Reference Information Specifications for Europe (RISE)
Specific Support Activity SSA3-2005-012141
Project co-funded by the European Commission within the 6th Framework Programme (2002-2006)
Integrating and Strengthening the European Research Area – Priority 4: Aeronautics & Space

Exploitation Guidelines

Version 1.1

Deliverable number: 34

Date: 16 November 2007

Project started: 1st September 2005

Duration: 27 months

Project Coordinator: Nick Land/Dave Lovell, EuroGeographics

Bundesamt für Kartographie und Geodäsie

Customer:	European Commission
Customer Reference:	Contract FP6-012141
Project Title:	RISE: Reference Information Specifications for Europe
Document Title	Exploitation Guidelines
Principle Author	Jörgen Hartnor, Helen Eriksson
Principle Contributors	PCMG participants
Responsible Partner	Lantmäteriet
Reviewed By	RISE PCMG
Approved by	Dave Lovell
Filename	RISE34_Exploitation_Guidelines_V1.1
Distribution	PU
Contact	http://www.eu-rise.org/ Jörgen Hartnor, Helen Eriksson firstname.lastname@lm.se

Revision History			
Version	Author	Date	Comments
0.1a	Jörgen Hartnor, Helen Eriksson	2007-02-15	First Draft
0.2	Jörgen Hartnor, Helen Eriksson	2007-04-24	Second Draft, updates and amendments following discussions at PCMG meeting in Kiruna
0.3	Martin Klopfer	2007-05-03	Third Draft, major revision of structure, added exploitation section 4.
0.4	Jörgen Hartnor, Helen Eriksson	2007-05-28	Fourth Draft, revision of structure, updates and amendments
0.5	Jörgen Hartnor, Helen Eriksson	2007-06-12	Incorporated comments from Dominique Laurent, and made other updates and amendments
0.6	Martin Klopfer	2007-06-27	Revision based on 0.5 comments from BKG & IGN
0.7	Jörgen Hartnor, Helen Eriksson	2007-09-11	Revision based on 0.6 comments from PCMG
0.8a	Wyn Cudlip	2007-09-19	Inserted Plan for using and disseminating the knowledge as Chapter 5 – as per EC format
1.0a	Jörgen Hartnor, Helen Eriksson	2007-09-26	Final draft for revision by the PCMG
1.0	Helen Eriksson	2007-09-28	Issued
1.1	Jörgen Hartnor, Helen Eriksson	2007-11-16	Minor additions based on external reviewer's comments

Executive Summary

The primary aim of the RISE project is to produce guidelines for the creation of harmonised geospatial data product specifications - consistent with the relevant international and industrial standards - to facilitate the production of data product specifications on the conceptual and implementation level.

The key outcome from RISE is therefore the definition of a process – a repeatable methodology – for developing, adopting and maintaining harmonised data products specifications. The resulting RISE methodology in particular addresses issues concerning the harmonisation of heterogeneous data sources and has been developed, tested and improved based on use cases addressing the topic of diffuse nutrient leakage into surface water bodies. The choice of use cases addresses GMES, INSPIRE and WFD interests and issues. The approach is documented in the RISE Deliverable RISE15 Methodologies and Guidelines V1.2 and has been submitted to the INSPIRE Drafting Team on Data Specifications as input for their developments.

This document identifies the key stakeholders with an interest in data harmonisation and provides guidelines for dissemination and exploitation activities to promote the adoption and commercial uptake of the RISE Methodology. A more detailed view on cost benefit aspects related to applying the RISE methodology is provided in the RISE Deliverable RISE30 Cost Benefit Report.

To put the exploitation guidelines into perspective, this document starts with a short description of the requirements and reasons for harmonisation of geospatial data, followed by a short presentation of the RISE approach. It then identifies the relevant stakeholder communities, the specific value proposition for these groups and the relevant means and activities for communication with these communities resulting in an exploitation plan.

More detailed information about the RISE project as well as all public documents can be found at the project web site: http://www.eu-rise.org

Terms

Data harmonisation

providing access to data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using within the ESDI a common set of data product specifications

NOTE This includes agreements about coordinate reference systems, classification systems, application schemas, etc.

Data product specification

detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to and used by another party [ISO/DIS 19131]

Data specification

data product specification that describes INSPIRE or GMES datasets of a specific theme from different data providers in a harmonised way

ESDI

European spatial data infrastructure as built based on the INSPIRE framework directive

NOTE The ESDI is expected to include, for example, additional content beyond the data provided by those that are legally mandated to do so according to the directive.

GMES

concerted effort to bring data and information providers together with users, so they can better understand each other and make environmental and security-related information available to the people who need it through enhanced or new services http://www.gmes.info

NOTE GMES is the abbreviation of "Global Monitoring for Environment and Security".

INSPIRE

Framework directive for building an infrastructure for spatial information in the Community http://inspire.jrc.it

Interoperability

capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units [ISO 2382-1]

ability of two or more systems or components to exchange information and to use the information that has been exchanged [IEEE]

NOTE It is worth to note that strictly speaking there is no "interoperability" between data sets. The only things that can interoperate are services and systems. In the case of several heterogeneous data sources, interoperability requires "wrapping" data sources into services that conform to standards. The output of these services is what is to be harmonised, not their inputs (database schemas). Thus the legacy is maintained and can evolve to support the specified service interfaces. As a result, data producers will not have to change the structure of their data.

NOTE Interoperability in the ESDI context means that each country maintains their own infrastructure, but adopts a framework that enables existing datasets to be linked up from one country to another (e.g. via transformation or translation).

NSDI

A National Spatial Data Infrastructure (NSDI) has come to be seen as the technology, policies, criteria, standards and people necessary to promote geospatial data sharing throughout all levels of government, the private and non-profit sectors, and academia. It provides a base or structure of practices and relationships among data producers and users that facilitates data sharing and use. [FGDC]

Thalweg

The line defining the lowest points along the length of a river bed or valley.

Web Coverage Services (WCS)

The Web Coverage Service is an OGC standard web service for exchanging geospatial data. WCS provides available data together with their detailed descriptions; allows complex queries against these data; and returns data with its original semantics (instead of pictures) which can be interpreted, extrapolated, etc. -- and not just portrayed. This is in contrast to a Web Feature Service (WFS), which returns actual vector data, and a Web Map Service (WMS) which produces a digital image file

Web Map Services (WMS)

An OGC Web Map Service (WMS) produces maps of spatially referenced data dynamically from geographic information. This international standard defines a "map" to be a portrayal of geographic information as a digital image file suitable for display on a computer screen.

Web Feature Services (WFS)

The OpenGIS Web Feature Service Interface Standard (WFS) is an interface allowing requests for geographical features across the web using platform-independent calls. The XML-based GML is the default payload encoding for transporting the geographic features, but other formats like shape files can also be used for transport.

Abbreviations

CBA	Cost Benefit Analysis
CEN	European Committee for Standardization (in French Comité Européen de Normalisation)
DNL	Diffuse Nutrient Leakage
EC	European Commission
ESA	European Space Agency
EU	European Union
FP	Framework Program (EU financed programs)
GI	Geographical Information
GIS	Geographical Information System
GML	Geography Markup Language
ICT	Information and Communications Technology
IT	Information Technology
LMO	Legally Mandated Organisations
ISO	International Organisation for Standardization
OGC	Open Geospatial Consortium
NGO	Non Governmental Organisations
PCMG	Project Consortium Management Group
RISE	Reference Information Specifications for Europe
SDIC	Spatial Data Interest Community
SDI	Spatial Data Infrastructure
UML	Unified Markup Language
UN	United Nations
WFD	Water Framework Directive
XML	Extended Markup Language

Reference documents

[1] RISE13 Data Harmonisation Requirements. V1.0. 10 February 2006.

[2] RISE15 Methodology & Guidelines on Use case & Schema Development. Version 1.2, 24 September 2007.

[3] RISE17 Services Architecture Outline. V1.0. 23 March 2007.

[4] RISE18 Use Case Document. V1.5. 28 September 2007.

[5] RISE23 Conceptual Schema in UML, V1.1. 7 September 2007.

[6] RISE25 Data Product Specifications. V1.0. 28 September 2007.

[7] RISE30 Cost Benefit Report. V1.1. 13 November 2007.

[8] RISE36 Testing System Report. V1.0. 31 October 2007.

