Information Architecture:
creating the foundations for interoperability
at Scottish Natural Heritage

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Resumen

La necesidad de trabajar en la dirección del programa de Modernización Gubernamental condujo al Scottish Natural Heritage (SNH) a la compra e implementación de un Sistema de Gestión de Documentos y Registros Electrónicos. Se era consciente de que la tecnología solo proporcionaba parte de la solución. Aquí se describen los aspectos del proyecto que tienen que ver con un factor clave de éxito: la interoperabilidad dentro del SNH.

Palabras clave: Arquitecturas de información. Interoperabilidad. Patrimonio Natural. Escocia.

Abstract

The necessity of working towards the Modernising Government agenda led Scottish Natural Heritage to the purchase and implementation of an Electronic Records and Document Management System. It was recognized that new technology only provides part of the solution; other aspects that need to be in place are a cohesive information architecture and the culture to support information sharing. This paper describes aspects of the approach taken by SNH in working towards this interoperability.

Keywords: Information Architectures. Interoperability. Natural Heritage. Scotland.

1. Introduction

The Scottish Executive is the devolved Government for Scotland and has a budget of £27 billion (approximately 40 billion Euros) which is used through local authorities and public bodies. One of these public bodies is Scottish Natural Heritage which was established under statute in 1992 to: "Conserve and improve Scotland's natural heritage; promote understanding and make it easier for people to enjoy Scotland's natural heritage; help to make sure that its use and management

are sustainable" (*A Natural Perspective, Scottish Natural Heritage's corporate strategy. Nov. 2003).*

SNH's responsibilities include the conservation and enhancement of habitats, species and landscapes for the whole of the land mass of Scotland and the surrounding waters. The headquarters provide management and support services for 11 areas made up of 41 offices throughout Scotland. SNH has an Advisory Services unit, as part of the headquarter function, which provides scientific advice where required including to the Scottish Executive on the development of policy relating to the natural heritage.

In Scotland approximately 20% of the land area is protected by UK, European or international legislative powers. SNH has specific responsibilities for designated areas, of which there are many types at national level including national parks, national nature reserves and over 1,400 sites of special scientific interest spread throughout Scotland.

In Europe the most significant natural heritage legislation is Natura 2000, which provides the obligation to create designated sites for the protection of wild birds, plants and animals and their habitats.

A key operating principle of SNH's management is to devolve decision making to the local level, which enables SNH to work more effectively and responsively with its partners and clients. These include, at the local level, landowners, farmers, foresters, recreation groups and local communities.

SNH relies heavily on the ability of the organisation to capture, manage and access information as a key support in the decision making process at both local and national level, as such SNH's main business is dealing with information.

There is a need for public bodies in Scotland to meet the requirements set out by the UK and Scottish Parliaments to provide access to information for the public, and in modernising the services they provide. This requirement to maintain and provide access to official records is leading many public bodies to the implementation of electronic document and records management systems (eRDMS). However, successful implementation of eRDMS is about "ways of working" and the ability and willingness of individuals and teams to share information, as much as the configuration and installation of the actual hardware and software.

As such, SNH took forward the implementation to meet its business requirements establishing a "building block" approach, which includes information principles, an information framework for metadata, templates (documents that are used repeatedly to ensure a standard structure, similar to forms) and controlled vocabularies. These building blocks are developed, in a planned manner, over time as business needs evolve.

2. Background

In 1999 an outline infrastructure option was established as part of the IS Strategy. This identified that a review of the database software, and IS development and analysis tools was needed to define the most efficient and effective infrastructure. A project was initiated for this and following a careful examination of the available products, site visits and trials, Oracle was selected as the new corporate database and Oracle development tools for IS development.

The IS Strategy was reviewed during late 2002 and a refreshed strategy produced in March 2003. This reinforced the existing way forward and fitted the Modernising Government agenda which is the key driver for the next several years.

3. Legislation and the impetus for change

The Modernising Government agenda was presented by the Prime Minister to the UK Parliament in 1999. The key concepts within this agenda require public bodies, in the UK, to deliver services electronically. For an organisation like SNH this means making much of our existing data and information resources available in an electronic environment.

