Enterprise Content Management and Digital Curation Applications

Maturity Model Connections

Shadrack Katuu
International Monetary Fund

Abstract

Organizations have a variety of business systems to help them manage their digital content. Depending on the institution, the digital content connected to these systems could either be managed in network drives, or through the use of specialized business applications including ECM applications or even left unmanaged. This paper narrowly focuses on the issues related to the transfer of digital content from Enterprise Content Management (ECM) applications to Digital Curation (DC) applications. It does so by defining ECM applications and their relations with other similar applications such as Electronic Document Management Systems and Electronic Records Management Systems. It also defines Digital Curation applications and highlights why they are different from ECM applications. The paper argues that the process of transfer digital content from ECM to DC applications requires support of maturity models. At the core of maturity models is the quest for continuous improvement by providing a framework of assessing processes and a roadmap for advancement. The article provides an outline of one model for ECM applications and another related to digital preservation, illustrating briefly their utility. It concludes by stating that there are few published articles on the transfer of digital content from ECM to DC applications and theirs is yet more insight to be gathered from the few examples so far. It adds that maturity models are not in themselves perfect and continuously need improvement, which is at the core of the mission of maturity models.

Author

Shadrack Katuu has had a diverse international career, spanning various information management fields in several countries including Botswana, Canada, Kenya, Namibia, South Africa, Swaziland and the US. He has an undergraduate degree from Kenya and studied at the School of Library, Archival and Information Studies at the University of British Columbia in Canada. He is currently undertaking doctoral studies with the University of South Africa. He was a staff member at the Nelson Mandela Foundation (NMF) between 2005 and 2009, and for the latter half of the duration was manager responsible for all information systems including the institution's ECM application. He is currently an archives/records officer at the International Monetary Fund (IMF) in Washington DC.

1. Introduction

Organizations have a variety of business systems to help them manage their digital content. These business systems are connected to a number of functions and activities including human resources (such as recruitment and payroll), communication (through using email), finance, marketing and other aspects of administration. Depending on the institution, the digital content connected to these systems could

either be managed in network drives, or through the use of specialized business applications including ECM applications or even left unmanaged.

The way these systems are connected within an institution can be quite complex. The diagram below provides an illustration of how some of the business systems were organized in 2003 at the World Bank Group (Van Garderen 2002).

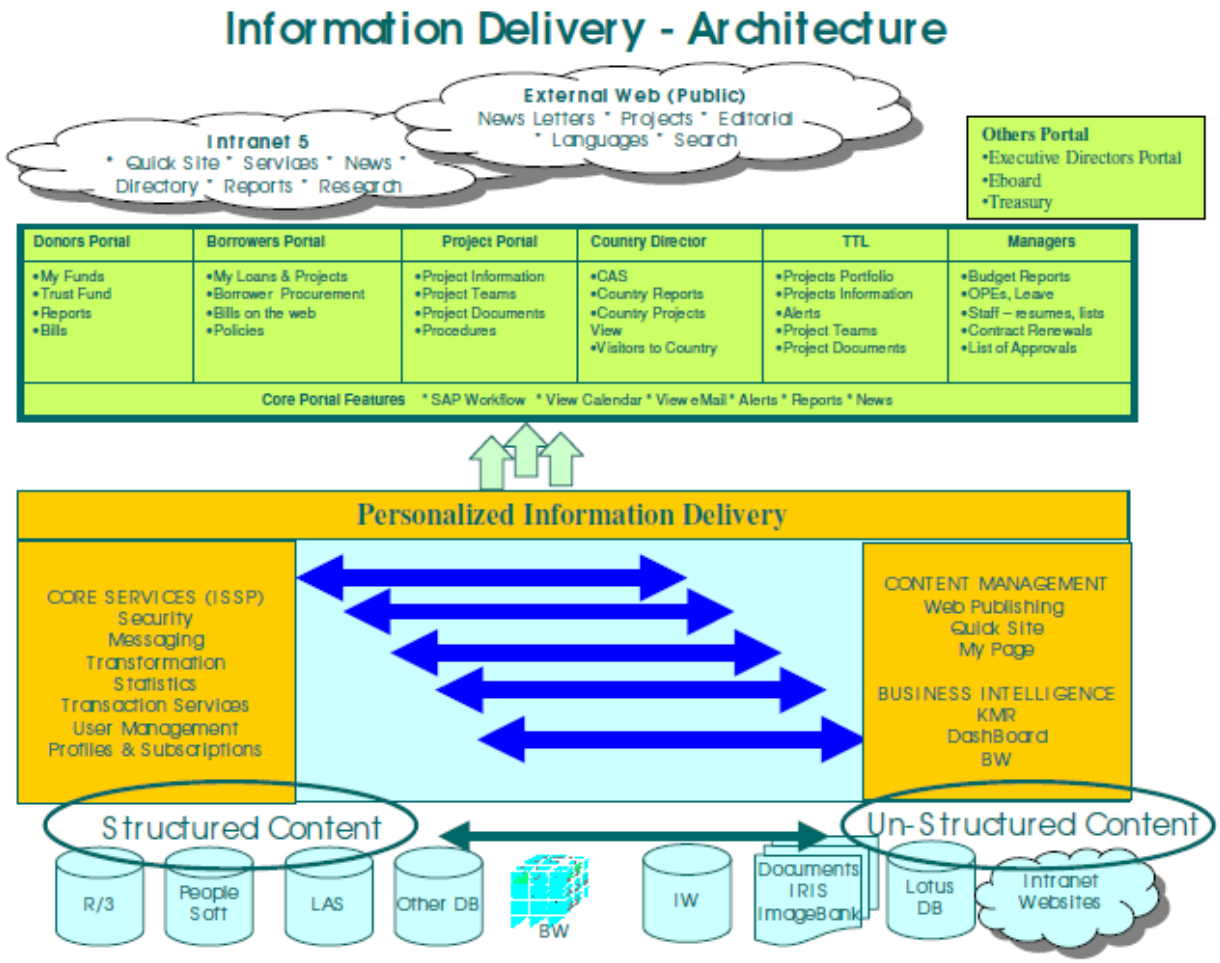

Figure 1. Showing the information delivery architecture at the World Bank

The diagram above shows that in order for the World Bank to conduct its business, it depended on numerous applications. For purposes of accountability, it would be critical to keep the information generated and maintained in these applications over the long-term. Most business systems are, however, not designed to keep transaction information in the long-term, so for this reason, a different set of applications, Digital Curation systems, could be considered. This is not only true for the World Bank but for other institutions such as municipal governments like the City of Vancouver in Canada (Dingwall 2011) or an international criminal court like the International Criminal Tribunal for Rwanda (Peterson 2008).