[9] INSPIRE Architecture and Standards Position Paper.

http://inspire.jrc.it/reports/position_papers/inspire_ast_pp_v4_3_en.pdf

[10] GMES website http://www.gmes.info/

RISE document available from:

http://www.eu-rise.org/ or http://www.eurogeographics.org/eng/03_RISE_downloads.asp

Table of Contents

1 Data Harmonisation

1.1 Why Data Harmonisation?

The general situation on spatial information in Europe is one of fragmentation of datasets and sources, gaps in availability, lack of harmonisation between datasets at different geographical scales and duplication of information collection. These problems make it difficult to identify, access and use data that is available.

Every information system works with data stored according to an internal data model based on its own set of requirements. A key step in the data harmonisation process is to achieve interoperability on the conceptual level (semantic interoperability) so that users and implementers of different information systems from the INSPIRE, GMES or any other information community can understand the semantics of the relevant information provided by the other system.

Principally speaking, there are two possible ways to solve the problem, full data harmonisation and interoperability. The definitions below have been worked out together with the INSPIRE Drafting Team for Data Specifications:

- *Data harmonisation* requires that all participants use a common set of coordinate reference systems, data model, classification system, etc.

- *Interoperability* requires that each country/organisation maintains their own infrastructure, but adopts a framework that enables existing datasets to be linked up from one country/organisation to another (e.g. via transformation or translation)

Interoperability is the ability of two or more autonomous entities to communicate and co-operate between themselves. This interaction should not require special efforts by the data producer or consumer - be it human or machine. It must be noted that there is no "interoperability" between data sets per se. The only things that can interoperate are services and systems. In the face of heterogeneous data sources, interoperability requires "wrapping" data sources into services that conform to standards. The output of these services is what is to be harmonised, not their inputs (database schemas). Thus the legacy is maintained and can evolve to support the specified service interfaces.

Eventually the requirements from the user community must serve as guidance when it comes to the more detailed description of harmonisation needs. To some extent different user groups have conflicting interests and requirements concerning spatial information and related services, but on a general level the user requirements fall into one or more of the categories below.

1.1.1 Usability Aspects

In order to make use of spatial information in an efficient way and support important sectors in society, the spatial information is to be regarded as an essential component in different kinds of activities, e.g. environmental monitoring, forestry, agriculture or risk management. The spatial information should not be specified for one single usage, including a specific handling system. Instead, the data and information specifications for fundamental data should - as far as possible - meet different user requirements. Furthermore, it should be easy to:

- Use the same kind of fundamental spatial data in different sectors and to add sector specific information to the fundamental data

- Exchange data between different sectors and technical applications, which implies that the spatial data must be object oriented and built on a standardised application schema. Furthermore, the data must be updated and it must be possible also to receive "historical" data.

- Handle the data seamlessly.
- Handle the data with standard GIS tools.
- Discover relevant data sources.

1.1.2 Sustainability Aspects

A model-driven approach is promoted. The lifetime of a technical implementation is shorter than the lifetime of the information it handles. This makes it necessary to describe the information in a way that allows for new techniques and implementation environments to be applied.

The ISO 19100 series of standards provide such a model-driven approach, which means that the information is described by a formal, implementation-independent schema. Implementation of various techniques and implementation environments can be derived from the schema in a more or less automatic way. Changes in information requirements are applied to the schema; never directly to the implementation. Formal schemas are in ISO 19100 named application schemas. They contain semantics for data interpretation as well as data structures for generation of, for example, XML-schemas.

1.1.3 Quality Aspects

It is essential to define efficient procedures for evaluation and quality management of the data flow from acquisition and updating to use in final applications. This concept underpins the integration of a quality management scheme needed to assure data quality. The ISO 19113 quality model contains description of different quality characteristics: availability, up-to-dateness, completeness, consistency, correctness and accuracy.

The possibilities to disseminate large data volumes require good quality descriptions in order to support the users. The users do not always require the highest data quality, but they need to understand that the quality is known, stringently described and appropriate for the actual use. Furthermore, the quality information as well as information on usage rights must be easily available in a metadata description.

1.1.4 Economical Aspects

From a user perspective it is also important that the pricing of spatial information does not discourage efficient use. The models for financing and pricing of data must be easy to access and to understand.

1.2 Harmonisation Initiatives

Generally speaking, tackling environmental issues requires co-operation both within Europe and globally and puts great demands upon harmonisation and interoperability between different global, continental/regional, national and local geographical datasets.

- The EU has launched a number of initiatives relevant to the issue of data harmonisation. In this context, perhaps the most important one is the INSPIRE directive which provides the legal basis for far-reaching interoperability and, where practicable, harmonisation of many important data themes
- The EU-led initiative GMES initiative has been set up to establish a European capacity for Global Monitoring of Environment and Security starting in 2008.
- The work led by UN on Group on Earth Observations (GEO) is another example of an initiative to co-ordinate geographical information so that global environmental issues can be handled in a more efficient way.
- Trade and industry demands require increased harmonisation of geographical data across the

borders and a simpler way of accessing data administered by public authorities. This is obvious for the development of positioning and navigation services, but also for areas such as the real-estate market.

Different nations and organisations within a nation will start from different positions in the harmonisation process, depending on the degree to which feature catalogues and data models for their geographical datasets etc. have already been implemented. Due to different political, economic, cultural and organisational drivers it will not be possible to achieve total harmonisation across all nations. But still, due to INSPIRE, all EU member states will have to create regulations on how data and services will be harmonised within two to five years after the adoption of the directive, based on different time scales for themes in the different INSPIRE annexes I - III.

RISE is providing a basis for addressing all these initiatives through its Methodology and Guidelines document. As is described in section 2.4, testing of the methodology is carried out through Use Cases on diffuse nutrient leakage into rivers emanating from the reporting requirements laid down in the Water Framework Directive.

1.3 Harmonisation Principles

The following description identifies the principles for data harmonisation that are guiding the process to a Data Specification. They shall clarify the meaning of data harmonisation in GMES and INSPIRE.

The framework was developed by the INSPIRE Drafting Team “Data Specifications” in close cooperation with the RISE project and is based on the following assumptions:

- All Member States and organisations start from different positions in terms of conceptual schemas, etc. Due to different political, economic, cultural and organisational drivers, we will not achieve and should not aim at achieving total harmonisation across every nation as part of the INSPIRE process. Regional diversity will and should continue to exist.
- A mechanism that provides a common language to support needs at European Union and other large cross-border and cross-sector levels is required.
- The trend towards the integration of geographic information into the information and technology mainstream will accelerate.
- The main goal at least for the foreseeable future will be to achieve a "virtual harmonisation“ by enabling interoperability in a service-based architecture rather then harmonisation of the underlying conceptual models. Two aspects of harmonisation need to be distinguished:
    - a common process and methodology of developing data specifications in order to have an harmonised conceptual schema for all the themes involved in INSPIRE
    - for every individual data specification a conceptual schema needs to be designed that is capable of representing data from the various data sources and providers that need to provide the content for the download services
- In this context data harmonisation requirements have to be considered on different levels:
    - the application schema level (use of common application schemas independent of the application schemas of the base data)
    - the data level (e.g. edge matching in border areas)

2 The RISE Project

2.1 Overview

The RISE project builds on the results of previous projects and develops synergies with current activities and projects relevant to the RISE project. In particular, RISE has performed a detailed desk study on the data harmonisation requirements as can be found in the various GMES projects and INSPIRE. Also, RISE has developed a close working relationship with the INSPIRE Drafting Team on Data Specifications.

The first outcome of the RISE project was a *Data Harmonisation Requirements* document. The GMES projects database of the EC was used as one of the sources. It was recognised that the need for integration and harmonisation of data is one common denominator among all the GMES projects in the desktop study. Most projects also recognise the lack of a suitable standard. To the extent possible, existing standards are used, but when no such standard is available, the projects often have had to develop their “own” common language.

A key outcome of the project is the definition of a repeatable capability for the development, adoption and implementation of harmonised data product specifications. This is documented in the *Methodology & Guidelines on Use Case & Schema Development* document, developed in close co-operation with the above mentioned Drafting Team.

The methodology has been tested and improved with use cases on diffuse nutrient leakage into rivers emanating from the reporting requirements laid down in the Water Framework Directive (WFD) where the requirements of GMES, INSPIRE and – of course – the WFD can be tested. Based on the Use Cases, harmonised data product specifications for the geographic themes of ‘hydrography’, ‘land cover’ and ‘elevation’ have been developed.

With the use case description as a basis, an application schema has been developed in UML. The schema has been implemented in a prototype and tested.

To understand and quantify costs and benefits for data harmonisation work during the implementation of the INSPIRE framework and later phases of GMES operation, RISE provides a template outlining the benefits of each of the steps of the RISE methodology on a qualitative level and identifies the areas which need to be considered in detail for a quantitative case by case study.