Until the start of the eRDMS project, most SNH staff shared information only with their local staff and within their teams. This meant access to information across projects was heavily dependent on an individual's knowledge of who to contact within the organisation.

Also the introduction of the Freedom of Information (Scotland) Act 2002, has meant: "Any person who requests information from a Scottish public authority which holds it is entitled to be given it by the authority". This has meant that both individuals and organisations have to start from the premise that all information is for public access unless it falls into one of the clearly defined exceptions.

It is recognised that to implement eRDMS it is necessary to address wider information management issues. As such, the scope of the project included the laying of key information management foundations (hard factors) and a fundamental change to the "ways of working" (soft factors).

3.1. Information Management Principles

Recognising the importance of changes to "ways of working" means a culture change within SNH and as such requires the commitment of senior management to supporting the new information sharing culture. This includes the provision of a team of experienced information management professionals to work with senior management support instigating the necessary policy and procedures as well as roles and responsibilities.

The development of the framework for information governance was considered the first step in this process. Therefore a selection of individuals from across the organisation worked together to develop the Information Management Principles, i. e., business analysts, scientists, senior managers, business project managers and information management professionals.
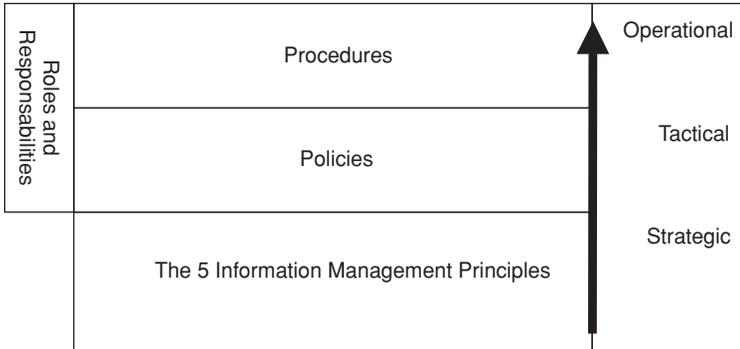

Figure 1. Information principles in developing information governance

The development of these principles has laid the foundation for information management practices and roles and responsibilities, which, according to Orna (1999, p. 210), provided the "policy framework for the strategy".

SNH's principles are that we will ensure that: information within SNH will be treated as a shared resource; information will be available, except where there is agreed justification to the contrary, for example Personnel records; information will be made available, accurate, up-to-date and fit for purpose; individuals and teams will have defined responsibility to manage, store and use information consistently; and the management of information will comply with all relevant security, legal and environmental requirements.
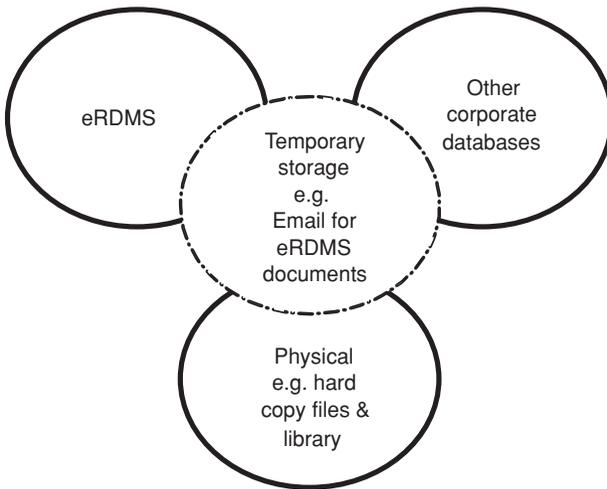
These principles reinforce the culture change required to support the introduction of the eRDMS and associated new ways of working; starting from the premise that all information is to be made accessible unless there is a justifiable reason not to. The success of the necessary culture change is dependent on senior management willingness to take ownership of these concepts as part of a wider Business Change programme.

3.2. Changes in the use of email

The introduction of email in SNH has been revolutionary; it is used by all staff and is the communication medium where the majority of decisions are made. These

decisions were previously retained, as part of the record, by printing out and putting on the official file. The introduction of eRDMS now means they can be stored electronically in the appropriate virtual file.