Whenever organizations consider managing digital content in the long-term, moving the content into Digital Curation systems becomes a challenge. This paper narrowly focuses on the issues related to the transfer of digital content from Enterprise Content Management (ECM) applications to Digital Curation systems.

1.1 Defining ECM

Enterprise Content Management (ECM) is a concept that has been used by information professionals for more than a decade. As early as 2001, Karen Shegda from Gartner, a leading research and advisory firm, discussed integrated document management software functionality and noted that software vendors were morphing their products into content management systems (Shegda 2001). In the same year Bob Ward of Teamware Group, a technology consulting company, published an article arguing that content management was a growing sector in the information technology industry and titled the article enterprise content management (Ward 2001).

For a long time the term ECM has been used interchangeably with electronic document and records management systems and other concepts. For the purpose of this article, ECM is viewed currently as the most sophisticated point in an evolutionary process. The other predecessor points in this evolutionary point are Electronic Document Management Systems (EDMS), Electronic Records Management Systems (ERMS), Integrated Document and Records Management Systems (IDRMS) and Electronic Document and Records Management Systems (EDRMS). This evolutionary perspective accommodates predecessor concepts (Sprehe 2005) and would help clear any confusion regarding the different concepts (Nguyen L T, Swatman P M C, and Fraunholz 2007). The evolutionary process is illustrated in the diagram below.

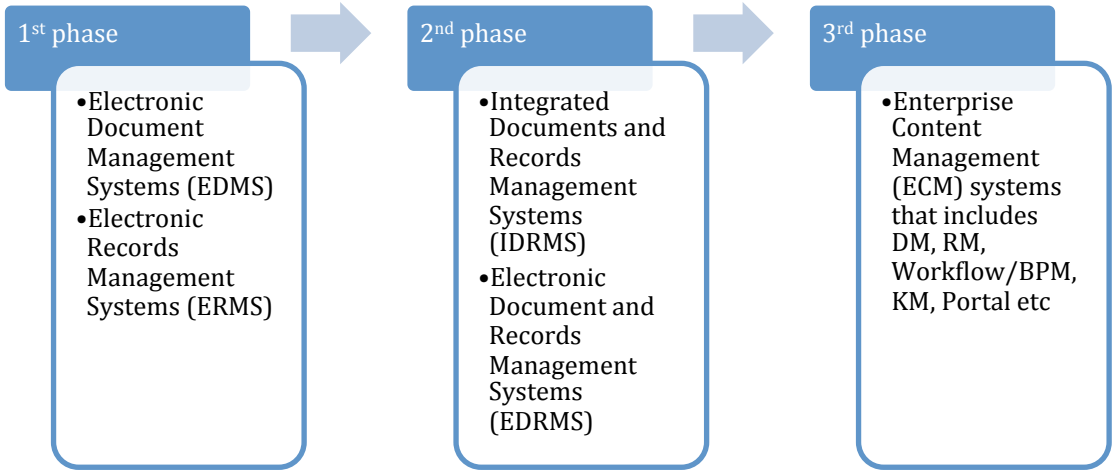

Figure 2. The evolution of various concepts culminating into ECM

This evolutionary perspective to the concept of ECM is supported by published reports from leading research organizations in document and records management. These reports have, over the last few years, evolved from using terms such as IDMS and EDMS to ECM. Gartner published a report in 2003 that used the concept IDMS (Gartner 2003), but from 2004 used ECM as a concept (Shegda et al. 2004). Another leading research and advisory firm, Forrester, had already used the term ECM in a report published in 2003 (Moore and Markham 2003) and continued to use the term in subsequent annual reports.

In order to sufficiently differentiate ECM with predecessor concepts it is important to define it and provide constituent parts. AIIM (2010) defines ECM as constituting "strategies, methods and tools used to capture, manage, store, preserve and deliver content and documents related to organizational processes." ECM applications and strategies allows the organization to manage its information more effectively (AIIM 2010).

When these strategies, methods and tools are targeted at organizational processes, they manifest themselves in several modules. The precise number and composition of the modules remains a subject of debate. For the purpose of this article, the 10 modules considered fundamental include: Document Management (DM), Records Management (RM), Workflow or Business Process Management (BPM), Collaboration, Portal, Knowledge Management (KM), Imaging, Digital Asset Management (DAM), Digital Rights Management (DRM), and Web Content Management (CMS Watch 2010, 21-86; Kampffmeyer 2004, 2006). The diagram below shows a graphical representation of these modules of ECM.