2.2 The RISE Approach

In order to produce sustainable results and provide best support for GMES, INSPIRE and related operational scenarios, RISE is following a standardised and well-documented approach which is described in the OpenGIS Reference Model (ORM). It provides the framework for a Spiral Development process which is predictable and repeatable.

In RISE, each spiral in the Spiral Development process is defined by the following steps:

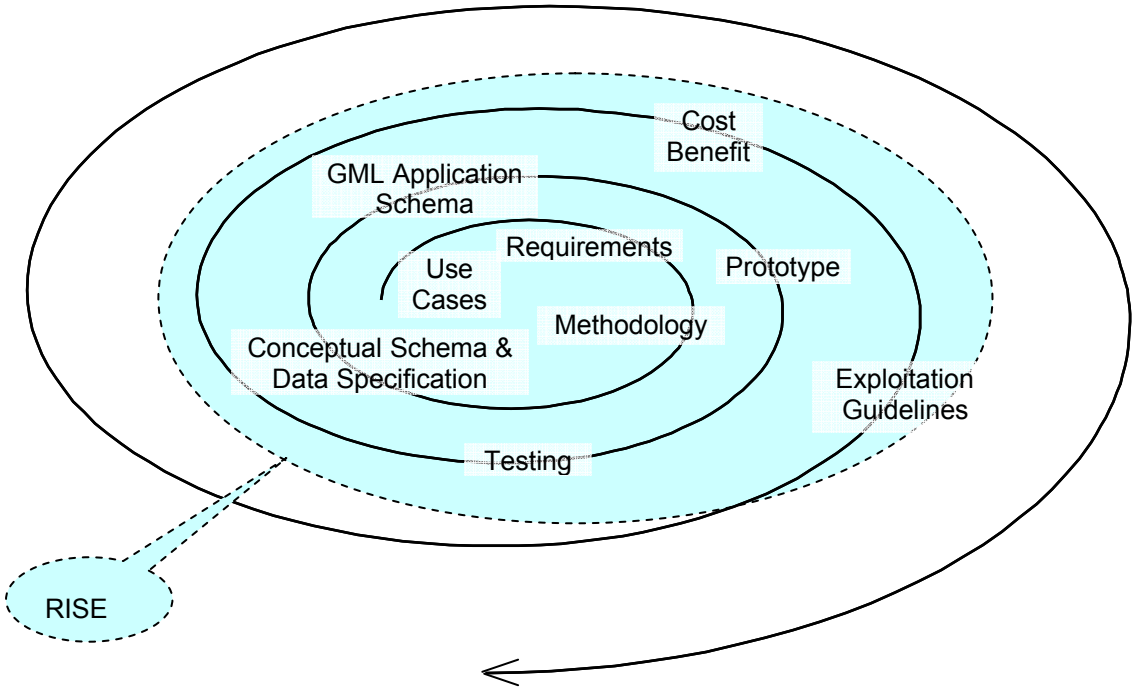
- Requirements expressed as capabilities are described in use case scenarios.
- These use cases describe the relevant universe of discourse which is then documented as an application schema which is a model based on feature types and their properties resulting in a common terminology and described in a conceptual schema language. This application schema constitutes a core component of a Data Specification.
- The Data Specifications are documented according to ISO 19131, the (draft) International Standard specifying the contents of Data Product Specifications in the field of geographic information. A Data Product Specification includes at least the following sections: specification scopes, data product identification, data content and structure, reference systems, data quality,

data product delivery, and metadata.

- Based upon the application schema, a GML application schema (GML = Geography Markup Language = ISO 19136) is generated following the normative rules for such conversions.

- These results are tested within a prototype under real world conditions and brought forward to INSPIRE, OGC and industry for appropriate consideration and feedback.

- The costs and benefits of the harmonisation efforts are tracked based on the actual efforts which have been spent in the project to create initial samples of harmonised data products and specifications following the RISE Methodology. The RISE Cost Benefit Analysis thus provides a template for organisations who wish to deploy the RISE methodology. By outlining the necessary steps and related efforts, each third party will be able to do a cost estimate based on its very own internal structure, processes and procedures as well as financial framework. In the same way the benefits are outlined on a generic level, thus allowing an organisation to calculate e.g. potential savings on the production side or gains due to newly addressable market segments based on their very own cost structures and marketing strategies.



For the creation of final harmonised data product specifications and products in an operational environment, it is recommended to address a reasonably large sample of users, covering a broad range of application requirements and to apply the spiral cycle more than once, so that the feedback from user testing can be applied to review and enhance the initially identified requirements and the resulting specifications.

The related documents for the steps described below are available at the RISE project website at: http://www.eu-rise.org

2.3 Methodology Guidelines

The primary aim of RISE is the definition of a process – a repeatable methodology –for the creation of harmonised geospatial data product specifications consistent with the relevant international and industrial standards. The guidelines are presented in the RISE document "Methodologies and Guidelines on Use case and Schema Development". The methodology is based on the standards and guidelines laid down by OGC and ISO (ISO 19100 series of standards) and provides a Use Case Template and a Checklist Spreadsheet to assist with the analysis.

The key aspect of the RISE Methodology is to use a Use Case analysis to convert the general business requirements for harmonisation (e.g. the need for a harmonised WFD reporting for river networks) into specific data harmonisations requirements (e.g. common terminology, data structures, co-ordinate reference systems etc.). The process involves an “as-is” analysis followed by a gap analysis and a definition of a harmonisation approach. These activities combined allow a harmonised Data Product Specification to be defined. The Use Case analysis aims at providing the necessary understanding of relevant data sources and models, actors and their interactions, and the workflows towards meeting the user requirements posed by an application.

The steps of the methodology are not carried out sequentially, but with a considerable overlap to allow for rapid feedback. At every step, potential issues are pushed back to the previous steps to enhance the process, if required. This iterative development should be completed by user testing of the resulting specifications and products, which in turn can lead to a refinement of the initial use case description.

1. **Use Case Description**
   Purpose: identify and describe business requirements
   Result: Use case description, updated glossary
   Documented in: Use case template
2. **Identification of Requirements**
   Purpose: identify and describe requirements from the use case. These requirements are transformed by a GI expert to a first-cut of the data product specification (first-cut application schema).
   Result: List of feature types, list of requirements
   Documented in: Data harmonisation checklist
3. **As-is-analysis**
   Purpose: identifying the available information
   Result: Description of the current situation (per source dataset)
   Documented in: Data harmonisation checklist
4. **Gap Analysis**
   Purpose: compares the results of the 'as-is' analysis with the first-cut application schema, evaluates if the identified source material is sufficient to fulfil the requirements in the application schema. Identifies how to extract information from these data sources into the application schema
   Result: Description of data harmonisation issues derived from the identified requirements and taking the as-is analysis into account
   Documented in: Data harmonisation checklist
5. **Application Schema and Data Product Specification**
   Purpose: The results from the use case and the analysis are formalised in the data product specification.
   Results:
   1. ISO 19109 application schema specified in UML. A GML application schema is derived automatically from the UML application schema.
   2. Data product specification with clauses specified in ISO 19131 (including application schema in UML as well as the corresponding feature catalogue and GML application schema)
   3. Updated data dictionary, updated glossary
   Documented in: Application schema, Data product specification and Data Dictionary
6. **Implementation, test and validation**
   Purpose: To test the data product specification in a real implementation.

Results:
1. Implementation of an application using the data product specification and an associated Data Service.

2. Report on the test implementation

2.4 Use Case Development

The RISE Use Cases provide a working example on the use of RISE Methodology and Guidelines to develop a use case based on Diffuse Nutrient Leakage (DNL) Reporting to the Water Framework Directive. Reporting on that topic, and other issues, had to be carried out by all EU Member States for the first time in 2005 under a limited set of requirements. The actual specifications for the 2010 requirements are currently under discussion by the relevant working groups at national and EC level.

RISE does not address the whole issue of DNL reporting; rather, it addresses the issues associated with harmonising some of the input datasets required as part of the overall process. RISE has chosen the themes of hydrography, land cover and elevation to generate examples of the use of the RISE Methodology to develop harmonised Data Product Specifications covering these three themes. These components are relevant to DNL reporting and are also relevant to the INSPIRE 'priority common basic data' list (INSPIRE Annexe 1) and to many GMES applications.

To provide additional focus for the Use Case analysis, the scenario in Sweden, Norway and France is evaluated in detail. Specific user-experts from these countries have been involved in the process. The use of the two Scandinavian countries has allowed both the cross-sector and the cross-border aspects to be addressed in the scenarios.

