Cultivating Capability: The socio-technical challenges of integrating approaches to records and knowledge management

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Purpose

This paper advocates that significant human and systems-based capabilities (termed ‘socio-technical capabilities’) need to be developed in government departments and other public sector organisations to support more effective description of information resources, collections and their context in online environments.

Design/methodology/approach

The ideas in this paper draw upon the findings of several action research interventions undertaken within a government department in Victoria in Australia since 2011 as part of a knowledge management initiative. Specific focus is given to the design and development of a new record-centric knowledge curation tool (KCT).

Findings

Effective functioning of KCT relies upon the input of well-structured, standards-based metadata used to describe collections, information resources and their context. The central claim is that the move towards standards based descriptions will fundamentally change the capabilities required to manage, search for and disseminate knowledge and records.

Research limitations/implications

In addition to the capabilities discussed, management of records and knowledge through time requires commitments to stable repository, workflow and administrative systems, and working with contemporary systems involves technical knowledge such as the use of application programming interfaces (APIs). These aspects are not discussed here.

Practical Implications

The capabilities discussed in this paper are socio-technical in nature. This means there is a requirement to shift current perspectives about who is responsible for managing organisational information as collections.

Originality/value

While some of the concepts discussed will be familiar to information professionals, the paper provides a unique description of how existing archival and recordkeeping practices are being integrated in innovative ways within organisations outside the information management professions.

Keywords

records management, archives, capability, knowledge management, metadata, context, standards

Article Classification: Case Study

Introduction

In the first half of 2015 the agricultural section of the Victorian Government's Department of Economic Development, Jobs, Transport and Resources (DEDJTR, hereafter referred to as 'the Department') initiated a technology development project. This built upon scoping studies and proof-of-concept work in 2014 in the Department of Environment and Primary Industries (DEPI), which in turn emerged from a number of years of work with the Department and its predecessors by knowledge management staff and external consultants, including the authors of this paper.

The technology system developed included two major components: EMMA (Enhanced Metadata Management Application), a custom-built backend database with an interconnected metadata registry and metadata repository for managing standards-based content through time; and KCT (Knowledge Curation Tool), a series of user interfaces for the capture and curation of structured metadata for storage in EMMA. The initial development was also designed to support a small number of sample dissemination modules ('widgets') to demonstrate some of the advantages of well-curated metadata to the business. KCT/EMMA has been developed by combining Australian Government and international standards for records and archives with theories of contextual information management drawn from archival science and complex network theory. In this paper, we will examine the capabilities required to effectively implement a system of this type, as well as some of the significant challenges that exist when developing these capabilities in an organisation which is not directly part of the information management sector.

There are clear drivers for developing such skills and resources. The Department has inherited significant information management challenges from its predecessors, compounded by two major machinery of government changes in the past three years. These challenges affect the Department's ability to comply with contemporary information management policies at state and national levels, as well as its capacity to effectively meet the needs of a wide range of audiences. However, the skills needed to address these challenges are both specific and complex. It is our contention here that the capabilities required for knowledge curation work of this type are socio-technical (requiring more than just the introduction of a new tool) and are more akin to those found in information management professions – archival science, librarianship, metadata management, records management – than those usually found or expected in organisations where these professions and their functions are not perceived to be "core business".

EMMA and KCT

The origins of the EMMA/KCT initiative within the Victorian Government can be traced back to a 'proof of concept' project in the Department of Primary Industries (DPI – subsequently the Department of Environment and Primary Industries, DEPI, and DEDJTR after that) in late 2011. The project was related to the design and development of knowledge hubs for the dairy and grains industry sectors. The Farm Services Division of DPI funded the University of Melbourne's eScholarship Research Centre (ESRC) to demonstrate how a more structured, sustainable

approach to managing knowledge resources and their context could contribute to DPI's aim of becoming a provider of authoritative knowledge, advice and information to farmers and industry (Jones et al., 2011, pp. 3–5).

As part of this project, archivists from the ESRC reviewed the management of knowledge and information in DPI, and found the following:

They currently have no digital library capability, no true publication management system, no established links to emerging national information infrastructure, and rely primarily on technology solutions (rather than specialised staff) for records management functions. Compounding the problem, the objectives of internal technology strategies have primarily been based on supporting internal administrative functions or performance management objectives, rather than the holistic design of knowledge assets (McCarthy et al., 2012, pp. 4–5).

