the diverse initiatives were pushed by the international scene. The latter called for integration, which is where the cracks started to appear in terms of dissemination of spatial data in the wider for a. The first pitfall referred to the lack of a appropriately projected base datasets which would allow integration to international cross-border datasets.

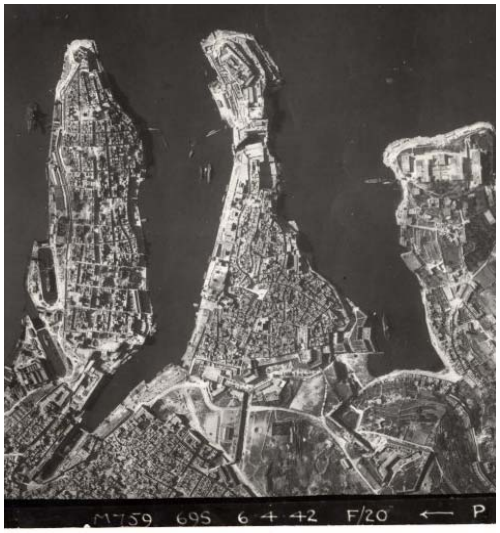


Figure 9a: 1942 Aerial Photo

Figure 9b: 2004 Aerial Photo

Figure 9c: 1:1000 Basemap (1998)

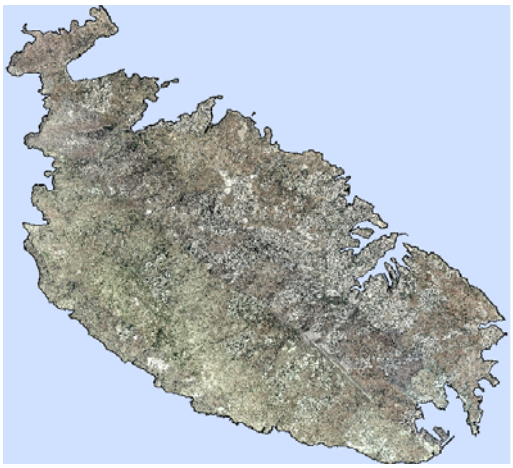


Figure 9d: 1:50,000 Basemap (2004)

Due to severe hardware restrictions and high storage costs, a decision was taken to truncate all the spatial data (Malta falls within 1 zone on the UTM projection). Such was done in order to save money on harddisk space, a decision that was aimed to ease the rolling-out costs but which is currently hindering all the EU/EEA data reporting to the various agencies, since any such data need to be reconverted to the original full UTM. This space and cost-saving measure is now estimated to incur EUR100,000s since the whole country's organisations have to reconvert all their data to fit within the international projection and which is causing severe restrictions on data convergence.

This process was further hindered by Malta reporting requirements to the EU which dealt several shocks to the system. Late deliveries due to reporting mishaps, missing or non calibrated data, spatial elements not supported by metadata and other hiccups resulted in negative outcomes for Malta's position in the EEA league [8]. However, the process had its bright moments with the creation of several high level outputs in conjunction with other agencies such as the Austrian Umwelbundesampt (UBA)[8]. Such datasets included the Corine Landcover 1990-2000-2006 and the relative change analysis, elevation maps, environmental protection maps (EEA CDDA, Natura 2000, SAC) [9], terrestrial and marine habitats as well as a Posidonia baseline survey and, in 2011, the Land use/cover area frame survey (LUCAS) field survey [10].

5.2 The planning aspect and GIS integration –NMA's output within planning

GI came into fruition first within MEPA's predecessor, the PA (Planning Authority – an autonomous organisation), through the integration of the National Mapping Agency as part of its function, later called the Mapping Unit. Its main activities were based on the creation of a basemap, its introduction of GI services as well as the widening of knowledge within its staff, through the creation of land-use data layers, such as those required for strategic, local and action planning. The late 90's saw the introduction of GI use for predictive modelling, with an emphasis of the socio-technic approach away from the techno-centric function that such disciplines tend to occupy. A case in point was the launching of a Census web-map based on large-scale local-council (administrative unit) layer creation. This was followed by a full web-mapper that still is in operation (Figure 10).

Figure 10a: Census Web-Map (Formosa, 2000)

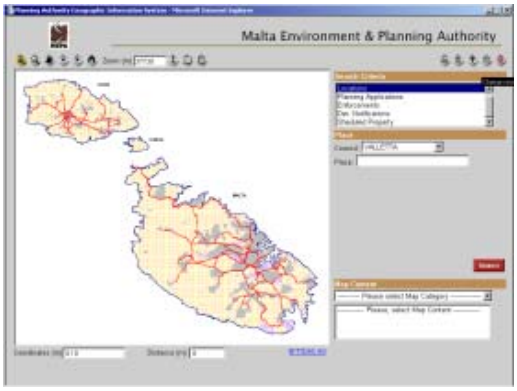


Figure 10b: MEPA Mapserver

[8] The project was developed through an agreement between the European Environment Agency, the Malta Environment and Planning Authority and the Umweltbundesamt-Vienna, the latter providing interpretation and implementation expert support through the Twinning Project MT2002/IB/EN-01 "Establishing Institutional Capacity in the Environmental Sector".

5.3 The new GI structure

The first years of 2000s saw the amalgamation of the then governmental Environmental Planning Department within the PA structure, resulting in the current MEPA organisation. GI was not the forte in the EPD's function, but its role necessitated the creation of a new host of spatial datasets. This was further enhanced through Malta's commitment to the European Environmental Agency (EEA) and the EU directive legislation transposition process. New datasets such as NATURA 2000, SACs, Water Framework Directive-related and State of the Environment Report-related layers and myriad spatial environmental datasets were added to the PA's datasets that included such layers as habitats, posidonia oceanica, and bathymetry, amongst others. The datasets were also placed on the mapserver for public dissemination. New datasets include both urban and environmental integrated info that accentuates MEPA's urban and environmental integration highlight. Case examples such as CLC2000, soil sealing, air quality surveys and development-planning impact on the environment stress this importance (figures 11 and 12). Other far-reaching analytical exercises inclusive of spatial criminology analysis through enforcement monitoring, illegal development and legal infringement can offer further enhancement of this role. The introduction of metadata, lineages and international-model systems has helped enhance the GIS model.

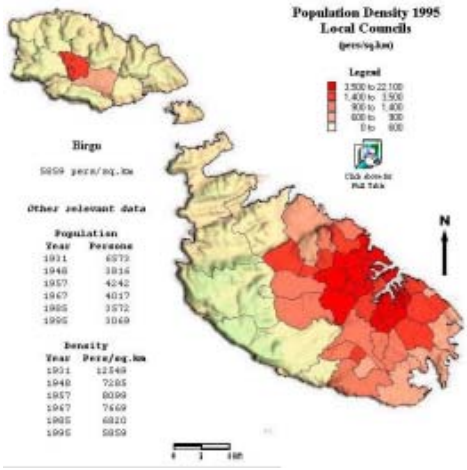


Figure 11a: Population Density Map (Planning)

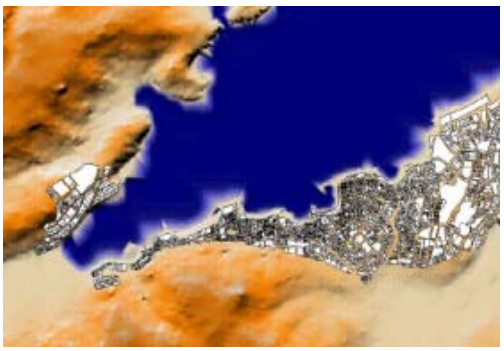


Figure 11b: Landuse Monitoring (Planning)

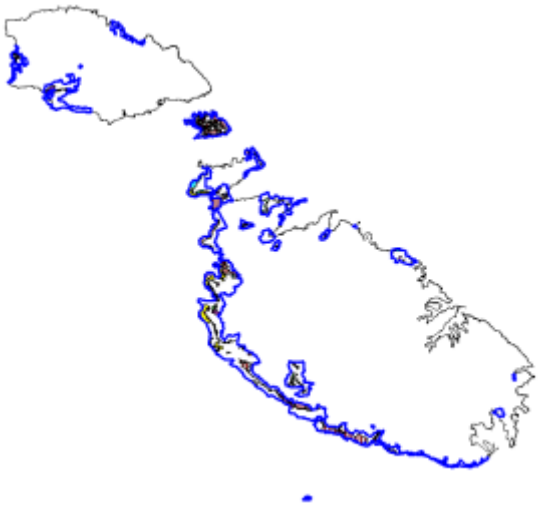


Figure 12a: NATURA 2000 (Environment)

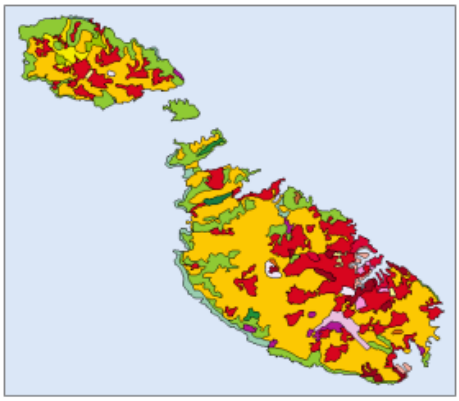


Figure 12b: CLC2000 Malta Result

5.4 Impact of international reporting: large to small scale

A sea-change was experienced through MEPA's legal reporting obligations to EU Directives, whence the process of large-scale mapping had to be paralleled by small-scale mapping for such exercises as CLC2000 and the WFD. Spatial layers that were previously created using hi-res 1:1000 aerial imagery are being complemented by small-scale 1:50,000 to 1:1,000,000 satellite imagery. These layers result in the 'perceived' loss of spatial integrity in MEPA's maps, as generalisation can cause drastic misinterpretation for such small states as Malta. This has resulted in too-generalised maps, loss of definition as well as loss features such as small hamlets, open water surfaces, etc. In addition, the change necessitated the re-integration of a full-UTM geo-referencing process (that had been enabled due to Malta's small size as well as pre-1990's hi-cost storage space limitations), where based on WGS84 the Northing lost the first '4' numeric and the Easting lost its first two '39'digits. The eventual large to small-scale process has enabled a knowledge-based widening for local GI experts as well as an eye-opener for large EU states that do not have the small-state experience but need to report to the same institutions.

5.5 Research Process: analysis-design-output

MEPA's remit emphasised the need for a fully-functional research function, which aided by its SWAT (skilled with advance tools) approach has enabled a multi-discipline multi-tiered approach to the data model. Model creation, data gathering, input (through document management, document

capture, scanning, digitisation, surveys, etc), analysis and output are catered for within the organisation. The role of GI has grown from basic use of statistical tool results integrated within GIS through to full GI-statistical roles. Tools such as MapInfo®, ArcInfo, Vertical Mapper™, and a whole array of spatial applications, acquired and programmed within MEPA, have made this possible. The tools, together with highly advanced analysis procedures such as view-shed analysis, 3D modelling for permit and monitoring short/long-term processing, predictive modelling, have enabled the introduction of the scientific approach to the essentially non-spatial approach previously advocated.

Examples of such exercises include Structure Plan modelling, transport impacts, social impact analysis and 3D highrise impact assessment on the planning side (Figure 13). The environmental side of affairs has seen GIS employed within such research analysis as environmental impact assessment, protected area studies, visualisation analysis, and protected area analysis.

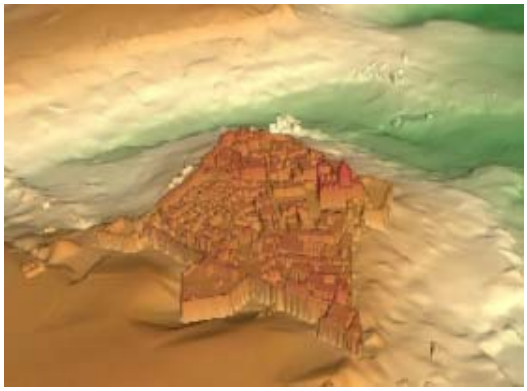


Figure 13a: 3D Urban modelling – Mdina Case Study

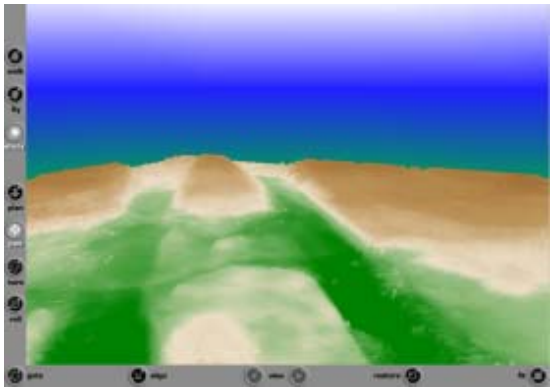


Figure 13b: Cart Ruts VRML output

5.6 Laying the Structural and Academic Foundations

The need for change has been felt for some time since the mid-1990s when a review was carried out on the GIS legacy that had been acquired since 1964, which experienced rapid changes in visualization and data transfer (GATT & STOTHERS, 1996). With major changes experienced in geographic information systems (GIS) from 1985 onwards, two main phases were identified, those related to Digital Mapping/ data collection phase and those related to the application of GIS in an operational context (Figure 14). The process entailed the setting up of a national mapping agency (NMA) in 1988, a transition to a fully digital scenario between 1994 and 1998 which also saw the introduction of GIS, and the launch of the mapserver in 2000 (MEPA, 2000).