The Swedish and Norwegian approaches to processing input data for the Hydrography and Land cover themes have been used as examples; and these have been based on real user requirements whenever possible. The 'Elevation' theme is dealt with through looking at a French reporting example involving the generation of "thalwegs", i.e. the line defining the lowest points along the length of a river bed or valley[1].

2.5 Data Specification Development

The RISE UML Application Schema is derived from the use cases addressing the themes of hydrography, land cover and digital elevation. The application schema has been designed by a team that was composed of domain experts, GI experts and software engineers. A facilitator from the RISE project managed the process.

For the hydrography theme, RISE could build on guidelines and UML models from the GIS Working Group of the Water Framework Directive. The development of the RISE application schema was thus fairly straightforward.

For the land cover theme the requirements were less clear than for hydrography. In an attempt to build on previous projects, a first draft of the application schema was based on the Euroharp project. However, after discussion this approach was rejected because it was far too detailed to be used for nutrient leakage calculations. The experts then developed a more dedicated approach. The starting point for this approach is the coefficients used to calculate nutrient leakage from different types of land cover, which are fairly coarse. This enabled the aggregation of the various land cover classes in the national datasets into a more manageable number, without jeopardising the calculations. The resulting application schema could be used for the nutrient leakage reporting as required for 2010.

The development of an application schema for elevation suffered from the absence of any documented requirements by the time the work started. The consortium analysed the as-is situation concerning the Digital Elevation Models in the member countries to find applications that relate with the RISE use case.

[1] http://www.thefreedictionary.com/thalwegs

This analysis resulted in a new use case, the computation of “thalwegs” ("theoretical hydro") in France. Further development was rather delayed but straightforward.

2.6 RISE Test Environment (RTE)

The final step in the RISE Methodology is to test the harmonised Data Product Specification in a real implementation. To satisfy this step a RISE Test Environment (RTE) was created consisting of a number of on-line services sitting on an underlying Oracle database.

The main goal of the RTE was to demonstrate the creation of harmonised data products “on the fly” and to allow users to test the associated Application Schema generated by the RISE Project.

This was achieved by making use of an interactive website where users can view or download harmonised data products. The datasets are generated automatically from the original proprietary datasets based on the RISE harmonised Data Product Specifications (hDPS). The user feedback allows further refinement of the initial use case descriptions and subsequent development of the Application Schema if required.

The RTE had a number of requirements to satisfy and these can be summarised as follows:

Off-line:

- To ingest existing test datasets – from participating end users.
- To ingest metadata associated with test datasets.
- To receive GML Application Schema (GAS) (automatically generated from UML Schema).
- To generate sample “harmonised” data products (hDP) from the GAS by means of a dynamic Feature Translation Service (or a Web Coverage Service in the case of the DEMs).
- Create a website where users can view and retrieve relevant documents and access the RISE Test Services

On-line:

- Provide Users access to view and retrieve relevant documents, including:
  - The harmonised RISE Data Product Specifications (text).
  - The UML (Conceptual Schema) diagram.
  - The GML Application Schema (text).
- Demonstrate on-the-fly creation of hDP covering:
  - feature translation and attribute creation (particularly for hydrography).
  - aggregation (particularly for Land Cover),
  - re-projection and tile merging in the case of DEM
- Provide capability to allow capture of hDP as it is being generated and served.
- Provide a Data Portrayal Service to aid in the testing process (through the use of a WMS).
- Provide capability to compare ingested existing data with the new hDP.

Full details of the RTE, including its requirements, design and test results, can be found in the RISE Testing System Report [6]. Similar requirements are likely to apply to any test environment implemented to test future harmonised Data Product Specifications.

2.7 Cost-Benefit Aspects

To aid exploitation activities and support the uptake of the RISE methodology, the project also addresses the costs of developing harmonised data product specifications and outlines the foreseen benefits of applying the RISE methodology.

To understand and quantify costs and benefits for data harmonisation work during the implementation of the INSPIRE Framework and later phases of GMES operation, the starting point for the documentation of the cost aspects for RISE are the actual costs incurred within RISE for the development of selected harmonised data product specifications.

The actual benefits cannot be quantified on a generic level, but need to be addressed on an individual basis, taking into account the specifics of the domain and players involved. Therefore RISE has chosen to provide a template outlining the benefits of each of the steps of the RISE methodology on a qualitative level and to identify the areas which need to be considered in detail for a quantitative case by case study.

Given the limited time and resources available within the RISE project, it has not been possible to verify all aspects of the use of the template. However, as the implementation of standards is vital to data harmonisation, RISE has studied the costs and benefits related to a number of activities, including the implementation of the Swedish Surface Water Standard in the Swedish National Land Survey as well as the introduction of the IDPR methodology in France.

The RISE Cost Benefit Report [5] identifies the following benefits to be analysed for the different steps of the RISE methodology:

- **efficiency benefits**
  Often called “costs savings” or “costs-avoided” benefits, efficiency benefits are those that arise by reducing the costs to perform existing tasks in an organisation. This is most often achieved by making it faster and cheaper to carry out tasks and projects. Efficiency benefits may be directly measured in terms of the number of staff hours/ salary that are saved (Craglia, 2003; Halsing *et al.*, 2004; EC 2006).

- **effectiveness benefits**
  Sometimes called “value-added” benefits, effectiveness benefits are those that arise by improving the outcome of projects or tasks because of better information (e.g. reduced uncertainty due to higher quality or more up-to-date data) or the addition of new tasks that could not be performed before (Craglia, 2003; Halsing *et al.*, 2004).

- **social-political benefits, including:**
  - Benefits to citizens (for example greater access to information, more transparent and accountable governance, greater empowerment and participation)
  - Benefits to government (for example improved collaboration with other stakeholders within and outside government, greater political legitimacy)
  - Benefits to business (for example increased innovation and knowledge spill over, increased concentration of and quality research, new business opportunities and applications, job creation).

3 Identifying Stakeholders

The results from the RISE project provide benefits to a variety of stakeholders;. it is therefore important to identify the stakeholders and their respective situation (e.g. line of activities, potential interest, position on the market, potential outreach etc) such that it is possible to address the stakeholder from his own perspective.

Following an initial analysis, the identified stakeholders have been grouped into five categories:

- Data Providers,
- Data Integrators,
- Harmonisation & Standardisation Initiatives,
- FP6/FP7 Projects and
- End User Community.

The following sections address each stakeholder group in more detail.

3.1 Data Providers

Data Providers form the foundation of each country's national data infrastructure and thus hold the key to a successful implementation of any data harmonisation efforts. Their existing data models and resulting products are geared towards existing business models and markets. The key to convince data providers to adopt harmonisation guidelines and provide according products lies in appropriate business models in support of related investments.

Many data providers are governmental organisations with legal obligations. At least for these organisation, the implementation of the INSPIRE directive will be mandatory. INSPIRE provides the legal basis for far-reaching harmonisation of many important themes. Most of the work for harmonising geospatial data lies with the data providers. They have to see to it that their geospatial data can be "mapped" to harmonised data product specifications (i.e. data interoperability) in order to be able to provide harmonised geospatial data through, for example, Web Map Services (WMS) and Web Feature Services (WFS).

This group contains for example:

- **European National Mapping and Cadastral Agencies** manage the national cadastral systems and topographic mapping, and are responsible for the efficient provision of basic national geographic and land information.
  Their outreach is mainly national and their clients are in central and local government sectors, in the private sector and amongst the general public.

- **European National Meteorological and Hydrological Institutes** provide, for example, general weather forecasts, customised forecasts, analyses, surveys, statistics, expert opinions and reports, climate studies and research.
  Their outreach is mainly national and their clients come from various sectors, from the general public to governmental and private sectors with specific needs on meteorology, hydrology or oceanography.

- **European National Geological Surveys** studies, documents and provides information about national bedrock, deposits and groundwater.
  Their outreach is mainly national and their clients are local authorities, county administrative boards, government agencies, exploration companies, and construction and civil engineering companies.

- **Private companies** such as Satellite data providers and Aerial Photography companies are also part of the group of data providers. They all supply data and services along the complete value chain of geographic information. Most of these geographical data are provided to users by license agreements.