Among the effects of this was a general inability for users internally and externally to readily search and discover publication and citation information, and substantial difficulties in locating and accessing relevant content. ('Content' here refers to a wide variety of organisational records, including everything from peer-reviewed research papers to information sheets, presentations, project plans and other digital and physical information objects created by the Department and its staff, as well as comparable and complimentary content produced by or in collaboration with varied public, academic, and private external organisations.) When content could be located and retrieved, users then found it difficult to determine its meaning, utility, relationship to key projects and programs, and were unable to place it within broader initiatives and strategies (McCarthy et al., 2012, pp. 12–13).

Recommendation 1 from the final report read as follows:

We recommend DPI engage with national and international standards for the description of context, records and data to develop and implement a comprehensive organisational metadata strategy. This will increase the consistency of information captured and held across all systems, help improve data quality and navigability, and support information harvesting and interoperability between systems (Jones et al., 2011, p. 55).

Other recommendations to the Department suggested they make structured metadata describing the Department and its activities available, develop more distributed approaches to information dissemination, and develop a contextual information management strategy (Jones et al., 2011, pp. 55–56). The project also provided DPI with a detailed and comprehensive 'Lessons Learned' report outlining the value of more structured, standards-based approaches to information and knowledge capture, management and dissemination (Jones and McCarthy, 2011).

The work on knowledge hubs did not result in practical, demonstrable change in the systems and processes of the Department; however, the idea of a more structured,

standards-based approach had been introduced. In 2013, the ESRC was again requested to provide advice as to how such an approach might apply in the potential development of cross-institutional and cross-jurisdictional communities of practice, communities of interest and learning networks (Vines et al., 2013). In this way, the idea of the effective management of context was introduced once again, and recommendations made about possible standards and structures for the management of such context.

Conceptually these ideas emerge from the archival community and recent developments in archival theory and practice. They were applied in these projects primarily with the intention of making records more discoverable and understandable through time and in different contexts, with less explicit focus on other functions of archival description such as establishing the trustworthiness of records as evidence of business activities. However, this latter area remains significant. As noted above, many of the information resources under consideration have been created by a government agency and therefore fall under the Public Records Act 1973 (State Government of Victoria, 2010). Improving record keeping practice and metadata capture for such records is therefore of substantial benefit in its own right.

That archival concepts have been applied when working with current records and knowledge assets has at times been perceived as problematic, as non-specialists often associate archivists and their work solely with the past, the term conjuring thoughts of historic documents and records no longer in active use. Interventions in the Department attempted to counter this, highlighting that this notion of archives is itself no longer in active use in the Australian archival community. As part of this project members regularly drew on two areas of contemporary Australian archival science, concepts that are also directly relevant to EMMA/KCT and the capabilities required by people working in this space: the records continuum; and contextual information networks.

The ideas behind the records continuum can be traced back to Australia's Commonwealth Archives Office in the 1960s. Here, Chief Archivist Ian Maclean fostered operations which challenged the distinction between archivists and records managers, arguing that the 'true archivists' were those in government departments who developed record-keeping systems and maintained information about where records were produced and kept from the moment of creation. Colleague Peter Scott added to this the 'series system' which allowed control of records through time, from creation to custody in government archival repositories (McKemmish et al., 2010, pp. 4448–4449). In the 1990s these ideas were expanded and formalised into what is now known as the record continuum model, with the seminal representation (still in use today) first published in 1996 (Upward, 1996).

The model includes four dimensions – Create, Capture, Organise and Pluralise – which shape the way most Australian archivists think about all areas of records, archives and related content management. For example, considering appraisal from a continuum perspective:

Appraisal ceases to be about evaluating the value of a record for evidential and informational purposes from an archival perspective. Rather it becomes a multifaceted, recursive process which begins with defining what should be created (first dimension), what should be captured and managed as a record (second dimension), what should be managed as part of individual or organizational memory (third dimension) and what should be pluralized beyond organisational or individual memory (fourth dimension) (McKemmish et al., 2010, p. 4455).

From this base, contemporary archival science is not just interested in preserving the past. Archival thinkers such as Sue McKemmish have instead developed extensive experience in “the building of conceptual models for describing records in their societal, business, and documentary contexts” (McKemmish, 2001, p. 335).