This drive identified several hardware restrictions and high storage costs, which caused the NMA to truncate all the spatial data (Malta falls within 1 zone on the UTM projection) by removing part of the northings and eastings which were the same within all the national datasets. Whilst such a decision was aimed to ease the rolling-out costs, it has obstructed all the EU/EEA data reporting to the various agencies, since such datas need to be reconverted to the original full UTM. In order to reconvert all the resultant 20-year data legacy as required for convergence, costs are estimated to have overtaken any savings made over the decades; a situation that requires immediate action.

A new wave of data creation initiatives brought about by EU membership gave a boost to the drive to give birth to a phase through creation of baseline datasets against which all new information would be gauged against. This process was tested for its potential through the creation of datasets such as Corine Landcover 1990-2000-2006 and the relative change analysis, elevation maps, environmental protection maps (EEA CDDA, Natura 2000, SAC) and in 2011, a Land use/cover area frame survey (LUCAS) field survey.

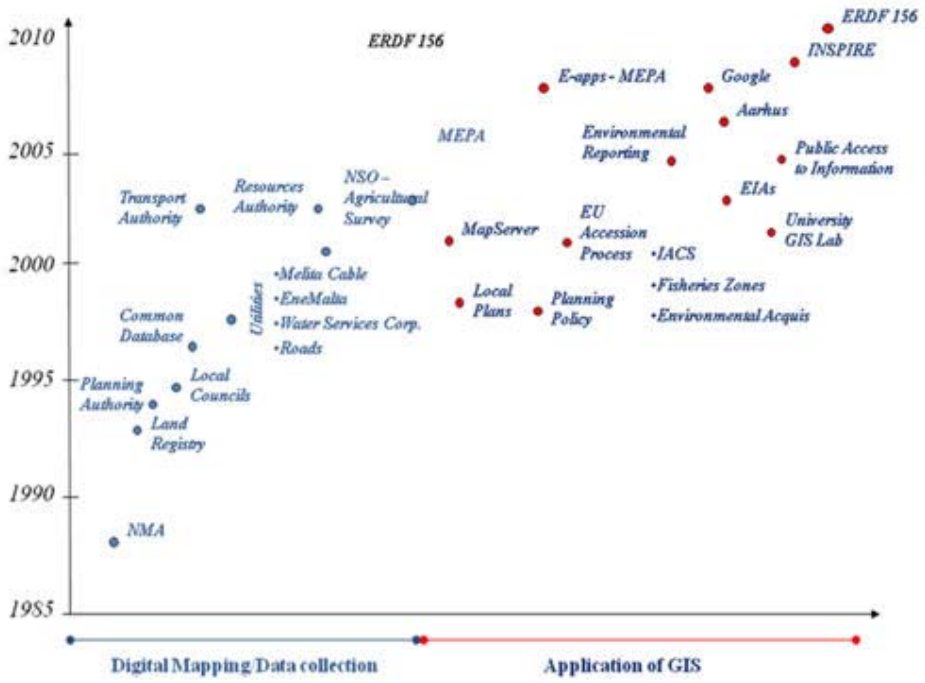


Figure 14: The GI data process.

On the academic side, various research initiatives were initiated. These included studies on organisational change (GATT ET AL, 1996), remote sensing (TABONE ADAMI, 1998), census web-mapping (FORMOSA, 2000), environmental-landuse (TABONE ADAMI, 2001), GML-related (AGUIS, 2003), ethics in GIS (VALENTINO, 2004), 3D GIS for spatial planning (CONCHIN, 2005), environmental (FARRUGIA, 2006), quality improvement cycle (RIZZO NAUDI, 2007), through to socio-technical approaches to GIS (FORMOSA, MAGRI,

NEUSCHMID & SCHRENK, 2011). The iterative studies have helped to consolidate the GIS-based data and operation structure which eventually shaped the foundation for a national geographic information data structure which culminated in the ERDF project ERDF156.

5.7 Taking the Plunge and the Availability of Resources

With the integration of the spatial planning and the environmental agencies, the need was felt to consolidate all the data gathering processes, create a comprehensive strategy for data reporting, integrate the initial data-related projects such as those emanating from the Structural Funds 2007-13, EAFRD 2007-13, Transition Facility Programme for Malta, Pre-Accession Funds, and other programmes, with the main project being that related to the establishment of institutional capacity in the environment sector [20]. The latter project that laid the ground for the current project was entitled "Establishing Institutional capacity in the Environment Sector" and was financed by the National Plan for the Adoption of the Acquis Programme for Malta 2002 which aimed to prepare the Maltese administration to face the challenges posed by EU accession. The overall objective of this project was to strengthen the institutional capacity within the environment sector in order to achieve compliance with the EU environmental Acquis. The project team closely examined the organisational structure of the institutions involved in the implementation and enforcement of the environmental Acquis and provided multi-disciplinary training to staff engaged in carrying out environment protection functions. Finally, the project also laid foundations for the development of further technical capability to manage new and existing infrastructure in various sectors, including waste, air quality, biodiversity and water, establishing technical standards and codes of practice for various functions related to environmental protection.

The outcome of the project which was concluded in 2004 set out the groundwork for the creation of a strategy to improve the data availability to the experts trained through the 2002 project. The groundwork laid out, the time was ripe to take a decision on the identification of a way forward for the integration of the environmental domain with the spatial development domain through the integration of information resources and information technology infrastructure in line with the Aarhus, INSPIRE and SEIS requirements as well as the outcomes of such projects as Plan4all (BEYER & WASSERBURGER, 2009).

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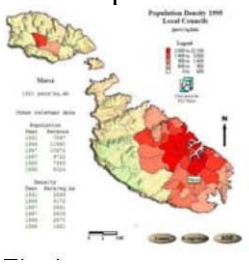
6 Evolution of Webmaps in Malta

6.1 Initial Steps

The first Maltese web-mapping exercise predated the PA mapserver by a year (Formosa, 2000), which service was based on image mapping and GIS-client (Figure 15-1). This was followed by the launching on the mapserver in 2001 (http://www.mepa.org.mt/index.htm?links.htm&1) (Figure 15-2), a fully-fledged on-line GIS based on MapXSite. During this phase, research into GML was initiated in order to investigate how such technologies could enhance the process (AGIUS, 2003)

Figure 15Ġ Webmaps



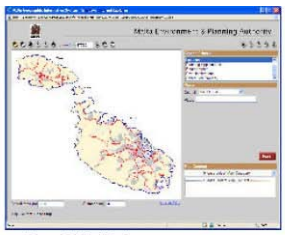


Fig. 2: MEPA mapserver

Fig. 3: MEPA eApps

The next phase used ArcGIS technology was launched in 2007 (eApplications) and takes the mapserver one step forward where users can query the data and access diverse concurrent data layers (Figure 15-3). This led to the free distribution of public sector information (PSI), public access to environmental information and won national awards (best e-business solution for 2007 by the Computer Society of Malta) as well as international awards ('Special Achievement in GIS' - 2006 ESRI International User Conference and the ePractice.eu Good Practice label for 2007). From a setup of a Town Planning Section within the Maltese Public Works the Planning Authority (PA) was established in 1992 with a remit for the administration of national mapping; carrying out of land surveys of specific areas; and maintaining an up-to-date national geographic database (DPA, 1992), which integrated the National Mapping Agency (RIZZO NAUDI, 2005). In 2002, the Environment Protection Department was integrated with the PA to form MEPA. The latter process enabled the creation of the environmental GI data layers such as Corine 2006 and habitats maps (FORMOSA, 2005a).. Thematic GI was taken up by the Information Resources Unit, whilst the Mapping Unit tasked with capturing data by photogrammetric methods, also digitizes the 1:1000 and 1:2500 base map (RIZZO NAUDI, 2005; RIZZO NAUDI, 2007)

Granting access to the general users necessitated the implementation of a series of steps primarily based on the use of a dedicated GIS package, namely MapInfo and a proprietary MapBasic programme called NPI.mbx specifically created for the HMS. However, the GIS system was

developed for use within the Planning Authority and internal users only could access the information through the organisation wide GISViewer. Together with the development planning information system which houses all applications from 1993 to date, the NPI could now be shown against constraints for new development. This system proved to be a success, however the need to go further was felt as the data needed to be disseminated on a wider level – the public level. This involved discussion on the type of data to be disseminated, which imagery could be produced as well as the type of access that users could have.

The debate at this stage concentrated on the medium to be used. The best option would have been to go for a high end Web-GIS system where users could access the GIS directly from their home through the employment of a dedicated map-server (Green, 1996; Laver, 1997; McGill, 1997; Plewe, 1997; Harder, 1998; Greenwood, 1999). This thin-client fat-server system is an ideal scenario though it required the setting up of an organisation-wide map-server that would also comprise development application maps, ecology maps, constraints maps, and a host of other layers residing in the Planning Authority systems. At this stage, the web-server had yet to be developed and was still some months away. Also, being a high-end system with a complex interface, the map-server could create some problems for users who may not be so comfortable with technology. Thus the next option was to go for a simple low-cost, low-end thin client, thin-server option through the use of HTML and JavaScript, a process called Image-Mapping (Formosa, 2000). It was used with success in the development of a Census of Population and Housing site (http://www.mepa.org.mt/Census/index.htm) and in this case proved to be the best option for the dissemination issue as a CD could be subsequently developed based on the same setup, something that was not possible with a dynamic web-server.

6.2 Case 1: The National Protective Inventory (NPI)

The NPI will be of value when there is full availability to the broad range of business processes throughout the Planning Authority, spanning archival recording, development application and policymaking function. The Environmental Management Unit aided the development of the first phase of a geographical database system through the process of georeferencing storing of data and imagery scanning of each property. The GIS system eventually provided a geographical link to all the property information within the same dataset, whilst the interface also allowed this data to be correlated with various other spatial datasets within the Authority. The system maximises the availability of the NPI enabling a broad spectrum of operational staff to access the National Protective Inventory on-line.

The ultimate objective in this digitizing process is to increase availability of the system within the Authority and establish a platform/inventory that could be later distributed/sold or act as a hub on a National level. The standardization of the system will be in line with Council of Europe's report on a computerized heritage documentation centre and Recommendation No. R(95) 3 of the Committee of Ministers of Member States. This Heritage Management System will improve the scheduling process, monitoring of scheduled areas, zoning within urban conservation areas, delineation of UCA perimeters and enforcement.

The Process

The NPI system has been developed over the past three decades from 1967. There were successive attempts in scheduling methodology. Although the system always followed criteria set by the Council of Europe (I.E.C.H.) it was only after 1987 that the Malta Town Planning Services Division resumed the exercise of filling in the Data Capture Cards. In 1991 an expert from the Council of Europe reported on the situation. In 1992 a report was presented to the Council of Europe "Technical assistance for a computerized heritage documentation centre in Malta" however this system was never applied.

The data capture cards in use at the time were unfortunately rarely compiled according to the standards proposed in the Manual for the use of the Research Team Assistants prepared in August 1990 and the result of this exercise leaves much to be desired. All the cards are partially empty (20%-50%) and significant data has been left out eg:-architectural history, typological data, basic bibliography, legal data, ownership, proposed utilization.

The initial stages of the data mining process required a considerable amount of scanning and data entry in order to capture the available datacards, many of which were in handwritten format.

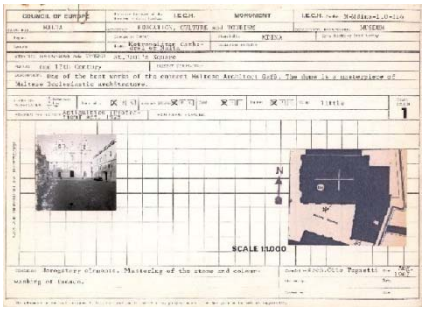


Figure 16.1a The analogue card

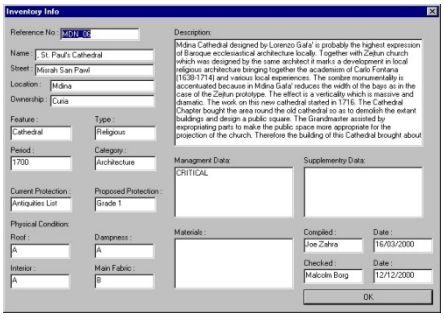


Figure 16.1b The digital card –

– scanning process.

necessitated an extensive inputting process.

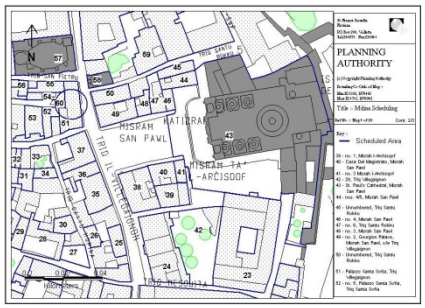


Figure 16.1c The PA Scheduling maps – linking the information at the PA to the NPI

Figure 16.1d The imagery – linking of the analogue/digital cards to the real world-links to aid recognizance

Figures 16.1a to 16.1d Information Sources: card system (analogue and digital), scheduling-base-mapping and imagery.