  Satellite data providers are for example:

  - Spot Image www.spotimage.fr
  - EuroMap www.euromap.de
  - Space Imaging Europe www.euspaceimaging.com

  Aerial Photography companies are for example:

  - BLOM AS www.blomasa.com
  - EuroSense www.eurosense.com
  - Hansa Luftbild www.hansaluftbild.de

3.2 Data Integrators

Today, data integrators are often faced with the situation of having to integrate and manipulate heterogeneous data from different sources in order to get the desired result. Once data is harmonised and exchanged using a predefined format, this task will either be much simplified or not necessary to perform at all any more. Below is a description of some of the data integrators.

3.2.1 Eurogeographics

Eurogeographics represents nearly all European National Mapping and Cadastral Agencies (NMCAs) in Europe, currently 49 organisations from 42 countries. Eurogeographics develops pan-European products and services, promotes collaboration and sharing of best practice between members, is the official and united voice of Europe's NMCAs and helps the European Commission with its programmes and directives.

The outreach is mainly among their members.

3.2.2 GMES Fast Track Services

Fast Track Services are GMES services that have been identified as first candidates for “fast track” treatment, with the objective of being operational by 2008. This selection has been performed on the basis of the following criteria: their maturity, uptake by user communities and long term sustainability of demand and supply. As a result, three "fast track" services have been identified; **Emergency response** (INSCRIT - Information Service in Response to Crises, Disasters and Emergencies), **Land monitoring** (LMCS - Land Monitoring Core Service) and **Marine** (MCS - Marine Core Service).

In the first instance, the outreach is mainly the user organisations and industrial partners that have participated in the various GMES projects. At a later stage, the intention is that the services should be available to all kinds of organisations and to the general public.

3.2.3 Content Industry

Companies and organisations undertaking various GIS consultancy work within all fields of application. There are many such organisations in any country, few examples are mentioned below:

- ESRI, www.esri.com
- Intergraph www.intergraph.com
- InfoTerra (now Grantium Inc.) www.grantium.com

- Blom www.blomasa.com
- Thales www.thalesgroup.com

3.2.4 GIS vendors

Some of the GIS vendors that operate in Europe are:

- ESRI, www.esri.com
- Intergraph www.intergraph.com
- Autodesk www.autodesk.com
- IBM, www.ibm.com
- GE Network Solutions www.gepower.com
- MapInfo http://www.mapinfo.com/
- Leica Geosystems www.leica-geosystems.com

3.3 Harmonisation & Standardisation Initiatives

There are currently many ongoing harmonisation and standardisation initiatives. They play a crucial role in producing methods/standards and for the implementation of harmonised data products and services. The most important initiatives are described below.

3.3.1 INSPIRE

The INSPIRE Directive has been adopted by the EU and lays an important legal foundation for data harmonisation. The INSPIRE Work Programme identifies a step-wise approach for the definition and preparation of the detailed Implementing Rules (IR) needed for a coherent application of the INSPIRE Directive. The IRs take the form of a Commission Decision or a Regulation, which is legally binding on all individuals or organisations to whom it is addressed. IRs are produced by Drafting Teams and adopted by the Commission which is assisted by a Committee representing the Member States. The most interesting Drafting Team from a data harmonisation perspective is the INSPIRE Drafting Team on Data Specifications.

The organisational structure that will be used for the development of draft Implementing Rules for a particular data theme depends on the amount of work that existing specifications need in order to fulfil the user requirements. Three scenarios are envisaged:

1. Candidate specifications available
   → Adoption procedure of candidate specifications for draft INSPIRE Implementing Rules
2. “Raw material” available
   → Specification development process shared by the INSPIRE stakeholders
3. No or insufficient “raw material” available
   → Specification development process with involvement of experts

For scenarios two and three a Thematic Working Group (TWG) will be set up, consisting of experts from approximately three to five SDICs or LMOs.

3.3.2 The Open Geospatial Consortium

The Open Geospatial Consortium Inc (OGC) is a non-profit voluntary standards organisation. The OGC is an international industry consortium of 339 companies, government agencies and universities participating in a consensus process to develop publicly available interface specifications. The specifications empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. Specifications are developed in a consensus process supported by OGC industry, government and academic members to enable geo processing technologies to interoperate.

OGC has a focus on geographical information and the standards and specifications adopted are followed worldwide by all organisations involved in such work. Of particular interest is that the software vendors play an active role in OGC.

3.3.3 ISO

ISO, the International Organisation for Standardisation, is a network of the national standards institutes of 157 countries, on the basis of one member per country. ISO is a non-governmental organization. ISO is working with all kinds of standards, not only within the geo information spherehttp://www.iso.org/iso/en/aboutiso/introduction/index.html - top#top. Of immediate relevance to RISE is the ISO 19100 series of standards and there are currently on-going work with – for instance – standards on data exchange which is one of the main issues of RISE.

The standards adopted by ISO for geo information are – to a larger or smaller extent – followed worldwide by all organisations involved in such work.

3.3.4 CEN

CEN, the European Committee for Standardization, comprises of 30 European member states and 7 associated members. Like ISO, CEN is working with all kinds of standards, not only within the geo information sphere.

Its outreach is similar to that of ISO, but with a focus on Europe.

3.4 ESA and EU FP6/FP7 Projects

There are many on-going projects financed by the ESA and the EU that are faced with data harmonisation issues to a larger or smaller extent. During the project, RISE has been in touch with many ESA/EU-funded projects addressing harmonisation issues. The most relevant projects are listed below.

3.4.1 MOTIIVE

Marine Overlays on Topography for Annex II Valuation and Exploitation, MOTIIVE, is a 2-year project funded by the EU 6th FP under the GMES budget. The project started on September 1st 2005 and comprises 9 partners. MOTIIVE builds on the work of the MarineXML project, which ended in February 2005.

The objective of MOTIIVE is to examine the cost benefit of using non-proprietary data standards while addressing data harmonisation requirements between the INSPIRE data component “elevation” and INSPIRE marine thematic data for “sea regions”, “oceanic spatial features” and “coastal zone management areas”.

3.4.2 HUMBOLDT

The HUMBOLDT project is an Integrated Project partly financed under the GMES budget of the 6 FP of the EU comprising 27 partners from 14 European countries. The project has duration of four years and started in October 2006 with the aim to manage and advance the implementation process of the ESDI. The main goal of Humboldt is to enable organisations to document, publish and harmonize their geospatial data, partly by creating software tools and processes. To support this harmonisation effort, the project will create a framework for the management of geospatial data, thus facilitating data exchange between data providers and users.

HUMBOLDT will – among others – support some of the GMES application areas and is thus expected to in particular have an impact on these projects.

3.4.3 WISE

Water Information System for Europe (WISE) is a system for data upload, sharing and analysis of requirements for the Water Framework Directive (WFD). WISE is a joint initiative of DG Environment, The European Environment Agency (EEA), Eurostat (ESTAT) and the Joint Research Centre (JRC). A GIS Working group consisting of Member States GIS experts is also connected to the WISE initiative. Their role is to discuss the practical process on how to continue GIS work under the WFD.

The outreach for WISE is mainly the governmental bodies of the EU member states involved in WFD reporting.

3.4.4 GSE Land

The overall goal is to implement a European service network responding to the demand of international, national, regional and local user organisations.

The GSE Land Information Services is based on the main results related to land issues of the three projects SAGE, GMES Urban Services (GUS) and CoastWatch from the GSE consolidation phase and provides guidelines to establishing a set of priority information service centres responding to the main information needs of European institutions.

3.5 End User Community

Many actors within the end user community are also data integrators and data providers. This is for instance the case within the RISE use cases. However, in general this community includes, but is not limited, to the groups below.

3.5.1 The European Commission

The European Commission (EC) is working in a number of fields where use of geographical information of various kinds will bring many benefits. In addition to the needs of the EC itself (which mainly are on the pan-European scale) the EC is also responsible for collecting information from its Member States as well as adopting Directives in various fields that obligates Member States to report different activities. These activities in turn require the Member States to collect geographical information matching the requirements.

The EC thus has a vast impact and outreach all over Europe, mainly on the various national organisations.

3.5.2 National and Regional Authorities

Some examples of National and Regional Authorities are:

- **Water Authorities**
  The National Water Authorities coordinate activities within their water district. They prescribe Environmental Quality Standards, Programme of measures and River basin management plan. They are responsible for describing the water status, to recommend quality standards and to establish necessary measures.
  Their outreach is mainly national.

- **County Administrative Boards**
  The County Administrative Board has many different responsibilities, e.g. to ensure that national goals are reached at county level, to supervise that various bodies observe the law and guidelines, to coordinate different interests, to act as a service organisation and providing expert help to all who live and work in the county

- **Local Authorities**
  The main duties of the local authorities are to handle education (except universities), social

care, building control, control of the environment, health care, rescue services, culture and recreation.