Though context and its description has become a central concept in contemporary archival practice, discussions of the term outside the archival profession rarely draw on archival theory. For example, William Loyola’s 2007 examination of “existing relevant literature” on context and its formalisation includes numerous models and approaches, drawn from systems analysis, computation, knowledge management and more, but fails to consider archival science (Loyola, 2007). It is unclear whether this is simply an oversight, or a symptom of the misguided belief archival science has nothing relevant to say about current knowledge management issues.

However, these archival notions of context are the key to any effective deployment of KCT (or comparable systems) in an organisational context. Daniel Pitti writes: “Context information is not metadata that describes other information resources, but information that describes entities that are part of the environment in which information resources (i.e., records) have existed” (Pitti, 2001, p. 19) and, equally, in which information resources currently exist. This is not just information to support the description and understanding of records. The information captured, Pitti continues, “can have value as an independent ... resource, separate from its use in supporting the description, retrieval, and interpretation of records” (Pitti, 2001, p. 20). As with all metadata, contextual content is also valuable data in its own right.

Collecting such information in an active business is often not trivial. In an organisation knowledge is created and organised by individuals, teams and departments who are embedded in a particular, familiar context. Here there is a reliance on tacit and implicit knowledge when sourcing, interpreting and using information resources (Al-Hawamdeh, 2002; Nickols, 2000). Thus, much of the contextual information required when a record is in dimension three or four of the continuum is never made explicit. Failure to capture and manage resources, contextual information, and the relationships between the two for use in other dimensions and by other audiences is a major contributing factor to the difficulties in locating, accessing, and determining the meaning of content within the Department. These are the same difficulties referred to earlier when discussing the ESRC’s findings from 2011.

Over many years the ESRC has developed a process called Context Entity Analysis (CEA) to reveal and capture this information. CEA has been covered in detail elsewhere (McCarthy et al., 2012). Briefly, the process involves the analysis of explicit knowledge resources such as reports, journal articles, books, news items or websites, along with discussions and interviews with people working in relevant contexts, to uncover and document the key people, organisations, events, concepts, information objects and other entities which make up a domain, as well as the relationships between these elements. When compared with constrained hierarchies and ontologies, the resulting open complex network – while still an abstraction – aims to more closely mirror the multiplicity of actual connections and interactions within corporations and governments, capturing knowledge about the relationships and links that enable communities to function and creating the foundation for effective knowledge transfer in the present and through time (McCarthy, 2011; McCarthy et al., 2012, pp. 10–11; McCarthy and Upshall, 2006).

Equally important is that this contextual knowledge be captured effectively, and in a form flexible and extensible enough to support multiple uses, including ones not yet considered. This is done using structured metadata. Ataman notes three distinct classes of metadata: contextual (who, why and where a document was created); structural (when and how documents were created, the fonts and file formats used, and so on); and content metadata (what the document says, title, subject, summary, keywords, and so on) (Bekir Kemal Ataman, 2009, p. 218). Many technology systems designed for managing information resources allow the capture of the latter and automatically record some structural information, while providing only rudimentary functionality for recording contextual metadata through the provision of single fields for authors, creators and similar. Ideally these values are controlled by some sort of authority register; but even then, there is little scope to record detailed information about these context entities, and even less to capture the nature and scope of their relationships to resources and to each other. This often results in the intertwining of Ataman's metadata types within single resource records, limiting the ability to effectively manage context as complex, structured data in its own right.

The archival community has experienced similar problems and argued (again since the 1960s) for the structural separation of contextual description from descriptions of records (Pitti et al., 2014, pp. 79–80). In 1996 the publication of a new archival standard – International Standard Archival Authority Record For Corporate Bodies, Persons and Families, or ISAAR(CPF) – took a significant step toward this goal, one which was further refined by a second edition of the standard, confirmed in 2003. From the second edition:

This standard is intended to support the sharing of archival authority records by promoting the preparation of consistent, appropriate and self-explanatory descriptions of corporate bodies, persons and families that create records. It is intended to be used in conjunction with existing national standards or as the basis for the development of national standards (ICA Committee on Descriptive Standards, 2004, p. 7).

ISAAR(CPF) also allowed for the capture of structured information about the relationships between these authority records. But despite this progress, and the subsequent development of a corresponding XML schema – Encoded Archival Context Corporate Bodies, Persons and Families, or EAC-CPF (Society of American Archivists and Staatsbibliothek zu Berlin, n.d.) – few technology systems are available which allow for effective enterprise-level capture of ISAAR(CPF) data.