This said, the digitisation process provided a base for the different data formats to be compared and integrated into one main information system aptly named the Heritage Management System. Where problems were encountered, a system upgrade would also take into consideration the revision of these cards. This process may have provided a platform for the digitizing of each card however the data that was not compiled still has to be filled in.

Considering that the analogue phase of the project has been 35 years in the making, the digitisation process was smooth to say the least, albeit having to overcome a number of flaws and lacunae. One such significant flaw in the system adopted to date is the approach, which was not systematic and critical areas have been left out, as in the case of Mdina, Valletta, Victoria, Rabat. Even areas of Cottonera have not been covered to date. Where data existed, this was catalogued for the eventual development into a GIS template as shown in Figure 16.1b.

The launching of the second phase of the project necessitated that the spatial entities and attribute designations be integrated with the digitised card material enabling the developers to create an Image-Mapping system. This phase was based on the creation of a template through the use of the MapInfo[9] add-on WebPublisher[10]. The latter software generated an HTML frame setup that was incorporated within the main site framework. Creating the site necessitated a degree of HTML

[9] MapInfo is a product of MapInfo Corporation
[10] Web.Publisher is a product of DataView Solutions

authoring. The prototype was based on the NPI of the town of Pieta and later the city of Mdina (Figures 17 and 18).

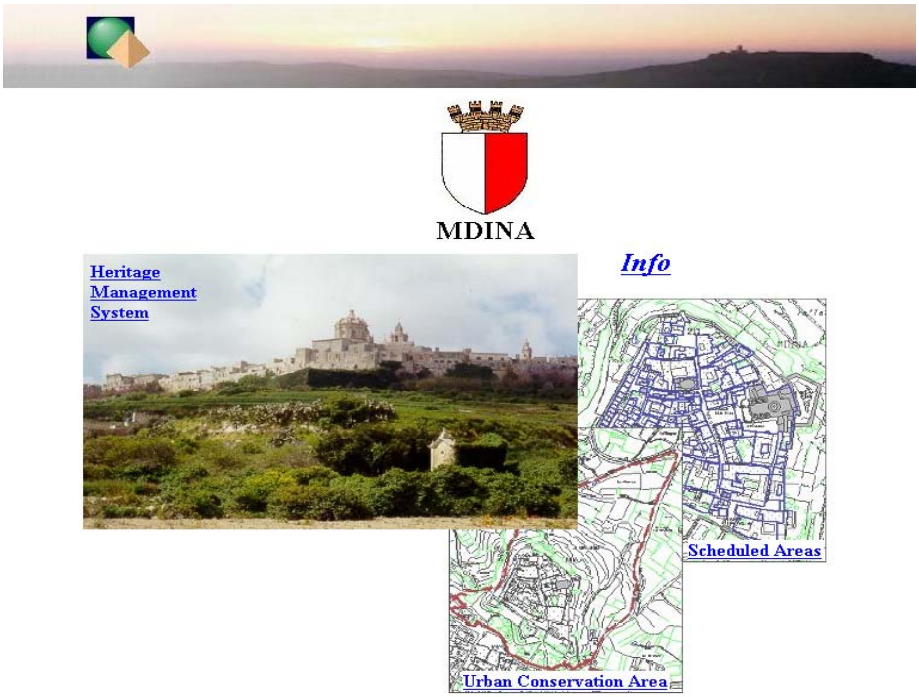


Figure 16 Web-mapping interface (http://www-mepa.org.mt)

Once the prototype was rectified for errors, feedback on ease-of-use was received and encompassed into the system. The site has since been uploaded into an intranet and the Internet (http://www.mepa.org.mt) as well as being promoted through the publication of a number of CDs, satisfying the major user base.

The Image-Mapping system provides the user with a graphic interface that allows for pre-prepared maps of the town in question, which maps (Figure XX.4) highlight the Scheduled property, clicking on which activates the data portal relevant to that property. Further clicking within the data portal activates text boxes and imagery with details on the property.

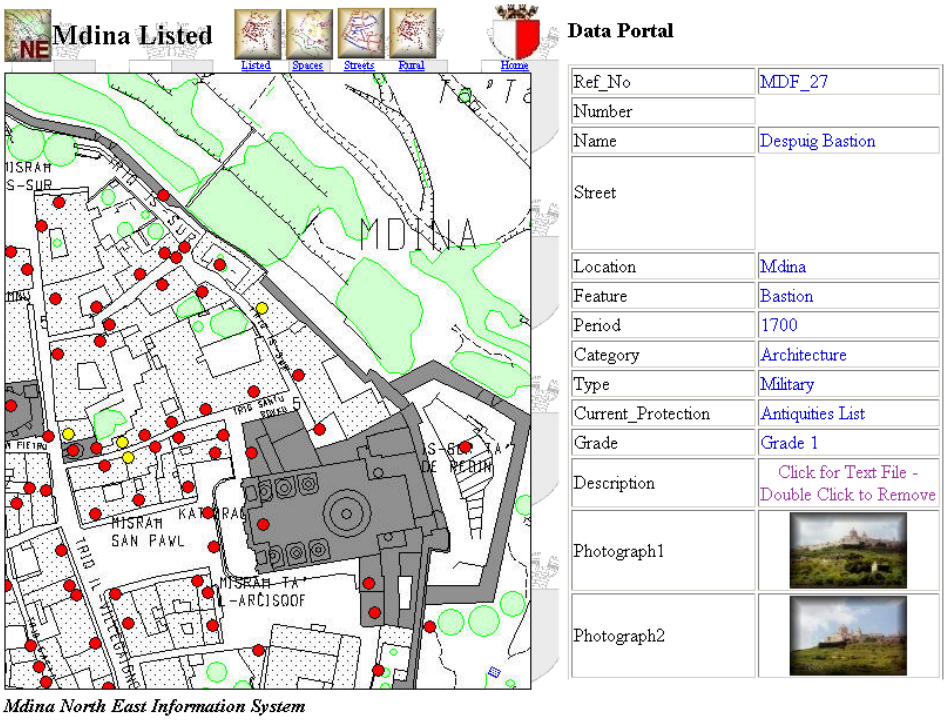


Figure 17 Interactive Image-Mapping System and Data Portal

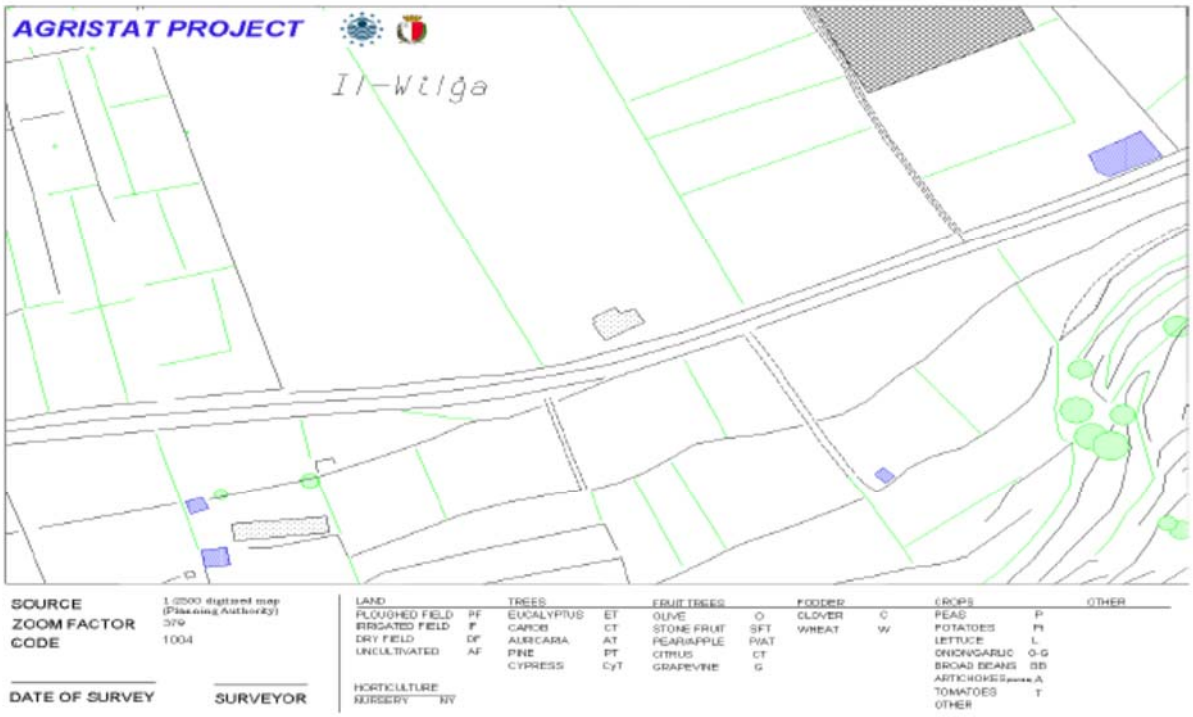
As new technology was introduced within the Planning Authority, the Pieta and the subsequent Mdina HMS were seen as the main information systems that could be included in the new web-server. Plans are in line to convert this system into a full Web-GIS system as an add-on layer to the Internet-based map-server developed since the Image-Mapping launching. This technology is a massive improvement of the Image-mapping format since it caters for dynamic updating from the main MapInfo information systems, which in the Image-Mapping option is a laborious task and needs programmer intervention. The map-server option is seen as the natural heir to the Image-Mapping system. However, even this technology is being dated with such developments as XML and GML. GML2 is even better than XML as it deals with spatial objects and GML3 is envisaged to deal with other issues such as querying and topology, amongst others.

6.3 Case 2: Agristat Mapping

A NSO-related project entitled AGRISTAT (Statistical Agricultural Survey) was carried out the early 2000s, where NSO brought on board the Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) to conduct a comprehensive geographical survey of national agriculture-related

statistical data. The survey, termed as AGRISTAT, was based on ground truthing, aerial photography and GIS-based estimation methods. The main objectives of this project were to collect statistical information related to agriculture land-cover by type and are per locality, and to transfer this information onto a geographic information system. The comprehensive survey was earmarked to capture the maturation of winter crops, thus providing an opportunity to survey a wide variety of pre-harvested winter agricultural produce and a map output was resultant as based on a comprehensive data collection form (Figure 18).

Figure 18. Agristat Data Collection Form

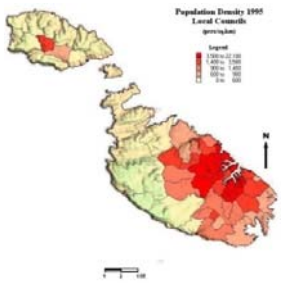


Source: Euro-Mediterranean Centre on Insular Coastal Dynamics. Agristat: NSO

6.4 Case 3: Census Web Mapping

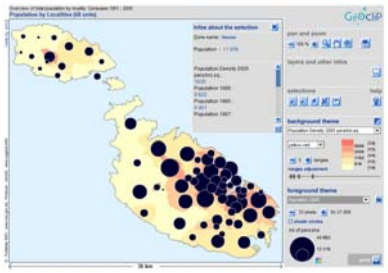
The first thematic Maltese webmap was created in 2000 as based on the mapping of the Census of Population and Housing data [15][11], which service was based on image-mapping and GIS-client technologies (Figure 19a). A year later (2001) the Malta Planning Authority launched its development planning mapserver[12] which was based on MapInfo MapXSite[13] that however lacked extensive querying capabilities (Figure 19b). The next web-map employing interactive technology was published by the National Statistics Office depicting the Census of 2005[14], which employed geoclip[15] and MapInfo applications (Figure 19c). The next process initiated through the creation of environmental GI data layers such as habitats maps, which was carried out as part of a process to enhance spatial information for the general public and the research community in line with the EU/EEA dataflow requirements[16]. This process was achieved through the implementation of the Aarhus Convention that ensures that environmental information is disseminated for free[17].

Figure 19. Thematic Maltese webmaps *(a)* Population Density Imagemap *(b)* MEPA Mapserver (c) Census Interactive Map



a) NSO 1995

b) PA 2001



c) NSO 2005

6.5 Case 5: The crime spatial outputs

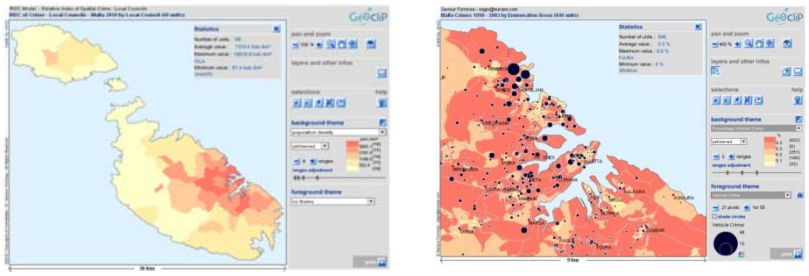
Based on the above benchmarking exercise, the different options available for the criminological study were identified and a local crime-mapping site developed. The technology employed is based on a MapInfo mbx programme developed by *emc3*[18], which uses Flash (swf) technology as its spatial carrier. Users can interact with the mapped data in a format they are already familiar with when browsing the internet. Simple help files are also available and guide the user on how to

[11] http://www.mepa.org.mt/Census/index.htm
[12] http://www.mepa.org.mt/index.htm?links.htm&1
[13] http://www.pbinsight.com/
[14] http://www.nso.gov.mt/site/page.aspx?pageid=570
[15] http://www.geoclip.net
[16] http://www.eea.europa.eu/
[17] http://www.nesis.eu/index.php?option=com_wrapper&view=wrapper&Itemid=158
[18] http://www.geoclip.net

interact with the crime-map. Such a new approach is a major improvement from the early technologies of image-mapping and GIS-Client that required extensive downloading sessions. It is also an improvement as against a full map-server function that requires a remote and potentially heavy site [15]. Flash technology enables integration of the GI datasets and maps within a very small and simple flash file that can be conveyed easily over the web and even used on a standalone computer.