3.5.3 Non Governmental Organisations (NGOs)

Some examples of non governmental organisations are:

- **Greenpeace**
  Greenpeace is an international environmental organization known for its campaigns to stop atmospheric and underground nuclear testing. Now the focus has turned to other environmental issues, e.g. global warming, ancient forest destruction, nuclear power, and genetic engineering.

- **Red Cross**
  The International Red Cross is an international humanitarian movement whose stated mission is to protect human life and health, to ensure respect for the human being, and to prevent and alleviate human suffering, without any discrimination based on nationality, race, religious beliefs, class or political opinions

3.5.4 General Public

This group includes individual end users, who require geospatial data for a specific purpose. When more services containing harmonised data that becomes available the more activities can be expected within this group. For example, with the availability of harmonised data products it will be easier to create generic display processes for implementation in, for example, Google Earth.

Also, the INSPIRE Directive is not only for public authorities but also for providing better information to the citizens, e.g. transparency in environmental policies.

4 Value Propositions

In order for any organisation to adopt new working methods, the organisation needs to identify that it would produce benefits. Such benefits are normally found within the financial area but could also be in the form of meeting a legal obligation. The latter is of course in particular valid for any public organisation, that - for instance - will have to comply with the INSPIRE Implementing Rules once the INSPIRE directive has been incorporated into the national legislation. However, even if it's a legal obligation for such organisations, the implementation is facilitated if the organisation also can identify financial or other benefits.

The sections below identifies three categories of benefits and how each stakeholder group will benefit, resulting in identifying the most appropriate means of addressing each stakeholder group in order to facilitate their uptake of the RISE methodology. One section also gives a brief description of the steps in the methodology and the outcome from each step so that the stakeholders can get a better understanding in how they can gain from using the methodology.

4.1 Identified User Benefits

The benefits that data product harmonisation provides can be described from different perspectives. Below is a description of the benefit categories.

4.1.1 Efficiency Benefits

Often called "costs savings" or "costs-avoided" benefits, efficiency benefits are those that arise by reducing the costs to perform existing tasks in an organisation. This is most often achieved by making it faster and cheaper to carry out tasks and projects. Efficiency benefits may be directly measured in terms of the number of staff hours/ salary that are saved (Craglia, 2003; Halsing *et al.*, 2004; EC 2006).

4.1.2 Effectiveness Benefits

Sometimes called "value-added" benefits, effectiveness benefits are those that arise by improving the outcome of projects or tasks because of better information (e.g. reduced uncertainty due to higher quality or more up-to-date data) or the addition of new tasks that could not be performed before (Craglia, 2003; Halsing *et al.*, 2004).

4.1.3 Social-Political Benefits

Whilst Efficiency and Effectiveness Benefits constitute commercial reasons to commission a User Requirements Documentation, Social and Political Benefits are of a more intangible nature and only served indirectly, once harmonised products are available, together with potential new application areas and markets, e.g.:

- Benefits to citizens (for example greater access to information, more transparent and accountable governance, greater empowerment and participation).
- Benefits to government (for example improved collaboration with other stakeholders within and outside government, greater political legitimacy).
- Benefits to business (for example increased innovation and knowledge spill over, increased concentration of and quality research, new business opportunities and applications, job creation).

4.2 Stakeholder Specific Benefits

In order to motivate a stakeholder to make use of any new product or method it is important to understand his/her current situation and the benefits that this novelty would bring.

The following sections outline the general benefits that the Methodology and Guidelines document could provide to each category of stakeholders and thus enable identification of the most appropriate means of addressing each community.

4.2.1 Data Providers

Data Provider	Description of harmonisation activities likely needed	Possible use of Methodologies and Guidelines (M & G) document	Potential benefits	Efficiency Benefit	Effective-ness Benefit	Social-Political Benefit
European National Mapping and Cadastral Agencies, European Meteorological and Hydrological Institutes, European Geological Surveys	They will have to implement the parts of the INSPIRE directive for which they are data providers.	The M & G document provides a proven and standardised method for data harmonisation that can guide them in their work. It also describes how existing datasets can be mapped to harmonised data specifications.	Enables a more straight forward and time saving approach as well as increased usage and thus more income.	√	√	
Satellite data providers and Aerial Photography companies	Most of the geographical data are provided to users by license agreements. These data would benefit from being compliant with a harmonised standard.	The M & G document provides a proven and standardised method for data harmonisation that can guide them in their work. It also describes how existing datasets can be mapped to harmonised data specifications.	Enables a more straight forward and time saving approach as well as increased usage and thus more income.	√	√	

4.2.2 Data Integrators

Data Integrator	Description of harmonisation activities likely needed	Possible use of Methodologies and Guidelines (M & G) document	Potential benefits	Efficiency Benefit	Effective-ness Benefit	Social-Political Benefit
Eurogeographics	Coordinates the implementation of different harmonised products and data (e.g. Euro Regional Map, EuroRoadS). They also have the possibility to arrange different work shops on the data harmonisation theme for their members.	Eurogeographics participates in the RISE project and is thus in a good position to understand and carry forward the RISE methodology amongst its members, on its website and in its various technical working groups. Eurogeographics can follow the M & G when creating new pan-European products and also use it as reference material on data harmonisation workshops.	Eurogeographics can, in its continued work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work. Enables a more straight forward and time saving approach.	√	√	
GMES fast track services	Will contribute to facilitating access, use and harmonisation of geospatial information at pan-European level. They will develop the needed spatial data infrastructures and the implementation of the INSPIRE directive will be supported.	If the M & G document is used, it would give a standard approach to all harmonisation efforts while creating the fast track services.	Enables a more straight forward and time saving approach. Reduces the costs of implementations	√	√	
Content Industry	When all EU member states are going to implement the INSPIRE directive many GIS consultants will be needed to help out with the data harmonisation.	If the M & G document is used, it would give a standardised approach to all harmonisation efforts.	Enables a more straight forward and time saving approach. Reduces the costs of implementations in Member States	√	√	
GIS vendors	Will need to see to it that their products can support the use of ISO standards that the M&G document and INSPIRE recommends to use, especially GML	Can see to it that their software makes it possible to exchange data using the standards that the M&G document recommends	The SDI initiatives (out of which INSPIRE is one) require harmonised geospatial data. When producing these data, the demand for GIS will increase. When more harmonised data is available, the usage of such data is likely to increase, resulting in increased sales of GIS software.	√	√	
WISE	The WISE Technical Group is currently in the process of updating the WFD GIS Guidance document.	By providing a standards based template, the M&G document could support the development of common implementation strategies.	A “Common Implementation Strategy” process is applied during the implementation of first WFD and now the other water-related policies.			√

4.2.3 Harmonisation and Standardisation Initiatives

Harmonisation and Standardisation Initiative	Description of harmonisation activities likely needed	Possible use of Methodologies and Guidelines (M & G) document	Potential benefits	Efficiency Benefit	Effective-ness Benefit	Social-Political Benefit
INSPIRE Drafting Teams (DT) and Thematic Working Groups (TWG)	Creation of various documents (e.g. Methodology for the development of data specifications, Generic Conceptual Model) Compilation of INSPIRE Implementing Rules.	The final version of the M&G document has been submitted to DT "Data Specifications". They have adapted it to the INSPIRE context to create the INSPIRE document D2.6. The TWGs that will create the theme data specifications will use the INSPIRE methodology as guidelines.	The M&G document has been tested under real world conditions. Furthermore, the experts involved in both RISE and INSPIRE have gained useful experience within RISE.	√	√	
OGC	Compilation of standards to be used for data harmonisation.	OCG-Europe participates in the RISE project and OGC is thus in a good position to understand and carry forward the RISE methodology amongst its members, on its website and in its various technical working groups. In particular since most of the RISE methodology is based on OGC ORM.	OGC can, in its continued work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work. RISE has tested and promotes the OGC ORM via the RISE methodology.	√	√	
ISO	Compilation of standards to be used for data harmonisation.	Use the RISE M&G document as part of the foundation for its continued work. ISO could, possibly, carry forward the RISE methodology amongst its members, on its website and in its various technical working groups, in particular the ones working on the draft standard for data exchange.	ISO can, in its continued work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work. RISE has tested and promotes several ISO standards via the RISE methodology.	√		
CEN	Compilation of standards to be used for data harmonisation.	Use the RISE M&G document as part of the foundation for its continued work. CEN could, possibly, carry forward the RISE methodology amongst its members, on its website and in its various technical working groups.	CEN can, in its continued work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work.	√		
The EC	The European Commission and in particular DG-ENV is a very important stakeholder with respect to streamlining of reporting in the context of various EC directives. The development of harmonised data specifications is a key part in the streamlining processes	In their work with streamlining the reporting to the EC, DG-ENV can use the M&G document as guidelines	DG-ENV can, in its continued work, build on the experience that has been gained through RISE and thus do not need to repeat this work.	√	√	√