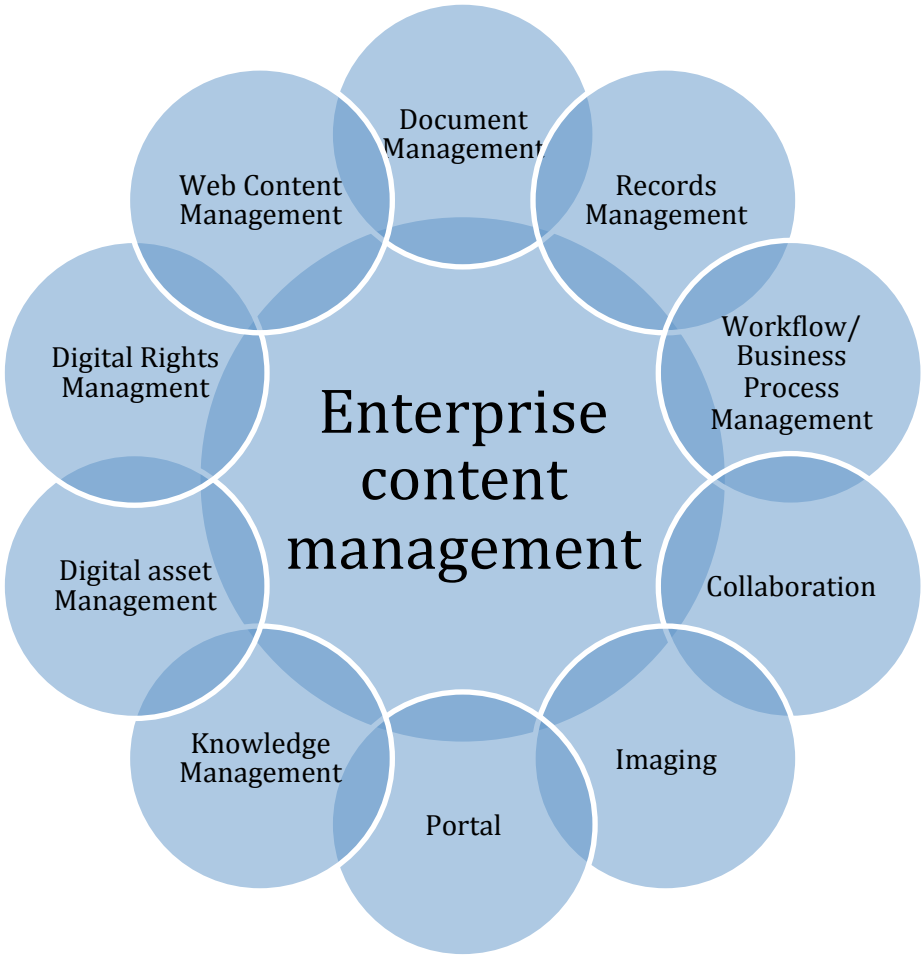

Figure 3. The modules of a typical ECM application

For the most part, scholarly discussions on the systematic management of digital content have dwelt on EDRM applications (Wilkins, Swatman, and Holt 2009; Wilhelm 2009; Biagio and Ibiricu 2008; Scott-Jones 2002). Based on the foundation laid in this article, EDRM applications have merely two of the modules that would be available in the ECM suite. In a survey of 10 South African institutions that

considered themselves as having implemented ECM applications, nine of the institutions had both records and document management modules (Katuu 2012b). If these were the only modules implemented, then it would mean EDRM applications are in place. However, most of these institutions had more than just DM and RM modules in place which demonstrates that institutions tend to go beyond just two ECM modules (Katuu 2012b, 50). These realities are important to bear in mind when considering the preservation of digital content in the long-term. This is because the more modules an ECM application has the more complex the transfer process tends to be.

1.2 Defining Digital Curation applications

There have been debates about the differences between digital preservation and digital curation (Lazorchak 2011). Elizabeth Yakel argues that digital preservation is a subset of digital curation which she defines as "the active involvement of information professionals in the management, including the preservation, of digital data for future use" (Yakel 2007). According to Foscarini, Kim et al (2010, 1) digital preservation "aims to ensure that digital objects of value to society…can be meaningfully reproduced over time, despite evolving representations, mechanisms, rapidly advancing technologies, and continually emerging user expectations". While digital curation is holistic and spans the whole of the lifecycle of the digital content, digital preservation is a specific point in that lifecycle (Caplan 2011).

Lee and Tibbo (2011, 126) trace the emergence of the concept of curation from diverse perspectives and how it has served as "an umbrella concept spanning activities across a diversity of professions, institutions...and sectors". At the core of digital curation activities are digital repositories. A digital repository is seen as "a combination of services, resources that are required to carry out those services as well as supported by the service, and policies that determine how the services should be implemented" (Lee et al. 2009, 113). They add that no two repositories regardless of configuration or use of same kinds of infrastructure will be the same since they will differ based on services, resources or policies (Lee et al. 2009, 113).

Digital repositories range from very large storage management schemes, peer-to-peer integrity checking among mirrored repositories (Galloway 2009, 1519) as well as micro-services based repositories (Archivematica 2012). These technologies have adhered to the OAIS reference model which has become a basic reference point for discussions on digital repositories (Galloway 2009, 1521). These technologies could also be grouped according to whether they are open source or proprietary systems.

2. Transfer of digital content from ECM applications to Digital Curation applications

There has been an argument that if digital content is already in ECM applications then those applications should be used as Digital Curation systems. According to Seles (2012), EDRMS applications could be used as holding tanks if institutions cannot support digital repositories. Indeed, in some instances, ECM applications have been modified to become Digital Curation systems. For example, the State of Victoria in Australia commissioned a digital repository in 2005 that used an ECM application (Waugh 2007). Another example is the Municipality of Lisbon in Portugal that was reportedly integrating an ECM application "with a set of business workflows for a wide range of organizational entities, including the Municipal Archives" (Becker et al. 2011, 8)

However, according to Waugh (2007), the fundamental operational model of a commercial ECM application is different from that of a digital repository and, therefore, in Australia's experience, this

reality caused several challenges. This sentiment is echoed also by the City of Vancouver Archives in Canada which sought to use a dedicated Digital Curation system to import digital records from their ERDMS application (Dingwall 2011). The issue of incompatibility stems from the fact that ECM applications and Digital Curation applications have drastically different functions and, in a standards based approach, would have to meet different functional requirement guidelines.

On the one hand, there are a diverse number of functional requirements, standards, and best-practice guidelines that relate to ECM applications. These range from those within certain national jurisdictions such as Australia's ERMS functional requirements (National Archives of Australia 2007) and the United States' DOD standard 5012.5 whose latest version is version 3 (Department of Defense [United States] 2012) to regional ones such as European Union's MOREQ standards whose latest version is MOREQ2010 (DLM Forum Foundation 2011). The International Council on Archives (ICA) developed a high-level and generic set of functional requirements for ERMS applications (International Council on Archives 2008, 8) that seeks to serve a more global audience. According to the ICA functional requirements, there are eight functional requirements: capture, identification, classification, managing access and security, managing hybrid records, retention and disposal, administration and finally search, retrieval and rendering (International Council on Archives 2008).

On the other hand, Digital Curation applications that adhere to the OAIS reference model have seven main functions: access, administration, archival storage, common services, data management, ingest, and preservation planning (Lee 2009, 4025). The City of Vancouver has made this argument from a graphical perspective as represented in the illustration below (Van Garderen 2012).