The prototype site created by the author encompasses a Web-GIS view with interaction on a number of variables such as police-reports crimes from 1998 to 2010, vehicle crime, serious and non-serious crime, amongst others. In terms of benchmarking, it is tagged with a 3-star rating for its pre-prepared structure that at the same time allows extensive user interaction such as personalised map creation and outputting. Figures 20a-b depicts the Malta Crime Web-GIS created for this study (www.crimemalta.com).

Figure 20. Malta Crime Web-GIS - www.crimemalta.com *(a)* choropleth *(b)* RISC map: choropleth and graduated



a) *b)*

6.6 Case 5: The Plan4all input

The CRISOLA outputs have had a significant input into the understanding of a social theme using a spatial construct, but the model itself needs to be structured towards a more realistic web-map structure. To date it is still too crude and requires streamlining towards the requirements of the INSPIRE Directive [16][19]. In effect, one project that has set the ball rolling for the next phase of spatial-social data interoperability for the CRISOLA outputs is the Plan4all project.

Plan4all was a European project running from May 2009 until October 2011 and co-financed by the eContentplus programme of the European Commission. Plan4all focuses on interoperability and

[19] The acronym INSPIRE refers to the Directive 2007ċ2ċEC of the European parliament and the Council of 14 March 2007 with the aim to establish an Infrastructure for Spatial Information in the European Community. The directive entered into force on 15 May 2007 and will be fully implemented by member states in 2019.

harmonisation of spatial planning data in Europe to support holistic spatial planning activities. All planning tasks and processes must be solved comprehensively with input from various sources inclusive the social themes. The diversity of data across the physical and social domains makes it necessary to make inputs interoperable because it allows the user to search data from different sources, view them, download them and use them with help of geoinformation technologies. Data harmonisation means that all member states use a common set of coordinate reference systems, data models, classification schemes, portrayal rules, etc. Interoperability is understood as providing access to spatial datasets through network services, independent from whether the existing dataset is actually changed (harmonised) or just transformed by a service for publication [17].

Why choose the Plan4all structure as a base for CRISOLA? The Plan4all metadata profile [18] states one of its aims at making spatial plans comprehensible and comparable. Spatial plans do not stand in a vacuum but require an understanding of the context they operate in, hence the social construct. As CRISOLA integrates social, criminological and landuse themes, the interoperable landuse pivot in both CRISOLA and Plan4all serves as a integrative function that will push the Malta model from its current 'quasi-static' phase to the next level. The issue stems on which structure one should use to move from a one-off output (the current crimemalta maps) to a dynamic webmap as is the planned Plan4all output using geoservers. For a social scientist this problem is inherent in its very structure; understanding all the available protocols and products is still a quagmire for GI experts let alone for the non-technic users. There are still too many languages and too many platforms that work in differential modes, which situation has created a veritable modern Tower of Babel. The problem that first Tower faced pivoted on the multiple-languages that the architects ended up speaking in and thus lost communicative processing, which fact killed the edifice. This time round too many protocols and too many disparate systems may yet kill the contemporary one. The need for technologists to understand the issues underlying data structures, datacycles and issues of access is paramount, especially when transferring this function to those related to the social disciplines.

The Plan4all project's focus on the definition of common procedures and methods for spatial planning data interoperability and harmonisation is something that CRISOLA aims to take up. CRISOLA can employ Plan4all metadata profile and object-oriented data models for data sharing via the Plan4all geoportal[20] and guide them towards take-up within the social themes, themes that are not covered by the INSPIRE Annexes. The CRISOLA outputs can be brought into the Plan4all fold through the alignment of the already existent metadata, models and geoportal. Due to the fact that most of the data within the CRISOLA model falls within the landuse component, the direct linkage to the Plan4all is seen as the natural evolution for the model. The commonalities between

[20] httpĠċċwww.plan4all.euċsimplecmsċĊmenuID=37&action=article&presenter=Article

CRISOLA and Plan4all lie in the fact that both profess a goal to support the exchange of compatible spatial planning data and to support the access to the data. Both have made access possible through options varying from simply viewing spatial data, up to even having the right to download it. Plan4all's concept to move away from 'insular information islands' towards 'information systems' and 'information infrastructures' that allow different kinds of user access to spatial data from various sources is seen as the springboard to use the functionality for social thematic spatial dataset creation [19] [20]. In Malta social data is rarely created into spatial format and CRISOLA managed to link the landuse domain to the social domain and show that policy making can be done using such outputs. The next step is to take it to a full web-map format but within and established framework. The framework has been presented by INSPIRE and actuated by Plan4all.

This can be done for CRISOLA since the Plan4all geoportal presents geographic information from various sources in a unified way [21]. The Plan4all geoportal has two features that are basically map and catalogue. The catalogue client allows searching for metadata using OGC Catalogue Service for Web (CSW), something unheard of in the social domains. The map client allows viewing maps based on OGC Web Services and other formats (Google maps, KML, MapServer, GML). The basic functions include viewing web services (OGC WMS, WFS) selected by user from the catalogue or directly by address; saving user defined map projects on local hard drive a re-loading of this saved composition (OGC WMC); distance and area measurement; searching in the map; inserting user defined objects into the map, large format printing in PDF; showing legends, metadata and querying in the map. The Plan4all geoportal will enable users to search and view harmonised spatial planning data from the Plan4all partners with the aim to further extend the network with affiliated partners (Plan4all geoportal, http://www.plan4all.eu). CRISOLA will take the next step and attempt to extend that network to the social domains.

The main outputs which have been employed for the NSO mapping exercise were based on the main metadata structures prepared as part of the Plan4all output.

General description of existing metadata

The situation of metadata production in Malta has taken both a proactive role and a reactive one that has seen a slow uptake of the eventual metadata creation process. Since Malta, through various SDICs, was involved at the early stages of INSPIRE activities it was well geared to create its metadata services and employed a policy of creating its metadata through the use of the INSPIRE Metadata Editor[21]. In fact, this was carried out at such an early stage that the availability of an xml tool that read the outputs was created through a project entitled "Institution Building in the Environment Sector",

[21] http://www.inspire-geoportal.eu/index.cfm/pageid/342

which was financed from the Transition Facility Programme for Malta (2006)[22]. The metadata search facility was made available through http://www.ambjent.org.mt/.

The next step was aimed at bringing together all GI-related agencies in order to help each agency create its metadata, which process is ongoing and has yet to mature due to various reasons, mainly the transfer of responsibilities from MEPA to MITA and an as yet unclear strategy on how this will be achieved.

The existing metadata is thus sparse and exists in the form original created for the same dataset-creation process such as that resultant from the CLC1990, 2000 and 2006 runs.

Metadata Publication

- **Metadata Portal Solutions**

FTZ, as the national Maltese partner, for the purpose of this exercise employed the Plan4All Portal solution, with direct links from the FTZ Geoserver[23] to the respective metadata.

- **Web Services**

FTZ, served its metadata through the Plan4All geoportal and as such uses the web service offered through that site.

- **Metadata Preparation according to Plan4all profile**

The metadata profile was that based on the Plan4All metadataprofiles guidance document[24]. Each metadata was created both within an xls and an xml version employing the JRC INSPIRE metadata editor. Both were uploaded to the Plan4All service.

The xls version: CLC2006 example

Component	Description	Input cells
Resource title	Name by which the cited resource is known.	CLC2006_MALTA
Resource abstract	Brief narrative summary of the content of the resource(s).	The land cover project 2006 is part of the CORINE programme and is intended to provide consistent localized geographical information on the land cover of the 12 Member States of the European Community. The land cover for the whole of the islands was included with the data layer covering all the European member states.
Resource type	"dataset" or "series" should be used	Dataset
Resource	Mandatory if a URL is available to	http://www.mepa.org.mt/IR/dataset.html

[22] http://www.mepa.org.mt/tf06_aarhus
[23] http://ftzgeo.org:8080/geoserver/web
[24] D3.2.2_Plan4all_Metadata_Profile_-_Final_version_revised.doc

locator	obtain more information on the resource, and/or access related services.	
Unique Resource Identifier	Value uniquely identifying an object within a namespace.	n/a
Resource language	Mandatory if the resource includes textual information.	eng
Topic category	Main theme(s) of the dataset.	planningCadastre
Keyword	Commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject.	land cover, CLC,
Geographic bounding box	Geographic position of the dataset expressed by the smallest bounding rectangle.	14.410231 - 35.8399576, 14.5751157 - 36.0841138
Date	Reference date for the resource	01/01/2003
Temporal extent	Spatial plan effecting and expiration date.	31/12/2020
Lineage	General explanation of the data producer's knowledge about the lineage of a dataset.	onversion of projection for LANDsat image provided by Corine. Plotting of different uses (All assumptions and digitizing methods used for this project are covered in detail in the CORINE land cover technical guide – Addendum 2000). Then the checking of data from any unwanted sliver polygons. And the change of polygon colors so that they would match the ones from the original scanned legend.
Spatial resolution	Mandatory for data sets and data set series if an equivalent scale or a resolution distance can be specified.	2,500
Conformity	Conformity of spatial data sets with the implementing rules provided for in Article 7(1) and any additional document	Conformant
Conditions for access and use	Conditions for access and use of spatial data sets and services, and where applicable	No conditions apply
Limitations on public access	Access or other constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource.	No limitations
Responsible organisation	Identification of, and means of communication with, person(s) and organization(s) associated with the resource(s)	MEPA, information.resources@ mepa.org.mt
Metadata point of contact	Party responsible for the metadata information.	information.resources@mepa.org.mt
Metadata date	Date that the metadata was created.	10/07/2008
Metadata	Language used for documenting	eng

language	metadata.	
File identifier	Metadata file identifier.	mt_p4a_002
Parent Identifier	File identifier of the metadata to which a metadata is a child. It is used for identification of Spatial Plan which the dataset is part of.	Metadata_SPATIAL_PLAN_p4a
Metadata standard name	Name of the metadata standard.	ISO19115/19119 - Plan4All profile
Metadata standard version	Name of the metadata standard version.	2003/Cor.1:2006, Plan4all:2010
Spatial representation type	Method used to spatially represent geographic information (e.g. vector)	vector
Geometry type	Represents the geometrical type of a spatial dataset whose spatial representation type is 'Vector', and it may assume 3 possible values: Point, Polyline or Polygon.	polygon
Image	An image to illustrate the data that has been returned.	MT_NUTS5.jpg
Character set	Character coding used for the dataset.	n/a
Application schema	Provides information about the conceptual schema of a dataset	Land Cover
Data quality scope	Level to which data quality information apply.	dataset
Reference system information	Information on reference system.	Universal Transverse Mercator Zone 33, Northern Hemisphere (WGS84) (EPSG: 3263)
Distribution format	Information on distribution format.	Shapefile
Transfer options	Number of volumes, data carriers etc...	Medium: cdRom, online requests
Maintenance and update frequency	Information on updates frequency.	1990, 2000, 2006
Source	Represents the description of the dataset from which the present dataset is derived through the production process described within the metadata element 'Lineage'.	Census Data used for Spatial Planning, Sources include Census2005, Structure Plan Documents and planning boundaries
Process step	Description of process step of data acquisition or processing.	Georeferencing of data based on basemap and spatial maps created by the National Mapping Agency

These initial steps aimed at outlining a metadata structure for the NSO data were taken on board as part of the project work for the NSO project with an initial

6.7 The next steps for data and webmap access in the Maltese Islands

A new GI structure will not make it simply by employing the current available datacycle methodology and operating around that structure's available datasets; it needs new data feeds to ensure that the dynamic social structures are backed by new and updated information. This is coming in the form of the next phase for webmapping and dissemination in Malta as currently being developed through an extensive Maltese ERDF project[25] which entails the integration of physical, social and environmental data within a comprehensive Shared Environmental Information System[26] structure as proposed by the EC. Having experienced instances of lack of data, a dearth of metadata on one hand and a relentless drive to take up new technologies, the Maltese scenario is ripe to integrate all the three CRISOLA issues (together with other thematic natural-social-physical environments through the employment of hi-end technology both insitu and remote. The resultant output will employ data-capture and scanning technologies that may yet make inroads in the social and planning operational fields. Through a planned complete terrestrial LIDAR scan combined with a bathymetric acoustic scan up to 1 nautical mile from the baseline coast and the inclusion of bathymetric LIDAR ensuring consistency in data acquisition across the two surveys, the baseline data will be created for the eventual overlaying of the thematic data. Combined with oblique imagery takes and in-situ data trawling, the end result should enable the production of a unique model of the islands for use across the scientific platforms.