When considering standards, there are also Government requirements in place which the Department needed to consider. Australian Government Locator Service (AGLS) is a metadata standard used to describe online Government resources, and is mandatory for both Australian Government and Victorian Government Agencies (“AGLS Victoria,” n.d.). However, as with many other description standards, context is not managed as structurally separate data with its own requirements; that is, when using AGLS contextual entities are usually treated as attributes of the information resources themselves, rather than as structurally separate entities to be described in their own right.

KCT/EMMA brings these standards together. The system includes the ability to capture information about resources and collections of resources as structured data which can be expressed as AGLS metadata, while also providing functionality to create, manage and relate ISAAR(CPF) compliant records about entities (called Creators and Concepts in KCT/EMMA) and the complex networks of relationships that exist between entities and other entities, between resources and other resources, and between entities and resources. Furthermore, the system allows for the management of local standards, or local extensions to existing standards. For example, as the name suggests, ISAAR(CPF) is designed to capture information about Corporate Bodies, Persons and Families. KCT/EMMA extends the same type of structured description to other types of entities – strategies, programs, projects, places, events and other concepts – as part of contextual information networks.

Therefore, KCT/EMMA is a system which combines contemporary archival theory and standards with Government metadata requirements. A detailed examination of the motivation for this goes beyond the scope of this paper, but is multi-faceted and includes: a desire to improve knowledge management and knowledge resource management within the Department; the need to comply with both the Victorian Government’s AGLS requirement and the harvesting and information infrastructure requirements of the National Research, Development and Extension (RD&E) Strategy; a growing investment in cross-institutional and cross-jurisdictional collaboration; a continuing desire to remain an authoritative creator and distributor of research and research-derived content to communities; and the need to find more flexible and responsive approaches to the dissemination of useful, understandable content via the web (including through aggregation services and via widgets on industry and third-party sites).

As this list indicates, the benefits of a successful deployment of KCT/EMMA are substantial. But introducing a new element to the Department’s infrastructure stack –

here used to mean the abstract systems and technologies that make up the Department's infrastructure (this sense of the term is drawn from the work of Lynch, 2014) – means introducing a system which aligns with capability gaps in the organisation; and attempting to address multiple gaps with a single, highly flexible system means introducing concepts, standards and processes unfamiliar to the bulk of the organisation and its staff.

The term 'curation' is included in the name 'KCT' and is increasingly widely used within the Department to refer to the set of skills relevant to KCT/EMMA. Curation has distinct meanings in different contexts, from art galleries and museums, to research data management, to popular culture, and the flexibility of the term is part of its utility. In relation to KCT – as elsewhere – the concept incorporates the shaping and development of collections, the management of collection content, considering and contributing to the presentation of collections-based knowledge to various publics, and aspects of knowledge and content preservation and dissemination.

Knowledge management systems and capability development

Digital tools have become an inextricable part of the way we work, and technological innovation a critical part of organisational sustainability and success (Carroll and Helfert, 2015). The move from desktop computers to laptops, to mobile devices, Web 2.0 and social networking technologies has also brought with it an increased expectation of widespread non-specialist involvement in digital aspects of data, information and knowledge creation. As Meloche et al. write when examining wiki technology in 2009: "people take for granted their ability and right to access, and contribute to, the global knowledge repository that is the World Wide Web." (Meloche et al., 2009, p. 33)

It is important to highlight that Meloche et al.'s notion of a global knowledge repository does not equate to a singular or simple system, and necessarily includes distinctly different but overlapping knowledge spaces, previously described by Vines et al. as a 'personal knowledge space', a 'public knowledge space', and a 'boundary space' where there is overlap (Vines et al., 2013). Thus, working with organisational knowledge involves working with the dynamics of hierarchically complex adaptive systems where knowledge creation results from the co-existence and co-evolution of both top-down and bottom up processes (ibid, 2013). By implication, working with a tool such as KCT/EMMA involves more than just the management and description of content, or information resources. It involves researching, identifying and interpreting what is significant, and grouping bits of information in order to "make sense", take relevant action and facilitate impact. Effective work in this space also encompasses various organisational contexts, including areas where problems are identified and the social systems from which solutions emerge.