It is recognised that some staff in SNH use their email client as a separate storage facility, therefore creating an information silo. We aim to create a situation where it is easy for individuals to store emails on eRDMS and restrict the capacity for storage on the email client; working towards email client as only a temporary storage facility.

Figure 2. Email client as temporary storage
(sub group of the Information Architecture Group)

4. eRDMS the approach

The Scottish Executive, SNH's grant aiding sponsor, secured a contract with an eRDMS provider at the end of 2003. This ensured that the agreed best costs could be extended to other public bodies in Scotland, and allowed for permitted bodies, such as SNH, to agree follow-on contracts with the said provider in terms of scope and duration.

SNH were ready to secure a contract by October 2004. Within the organisation an ambitious timetable was set; to install the system fully configured and populated with existing metadata of the physical files to allow all records management activities to be undertaken on eRDMS by our Records Managers (one in each of the area teams and units), and provide read-only access to all other users by April 2005. This was achieved through the Project Board and a strong project team

including information technologists, information management specialists and business change specialist. To better enable the acceptance of change, it was decided at the outset of the eRDMS project, that the involvement of Record Managers in system design and configuration was important. Therefore a group of Record Managers were involved in all the system design workshops which led to their "ownership" of the project and has minimized their resistance to change.

As SNH is funded by public money it is essential that duplication of effort is minimized both in terms of human and financial resource. Research was undertaken to learn of other organisations' approaches to the implementation of eRDMS and their documentation was considered ahead of developing SNH's. Much was learned and carried over in terms of approach to training, for example; however the content of the policies etc required a "translation" into a style more suited to SNH. The most useful information received was from those organisations willing to share their more negative experiences around the areas of: managing change business process analysis naming conventions file plan design.

4.1. Corporate Records Management

Until the introduction of eRDMS, electronic documents were held locally on shared drives on local servers and hard copy on registry files. These registry files were stored using Corporate Records Management (CRM) guidelines which were developed from Public Records Office standards (now The National Archives). The CRM coding and classifications have been used across the organisation, within the 41 offices, to hold physical records and a tool was developed using spreadsheets to store and monitor the metadata. However, it was not possible for offices to view other spreadsheets held on local servers. This meant that knowledge of what was held at the offices was only fully appreciated at the local level.

4.2. File plan

The development of a file plan is a fundamental requirement of an eRDMS being the backbone of the file structure. File plan design was shown to be one of the most difficult aspects of implementing an eRDMS due to it being the first time all information had been stored in the one place. It became clear that the existing Corporate Records Management coding and classifications would provide a good outline for the File Plan as it covers the scope of the business functions, and is not based on the organisation's structure. In addition, 10% of the staff used the coding on a daily basis and many others are familiar with aspects in relation to their business areas.

The contract with the eRDMS solution provider included a period of 20 days to work with the project team to build a migration tool to facilitate the population of eRDMS with the details of the records held on the spreadsheets. In doing so the file structure to store folders and files on the electronic system was developed.

Figure 3. Top level of the file plan

Considering these spreadsheets had not been previously viewed in one place, it was recognised there would be some work necessary to rationalize the file plan and its contents. This work is ongoing and involves the Records Managers who work at the local level, with area and unit staff, and gives SNH a good basis on which to work and move forward the introduction of electronic document management across the organisation.

Figure 4. Hierarchy of the sites and designated areas section of the file plan

The file plan is one of the controlled vocabularies to assist the storage and retrieval of information and is a part of the information architecture.

5. Information Architecture

Gilchrist and Mahon (2004, p. XVII) define information architecture as "a coherent set of strategies and plans for information access and delivery inside organisations". This summarizes the activities of SNH very well, given that we have put in place a number of building blocks on which to construct a coherent architecture and supporting policies. To ensure this happens in a coherent manner it was decided to involve a range of individuals across SNH in the development of this approach.

5.1. The formation of a working group

In the setting out the Modernising Government agenda, an eGovernment Unit was established at the UK level who worked with others to develop an eGovernment Interoperability Framework (eGIF) and eGovernment Metadata Standard (eGMS).