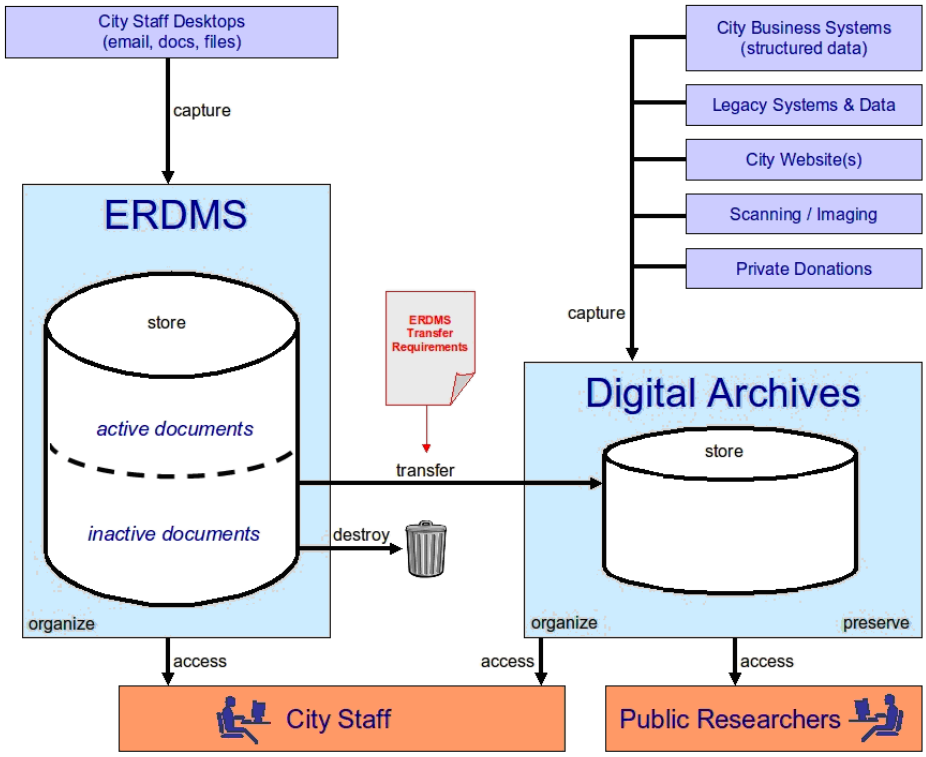

Figure 4. Showing the transfer process at the City of Vancouver Archives

As the diagram above shows, while the ERDMS may be able to provide access to its own records, these would only be available to the City of Vancouver staff and not members of the public. In addition, it would be incapable of processing digital content from diverse sources such as other business systems. This is because in most cases, as Mumma, Dingwall et al. (2011, 118) argue, digital content from diverse sources does not come in "neat packages ready for Ingest". In addition, there are number of archival processes that digital content needs to undergo. In traditional settings, archival processing constitutes accessioning, appraisal, arrangement and description and the provision of access to archival material (Pearce-Moses 2005; Spiro 2009). For the Archives of the International Monetary Fund (IMF), these basic activities take a slight sophistication with two appraisal processes and an additional process for review of confidential material through declassification as shown in the illustration below (International Monetary Fund 2012).

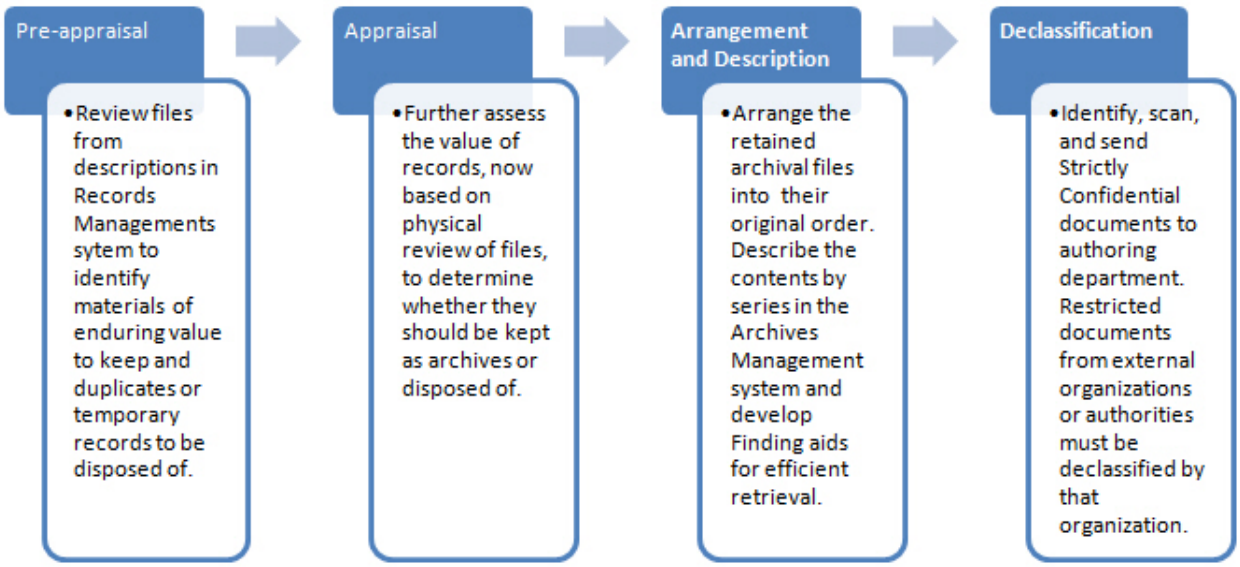

Figure 5. Showing the archival processes undertaken by the Archives of the International Monetary Fund

When processing digital records of the Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games, the City of Vancouver Archives identified three distinct stages of appraisal: Selection for Acquisition, Selection for Submission and Selection for Preservation (Mumma, Dingwall, and Bigelow 2011, 108). Presumably the first and third stages would mirror the two stages at the IMF Archives while the second stage emerges due to the realities of digital aspects of the records.

Based on these two examples, it would be very difficult to expect ECM applications to provide OAIS functionality such as being able to ingest and manage digital content from diverse record sources and/or providing public access to digital content (Dingwall 2011).

3. Enhancing reliability of digital content using maturity models

As digital content is being transferred from ECM applications to DC applications, there is concern about the trustworthiness of the records. Potentially, this could damage the trustworthiness of the digital content over time. During the first phase of the InterPARES research project, which examined attributes of digital

records[1], researchers found that often, not all these attributes were captured during the transfer process (MacNeil 2002, 53). One such attribute of digital records is the archival bond which is defined as "the relationship that links each record to the previous and subsequent one and to all those which participate in the same activity" (Duranti and MacNeil 1996, 49). In an ECM application, the archival bond may manifest itself as "a classification code or other record identifier that appears on the face of the record or in its profile" (MacNeil 2002, 29). The challenge in the transfer process is to ensure that the archival bond is still identifiable. In a research study of the City of Vancouver's Geographic Information System, Dingwall, Marciano et al (2007, 186-188) illustrated the preservation information that would be needed in order to create the archival bond which would then be revealed through the archival description process. This is just one example of one characteristic but illustrates the need to "ensure that knowledge of key indicators of identity is not lost when the records are removed from the specific electronic system and record-keeping environment in which they have been created and actively used" (MacNeil 2002, 33).