The envisaged free dissemination of the data through Aarhus-compliance to the general public and the scientific community should enable the launching of integrated research across the spatial and social themes. Urban and environmental planners can undertake urban modeling scenario-building for strategic, regional and local areas, with the addon integration of social, economic and criminological issues leading to healthier and safer localities. In addition, the data will be integrated with impact-analysis of baseline studies for air, water, noise, soil and radiation themes and their impacts on high population/urban density Malta. It is envisaged that the project outputs will serve as a base for the creation of updated data for the crimemaps, which outputs will also be disseminated to other geoportals inclusive of the Plan4all geoportal in a harmonized format, thus ensuring homogeneity across the datasets. Thus the base landuse-related data requirement will be supplied through the ERDF project and the social data will be delivered through the Census 2011, which would require georeferencing and structuring in order to allow integration with the Plan4all requirements. The next step would require the integration of the crimemaps within the Plan4all mapserver which calls for integration of the original (pre-geoclip) spatial datasets within the metadata profile to ensure that the data fits within the geoportal.

[25] http://www.mepa.org.mt/news-details?id=603
[26] http://ec.europa.eu/environment/seis/

As the CRISOLA landuse base data are the same used for the Plan4all geoportal harmonization should not offer major obstacles, especially since the base data layers created for the crimemaps adhered to the INSPIRE requirements. Malta's datasets originate from one datasource, the National Mapping Agency which has employed the JRC metadata editor since its launching phase, thus the crimedata fits within the requirements for that structure. In addition, whilst the current geoportals do not allow for user-interaction in terms of polygon creation at source, it is envisaged that such options be integrated in the project output to allow users to feed in into the online system.

Geographic data harmonization initiatives and projects such as INSPIRE, Plan4all and ERDF156 form a network of several thematic information systems – one being the Maltese Environmental maps – by providing harmonised, interoperable and accessible spatial data. The next phase will see its integration of the project objectives that encompass the definition of standards for spatial planning data harmonisation according to INSPIRE, the implementation of the Plan4all and ERDF geoportals that consist of harmonised spatial planning data that can be shared. It is expected that the take-up by NSO of the available data models and geoservers will be an important input to ensure that the initiation of social spatial datasets is set on a solid base.

6.8 A SEIS Initiative

An initiative to understand the best methods for dissemination processes was sacrried out through a project co-financed by the European Regional Development Fund, which provides 85% of the project's funding and the Government of Malta, which finances the rest under Operational Programme 1 - Cohesion Policy 2007-2013 - Investing in Competitiveness for a Better Quality of Life. The project sees to the integration of the requirements for EU environmental reporting through the employment of the INSPIRE Directive for the spatial component, the use of the Aarhus Convention as the conveyor for the dataflow and ultimately the employment of a tool pertaining to the SEIS requirements for the eventual online dissemination[27]. This triumvirate of Directives and Initiatives were used as a fulcrum to ensure that the full spectrum of Maltese environmental and spatial information reaches the public at no expense, empowering both the individuals, non-governmental organisations and governing bodies to receive knowledge at first hand in order to debate on strategic and local plans as well as monitor the health of their environment and in turn give the social structure the power to react with readily available knowledge as against being faced with barriers to access. This process is the fruition of a process begun in 1995 by the authors to ensure that data are disseminated for free.

[27] Standards employed in the Malta-SEIS: OGC WMS, OGC WMS - T, OGC WFS, OGC WCS, ANSI SQL, INSPIRE, Z39.50 and CSW

The technologies used, built up their dissemination technologies through the baselines set up by SEIS, mainly the implementation of an SEIS-based strategy and implementation of an online tool. This tool builds on the previous experiences with the MEPA Mapserver, the EEA CDR and the Aarhus capacity building project28. The objectives of this phase were set out to review and analyse the Malta's, national and EU-level requirements for the development and operation of the SEIS, taking into consideration all relevant factors. On the basis of this review, the project had to design the Maltese component of the SEIS and in turn develop and implement the SEIS, including a dedicated geoportal based on ArcGIS geodatabase design as based on ArcGIS server architecture and finally train staff on the use, operation, data analysis, maintenance and customisation of the developed SEIS.

The phase was aimed to review the state of play of the current developments with respect to the Shared Environmental Information System (SEIS), including the following:

- EU Directives supporting the EU's SEIS initiative and any proposed recommendations of the EEA, JRC, EUROSTAT;
- Commission's Communication COM (2008) 46 Final "Towards a Shared Environmental Information System";
- SEIS developments by the European Environment Agency (EEA);
- Overview and updates on the SEIS-BASIS (Shared Environmental Information System Baseline and Evolution Study) project which aims to provide guidance on how to improve the comparability and quality of environmental data, as required by SEIS;
- The outputs of the NESIS project and roadmap developments on how to move from the current information systems of EU's environment agencies towards an INPSIRE-SEIS based system. To include relevant results for the NESIS State of Play study on examples of best practice as a source of guidelines for MEPA' s proposed SEIS as informed by recent developments;
- Relevance of the INSPIRE Directive (Directive 2007/2/EC) and the Aarhus Convention to the EU's SEIS;
- Linking of an integrated reporting system is required in line with the EEA Reportnet initiative and its CDR (Common Data Repository) structure to SEIS;
- An analysis of the existing Maltese information management systems and platforms, as well as an assessment of the present institutional capacity necessary for the operation of the Maltese component of the SEIS;

[28] www.ambjent.org.mt (a project implemented under a Austrian – Maltese Twinning Project MT/06/IB/EN/01 "Further Institution Building in the Environment Sector".)

- New or emerging reporting standards currently being adapted, such as XML-related standards, to which the SEIS should conform.

This process involved the analysis of the current systems in place to process environmental monitoring data and data flows required, the design of the SEIS for Malta, and the development of such a web-based environmental information system.

The output resulted in the creation of a web-based environmental information system, on the basis of existing platforms, as well as on the basis of any other additional platforms and components that may be required, to achieve full interoperability and functionality of the Maltese component of the SEIS, in line with the applicable guidelines and best practices in this field. This phase forms a key part of the ERDF-funded project and will integrate all the environmental monitoring data acquired through this project and through other environmental monitoring initiatives administered by MEPA and other Maltese entities.

The development of the SEIS will amongst other include the delivery of a web-based GIS dedicated to environmental monitoring data incorporating existing aerial orthophotos and basemaps as well as newly acquired satellite imagery, oblique aerial imagery, LiDAR terrain datasets and bathymetric data. Moreover, since the plans are in place to migrate from an ArcInfo database to an ArcGIS geodatabase structure, the SEIS will be developed using an ArcGIS Server platform.

The proposal was to design a geodatabase data model that is flexible, caters for potential expansion, easily adaptable by the environmental agency and supports migration from current data structures. The following steps were highlighted in order to improve the development of the geodatabase schema.

i) Identify the data sources and key data themes for the GIS and characterise each thematic layer (including symbology, annotation, map scale, accuracy, data use, integration with other datasets)

ii) Develop representation specifications and relationships of the geodatabases (modelling of feature classes, definition of tabular database structure, spatial behaviour and data integrity rules, were relevant)

iii) Define the data capture procedures, map display properties and assignment of procedures for geodatabase building, conversions, editing and maintenance.

iv) Document the proposed geodatabase design (such as schema diagrams, map layer examples, metadata documents)

v) Since an ArcGIS Server platform will be used for the development of the SEIS, ArcSDE must be employed to manage the underlying geospatial data that will be stored in Microsoft's SQL Server RDBMS (Figure 21) [22].

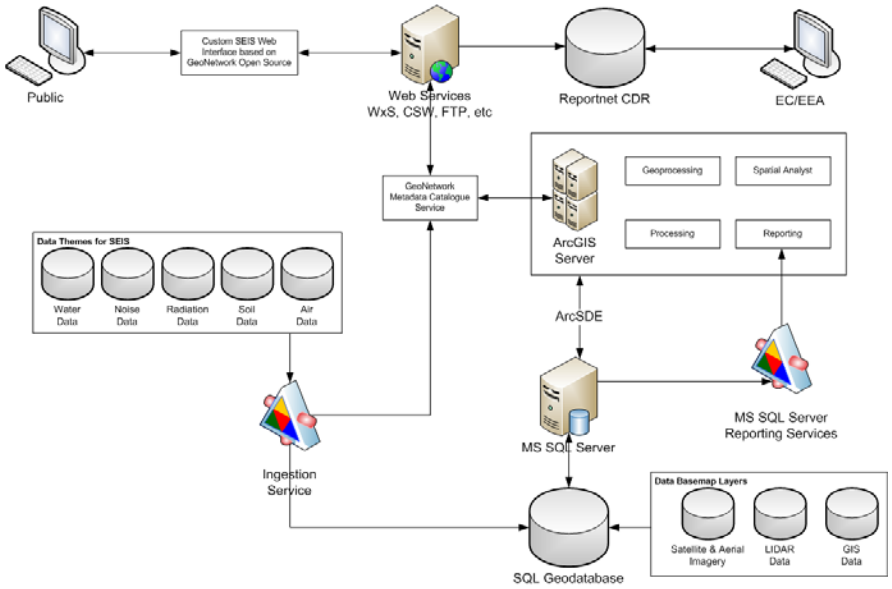


Figure 21. Malta-SEIS Architecture: Source: Bonazountas M., and Karampourniotis I (2012, 17)

Finally, the project envisaged a structure that conforms to the Aarhus, INSPIRE and SEIS structures as follows:

Web interfacing and security

ArcGIS Server's .NET API will be used to interface with ArcSDE to present the data on the web. This system would allow the viewing, data querying, reporting and analysis of all spatial datasets identified in the five themes and the information resources datasets;

Front end flexibility

Since it is expected that the SEIS will develop with time based on the increasing levels of geospatial data to be acquired, varying reporting demands and data analyses, the Malta SEIS will have an extensible front end that can be tailored to meet the new requirements of a changing and dynamic environment;

Discovery services/functions

The SEIS will include appropriate discovery services and functions since this is a requirement for users and such automated tools requesting data. Key spatial data sets should be published in ways that support the discovery of the data and provide access to these resources via product-neutral visualization and downloading services;

Geoportal

The geoportal is to be linked to the National Spatial Data Infrastructure (SDI) should this be established during the lifetime of the project and eventually linked to the EU SDI under development. All relative documentation relating to how spatial data and services can be interlinked respect the INSPIRE Directive's implementing rules as already outlined in the Plan4all project Malta test (Formosa, Magri, Neuschmid, Schrenk; 2011);

Social dataset integration

The system will ensure that other environmental domains not covered in the five themes will be covered as identified in the Plan4all Malta case study which reviewed the potential for such systems to integrate information from the physical, social, criminological, psychological and health domains. The studies of the impacts of environmental factors on health issues are seen as a major component that will lead to the public interest in the system and may eventually create a real scenario for volunteered geographic information in the Maltese Islands;

Spatial dataset standards

All spatial datasets will conform to the INSPIRE Directive (Directive 2007/2/EC) standards. The SEIS must conform to the requirements emanating from the various standards established by the environmental thematic areas. Therefore the project takes into account developments within the various ETCs (European Topic Centres) and to ascertain that the SEIS conforms to and seamlessly links to the European ones, where such protocols have been created. The geographic coordinate system for the SIES should be based on a Projection (UTM Zone 33 S), Datum (ED 1950) and Ellipsoid (Hayford International 1924);

Spatial data transfer

The project structure requires that the spatial data-transfer processes of the systems currently in place and new ones acquired through the project are thoroughly understood and depicted into the model with a target to establish a coherent data integration system that will allow the further transmission through the online portal.

In conclusion, the project, whilst an ambitious one, ensured that the whole process was an integrated one which takes into account the conceptualisation of a nation-wide strategy for access to data [23] employing various Directives and Conventions in order to ensure that data is transmitted for free to the general public whilst ensuring that the quality is assured. The project which was launched in December 2009 is expected to be concluded in 2013, with a planned maintenance procedure as established through such standards as ISO 9001: 2008 and those emanating from the INSPIRE and information related Directives.

The project though ideal for the NSO requirements was too complex and required the installation of the ESRI systems which were not deemed verycost efficient for the requirements of the National Statiostics Office, in turn calling for an approach as identified by the Plan4All study and its open-source geoserver.

7 Initial NSO Project Outcomes

7.1 Mindmapping Exercise

A mindmapping exercise was carried out at NSO in order to define the data issues prior to commencing a recview of which datasets were converted to GIS. The aim was to ascertain the status of data creation to dissemination process which covers the data management and legislative documentation on how data flows for each of the units (Annex I Section A). The exercise also focused on those units which identified a set of sample datasets that could be used for the project. In total especially on the units that provided the data for this project. Such was targeted to identify issues on sourcing, gathering, management, dissemination and what the officers perceive as the main lacunae/problems they have.

The directorates and units that participated were spread across all the NSO as listed in Table 2. Every directorate is represented which was vital for this project as the main idea was to initiate a knowledge process on the status of the spatial information awareness in NSO.