In the digital realm, different types of systems have proliferated to support new ways of working in these complex spaces, including tools for accessing information, semantic mapping tools, and tools supporting collaboration and helping people to access expertise (Balmisse et al., 2007). Equally, at enterprise level a range of systems

for content and document management, business records, process workflows, finance, human resources are now all common place. Staff are expected to use some or all of these as part of their daily work.

Such tools were – at least initially – focused on managing data, and to some extent information. We draw here on the ideas of Thomas H. Davenport and Laurence Prusak:

Data is a set of discrete, objective facts about events. In an organizational context, data is most usefully described as structured records of transactions ...

Like many researchers who have studied information, we will describe it as a *message*, usually in the form of a document or an audible or visible communication (Davenport and Prusak, 1998)

Whilst implementing digital systems to deal with data, information and records has revolutionised aspects of organisational practice, their intervention has not been unproblematic. As noted by Balmiss et al., the introduction of computerised systems in the 1990s was often excessively focussed on the characteristics of the technology rather than the content being managed (Balmiss et al., 2007, p. 119). And recent work suggests that, regardless of what was used, tools themselves were rarely the sole, or even the primary contributing factor to data, information and knowledge management failures in organisations. Nina Evans and James Price conducted a literature review as part of a recent study of “barriers to the effective deployment of information assets” and found that management failures are “social, rather than technological in nature,” that the main barriers to success were “behavioural, process, and organisational,” and that key factors included a lack of awareness and knowledge, as well as the effect of problems caused by the complexity of the technology and knowledge involved (Evans and Price, 2012, pp. 180–181).

Overcoming this requires a broader approach, one which is socio-technical in nature as it involves what Ganesh Bhatt describes as “the interaction between technology, techniques, and people” (Bhatt, 2001, p. 68). Key here is the idea of capability. Laframboise et al., drawing on work by Robert M. Grant, makes the distinction between resource inputs such as staff, skills and equipment, and capability which they describe as the capacity for these resources to come together to perform a task or activity that will be advantageous to the organisation (Grant, 1991; Laframboise et al., 2007). Reflecting back on the introduction to this paper, the purpose here is therefore to examine the capacity for staff, the KCT/EMMA system, and other resources within the agricultural section of DEDJTR to come together to produce benefits for the Department; and to consider how that capacity can be built over time. Significantly, these capabilities are required across many parts of the department if the KCT/EMMA system is to prove effective, not just in those staff currently seen as responsible for the Department’s information management needs.

Given the context described above the KCT/EMMA system forms only a part of the overall functions of knowledge management. As but one example, Aujirapongpan et al. (2010) proposes “four broad dimensions of process capability” for effective

organisational knowledge management – “knowledge acquisition, knowledge creation, knowledge storage and knowledge application” – whereas here we are primarily concerned with specific aspects of acquiring knowledge, and the processes of encoding that knowledge to support storage.

Identification of key processes and capabilities required

There are a number of processes involved in the effective use of KCT/EMMA, all of which fall under the broad category of collections development and curation:

1. Identification – identifying key collections, areas, departments, projects or initiatives (hereafter called ‘collections’ for simplicity) which contain or produce resources the business wishes to capture using KCT/EMMA.
2. Business alignment and prioritisation – looking at the collections identified, assessing business needs and demand (internal and external) and deciding which of the identified collections should become a priority for curation, based on an analysis of audience, policy, research priorities and access constraints.
3. Pre-appraisal – a survey of the potential collection, assessing the availability of information resources and the availability of the documents, data and expertise required for effective curation. This stage may result in the collection moving into the Appraisal phase, or a return to the Identification phase to find additional or more suitable material, or a combination of the two.
4. Appraisal – this involves creating a high-level description and assessment of the actual information resources (including number, size, scope, content and context) to assist with planning and to provide a foundation for more detailed curation activities.
5. Description – creating detailed and structured descriptions of collections, information resources, creators and concepts in KCT/EMMA.

Processes 1-3 occur outside the system, with processes 4 and 5 involving entry of data into the KCT/EMMA tool.

Some staff in the Department already have capabilities related to identification, business alignment and prioritisation. Identifying important collections and prioritising these based on business and customer needs is part of ongoing activity in a number of areas, and in general terms we do not perceive significant issues here.