There are different aspects to the trustworthiness of records. One such aspect is reliability and is defined as the trustworthiness of a record as a statement of fact and is established by examining the completeness of the record's form[2] and the amount of control exercised on the process of its creation (InterPARES 2 Project 2007).

For purposes of this discussion, the process of record creation is most significant. MacNeil (2000, 101) defines this process as constituting a "body of rules governing the making, receiving, and setting aside of records. Some of these rules refer to record-makers by establishing who is competent to create, modify, and annotate records. Others refer to how records must be handled in the course of their compilation, and others still refer to how records must be routed and filed". Regardless of the software applications, the rules on establishing who is competent to create, modify, and annotate records should be established using workflow procedures as well as access privilege management (MacNeil 2000, 101). In addition, there should be ways of verifying if such rules have been followed using audit trails which entails "recording all the interactions with records within a system so that any access to the record can be documented as it occurs" (MacNeil 2000, 102). According to Duranti (1995, 6), "[t]he more rigorous and detailed the rules, the more established the routine, the more reliable the records result from the application will be."

One concept that could be used to establish routines as well as improve on rigor and details of rules of both ECM and DC applications is maturity models. A maturity model is a management tool designed to help organizations implement effective processes in a given management discipline. It is a "structured collection of elements that describe characteristics of effective processes." It provides a place to start, the benefit of prior experience, a common language, a framework for prioritizing actions and a way to define improvement" (Murray and Ward 2007, 5).

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[1] According to the InterPARES project, digital records possess a number of characteristics including a *fixed documentary form*, a *stable content*, an *archival bond with other records*, and an identifiable juridical-administrative, provenancial, administrative, procedural, documentary and technological context. They participate in or support an *action*, and at least three *persons* (author, writer, and addressee) are involved in their creation (MacNeil 2002 p. 29)

[2] According to MacNeil (2000 p. 100) a complete record is one that that posses "all the elements of intellectual form necessary for it to be capable of generating consequences". These elements include: "date of record; time and place of creation, transmission, and receipt; identification of names of author, addressee, originator and writer (if either or both are different from the author), name (or crest) of creator, title or subject line, classification code, and any other element required by the creator's procedures and/or juridical system"

Even though the concept has existed for almost three decades (Cameron 2011, 21), very little has been published in connection with ECM and DC applications. The most prominent early application of maturity models is in computer software engineering in the 1980s and 1990s (Liu 2002) which later spread to other disciplines including, financial management (McRoberts and Sloan 1998), human resources management (Curtis, Hefley, and Miller 1995), the health sector (Gillies 2000), and project management (Kerzner 2001).

Lee and Tibbo (2011, 127) argue that the challenges associated with digital curation are not solely technical. According to Dryden (2011, 128), trust is critical when dealing with a digital repository and asks "[h]ow would one know that a digital repository could preserve digital information so it would be accessible over time for as long as it is needed?". To this end, a number of efforts have taken place around the world to develop audit mechanisms for repositories. These include the German NESTOR[3] project that developed a *Catalog of Criteria for Trusted Digital Repositories,* as well as the UK and Netherland DRAMBORA project that developed a risk based audit mechanism (Dryden 2011, 128-129). The International Standards organization published a standard in 2012 titled *Audit and Certification of Trustworthy Digital Repositories* that draws from a lot of the previous work done around the world in order to "enable the assessment and certification of a repository as being a trustworthy digital repository (TDR)" (Kroll et al. 2012). According to Cho (2012), while ISO 16363 provides for compliance requirements it does not provide for how to control performance of digital repositories and how to improve organizational capabilities over time. Therefore, Cho (2012) proposes the use of maturity models to address this shortfall.

Regardless of their disciplinary application, maturity models are developed on the basis that organizations do not move from zero capability to optimum capability instantaneously, but rather progress along a journey of maturity (Murray and Ward 2007, 5). This journey of maturity is documented in a number of levels of maturity. The number of levels may vary from three to six but five and six are the most common levels. Sections 3.1 and 3.2 below will outline a number of maturity models that have been proposed for ECM and DC applications respectively.

3.1 Maturity model for ECM

There are at least three ECM maturity models that have been developed to date. One was developed by an institution in South Africa (Katuu 2012a) while another was developed in the UK (Cameron 2011). Neither of these models have received much global attention. The third model, known as the ECM Maturity Model (ECM3), is probably the most well known and was developed in the US by four consulting firms as an open standard under creative commons license (MIKE2.0 2010). This section will highlight aspects of ECM3.

The first edition of ECM3 was published in March 2009 and a second edition in March 2010 (Pelz-Sharpe et al. 2010). ECM3 provides a structured framework from which to organize efforts by organizations to achieve business benefits from ECM, as well as to hold the attention of program stakeholders. (Pelz-Sharpe et al. 2010, 7). It is able to do this because it can be applied to audit, assess, and explain the current state within an organization, as well as form a roadmap for maturing organization capabilities (MIKE2.0 2010). The framework has 13 dimensions of maturity across three categories: human, information, and systems (Pelz-Sharpe et al. 2010, 8). The dimensions within the "Human" category relate to individual expertise in both business processes and information technology. In addition,

[3] This is the acronym for "Network of Expertise in Long-term Storage of Digital Resources"

they relate to the extent of strategic alignment between business drivers and the ECM application to ensure institutional success. The dimensions within the "Information" category relate to attributes affecting the digital content itself, while those within the "Systems" category relate to attributes of the ECM applications technical features. The diagram below provides a graphical representation of the maturity dimensions across three categories (MIKE2.0 2010).