SNH's initial response was to follow the developments and assess the SNH scenario, highlighting the key considerations and implications. A round table presentation and discussion was held where a number of people from across the organisation were gathered including the Internet and Intranet co-coordinators, Information Systems Services and the Deputy Head of Secretariat who assisted by Chairing the inaugural metadata meeting to which the Database managers, Information Systems Services and Head of Corporate Services all attended.

It was recognised that the best way to convey the importance and issues around metadata was by building demonstration models, therefore the Intranet Coordinator developed a practical demonstration of the effects and pitfalls of metadata tagging of documents. This proved very successful as it illustrated the concepts of information overload and wider and narrower searching. It also highlighted the limitations of the current situation as many of the existing documents had no proper title and were unable to be retrieved.

From this meeting a working group was formed, which incorporated both the technical and business teams. Recognising the significance of this work has meant that recently the Head of Business Change has taken over the role of Chair to ensure the work was carried out and integrated into day to day working practices.

5.2. Vision

The vision to make information more accessible to the external and internal customer is highlighted in the diagram above.

The Corporate Database tables form the key to the storage of reference data, each of these tables requires a business "owner" which is a new concept in SNH,
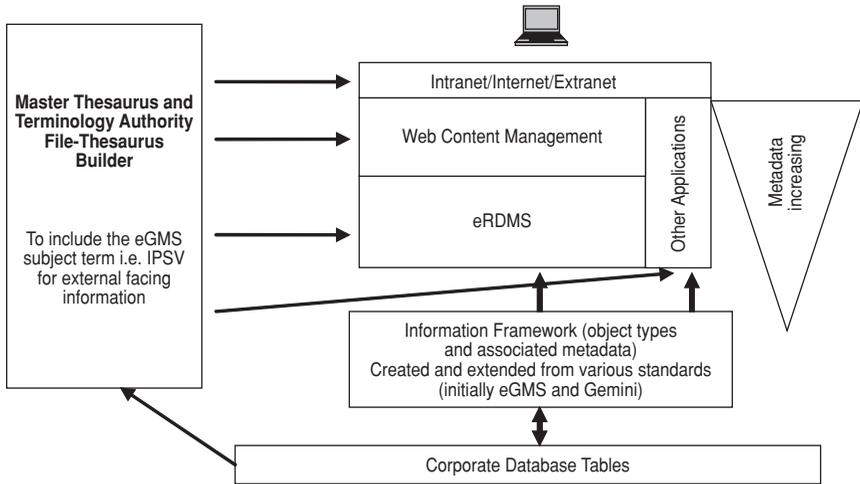
Figure 5. Vision – making information more "joined up" and accessible

as such the responsibility for change needs to be fully understood and recognised by the business as well as the technical team. This is particularly important given that a key concept in the strategy is to hold information once and use or "point to" many times.

The Master Thesaurus and Terminology Authority File is one of the key building blocks to interoperability. This Terminology Authority File is to be "sliced and diced" to support the key corporate applications for tagging purposes including the eRDMS and Web Content Management which provide the basis for electronic publishing.

This work has led to the development of an information framework which defines the metadata elements that will be used by SNH for different 'object types' and the need to identify, control, maintain, utilize and manage core vocabulary in SNH.

5.3 Information framework

The strategic and tactical management of information typically involves managing the response to external influences including legislation, standards and customer expectations and internal imperatives which are identified in the business objectives as highlighted in Asprey and Middleton (2003, p. 37). In the context of SNH's information architecture this means supporting the Information Management Principles by, amongst other things:

- Meeting eGovernment Unit standards on interoperability including the eGovernment Metadata Standard (eGMS). The eGMS is derived from Dublin Core

elements and seven of these are mandatory for public body websites: date, title, creator, subject.category, accessibility, identifier and publisher.

• The four mandatory elements for information systems are date, title, creator and subject.category. This includes the inclusion of the Government controlled vocabulary terms in the subject element (Integrated Public Sector Vocabulary).

• Identifying and mapping to eGMS other key standards, e. g. GEMINI, which is a defined element set for describing geo-spatial, discovery level metadata within the United Kingdom. This is vital considering much of SNH's information is held as spatial datasets.