In contrast, the pre-appraisal and collections development stages represent new activities for the business. They are also somewhat distinct from the archival notion of appraisal, about which there is already a substantial body of literature. Archival appraisal is focused on what records should be managed and preserved by an archive (and what should not be retained) based on legal and compliance requirements, evidential and informational value, collecting policies, user communities and other criteria (Hadley and Gurlie, 2006; National Archives of Australia, n.d.; Society of American Archivists, 2015). Here, potential or actual

collections have already been identified as significant by the business and prioritised accordingly. The two stage appraisal process is therefore designed more to look at whether the resources are available and accessible to curators, whether sufficient information is available to capture useful metadata about the resources and related concepts and creators, and what the requirements will be for the curation process itself. These phases therefore require both engagement with the business and its information resources (particularly in the Pre-appraisal phase) and an understanding of the metadata requirements and curation processes of KCT/EMMA, including a broad understanding of the requirements of the AGLS and ISAAR(CPF) standards. It is this engagement with the business where the boundaries between knowledge curation and collections come into play, requiring new types of socio-technical capabilities for the Department which are reliant upon social interactions between people and the systematic use of technology to support a knowledge curation culture.

The collections curation and management process includes six general levels of capability (excluding technology and system administration capabilities). These are given here in order of complexity and are not intended to represent a suitable process flow for curating content within the KCT/EMMA system:

1. Resource Description – describing individual information objects, with links to other information resources, collections, creators and concepts as applicable
2. Collection/Sub-Collection Description – structuring and describing collections and sub-collections
3. Creators and Concepts Description – describing contextual entities, and constructing contextual information networks
4. Quality Assurance – checking data entry and data quality, including accuracy of content, quality of description, and efficacy of network structures
5. Managing Types and Vocabularies – evaluating and making decisions on the need for new entity and relationship types; evaluating and managing attribute vocabularies
6. Standards/Registry Administration – administering the application and expression of AGLS and ISAAR(CPF) standards, locally developed extensions to these standards; evaluating and applying updates to standards as applicable, evaluating and incorporating new standards

The range of capability required here is significant. If the Pre-Appraisal and collections development processes have been effective, resource and collections / sub collections description should be relatively straight forward, with the resources and key information about them readily accessible. The appraisal stages should also provide some guidance on collection structures, though the writing of effective collection descriptions is a key skill.

In moving to level 3, the capabilities required increase sharply. Context Entity Analysis and the development, description and capture of effective contextual information networks is a complex, highly skilled task. Unlike Resource Description, it is potentially more subjective (while also being highly evidence-based). For

example, it is relatively easy to ascertain whether the details of a PDF report have been captured accurately based on available information, but deciding whether the organisational and conceptual context in which that report was created has been effectively described and captured as a network of related entities while also conforming to the requirements of ISAAR(CPF) and any local extensions in place can involve discussion, research, and the ability (and willingness) to work through multiple iterations to achieve useful results. Locating, understanding and effectively capturing this information also requires navigating the complex systems outlined above to draw on disparate implicit and explicit sources of knowledge.

Levels 3 to 6 all require additional experience. As in any area of capability, Quality Assurance requires a high level of understanding of all the preceding areas. Managing Context Entity Types and Vocabularies involves drawing upon deep understanding of the organisation and its data, the relationships (and conflicts) between local terminology, managed vocabularies, standards and interoperability, a sound understanding of the impact of changes or additions to types and vocabularies on all these aspects; plus a working knowledge of how these interact with metadata harvesters, widgets and other modules utilising data from EMMA. And finally, Standards/Registry Administration entails a thorough understanding of all the standards and data structures involved, the requirements of description at all levels within the organisation, and the requirements of harvesters, APIs, widgets and other systems relying on data from EMMA.

While not all capabilities have been required from implementation, due in part to the ongoing support of external consultants and expertise, if the KCT / EMMA tool system is to be effective in production capabilities will need to be developed within the business relatively quickly. Aside from the practical barriers – staff availability, time, suitable training material, access to external expertise, and so on – there are also conceptual and organisational challenges which need to be overcome if capability development in this area is to be effective.

Challenges for capability development

The challenges facing KCT/EMMA capability development fall into two categories: the characteristics and expectations of the Department; and the complexity and novelty of the KCT/EMMA system itself.

Within the Department, capability in the area of information and knowledge resource description and management is limited. The Siemens' knowledge management maturity model provides a useful scale for an organisation's performance in knowledge management:

- Initial – knowledge management activities are non-systematic and ad-hoc. No language exists for describing organizational phenomenon from a knowledge point of view.
- Repeated – pilot projects and single activities labeled as “knowledge management” are carried out.
- Defined – standardized processes make creation, sharing and usage of knowledge efficient and effective.