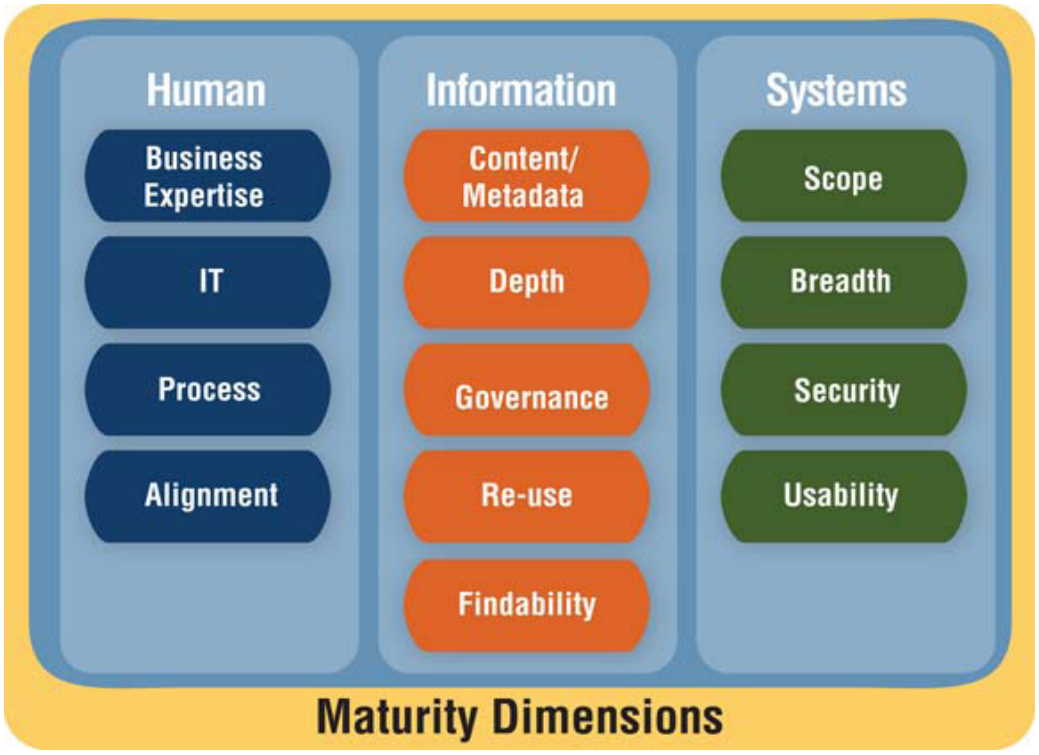

Figure 6. Showing the maturity dimensions in the ECM maturity model

The three categories and 13 dimensions are assessed in the five levels of maturity below:

- Level 1: Unmanaged
- Level 2: Incipient
- Level 3: Formative
- Level 4: Operational
- Level 5: Pro-Active (Pelz-Sharpe et al. 2010, 6).

When the levels of maturity are combined with the 13 dimensions, a comprehensive chart is developed as illustrated below (MIKE2.0 2010).

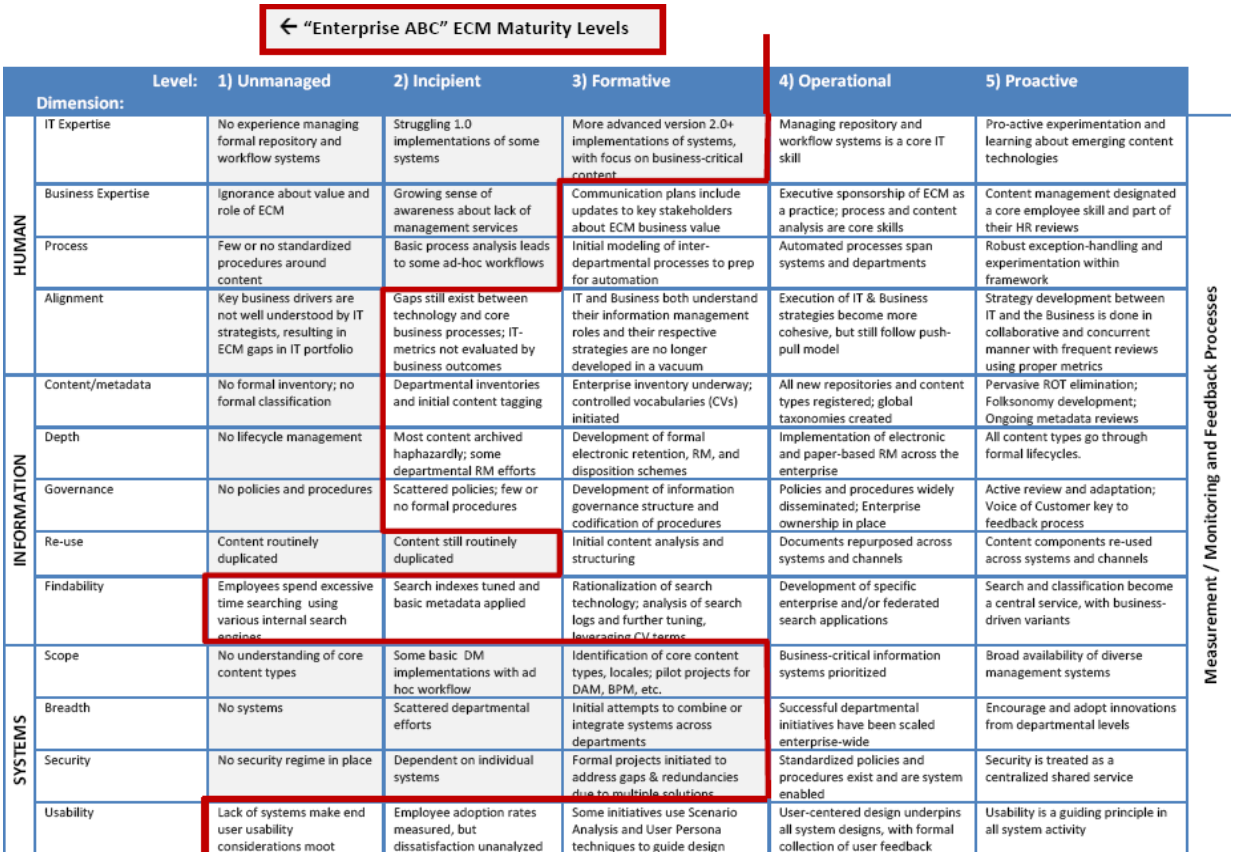

Figure 7. Showing an outline of the levels and dimensions of maturity in the ECM Maturity Model

The diagram above provides a sample assessment of a hypothetical Enterprise ABC showing different maturity levels achieved for each individual dimension (Pelz-Sharpe et al. 2010). Even though the ECM Maturity Model is reportedly used by a large number of institutions (ECM Maturity Model 2012) there has been little published about the experiences within these institutions (Katuu 2012a).