Table 2: Participating Units

Directorate	**Unit**	**Theme**
-	Unit 01	Methodology and Research
A: Economic Statistics	Unit A1	National Accounts Unit
A: Economic Statistics	Unit A2	Public Finance
A: Economic Statistics	Unit A3	Balance of Payments
A: Economic Statistics	Unit A4	International Trade and Transport Statistics
A: Economic Statistics	Unit A5	Price Statistics
B: Business Statistics	Unit B1	Structural Business Statistics
B: Business Statistics	Unit B2	Short-term Statistics
B: Business Statistics	Unit B3	Agricultural and Fisheries Statistics
B: Business Statistics	Unit B4	Environment and Resources Unit
B: Business Statistics	Unit B5	Business Registers
C: Social Statistics and Information Society	Unit C1	Living Conditions and Culture Statistics
C: Social Statistics and Information Society	Unit C2	Labour Market
C: Social Statistics and Information Society	Unit C3	Population and Tourism Statistics
C: Social Statistics and Information Society	Unit C4	Education and Information Society Statistics

- **Specific legislation covered by the different units**

The legislative tools employed by the diverse units on how to gather/analyse/report the data were spread across a wide range of themes as pertaining to the specific units requirements. The responses elicited the facts that the legislation covers both national and european datacycle requirements, either as a National Act or EU Regulation or a dataflow requirement to EU agencies such as Eurostat. Interestingly some areas do not as yet have reporting flows, such as the culture and crime themes. Spatial data pertaining to these legislatiove tools are generally not required which is why the drive for a GI-based structure has not been established, but where such exercises as the Census were taken up,GI was established as a foundation for new outputs such as Census 1995 and 2005 exercises, as well as the Environmental and Agricultural and Fisheries Statistics themes which in various instances may require spatial data (Table 3).

Table 3: Legislation employed

Unit	**Legislation**
Methodology and Research	Census Act (1948); EU Regulation 763/2008 of the European Parliament and the Council on Population and Housing Censuses; 2010 UNECE Census Recommendations
National Accounts Unit	Council Regulation 2223/96
Public Finance	Although a specific legislation is not in place, the geospatial data for the social security benefits is requested in terms of the Malta Statistics Authority Act (XXIV of 2000).
Balance of Payments	Legislation only applies to reporting. Gathering and analysis are not regulated. The legislation followed is that by Eurostat and the ECB. The main regulation is EC No. 184/2005 and ECB 2003/7
International Trade and Transport Statistics	INTRASTAT: Regulation (EC) No 638/2004 basic Act as amended by Reg (EC) 222/2009 and implementing provision 1982/2004 as amended by Reg (EC) 1915/2005, 91/2010 and 96/2010. Vale Added Tax(Collection of Supplementary Information) LN 131/2004 part of VAT Act. LN 413/2004 EXTRASTAT: Regulation (EC) No 471/2009 basic Act as implemented by Reg (EC) 92/2010 and 113/2010. Basic Customs Legislation Regulation (EEC) No 2913/1992 Combined Nomenclature (CN): Regulation (EEC) No 2658/87 with annual updates Geonomenclature: Regulation (EC) No 1833/2006 The compilation of Transport Statistics is primarily based on administrative data supplied by the Gozo Channel Company Limited, Transport Malta, the Police Department and the Guard and Warden Services Limited.
Price Statistics	All commission regulations related to price statistics in collecting and compiling the data.
Structural Business Statistics	SBS Regualtion EC No 250/2009 and 251/2009
Short-term Statistics	Local Legislation: NSO Act (2000) European Legislation: Specific STS-Regulations

	• Council Regulation 1165/98 introducing short-term statistics at European level • Regulation (EC) of the European Parliament and of the Council 1158/2005 amending Regulation 1165/98 introducing the European sample schemes, industrial import prices, output prices for services and other changes • Commission Regulation 1503/2006 defining variables and frequency of data compilation, repealing new orders received for building construction and new orders received for civil engineering • Commission Regulation 656/2007 on the definition of main industrial groupings (MIGS) in NACE Rev. 2 • Commission Regulation 657/2007 implementing rules for the use of European sample schemes in STS • Commission Regulation 472/2008 introducing the new base year 2005 and the statistical classification of economic activities, NACE Rev. 2, into short-term statistics • Commission Regulation 1178/2008 introducing further adaptations for European sample schemes in relation to the new economic classification • Commission Regulation 329/2009 introducing hours worked and gross wages and salaries for retail trade and services as new short-term statistics indicators • Commission Regulation 461/2012 repealing industrial new orders Other legal acts relevant for short-term statistics • Regulation (EC) 1893/2006 of the European Parliament and of the Council establishing the statistical classification of economic activities NACE Revision 2 • Council Regulation 696/1993 on the statistical units for the observation and analysis of the production system in the Community http://epp.eurostat.ec.europa.eu/portal/page/portal/short_term_business_statistics/legislation
Agricultural and Fisheries Statistics	Livestock and Animal Products – Regulation 1165/2008 Farm Structure Survey – Regulation 1166/2008 Fisheries – Regulation 216/2009 and Regulation 762/2008 Pesticides – Regulation 1185/2009 Crops - Regulation Regulation 543/2009
Environment and Resources Unit	• Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics. • Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. • Environmental Accounts EU Regulation 691/2011 • Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics • Directive 2008/92/EC of the European Parliament and of the Council of 22 October 2008 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users • Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC • Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC • EUROPE 2020 A strategy for smart, sustainable and inclusive growth.
Business Registers	Regulation (EC) No 177/2008
Living Conditions and	• SILC: o Regulation CE 1177/2003 of the EP and Council of 16 June 2003 concerning

Culture Statistics	Community statistics on income and living conditions (EU-SILC) o Regulation CE 1553/2005 of the EP and Council of 7 September 2005 amending Regulation CE 1177/2003 concerning Community statistics on income and living conditions (EU-SILC) o Regulation CE 1980/2003 of the EP and Council of 21 October 2003 on definitions o Regulation CE 1981/2003 of the EP and Council of 21 October 2003 on fieldwork aspect and imputation procedures o Regulation CE 1982/2003 of the EP and Council of 21 October 2003 on sampling and tracing rules o Regulation CE 1983/2003 of the EP and Council of 7 November 2003 on the list of target primary variables o Regulation CE 16/2004 of the EP and Council of 6 January 2004 on the content of intermediate and final quality reports o Regulation CE 28/2004 of the EP and Council of 5 January 2004 implementing Regulation CE 1177/2003 of the European Parliament and of the Council concerning Community statistics on income and living conditions (EU-SILC) as regards the detailed content of intermediate and final quality reports • Culture o No legislation • Crime o No legislation
Labour Market	EC Regulation 577/98
Population and Tourism Statistics	The methodology used for the collection and compilation of most of Tourism Statistics data is according to Eurostat recommendations and rules stipulated according to Regulation no. 692/2011. There are other data that are collected for national purposes, in which case, the variables have been selected and defined according to national users' needs and other Units within NSO (e.g. National Accounts). The same holds for the compilation of statistics on Demography and Migration.
Education and Information Society Statistics	ICT: (EC) No 808/2004

- **Data gathering methodologies employed by the different units**

In terms of the existence of an established methodology on how data is gathered the findings show that there is a veritable mix of data gathering methods employed by NSO, from direct surveys to online inputting through dedicated data trawlers that are based on structured generic data modules generally created by the same data source organisations, other NSO units or European entities, which help to integrate the data across the different EU countries. Table 4 depicts the unit inputs that were analysed in this study.

Table 4: Data Gathering Methodologies Employed

Unit	**Data Gathering Method**
Methodology and Research	Depends on the process being considered. For instance, if data is collected through CATI, no data entry phase is required and thus it is omitted. The Unit is responsable for various adhoc surveys which must be considred on a case by case basis. However,

	in general the process is closely related to the GSBPM (Generic Statistical Business Process Model) model. This maybe accessed through this link: http://www1.unece.org/stat/platform/display/metis/The+Generic+Statistical+Business+Process+Model
National Accounts Unit	The National Accounts Unit collects information on a quarterly basis from very large companies in Malta. Other annual sources are obtained from other units within NSO or third parties.
Public Finance	The data source is the System for the Administration of Social Benefits (SABS) held by the Department of Social Security. The SABS data is obtained from the NSO Unit C1 (Living Conditions and Culture Statistics), who obtain the data from the Department of Social Security.
Balance of Payments	Information for BoP and IIP are gathered through Direct Reporting (DR) surveys and complemented with administrative sources. Surveys are carried out monthly / quarterly / annually according to relevance of respondents.
International Trade and Transport Statistics	Data is gathered from administrative sources as follows: Intrastat (Trade between EU Member States) Monthly or on a per consignment basis information under VAT legislation (supplementary information) by traders who surpass the annual threshold of €700. Over 95% of the data is captured through electronic means (XML and webform) with the rest through manual forms lodged at Customs or at the NSO. Extrastat (Extra-EU Trade) is derived from Customs data. Data transfer is carried out on a monthly basis. The compilation of Transport Statistics is primarily based on administrative data supplied by the Gozo Channel Company Limited, Transport Malta, the Police Department and the Guard and Warden Services Limited. Transport data with reference to maritime and land transport is supplied by Transport Malta, while those for traffic accidents are supplied by the Police Department and the Guard and Warden Services Limited.
Price Statistics	As such there isn't an established methodology on how data is gathered. The methodology can change from time to time. Most of the data are collected using the following methods: Field work, internet, telephone, administrative sources and mail (only few). The RPI and the HICP are compiled on a monthly basis.
Structural Business Statistics	Yes the data is collected through a sample survey based on NACE class and employment. For certain strata, the data is census based.
Short-term Statistics	Methodology of short-term business statistics - Interpretation and Guidelines Methodology of short-term business statistics - Associated documents Methodological guide for developing producer price indices for services Guidelines for compiling the monthly index of production in construction Handbook on industrial producer price indices (PPI) http://epp.eurostat.ec.europa.eu/portal/page/portal/short_term_business_statistics/methodology Surveys used by the Unit:

	Quarrying Manufacturing Construction Water and Energy Wholesale and Retail Trade Services Producer Price Index Industrial Production Development Form
Agricultural and Fisheries Statistics	Yes for example: - Slaughtering data is collected on a monthly basis from the civil abbatoir (administrative source). Data is transferred by email and it is published on a quarterly basis. - Fisheries – Data on catches are collected on a monthly basis from the fisheries department (administrative source). Data is transferred by email and it is published on a quarterly basis. - Farm Structure Survey – This consists of a sample of 1,500 holdings. Interviewing is done face-to-face. Part of the holdings are interviewed over the telephone.
Environment and Resources Unit	Yes we have any established methodology according to various manuals which are issued by Eurostat. For example waste statistics is collected according to EWC codes and also according to a number of directives which are updated from time to time
Business Registers	The business regiter is based on annual data. The main sources are administrative, VAT and MFSA registry of companies. An intial survey is sent to all new enterprises for proper classification. Survey data from various NSO units is used to update mainly the employment and the main activity.
Living Conditions and Culture Statistics	• SILC o Annual survey of approx 4,500 households done by CAPI, transmission to Eurostat as follows: § Cross-sectional data: September N+1 (though we are being pressed by Eurostat to move this to June N+1, with early transmission of material deprivation variables in December N) § Longitudinal data: March N+2 § Intermediate quality report: December N+1 § Final quality report: December N+2 • Culture o Culture plan in collaboration with Creative Economy Working Group covering § Band clubs (census every 2-3 years) § Cinema statistics (census every 1-2 years) § Tuition of performing arts (census every 2-3 years) § Theatres (census every 2-3 years) § Museums and historical sites (census every 2-3 years) § Cultural events organised in local councils (annual census in collaboration with Superintendence of Cultural Heritage) § Library statistics (administrative data) § Non-governmental organisations (census every 3-4 years) § Sports organisations (census every 3-4 years) § Fireworks (census still under development) § Live music industry (census still under development) • Crime o Transmission of § Crime statistics to Eurostat (annually) § United Nations Crime Trends Survey to the United Nations Office on Drugs and Crime (annually)

	§ European Sourcebook on Crime (every 2 years) § Money Laundering Statistics (every 2 years) § Trafficking in human beings (every 2 years) o Data is all obtained from statistics held by other organisations (mainly Police, Prisons & Law Courts)
Labour Market	All LFS data is gathered by way of surveys. Information is gathered using paper questionnaires (for the first interview). Updates to data are carried out using customised CATI software.
Population and Tourism Statistics	Data collection on Tourism and Demographic Statistics is collected using different methods/sources: Tourism: • From the demand perspective, an ongoing border survey is conducted at the Malta International Airport and Seaport. Information on inbound and outbound tourism is collected. • A monthly census is carried out among hotels and questions are asked about the number of arrivals and nights spent. This measures tourism from the supply side. • A newly established data collection module on domestic tourism. Demography and migration: • Data is mainly collected from administrative registers although a high degree of data compilation is required to extract the main demographic indicators.
Education and Information Society Statistics	ICT: Two surveys one among Enterprises and the other among Households. In both cases the scope is limited to what is mentioned in the regulation. ICT Enterprises is a Census of Enterprises employing 10 or more persons ICT Households is a stratified random sample among households where at least one member is between 16 & 74 years old.