- Managed – creation, sharing and usage of knowledge is organizationally integrated and improved, including methods of measurement.
- Optimizing – knowledge management is developed and improved continuously (Kaner and Karni, 2004, p. 235).

With regard to the management of information resources and knowledge assets, only some areas of the business are at the 'Repeated' stage, due to the involvement of knowledge management staff and related specialists, while many are at the 'Initial' stage, with non-systematic and ad-hoc approaches to managing information resources.

While there are KM staff in the organisation there are no information professionals (in particular, library or archival staff) involved with existing experience in the standards being used or related areas of resource description and metadata management. Therefore, staff with little directly relevant experience (or, in some cases, interest) may be expected to spend time on the capture of structured, standards-based metadata. Reliance on 'non-specialist' staff for such work is, we believe, one of the consequences of the perceived accessibility and ubiquity of digital systems compared with their analogue equivalents. As noted in 2012:

where physical record keeping systems of the past (corporate archives, libraries) were usually the domain of librarians and record keeping specialists there is often now an expectation that all staff should be able to access and use distributed digital systems effectively. At times this seems akin to expecting every author to catalogue and shelve their own book in a library, which would no doubt have equally problematic results (McCarthy et al., 2012, p. 16).

Furthermore, issues may arise as to the level of interest generated in staff. Some information professionals are engaged by metadata standards and can be quite particular about the requirements of structured description. The work of Evans and Price on barriers to effective information management suggests non-specialists find the topic less interesting, recording participant responses to information management such as: "It's a pretty dry topic. I don't think most people really want to think about it, because it's pretty difficult. It's not as tangible as hard assets like money"; and: "You don't see people thinking that is a beautiful piece of information. It's a hard sell" (Evans and Price, 2012, p. 188).

Many of the staff expected to undertake this work are also embedded in the contexts they will be expected to describe. McKemmish, writing about description from a continuum perspective, notes that preserving information resources requires: "*disembedding* them from their immediate context of creation, and providing them with ever broadening layers of contextual metadata" (McKemmish, 2001, p. 336). Archivists and information professionals can become adept at this approach, in part aided by the fact that they have some distance from the 'immediate context of creation' (though this brings its own challenges). The challenge with Departmental

staff describing resources from their own area is that effective description requires the 'disembedding' of that resource from their own context. Though this feels counter-intuitive, particularly when there are competing business pressures and performance indicators pushing in the opposite direction, the effective capture of "broadening layers of contextual metadata" enabled by this distancing is what allows the use and reuse of resources in different dimensions and different contexts, including those not considered by the creators and immediate users of that resource.

The final internal barrier to effective capability development is time. Due to business priorities, KCT/EMMA has been developed to a tight time frame, and given the human and financial investment in its conceptual and technological development the Department is understandably keen to see 'quick wins' during the testing phase. Pressure of this sort can be valuable when attempting to prioritise work; however, there are also dangers here. Uppermost is that large amounts of content could be 'pushed' into the system by staff who do not yet have sufficient capability to understand the practical and conceptual implications of their actions. Aside from the bad data which would result (which comes with its own, not insubstantial, issues) this could also teach people shortcuts and quick approaches to problems, complicating the more robust – but also more time-consuming – approaches to capability development and quality assurance required to ensure the long-term success of the system.

As should be clear from the internal barriers to capability development, the implementation of KCT/EMMA in the department will require the input of advice, expertise, documentation and training from external expertise. This conforms to the findings of Addonizio and Case, who worked with a school and its students on ISAAR(CPF) data-capture. Their conclusion: "Do Not Try This at Home ... Unless under the Direct Supervision of an Information Professional" (Addonizio and Case, 2014, p. 49). But the expertise required is not as common as might be first thought. Gavan McCarthy wrote in 2012:

the skills needed to work effectively in contextual information management are only emerging through direct practice. Although many understand the need for reliable and readily available information about the past, very few have experience or even a sense of how this might be achieved (McCarthy, 2011, p. 5).