4.2.4 ESA and EU FP6 / FP7 Projects

ESA and EU FP6/FP7 Project	Description of harmonisation activities likely needed	Possible use of Methodologies and Guidelines (M & G) document	Potential benefits	Efficiency Benefit	Effective-ness Benefit	Social-Political Benefit
The MOTIIVE project	Examine the cost benefit of using non-proprietary data standards while addressing data harmonisation requirements between the INSPIRE data component “elevation”, “sea regions”, “oceanic spatial features” and “coastal zone management areas”.	According to the project contract, MOTIIVE has tested the usage of the RISE methodology in their work.	Provided that the RISE methodology is proven to work by MOTIIVE, this will bring benefits to the marine community because it can build upon the experience gained through the RISE and MOTIIVE projects.	√	√	
The HUMBOLDT project	Has the aim to manage and advance the implementation process of the ESDI. The main goal is to enable organisations to document, publish and harmonize their geospatial data.	The RISE M&G document could be used when they develop harmonised data specifications for some scenarios in their WP7. Eurogeographics has agreed to participate in the Advisory Board	HUMBOLDT can, in its work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work.	√	√	
WISE	Develops a system for data upload, sharing and analysis of requirements for the WFD.	WISE has already developed a portal for uploading, sharing and analysis and it’s thus not likely that the M&G document will be of any use.	Possibly, the M&G document could be used in future upgrades	?		
GSE Land	The overall goal is to implement a European service network responding to the demand of international, national, regional and local user organisations.	Use the RISE M&G document as part of the foundation for its work.	GSE Land can, in its work, build on the experience that has been gained through the RISE project and thus do not need to repeat this work.	√	√	

4.2.5 End Users

End User	Potential benefits using harmonised geographical data	Efficiency Benefit	Effective-ness Benefit	Social-Political Benefit
The EC	Needs harmonised geographical data on a pan-European level for planning and evaluation purposes. Harmonised geographical data is a must for implementing the INSPIRE Directive.	√	√	√
National and regional authorities	Need harmonised geographical data for better planning and modelling, and for preparing data for EC reporting.	√	√	√
Non Governmental Organisations	For instance, Greenpeace and the Red Cross would profit from easily available harmonised geographical data in their environmental evaluations and first aid planning.		√	√
General public	The general public would profit from easily available harmonised geographical data.		√	√

4.3 Conclusions and Recommendations

The above sections provide a brief description on the situation of each group of stakeholders and indications of the potential benefits that each group could realise by making use of the M&G document. It is of course also important to identify the means to motivate the different groups since each group reacts differently to different messages. The economical aspects are also important for all, but here as well, different groups have different goals and different means to reach them.

In order to facilitate the uptake, it is important to address each group with a message that is relevant to them. The following sections will provide such information.

4.3.1 Data Providers

In order for any data harmonisation activities to take place, the data providers need to be on-board. Also, the data sources in the various countries are often not well documented in terms of the data harmonisation components and this expertise is not always readily available This highlights that the development of specifications for harmonised data products will be a challenging task in the foreseeable future, unless it is taken up by the data providers.

Many data providers are governmental organisations with legal obligations to implement for instance the INSPIRE directive. These data providers might not have to develop their own harmonised data specification, instead they will have to map their existing data to the specifications developed by INSPIRE. The INSPIRE Implementing Rules will naturally guide this work, but also in this case the M&G document can guide the data providers since:

- it recommends the as-is analysis (and should thus avoid unrealistic data specifications)
- it describes experiences on how to map existing data to common data specifications

The INSPIRE directive deals with the pan-European and national levels. However, data harmonisation will be equally important on regional and local levels. Also, many data providers are not public organisations per se. Accordingly, there is a need for a more general approach such as the RISE M&G document.

The message to be communicated to this group is therefore that the need to make an initial investment could be cumbersome, but that RISE has shown that such investment is likely to have a rather short pay-off time. The gains are to be found in more efficient internal work procedures and more effective flow of information as well as new products. All together this is expected to better meet the market demands resulting in higher revenues.

4.3.2 Data Integrators

Data integrators are often faced with the situation of having to integrate and manipulate heterogeneous data from different sources in order to get the desired result. Obviously this is both time and cost consuming, resulting in prices that sometimes are too high for some market segments. Also, some tentative products and services are not possible to produce with the existing means.

Some data integrators may have a fear that part of their current activities will become obsolete when the more harmonised data becomes available, resulting in reduced revenues.

The message to be communicated to this group is therefore that once harmonised data products and services exists, their work of integrating data will be much simplified thus enabling lower prices on existing products and services. Also – and perhaps more important – that harmonised data services will open up new market segments because new products and services can be produced more time and cost efficient. Thus the early adopter will benefit. A prerequisite is of course that the data providers make harmonised data products and services available. One important task for the data integrators is therefore to convince the data providers of the need for such efforts.

4.3.3 Harmonisation and Standardisation Initiatives

The harmonisation and standardisation initiatives/organisations obviously play a crucial role in producing methods/standards and for the implementation of harmonised data products and services. Many relevant standards exist already today and there are many on-going data harmonisation efforts. However, there is no methodology and guidelines to assist the users in applying those standards, thus resulting in unnecessary difficulties amongst the users as well as duplication of efforts. With the adoption of the INSPIRE directive, it becomes even more important to provide as much assistance as possible to all the actors involved.

The INSPIRE DT on Data Specifications has already received the M&G document, which has been tested under real world conditions. In their continued work, they have thus been able to build on the experience that has been gained through the RISE project and accordingly didn't need to repeat this work.

The message to be communicated to this group is therefore that in their continuous work to facilitate the data harmonisation process for the users they can build on the RISE M&G document in a similar manner that the INSPIRE DT on Data Specifications has done. In addition to not having to repeat the work, the advantage is that the methodology and guidelines have been tested and improved under real world conditions.

4.3.4 ESA and EU FP6/FP7 Projects

There are many on-going projects financed by the ESA and the EU that are faced with data harmonisation issues to a larger or smaller extent. These projects are governed by their respective terms of reference (ToR) determined by ESA/EU. If they have data harmonisation as a task in their ToR they are an obvious audience and vice versa.

Data harmonisation issues are already today of big importance to all activities, especially since the INSPIRE directive now has been adopted. The full implementation of the INSPIRE directive will be an on-going process during many years but there are other initiatives that will start sooner, for instance the GMES Fast Track Services (FTS). It is important to have a common platform for data harmonisation in place before INSPIRE implementation activities starts within the EU member states. GMES FTS could possibly act as an "INSPIRE precursor" in this field. In order for this to happen, ESA/EU would have to prescribe the use of a common methodology.

The message to be communicated to ESA/EU is therefore that they can build on the RISE M&G document. In addition to not having to repeat the work, the advantage is that the methodology and guidelines have been tested and improved under real world conditions.

The message to be communicated to on-going projects with data harmonisation as a task in their ToR is that they can build on the RISE M&G document and thus do not have to repeat the work.

4.3.5 End Users

As depicted in the above sections, the end users are a much diversified group with many actors within the end user community also acting as data integrators and data providers. Also, organisations such as the EC and regional and local national authorities that are struggling with today's heterogeneous data sets would have the same efficiency and effectiveness benefits as data integrators. This section, however, focuses on these organisations role as "true" end users since their other roles are described in the sections above.

The end users are not interested in the methodology per se but on the end result, i.e. the harmonised data products and services. Therefore these organisations only have an indirect benefit from the M&G document.

The message to be communicated to this group is therefore that once harmonised data products and services exists, their work will be much simplified and – in all likelihood – the existing products and services will be available at lower prices. Also the harmonised data services will probably result in new and more user-friendly products and services. A prerequisite is of course that the data providers make harmonised data products and services available. One important task for the end users is therefore to convince the data providers of the need for such efforts.

5 Plan for using and disseminating the knowledge

This Section is in a format proscribed by the European Commission.

5.1 Section 1 - Exploitable knowledge and its Use

The following table gives an overview of the exploitable knowledge produced by RISE. These documents will continue to be made freely available through the RISE section of the Eurogeographics website in order to encourage European data harmonisation and they do not have explicit IPR associated with them.