• Identifying object types and the associated metadata requirement/scope. Different object types will require different metadata elements example it is considered mandatory for spatial data to be tagged with bounding coordinates, but not for correspondence.

• Identify encoding schemes and define and apply strict guidelines, roles and responsibilities for the maintenance of encoding schemes and the associated corporate database tables.

Figure 6. Extract from the information framework

SNH is currently developing and enhancing many of its information systems e.g. the majority of SNH datasets are being migrated into Oracle Spatial which means there are opportunities for the reassessing the process of metadata creation and management. It is important to ensure that an integrated information framework exists and is used to ensure that a cohesive information framework is built upon so that all information can be found, accessed and utilised by its staff wherever it may be stored.

5.4. Object types

Within the information framework object types are identified to establish how it can be supported in terms of resource description, information retrieval and rights management (Haynes, 2004 p. 64). Identifying the content of objects will enable the organisation to assign appropriate metadata elements to support storage and retrieval. This work has been brought to the fore with the introduction of the eRDMS and its development towards Web Content Management. Object types include: spatial datasets —requiring, for example, bounding coordinates— and email —requiring, for example, date and time email sent and received.

5.4.1. eRDMS object types

The eRDMS has the capability of being used to classify a large number of object types. Initially the main types were configured to support the migration of metadata from the physical records environment. Therefore the main object types were various types of files including:

- Physical file —storing metadata replicating the physical file plan, coding and classification.
- Electronic file —storing the electronic documents.
- Hybrid or mixed file —storing the metadata of physical files and electronic documents including emails.

These are being developed over time and now include email and others.

5.4.1.1. eRDMS templates

The introduction of the eRDMS has brought challenges and benefits, in terms of standardization.

Due to decision making being devolved to the local level, working practices have evolved to mean areas may have slightly different ways of working. This is totally appropriate in many respects to allow the best implementation of decisions to meet slightly different environments. However, this does present issues when standards need to be applied uniformly across the organisation.

The implementation of eRDMS means that templates have to be standardized. This is an aspect of implementation which acutely highlights the need of joined up working across the organisation and where some resistance to change is met. However, there are important benefits in using templates including appropriate metadata fields can be defined for each template.

5.4.2. eRDMS and Object Linking and Embedding (OLE)

Having extolled the benefit of accurate metadata creation in SNH it is recognised that it is very difficult to rely on all creators of documents to create metadata, both in terms of time taken and accuracy. Search capabilities are supported by ac-

curate metadata collected and data elements give the context for searching (Haynes, 2004 p. 93); however, the creator of a document is often reluctant to spend more than a few seconds on this task.

The OLE overcomes duplication of effort, regarding metadata creation, and provides the creator immediate benefits for its completion. SNH set up initial templates, e. g. memo whereby the user selects the document type memo and the associated metadata fields appear. Once the creator populates the fields, i. e., *To*, *From*, *cc*, *Subject* and *Date*, this populates the document itself as text. A trial number of templates have been set up, with the intention of creating more after testing.

5.5. Subject element

Within the eGMS there are two refinements for the subject element: the subject.keyword and the subject.category. The subject.category, which is mandatory, must contain at least one term from the Integrated Public Service Vocabulary (IPSV), which is being developed through the steering of Dextre Clarke and assisted by an Editorial team from across the public sector.

This then leaves a dilemma for public sector organisations such as SNH who recognize the need to develop their own controlled vocabulary to benefit their internal and specialist user community. Dextre Clarke (2004, p. 151) acknowledges that organisations also need to meet their internal requirements of utilizing the advantages of metadata tagging for their intranets, eRDMS etc. Using the subject.keyword can meet the organisation's requirements by pointing to an alternative controlled vocabulary. However, Dextre Clarke acknowledges there is often a requirement to map multiple vocabularies when it is necessary to access a pool of information that stretches across many organisations with similar interests.

5.5.1. Controlled vocabulary

SNH works with many organisations to provide environmental data and information. Much of this work involves knowledge of species and habitats. The National Biodiversity Network is aiming to provide access to environmental information across the UK and it is necessary to work with other environmental bodies to assess how best to develop a controlled vocabulary to support many needs.