This remains true in 2015. Though the ISAAR(CPF) standard is close to 20 years old it has not yet been widely implemented. (Interestingly, since 2010 there has been a noticeable increase in uptake. See, for example, Addonizio and Case, 2014; Collier Jr. and Samouelian, 2014; Doon et al., 2014; Éito-Brun, 2014; "Historical Context and Connections," n.d.; Lee, 2014; Pitti et al., 2014.) Plus, while the complexity of information resource description is not especially high, continuum thinking and non-hierarchical contextual information description have their roots in conceptually dense thinking, the former with ties to Michel Foucault, Jacques Derrida, Anthony Giddens and others and the later drawing on complex network theory and information systems research.

Finally, KCT/EMMA contains very few coded business rules. Though there are user roles and levels of access, the majority of quality assurance, compliance with good descriptive practice and development of useful information structures will need to occur through manual user-initiated processes. Capability development is therefore significantly more involved than teaching staff how to use a new tool. It will require developing the thinking and understanding of information resources, knowledge management, and the complex network of conceptual and contextual structures and relationships which make up the Department, its projects, its activities and its interactions with the public. And it will require interpreting and capturing these elements using the lens of an information professional.

Capability development in DEDJTR

Though the handover of KCT/EMMA occurred in mid-2015, capability development with regard to collections- and context-based thinking started in 2011. The Lessons Learned report and related activity introduced the ISAAR(CPF) and EAC-CPF standards to Departmental staff, along with ideas about networked knowledge content and the need to consider and manage contextual information as part of KM practice. A key catalyst for KCT/EMMA development was also a proof-of-concept project looking at a collection of Home Grown Forage resources, with staff members introduced to ideas of appraisal and the creation of context entities, collection descriptions and resources.

In preparing for and running the Home Grown Forage workshop, it was decided there should be a shift in language. Rather than referring to standards, ISAAR(CPF), entities, archives, series or items, the concepts behind the system were communicated using the terms 'collection' and 'resource' for items to be described using AGLS, and 'creators' and 'concepts' for entities which would be described using ISAAR(CPF).

This shift in language proved significant. More technical language had proved a barrier to understanding, which had problematised past efforts to develop capability. Through simplifying the language used, and excluding discussion of more complex standards and concepts which were not directly relevant to the task at hand, it was found the process of training staff in collection, resource and entity description was more effective than it had been in the past. As a result, this terminology has been built into the KCT user interfaces now deployed within the department.

External consultants with experience in the relevant information standards continue to be engaged on an *ad hoc* basis to work with Departmental staff on developing strategies for collection description, as well as assisting with the design of processes linking metadata with preservation copies of the information objects themselves in internal and external repository systems. Initial work has also involved experts from Australian Policy Online, based at Swinburne University, to create digital object identifiers, or DOIs (International DOI Foundation, 2015), for priority material and to assist with collection and resource description for these items. The intention here is twofold: to capture enough content in the KCT/EMMA system to be able to demonstrate its efficacy to the business, thereby fostering an interest in further

capability development; and, in utilising the skills of information professionals for initial metadata input, to create benchmark descriptions of actual business content which can be used as models for the training and development of Departmental staff.

Throughout, Departmental KM staff and external consultants continue to collaborate as DEDJTR works on embedding KCT/EMMA as an enterprise system. Further work is still required developing documentation, training manuals, online help tools, exemplar collections and more; and, with reference to the levels of capability outlined in the previous section, efforts will be made to try and ensure (as much as is possible) that this work adequately supports the gradual and staged development of the expertise required rather than becoming side-tracked or swamped by shifting business priorities.

Finally, beyond the use of KCT/EMMA, there are numerous inter-related capabilities to be considered when implementing a records- and collections-based KM system within a large organisation. These include technical and conceptual engagement with national information infrastructure, system interoperability, metadata harvesting, repository management, and legislative requirements related to archiving and records management. While these fall outside the scope of this article, when considered (even in passing) the scale of the challenge begins to reveal itself.

Conclusion

Reaching a point where KCT/EMMA could be developed and deployed in DEDJTR was itself a process of capability development that took several years and numerous interventions to achieve. Now that the tool exists, new types of socio-technical capabilities are required to produce the desired results. Success will require an understanding of the levels of capability required, effective language to communicate often complex ideas in ways which the business will understand, and the ongoing collaboration of information professionals and Departmental staff to build expertise in collection appraisal, descriptive metadata, and context entity analysis. Despite the challenges, in a world where most large government departments and public institutions rarely employ specialist librarians, archivists and related specialists, we believe these capabilities are required to help make effective, sustainable records-based knowledge management part of the way modern organisations operate.

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