3.2 Maturity model for digital preservation and digital repositories

There are at least three maturity models that relate to either digital preservation or digital repositories. These are: *Digital Preservation Capability Maturity Model (DPCMM)* (Dollar and Ashley 2012), *Shaman/Scape Capability Model* **(Becker et al. 2011)** and the *Trusted Digital Repository Maturity Model (TDRMM)* (Cho 2012). One notes that all these models are at different stages of development and have different areas of emphasis due to their different perspectives. This is a reflection of how new the concept is in this discipline. The first has been developed to the point of being used in institutions while the second and third are still being developed. This section will only highlight the first model.

According to Dollar and Ashley (2011, 8), the objective of DPCMM is to "provide a process and performance framework…against best practice standards and foundational principles of records management, information governance, and archival science". DPCMM draws from the functional specifications and preservation services identified in ISO 1472, as well as checklist criteria found in TRAC guidelines (Trustworthy Repositories Audit and Certification: Criteria and Checklist). It is

centered a trusted digital repository which is the results of digital preservation infrastructure as well digital preservation processes (Dollar and Ashley 2012). The diagram below is a graphical representation of the model (Dollar and Ashley 2012).

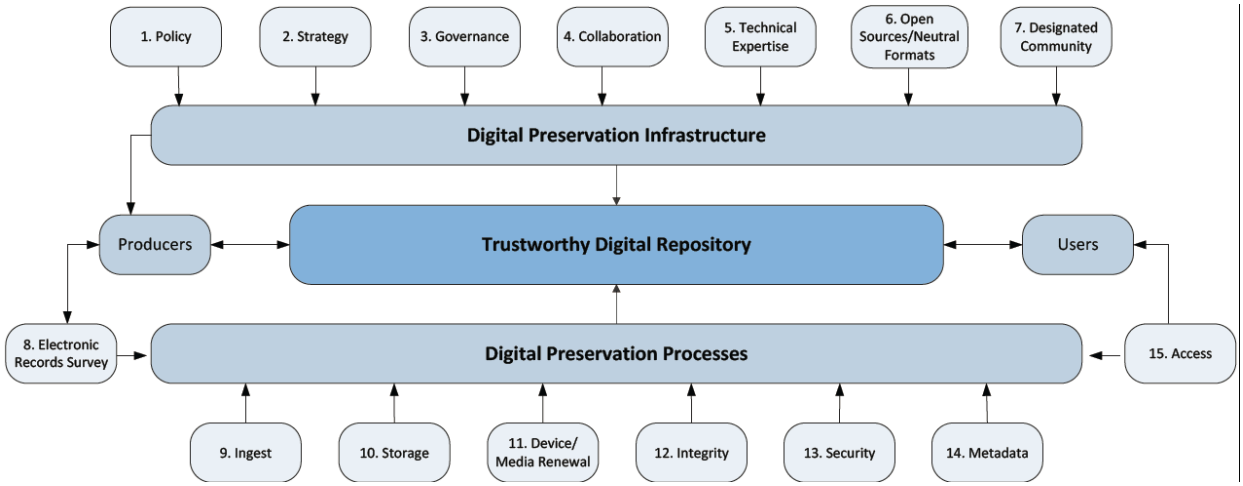

Figure 8. Digital Preservation Capability Maturity Model

The model has 15 process elements that are assessed using five maturity levels. According to Dollar and Ashley (2012). Amongst the strengths of DPCMM is that it shows clearly defined components, which then enables priority setting based on risk, requirements, and resources for digital preservation processes. The diagram illustrates the kind of roadmap that could be developed based on an assessment of an organization using the model and demonstrates how the model could used to monitor incremental improvements over time (Dollar and Ashley 2012).

Reference Model Components	Current	Year 1	Year 2	Year 3	Year 4	Year 5	Difficulty
PROCESSES							
Electronic Records Survey	1	⇨	2	3	⇨	⇨	MEDIUM
Ingest	0	⇨	⇨	1	⇨	2	HIGH
Archival Storage	0	⇨	⇨	1	2	⇨	LOW
Media & Device Renewal	1	⇨	⇨	2	⇨	3	MEDIUM
Integrity	0	⇨	⇨	⇨	1	2	MEDIUM
Security	1	⇨	⇨	2	⇨	3	MEDIUM
Preservation Metadata	0	⇨	⇨	1	2	3	MEDIUM
Access	1	⇨	⇨	⇨	2	⇨	MEDIUM

Figure 9. Showing Digital Preservation Capability Improvement Road Map

The model has been used by a number of institutions, primarily in the US and Canada. These include: Council of State Archivists (Corridan 2012), City of Toronto (Melikhova 2010), Delaware State Library and Archives, and Georgia State Archives (Dollar and Ashley 2012).

4. Conclusion

This article began by stating that organizations use a variety of business systems to assist in carrying out their mandate and that ECM applications are just one type. However, the focus on ECM applications was not just about managing the scope for discussion but also because surveys have shown that organizations are increasingly adopting these applications to manage their digital content. Over the last three years, AIIM has conducted a number of surveys on the state of the ECM industry in the world. In 2009, 43% out of a total of 478 institutions from five continents were either implementing or had completed implementation of ECM applications (Miles 2009, 7). In 2010 the rate was at 38% out of a total of 680 institutions worldwide (Miles 2010, 7) and in 2011 the rate was at 35% out of a total of 586 institutions worldwide (Miles 2011, 8). When one adds the number of institutions that were planning to implement these applications, then the figures go well beyond 50%.

This article has made the argument that ECM and DC applications fulfil different functions and, therefore, should be considered as separate systems. Regardless, there's a requirement that they don't compromise the trustworthiness of the digital content that they manage. In order to maintain and improve reliability, rigor is required in the process. Maturity models have been proposed as a means of improvement and the diagram below provides an illustration.