Recognising that the use of the IPSV is mandatory has prompted SNH to assess how best to pull together the existing controlled vocabularies, used in the environmental sector and in SNH, to assist in interoperability.

As a starting point SNH commissioned a scoping study by TFPL (Alan Gilchrist) to investigate ways of taking this work forward; the project resulted in the compilation of a draft Master Authority File.

The Master Authority File concept has been developed by TFPL and is based on the principle that each application is supported by its own vocabulary and these

vocabularies are brought together and managed in one file. This concept allows the flexibility necessary for supporting each corporate application but retains the necessary integrity for management purposes.

This concept supports the vision for interoperability and is being considered by partner agencies as well as SNH.
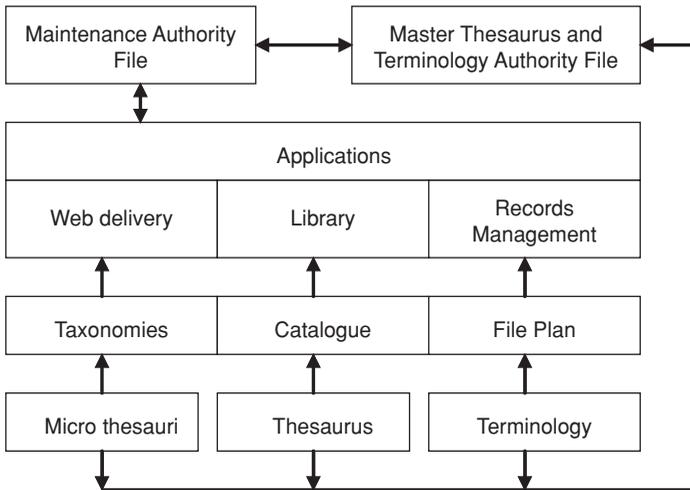

Figure 7. The Master Authority File concept (TFPL)

6. Web Content Management

Investigations into Web Content Management (WCM) solutions for SNH have led towards the building on the work already undertaken in eRDMS. According to Asprey and Middleton (2003, p. 21) the more effectively an organisation can manage documents the more usefully they can be reutilized. Publishing to the Web is largely the repurposing and reutilization of documents therefore the requirements for SNH WCM would include: retrieve documents from the eRDMS; repurpose documents from eRDMS; maintain metadata integration with eRDMS; maintain version control and other management metadata from eRDMS; automatically update versions and retention schedules from eRDMS; be able to access Master Authority Files for dynamic pages, e. g. staff table in the corporate database table for a staff directory; build on eRDMS metadata, including requiring mandatory supplementary fields, e. g. Subject terms for Integrated Public Service Vocabulary as specified as mandatory in eGMS

In taking the approach outlined above our information would be managed through its lifecycle with the appropriate level of metadata at each stage for its storage, management and disposal.

7. Conclusion

The Modernising Government agenda and Freedom of Information legislation, have acted as external drivers requiring UK public bodies to work together towards greater interoperability. This in turn has provided the necessary impetus for SNH to assess internal information management practices to enable more effective and efficient information sharing and retrieval.

The information framework is an essential tool to assist in managing the development of metadata standards and as a reference to understand the various standards that apply to Public Bodies. It is essential that this framework is used when considering the development and enhancement of other corporate applications.

The making of the subject element mandatory in the eGMS has led information professionals across different public bodies to discuss the use of controlled vocabularies, and consider the benefits and issues of development.

Introducing an eRDMS into SNH has benefited the organisation in terms of information sharing, audit trails, records management and version control. Plans are in hand to build on the eRDMS for the delivery of information across the Web resulting in the organisation achieving its aim of increasing the accuracy and amount of metadata stored against external facing information.

The elements in this paper go some way to providing a framework for the development of an integrated information architecture. While the development of the Information Principles is a key stage at the strategic level, it requires a change in culture, to one where information is a shared resource unless there is a justifiable reason to the contrary, and information management procedures are an integrated part of everyone's way of working. The success of this culture change is dependent on senior management's ownership of these concepts as part of a wider Business Change programme, so that decisions made at strategic level can be successfully delivered through tactical policy and operational procedures.

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