- **Data management procedure on how the data processing occurs (from source to reporting)**

Data processing is heavily dependent on the main data requirements pertaining to each specific datasets. Whilst some units have no established data management procedures in place, others have an established data sourcing, gathering, inputting, cleaning, weighting, analysing and outputting that is verifyable and can be replicated. This is particularly so for those datasets that require reqporting to the various external entities. In terms of the establishment of a spatial data process, such a pre-established structure will enable NSO to build a lineage legacy for the spatial part of the process. Table 5 depicts the data management procedures employed by the different units.

Table 5: Data management procedure on how the data processing occurs (from source to reporting)

Unit	**Data Management Procedure**
Methodology and Research	Subject to the process under study.
National Accounts Unit	No.
Public Finance	Follow a data management procedure but this is not documented.
Balance of Payments	Procedures are regular. Sending out of questionnaires; vetting; data

	capturing; analysis.
International Trade and Transport Statistics	A data management procedure is followed to integrate Intra and Extra-EU data for dissemination purposes. The trade system is an integrated IT solution to carry out preliminary validations at the data entry stage. After validity and credibility validations, ad-hoc extractions are performed to identify errors and facilitate their correction. Corrections and flagging operations are carried out manually.
Price Statistics	No.
Structural Business Statistics	Once questionnaires are received, the data is vetted and entered into an application programme. Some estimations will be done based on administrative data. Queries are tackled by calling the enterprises or when available checked against administrative data. Follow-ups are done for non-respondents.
Short-term Statistics	The unit has a working procedure which is as follows: 1. Send questionnaire by post to respondents (with the exception of PPI which is issued via e-mail.), 2. Allow for a reasonable time-frame for client to complete questionnaire, 3. On receipt of each questionnaire, the questionnaire is vetted and registered in our computer system as received, 4. When the deadline expires a reminder is issued to respondents. This can be either by e-mail or by telephone or both, 5. If reasonable time has elapsed, often two periods of non-compliance, and no data was received a legal notification is issued, 6. Apply fines as measure of last resort. NB. Non response data is usually treated either by administrative sources or estimations.
Agricultural and Fisheries Statistics	Yes, this varies according to the data set.
Environment and Resources Unit	Receive most of the data sets on a monthly basis and some others on an annual basis. Most of the data is transferred via emails. Having received the information, then the unit staff checks and validates the data in order to be able to re process and disseminate it accordingly.
Business Registers	Data is analysed and uploaded in the Business Register depending on the various timeframes of the source. Checks across various sources are done prior to uploading.
Living Conditions and Culture Statistics	Yes, this varies according to the data.
Labour Market	Data which is collected via paper questionnaires is coded and checked and entered into a custom made data entry application. The rest of the data collected is saved directly into the data entry application. An extract of the data collected is made on a monthly basis and this is subsequently checked using a number of syntaxes and verifications. Information is subsequently aggregated on a quarterly basis where grossing up procedures are carried out to estimate the national results. Subsequently information is analysed and transmitted to Eurostat and published at a national level.
Population and Tourism Statistics	There are internal procedures although work is underway in order to improve efficiency in the current modes of data collection/compilation/storage.
Education and Information Society	ICT data is gathered, vetted (manually) & inputted in the system. Afterwards it is inputted & weighted in SPSS. Tables & reports are

Statistics	extracted from SPSS.

- **Dissemination processes**

Data dissemination processes were reviewed for their procedural aspects in terms of media employed and the main lacunae/problems the units face in the dissemination process. Table 6 depicts the different methods employed by the different units, which does not show maps as the main method, neither as a partial method, even though in terms of the Census and the Agri publications, the reports depict maps as either static images or even interactive GIS in the case of Census (Methodology and Research). The main mode of dissemination is based on press releases as managed by a central unit, dissemination through analogue or digital (online pdf or interactive CD/DVD) means, the NSO StatDB and other online systems.

Table 6: Dissemination Issues

Unit	**Dissemination Process**
Methodology and Research	Printed publications; NSO website; CD Roms
National Accounts Unit	Data is published on a through a press release which is freely available on the website of NSO in pdf and excel format. Data is transmitted to Eurostat in the format established by Council Regulation 2223/96.
Public Finance	The data on social security benefits by locality and districts is published on a printed publication and is available online for free.
Balance of Payments	Regular dissemination is with Eurostat, the ECB and the IMF. Dissemination to ES and ECB is done through Gesmes reports and sent through EDAMIS, which is the only acceptable way to the two institutions. Reports to the IMF are sent by email or through an IMF-dedicated processing module, the ICS.
International Trade and Transport Statistics	Trade data is disseminated on a monthly basis locally through News Releases and transmitted to Eurostat in aggregated and detail formats.
Price Statistics	All data are disseminated through the External Cooperation and Communication Unit. In the case of the RPI, a report highlighting the major changes characterising the monthly inflation rate is shared with the social partners during the RPI Advisory Board meeting. However, since they meet before the actual release is issued, all members in the board treat these data as confidential. The Release is then made public (disseminated) on a pre-specified date as indicated in the calendar. An electronic version of the release is sent to the media and uploaded on our website at 11am on the day it is issued. Data related to the HICP and the Property Price Index are sent to Eurostat normally one week before the releases are due to be issued by Europe's statistical arm. However, the releases of the HICP and the Property Price Index in Malta follow the same procedure of the RPI. In other words, the responsibility to disseminate this information is assumed by the External Cooperation and Communication Unit.
Structural Business Statistics	Once the data is analysed, we treat the data for confidentiality and is sent to Eurostat according to the transmission tables as specified by the Regulation. The data is finally disseminated via e-Damis.

Short-term Statistics	Data estimation is according to NSO dissemination policy. http://nso.gov.mt/docs/DisseminationNSO.pdf In general, our data is published in disseminated to the press, published on NSO's website and certain datasets are also available on our STAT DB section of our website.
Agricultural and Fisheries Statistics	Data is disseminated in the form of a news release. An annual cd publication is also released.
Environment and Resources Unit	The data is mostly disseminated through news releases, publications, leaflets and sometimes also through dedicated conferences.
Business Registers	The Business Register data is mainly disseminated in the Business Demographics Release and through various requests. An annual inquiry questionnaire is sent to Eurostat via eDamis.
Living Conditions and Culture Statistics	• SILC o Results published on Eurostat website, and by NSO in a series of news releases • Culture o News releases • Crime o Published in Demographic Review • News releases and publications are disseminated through NSO regular channels
Labour Market	Data is disseminated via news releases and transmissions to Eurostat.
Population and Tourism Statistics	Data is disseminated locally in the form of monthly (or sometimes quarterly) news release in the case of tourism. On the other hand, an annual publication (Demographic Review) is released. Data is also sent to Eurostat as per the respective regulations.
Education and Information Society Statistics	ICT Enterprise data is sent to Eurostat in aggregated form while microdata on ICT Households is transmitted. Locally two news releases - one on each topic, are published annually.

- **Dissemination outputs**

Data outputs include graphics, imagery, tabular and other means. Table 7 shows that the main method employed at NSO is that of Tables were all units publish their statistics in table form with all except 2 (Balance of Payments and Structural Business Statistics) using a multi-method approach that includes other methods. 87% employ the use of text whilst 67% charts/graphs. 60% employ all three methods, whilst 5 units never use charts/graphs for this purpose. Inetrestingly, the Methodology and Research unit were the only one who listed maps (7%) as an output. This finding shows that the need to concentrate on the visualisation aspect of maps as against or in combination with charts/graphs is a major issue that this project identified and which it tackled as part of its process.

Table 7: Dissemination Issues

Unit	**Graphs**	**Tables**	**Text**	**Maps**
Methodology and Research	X	X	X	X
National Accounts Unit	-	X	X	-
Public Finance	-	X	X	-

Balance of Payments	-	X	-	-
International Trade and Transport Statistics	X	X	X	-
Price Statistics	X	X	X	-
Structural Business Statistics	-	X	-	-
Short-term Statistics	X	X	X	-
Agricultural and Fisheries Statistics	X	X	X	-
Environment and Resources Unit	X	X	X	-
Business Registers	X	X	X	-
Living Conditions and Culture Statistics	X	X	X	-
Labour Market	-	X	X	-
Population and Tourism Statistics	X	X	X	-
Education and Information Society Statistics	X	X	X	-

- **Lacunae in the dataflow**

The main lacunae in the dataflow process pertain to the inherent processes that are experienced by statisticians particularly in terms data collection, redundancy, validation and timeliness. In other cases, software and tools are seen as the main issues related to data lacunae or processing hindrances (Table 8).

Table 8: Dataflow Issues

Unit	Issues
Methodology and Research	N/A
National Accounts Unit	The National Accounts collects data from all units of NSO, thus the format of the data often differs. The use of excel and the lack of a proper database is a problem.
Public Finance	To overcome any inconsistencies in the SABS database.
Balance of Payments	Current procedures are somewhat cumbersome and time-consuming.
International Trade and Transport Statistics	Most problems are encountered at the trade data capture processes due to late, inaccurate and partially completed declarations.
Price Statistics	The inability to validate more than 9500 prices collected every month.
Structural Business Statistics	Data collection and number of respondents are the biggest issues when the data is based on surveys.
Short-term Statistics	Our response rates are most often robust but many resources and efforts are allocated to non-response. The automation of questionnaires can also help reducing costs.
Agricultural and Fisheries Statistics	-
Environment and Resources Unit	Collaboration with other authorities and timeliness are the most issues which are hampering the data flows.
Business Registers	The Business Register contains more than 100,000 units (including dead and dormant). The consolidation of various administrative sources is the

	main concern.
Living Conditions and Culture Statistics	-
Labour Market	Different software which needs to be used to go through the different stages of the data collection and dissemination process.
Population and Tourism Statistics	The data collection stage is generally most problematic, especially in cases when the quality of the administrative data that is provided does not suffice to meet required quality standards.
Education and Information Society Statistics	The risk of under reporting is the main concern: Eg: ICT Enterprises depends on the Business Register to be fully updated for the reference year, otherwise there is a chance that in scope enterprises are not included during data collection.

- **Perceptions on spatialisation**

Table 9 shows that in terms of spatialisation (the conversion of data into maps) the reviewers were asked what their opinions on such a dissemination/analysis option where and whether they would consider converting their data into mapped format and why. Whilst most comment on the viability of such an exercise or technology use, others are cautious in terms of the level to which such data can be used and depicted. This mainly due to the perception that it is already difficult to analyse such data at national or NUTS 3 level, which situation would be gretaly complicated with LAU 1 and LAU2 level data.

Table 9: Perceptions on spatialisation

Unit	**Perceptions**
Methodology and Research	No because not all of the data would be feasible to be analysed at such a level of detail. This depends on the representation of the source and the particular subject being considered.
National Accounts Unit	No. National Accounts data is not organised by locality or regions so it is impossible to present the data in form of maps.
Public Finance	Our social security benefits publication is currently missing the use of maps. Should the maps be introduced they would elevate the publication into a new dimension. Software to convert the data into maps is not available at the NSO and the costs for outsourcing are high.
Balance of Payments	N/A
International Trade and Transport Statistics	Spatialisation of transport data with reference to traffic accidents may be a viable avenue to pursue.
Price Statistics	With respect to dissemination, it is already hard enough to determine inflation at national level let alone at locality level or regional level. Giving more detail might send the wrong signals to the market. That said, the tool might be useful to scrutinize the data.
Structural Business Statistics	No. Due to our small size, most probably the data broken down in such details as the tables where provided will cause confidentiality issues. Secondly, the data was broken down according to districts but in our case we cannot distinguish between the mailing address and the real

	address where the business is located. The data was issued according to the mailing address (where the questionnaire is sent). This does not imply that the enterprise is actually located at that address.
Short-term Statistics	It will only be beneficial for permit data and turnover for Annex C and D.
Agricultural and Fisheries Statistics	To have such dissemination option it would be interesting. It will not be a problem to convert the data into the mapped format if the data could be used for such process.
Environment and Resources Unit	Converting the data into maps gives a new dimension to the data. Not all the generated data can be plotted onto maps.
Business Registers	The Business Register contains both the mailing address and the business address but the main updates are only done on the mailing address.
Living Conditions and Culture Statistics	We would consider presenting results in this way in future, in fact, we have already received some requests of this type.
Labour Market	Spatialisation is worth exploring for labour market data.
Population and Tourism Statistics	We would be interested in using maps only for dissemination purposes and for data that is available at LAU 2 level.
Education and Information Society Statistics	I think this is a new and valid tool which may give new insight especially for reporting purposes. I would definitely consider converting parts of my data to this format once this option has been tested in this specific context.

- **NUTS/LAU Levels**

Table 10 shows that the responses are varied from unit to unit, with some, as detailed in section above, prefering NUTS1/2, whilst other pointing towards a better consolidation of dissemination at NUTS 5 level, which though constrained by high detail, can be aggregated towards the larger aggregated abstract levels such as NUTS3, 2 and 1.