In principle, the documents could be used by commercial companies as well as public organisations to help them develop data harmonisation services.

Exploitable Knowledge (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner & Other Partner(s) involved
Data Harmonisation Requirements	Data Harmonisation Requirements Document	Geospatial Data Management. Environmental monitoring	n/a	No IPR	NLS and RISE Partners
Methodology and Guidelines on Use Case & Schema Development	Methodology and Guidelines on Use Case & Schema Development Document	Geospatial Data Management. Environmental monitoring	End 2008	No IPR	OGCE and RISE Partners
Cost Benefit Analysis	Cost Benefit Report	Geospatial Data Management. Environmental monitoring	End 2008	No IPR	OGCE and RISE Partners
Exploitatition of RISE experiences	Exploitation Guidelines Document	Geospatial Data Management. Environmental monitoring	End 2008	No IPR	EGHO and RISE Partners
RISE Test Environment	Testing System Report	Geospatial Data Management. Environmental monitoring	End 2008	No IPR	QinetiQ and RISE Partners

Table 5.1. Exploitable knowledge produced by RISE.

5.2 Section 2 – Dissemination of knowledge

Members of the RISE Project have undertaken a range of dissemination activities during the lifetime of the Project in order to realise the strategic objectives defined in section 4.3 above. The identified stakeholder categories have been addressed using different exploitation mechanisms in actions aimed at addressing their individual situations. The types of exploitation mechanisms exploited include:

Website. A public website as been created associated with the main Eurogeographics website. An overview of the project is presented and public documents produced by the project are made available for download.

Press release. A press release was issued through the usual Eurogeographics channels.

User Workshop. A half-day User Workshop to discuss user requirements of GMES and other related projects was convened in association with the 55th OGC Technical Committee Meeting in Bonn in early November 2005. The Workshop was part of the GMES/INSPIRE ad-hoc meeting on the 8th November. All the presentations from the day, and the attendance list (>70), are available on the RISE Portal.

User Seminar. The RISE Project participated in the 3-day 13th EC/GIS Conference in Oporto on the 12-15th July. In particular, RISE was able to give a keynote presentation prior to the round-table discussion…

Other conferences, workshops etc. RISE has given presentations at a number of relevant events and workshops of the identified communities of interest, with a focus on promoting the RISE methodology.

Project Liaisons. The RISE methodology has been presented to other FP6 projects, as well as meetings of overarching initiatives such as GMES and INSPIRE.

Submissions to Standardisation & Harmonisation Initiatives. In addition to joint work with the INSPIRE Drafting Team for Product Specifications, RISE has presented relevant results to standardisation or harmonisation initiatives as described below.

The following table summarises the nature of the audiences at the various dissemination events undertaken by RISE.

Actual Dates	Type	Type of audience	Countries addressed	Size of audience	Partner responsible /involved
Sep-05	Public website http://www.eu-rise.org/	Users of geospatial data	Europe	1000's	EGHO
Oct -05	Press Release	Users of geospatial data	Europe	1000's	EGHO
Throughout the project	Presentations at a number of relevant events and workshops	Identified communities of interest	Europe	1000's	Various RISE partners
Nov-05	User Workshop at OGC Technical Meeting, Bonn.	People involved in GMES & INSPIRE	Europe	>70	EGHO/NLS
Jul-07	User Seminar at 13th EC/GIS Meeting. Oporto.	People involved in GMES & INSPIRE	Europe	~100	EGHO/BKG
Jul 07	OGC TC Meeting, Paris.	Standards developers	Global	~100	QinetiQ

Table 5.2. The main Dissemination Activities within the timeframe of the Project.

The following table identifies which stakeholder categories are reached with each activity within the timeframe of the project.

Activity	Data Providers	Data Integrators	Harmonisation & Standardisation Initiatives	ESA and EU FP6/FP7 projects	End Users	Responsible party
Final Conference in Conjunction with EC GI&GIS in June in Porto	√	√	√	√	√	EGHO
Presentation of Results at OGC TC Meeting in June in Paris	√	√	√	√		OGC
Publication of Key Results on OGC portals	√	√	√	√	√	OGC
Submissions to Standardisation & Harmonisation Initiatives	√	√	√	√		OGC
Promotion to the GMES Fast Track Services		√	√	√		EGHO
Continued cooperation with INSPIRE DT on Data Specifications			√			Relevant RISE partners
Interaction with the HUMBOLDT project				√		EGHO
Provide EEA with the M&G documents and other deliverables from the RISE project		√		√	√	EGHO
Provide ESA with the M&G documents and other deliverables from the RISE project	√	√		√		EGHO
Produce articles with various level of detail and seeing to it that these articles are published in various GIS- and application-oriented magazines	√	√	√	√	√	EGHO

Table 5.3. RISE dissemination events and stakeholder categories reached

It is intended that exploitation activities will continue after the end of the project. The following table summarises the continuing RISE related activities planned for after the end of the project.

Action	Data Providers	Data Integrators	Harmonisation & Standardisation Initiatives	ESA and EU FP6/FP7 projects	End Users	Responsible party
Maintain the current RISE website	√	√	√	√	√	Eurogeo-graphics
Adapt the RISE M&G document to INSPIRE, maintain and update it in the context of INSPIRE	√	√	√	√	√	INSPIRE DT Data Sp'cifications Drafting Team
Use the M&G document in own projects and publish experience for the benefit of other users.	√	√				Eurogeo-graphics
Promote the use of the M&G document to members and in other contexts.	√	√				Eurogeo-graphics
Continued interaction with the HUMBOLDT project to promote the use of the M&G document.				√		Eurogeo-graphics
On availability of INSPIRE theme specifications, develop and implement harmonisation services using the RISE methodology, and report the experience for the benefit of other users	√	√	√	√	√	National Mapping Agencies, EuroGeo-graphics

Table 5.4. Future . RISE dissemination activities and stakeholder categories reached

5.3 Section 3 - Publishable results

RISE has produced a number of Documents which form a valuable resource for future exploitation:

- RISE13 Data Harmonisation Requirements Report (V1.0).
- RISE15 Methodology & Guidelines Document (V1.2).
- RISE17 Services Architecture Outline. V1.0.
- RISE18 Use Case Document V1.5.
- RISE23 Conceptual Schema in UML V1.1.
- RISE25 Data Product Specifications V1.0.
- RISE30 Cost Benefit Report V1.0
- RISE40 Testing System Report. V1.0

All these documents are publicly available and can be downloaded from the RISE website at

http://www.eu-rise.org/ or http://www.eurogeographics.org/eng/03_RISE_downloads.asp

The main output from RISE is of course the Methodology and Guidelines document (RISE 15) and this has already been exploited by the INSPIRE Drafting Team on Data Specifications. In the future it can be expected that the INSPIRE guiding documents will become the reference for the “state of the art” in this domain. For the moment though, the scope of the RISE Methodology is less INSPIRE specific and may have broader applicability. The other RISE documents might also be relevant for other INSPIRE activities and organisations involved in data harmonisation activities as they present real world examples of a harmonisation process. To aid the interested stakeholder (mainly data providers, data integrators and harmonisation projects & initiatives), a description of how these individual document could be used is provided below.

Document	**Potential Use**
RISE13 Data Harmonisation Requirements Report V1.0.	Can serve as a basis for future studies of harmonisation requirements and to obtain an overview of all GMES projects and relevant FP 6 projects.
RISE15 Methodology & Guidelines Document V1.2	The main RISE output and expected to be relevant to many future harmonisation activities.
RISE17 Services Architecture Outline V1.0.	Provides an example of how to define the service architecture for systems providing harmonised data.
RISE18 Use Case Document V1.5.	A real world example of how a use case dealing with harmonisation issues can be structured and analysed.
RISE23 Conceptual Schema in UML V1.1.	A real world example of how a harmonising process can be implemented with UML and how application schema can be used to support the harmonisation process.
RISE25 Data Product Specifications V1.0.	An example of the structure and content of harmonised data product specifications.
RISE30 Cost Benefit Report V1.1.	A guidance both for the EC, Member States, various national and regional/local organisations and other harmonisation initiatives when carrying out a CBA for their harmonisation activities.
RISE34 Exploitation Guidelines V1.1.	Identifies “what’s-in-it-for-me” for each stakeholder category and could thus assist in promoting data harmonisation activities.
RISE36 Testing System Report. V1.0.	An example on how testing of harmonised data specifications can be performed in a service orientated architecture; and illustrates how harmonised data products could be generated “on-the-fly” and making use of automatic schema translation.