Table 10: NUTS/LAU Levels

Unit	NUTS/LAU Levels
Methodology and Research	Unit receives different types of data, of which, some are received at national level, others at locality etc.
National Accounts Unit	NUTS 2
Public Finance	LAU 1 and LAU 2
Balance of Payments	N/A
International Trade and Transport Statistics	Locality level.
Price Statistics	National Level - Malta and Gozo treated as one area.
Structural Business Statistics	Unit disseminates data to Eurostat NUTS 2 level.
Short-term Statistics	Unit refers to Nuts level 1 (Malta as a whole country incorporating Gozo)
Agricultural and Fisheries Statistics	Few datasets could be published at Nuts 4 level another at Nuts 2 and Nuts 3 level
Environment and	NUTS 2 levels

Resources Unit	
Business Registers	Preferably national due to the business address maintenance.
Living Conditions and Culture Statistics	Depends on the data. It is anticipated that data at NUTS 5 level and NUTS 4 level will be most useful to users.
Labour Market	Data is available at NUTS 4, however there may be issues of representation as well.
Population and Tourism Statistics	LAU 2; although unit is considering using specially designed regions for tourism purposes.
Education and Information Society Statistics	It depends on what comes out during the testing phase. The more detail can be produced the better.

- **Awareness of INSPIRE Directive**

Table 11 shows that the awarness of the INSPIRE Directive is limited at best with only 2 units stating pre-project awareness, either through international meetings and a discussing with the national entity responsible for implementing the INSPIRE Directive.

Table 11: Awareness of INSPIRE Directive

Unit	**Awareness of INSPIRE Directive**
Methodology and Research	No.
National Accounts Unit	No.
Public Finance	No.
Balance of Payments	No.
International Trade and Transport Statistics	Not aware of the Inspire directive before this questionnaire. It is understood that the INSPIRE directive was set up to establish an infrastructure for spatial information in the European Union and to facilitate data dissemination in this medium across the EU.
Price Statistics	No.
Structural Business Statistics	No.
Short-term Statistics	No.
Agricultural and Fisheries Statistics	Yes, it was mentioned in meetings attended at Eurostat
Environment and Resources Unit	Yes, had meeting with MITA about this some weeks ago.
Business Registers	No.
Living Conditions and Culture Statistics	No.
Labour Market	No.
Population and Tourism Statistics	No.
Education and Information Society Statistics	-

- **GI knowledge and training**

Table 12 depicts knowledge of GI available in the different offices and asks whether the unit heads would envisage training staff in the technology. In general, very few have any knowledge of GI and are willing to explore this venue and acquire training, except for one unit stating an over-bearing workload. The overall positive attitude is seen as a major positive aspect for this project since there is now an awareness of a potential tool for widening the units' work and output.

Table 12: GI knowledge and training

Unit	**GI knowledge and training**
Methodology and Research	Yes, it would be a fruitful experience.
National Accounts Unit	No there is no knowledge of GI in the National Accounts Unit. The unit is too busy to dedicate time for such training.
Public Finance	No knowledge of GI and training is always welcome.
Balance of Payments	No. More information required.
International Trade and Transport Statistics	No.
Price Statistics	No knowledge of GI is available in the unit. The use of such technology would help staff carry out a more in depth analysis of the collected data.
Structural Business Statistics	No.
Short-term Statistics	No knowledge of GI is available to the unit but all will be willing to learn more.
Agricultural and Fisheries Statistics	Yes basic knowledge is available. Training is seen as a requirement.
Environment and Resources Unit	Some knowledge of GI in the unit but staff need re-training since they are not using the software or plotting any data.
Business Registers	No.
Living Conditions and Culture Statistics	Following the course held at NSO 2 members of staff now have basic knowledge of GI.
Labour Market	GI knowledge is not available in the unit.
Population and Tourism Statistics	Not available. However the unit would be highly interested in providing training opportunities for staff.
Education and Information Society Statistics	No knowledge is available

In summary, whilst extensive methodologies are used in the diverse units, GI is not one of the strong elements, in fact only one unit stated that it employs maps as an output, however most units emphasise the need to employ this method as an example for future analysis and knowledge creation.

7.2 Datasets to be used in this project

The initial study identified a series of datasets that could be taken on board for the mapping exercise. These were spread across all the units with some units that did not have access to sub-national data being reviewed as part of the feedback session back the datasets completion (Annex I

Section B) was excluded from this exercise in order to concentrate on the individual units that can eventually deliver outputs in spatial format.

Data layers identified:

i) Methodology and Research:
   - Table 1 - Population by sex and age (in groups) for each locality and corresponding Enumeration Area

ii) Public Finance:
   - Table 2 - National Minimum Pension (NMP)
   - Table 3 - Children's Allowance (CA)

iii) Agricultural and Fisheries Statistics:
   - Table 4 - Animals as at December 2012

iv) Population and Tourism Statistics:
   - Table 5 - Number of total live births, by residence of parents: 2008 – 2010
   - Table 20 - Arrivals and nights spent by district - 2012

v) Business Registers:
   - Table 6 - Business Register - Turnover & Employment

vi) Structural Business Statistics:
   - Table 7 - Turnover, VAFS and Number of Enterprises by district
   - Table 8 - SBS - Number of Enterprises broken down by Nace Sector and by District

vii) Labour Market Statistics:
   - Table 9 - Activity Rate
   - Table 10 - Employment Rate
   - Table 11 - Unemployment Rate

viii) Education and Information Society Statistics:
   - Table 12 - 30-34 tertiary level attainment
   - Table 13 - Early school leavers rate
   - Table 14 - Individuals having computer access at home – 2011
   - Table 15 - Individuals with access to the internet at home – 2011

ix) Living Conditions and Culture Statistics:
   - Table 16 - At risk of poverty rate by sex and district: 2011
   - Table 17 - At risk of poverty or social exclusion rate by sex and district: 2011
   - Table 18 - S80/S20 ratio by district: 2011
   - Table 19 - Average household income by district: 2011

The datasets will be investigated as part of the second exercise post this interim report.

8 Initial Training

8.1 Training in Mapwindow

An initial training exercise in MapwindowGIS was held on the 15-18th September. The training material is attached in Appendix B.

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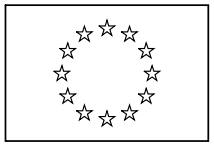
8 Annex I

8.1 Mindmapping Exercise



EUROPEAN COMMISSION
EUROSTAT
Directorate E: Sectoral and regional statistics

EUROSTAT UNIT: E.4 – Regional statistics and geographical information
THEME: 5.05. – Geographical and local information
Title: Merging statistics and geospatial information in Member States

EUROSTAT GRANT FOR 2012

Valletta, Malta

National Statistics Office, Malta 2012-2014
STATAMAP: Spatialisation and Dissemination of Statistics:
A Background Technical Report Survey
Dr. Saviour Formosa
September 2013

Title of the Project:	**STATAMAP: Spatialisation and Dissemination of Statistics**

Name of Contracting Organisation:	**National Statistics Office, Malta**

As part of the activities being carried out to review the situation of NSO's data spatialisation, the project Team is currently drafting a status document and requires your expert input on a number of issues which would enable us to acquire an overview of the status perspectives and requirements.

You are requested to fill in the respective data sheet pertaining to your unit. Section A entails the data flow sector and Section B refers to specific datasets that have been identified for the initial phase of this project. Where not applicable, kindly skip Section B or identify a specific dataset that would be suitable for the spatialisation process.

Data layers identified:

x) Methodology and Research:
   - Table 1 - Population by sex and age (in groups) for each locality and corresponding Enumeration Area

xi) Public Finance:
   - Table 2 - National Minimum Pension (NMP)
   - Table 3 - Children's Allowance (CA)

xii) Agricultural and Fisheries Statistics:
   - Table 4 - Animals as at December 2012

xiii) Population and Tourism Statistics:
   - Table 5 - Number of total live births, by residence of parents: 2008 – 2010
   - Table 20 - Arrivals and nights spent by district - 2012

xiv) Business Registers:
   - Table 6 - Business Register - Turnover & Employment

xv) Structural Business Statistics:
   - Table 7 - Turnover, VAFS and Number of Enterprises by district
   - Table 8 - SBS - Number of Enterprises broken down by Nace Sector and by District

xvi) Labour Market Statistics:
   - Table 9 - Activity Rate
   - Table 10 - Employment Rate
   - Table 11 - Unemployment Rate

xvii) Education and Information Society Statistics:
   - Table 12 - 30-34 tertiary level attainment
   - Table 13 - Early school leavers rate
   - Table 14 - Individuals having computer access at home – 2011
   - Table 15 - Individuals with access to the internet at home – 2011

xviii) Living Conditions and Culture Statistics:
   - Table 16 - At risk of poverty rate by sex and district: 2011
   - Table 17 - At risk of poverty or social exclusion rate by sex and district: 2011
   - Table 18 - S80/S20 ratio by district: 2011
   - Table 19 - Average household income by district: 2011

Section A:

Directorate:	
Unit Name:	

1. Do you abide by any specific legislation on how to gather/analyse/report the data? (Kindly list)

2. Does your unit have an established methodology on how data is gathered? Kindly mention and give examples where possible. (examples could include surveys, censuses, monthly data transfers, annual reporting, etc)

3. Do you follow a data management procedure on how the data processing occurs (from source to reporting)?

4. Which dissemination processes do you employ and how is the data disseminated? (Which media do you employ for such a service?) and what they perceive as the main lacunae/problems they have.

5. Which methods do you employ as part of dissemination in terms of graphics, imagery, tabular data?

Graphs	
Tables	
Text	
Maps	

6. What parts of the cycle do you perceive as the main lacunae/problems in ensuring a smooth flow of the data process.

7. In terms of spatialisation (the conversion of data into maps) what are your opinions on such a dissemination/analysis option? Would you consider converting all your data into mapped format and why?

8. At which LAU/NUTS level would you perceive your data in? Or would you prefer another categorisation (Regjuni, others)?

9. Are you aware of the INSPIRE Directive? Kindly explain.

10. Is knowledge of GI available in your office and would you like to train your staff in the technology?

<table>
<tr><td colspan="2">Section B:</td></tr>
<tr><td colspan="2">Information on this specific dataset</td></tr>
<tr><td>Dataset</td><td>Methodology and Research: Table 1 - Population by sex and age (in groups) for each locality and corresponding Enumeration Area</td></tr>
<tr><td>Source</td><td></td></tr>
<tr><td>Periodicity</td><td></td></tr>
<tr><td>Metadata availability</td><td>Is a metadata available? In which format/structure? (kindly attach such and where available a data cycle document that decsribes how you gather, clean, store disseminate the data)</td></tr>
<tr><td>Spatial Level</td><td>Which LAU Levels do you employ?</td></tr>
<tr><td>Process</td><td>
<table>
<tr><td>Source</td><td>Processing/cleaning</td><td>Analysis</td><td>Output</td></tr>
<tr><td>(How did you gather the data?)</td><td>(What did you do to process the data? Conversions, cleaning, populating, etc)</td><td>(How did you analyse the data: no processing (copy and pasting/pre-prepared formatted tables / simple mathematical functions / complex statistics</td><td>(How did you prepare the data for dissemination? Conversion to graphs and images /maps or text)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Lacunae/Issues</td><td>Are there specific issues that might impede this dataset to be converted to GIS or to be disseminated? (Would such a map make sense if disseminated at different LAU levels or even at this level or would a chart/graph be more acceptable?)</td></tr>
</table>

Each of the above forms was created for the list of datasets below:

Dataset	Public Finance: Table 2 - National Minimum Pension (NMP)
Dataset	Public Finance: Table 3 - Children's Allowance (CA)
Dataset	Agricultural and Fisheries Statistics: Table 4 - Animals as at December 2012
Dataset	Population and Tourism Statistics: Table 5 – Number of total live births, by residence of parents: 2008 - 2010

Dataset	Population and Tourism Statistics: Table 20 – Arrivals and nights spent by district – 2012
Dataset	Business Registers: Table 6 - Business Register - Turnover & Employment
Dataset	Structural Business Statistics: Table 7 - Turnover, VAFS and Number of Enterprises by district
Dataset	Structural Business Statistics: Table 8 - SBS - Number of Enterprises broken down by Nace Sector and by District
Dataset	Labour Market Statistics: Table 9 - Activity Rate
Dataset	Labour Market Statistics: Table 10 - Employment Rate
Dataset	Labour Market Statistics: Table 11 - Unemployment Rate
Dataset	Education and Information Society Statistics: Table 12 - 30-34 tertiary level attainment
Dataset	Education and Information Society Statsitics: Table 13 – Early school leavers rate
Dataset	Education and Information Society Statsitics: Table 14 - Individuals having computer access at home – 2011
Dataset	Education and Information Society Statistics: Table 15 - Individuals with access to the internet at home – 2011
Dataset	Living Conditions and Culture Statistics: Table 16 - At risk of poverty rate by sex and district: 2011
Dataset	Living Conditions and Culture Statistics: Table 17 - At risk of poverty or social exclusion rate by sex and district: 2011
Dataset	Living Conditions and Culture Statistics: Table 18 - S80/S20 ratio by district: 2011
Dataset	Living Conditions and Culture Statistics: Table 19 - Average household income by district: 2011

9 Annex II

9.1 Training Materials