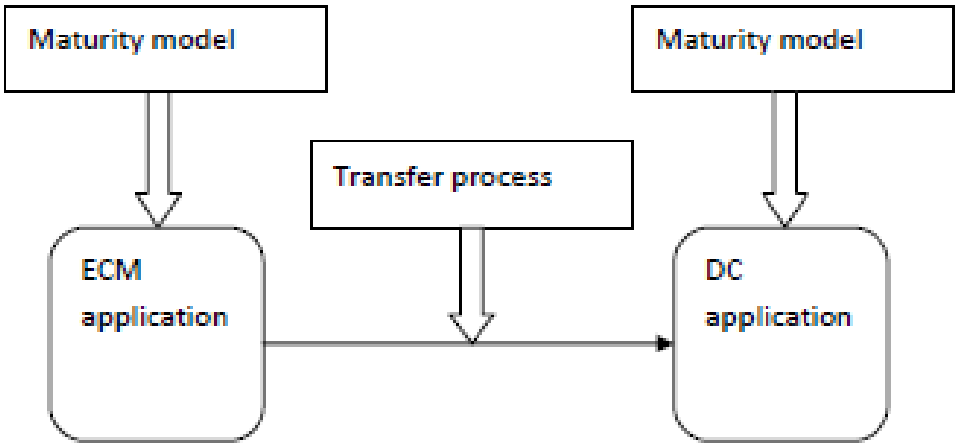

Figure 10. Showing maturity models influence on ECM and DC applications

To the best of this author's knowledge, not many institutions have extensive experience in the transfer process from ECM applications to DC applications. The City of Vancouver Archives has considerable experience processing records of the 2010 Winter Olympic games (Mumma, Dingwall, and Bigelow 2011), while the IMF Archives has some experience in the processing of email records (Jordan 2011). The City of Vancouver is expected to start transferring records from its ERDMS in 2012 (Mumma,

Dingwall, and Bigelow 2011, 95) and, therefore, the lessons learned from this process may yet take a little while longer before they are shared in professional forums[4]

Therefore, the suggestion being made in this article for the incorporation of maturity models in improving both ECM and Digital Curation systems may be, from a practical perspective, a bit far-fetched since institutions have yet to have extensive experience in the transfer process. In addition, while maturity models may add value they are, for the most part, still in the early stages of their development and only through extensive use would they be able to provide opportunities for further refinement. Cho (2012) states that most maturity models are structured either as grid-based or stage-based which essentially means that their perspectives are two dimensional. He argues that there's need to combine both perspectives in order to enhance the models (Cho 2012).

References

AIIM. 2010. *What is Enterprise Content Management* [cited 5th March 2011]. Available from http://www.aiim.org/What-is-ECM-Enterprise-Content-Management.aspx

Archivematica. 2012. *Micro-services*. Archivematica [cited 2nd August 2012]. Available from https://www.archivematica.org/wiki/Micro-services.

Becker, Christoph, Gonçalo Antunes, José Barateiro, and Ricardo Vieira. 2011. *Schaman/Scape Capability Model*. National Library Board Singpore and Nanyang Technological University. Available from http://www.ifs.tuwien.ac.at/~becker/pubs/becker_ipres2011.pdf.

Biagio, Maria Luisa Di, and Bernice Ibiricu. 2008. "A balancing act: learning lessons and adapting approaches whilst rolling out an EDRMS." *Records Management Journal* no. 18 (3):170-179.

Cameron, Stephen A. 2011. *Enterprise content management - a business and technical guide*. Swindon, UK: The Chartered Institute for IT.

Caplan, Priscilla. 2011. *Re:[digital-curation] Semantics: Digital Preservation vs. Digital Curation* [cited 20th September 2012]. Available from https://groups.google.com/forum/?fromgroups=#!topic/digital-curation/ehppkZT9XGs.

Cho, Namdo. 2012. *Trusted Digital Repositories Maturity Model (TDR-MM)* [cited 17th September 2012]. Available from http://aeri2012.wordpress.com/conference-schedule/paper-presentations/trusted-digital-archives/.

CMS Watch. 2010. *The ECM Report 2010* [cited 25th March 2011]. Available from http://replay.waybackmachine.org/20090524222117/http://www.cmswatch.com/ECM/Report/

Corridan, Jim. 2012. *State Electronic Records Initiative: An Update* [cited 8th August 2012]. Available from

[4] Aspects of the lessons to be learned are being shared on the Artefactual wiki http://artefactual.com/wiki/index.php?title=VanDocs_Interface but there is very little information.

http://www.digitalpreservation.gov/meetings/documents/ndiipp12/Sessions/Preserving%20Electronic%20Records%20in%20the%20States/SERI%20NDIIPP%202012.pdf.
Curtis, Bill, William E Hefley, and Sally Miller. 1995. *Overview of the people capability maturity model*. Software Engineering Institute, Carnegie Mellon University [cited 1st April 2011]. Available from http://www.ts.mah.se/utbild/Pv7040/pv7040ht04/mm001.95.pdf.

Department of Defense [United States]. 2012. *Records Management Application: DoD 5015.02-STD RMA Design Criteria Standard* [cited 27th March 2012]. Available from http://jitc.fhu.disa.mil/cgi/rma/standards.aspx.

Dingwall, Glenn. 2011. *Building a digital archives for the City of Vancouver*, 14th September [cited 17th September 2012]. Available from http://www.vancouvergis.org/docs/Digital%20Archives%20Preservation%20-%20GIS%20User%20Group%20(2011-09-14).PPT.

Dingwall, Glenn, Richard Marciano, Reagan Moore, and Evelyn Peters McLellan. 2007. "From data to records: Preserving the Geographic Information System of the City of Vancouver." *Archivaria* no. 64:181-198.

DLM Forum Foundation. 2011. *Moreq2010 - Modular Requirements for Records Systems* [cited 11th June 2011]. Available from http://moreq2010.eu/pdf/moreq2010_vol1_v1_1_en.pdf.

Dollar, Charles, and Lori Ashley. 2011. Digital Preservation Capability Maturity Model.
———. 2012. *A digital preservation maturity model in action* [cited 28th May 2012]. Available from http://lib.stanford.edu/files/pasig-jan2012/12F2%20Digital%20Preservation%20Capability%20Maturity%20Model%20in%20Action.pdf.

Dryden, Jean. 2011. "Measuring Trust: Standards for Trusted Digital Repositories." *Journal of Archival Organization* no. 9 (2):127-130.

Duranti, Luciana. 1995. "Reliability and Authenticity: The Cocnepts and Their Implications." *Archivaria* no. 39:5-10.

Duranti, Luciana, and Heather MacNeil. 1996. "The protection of the integrity of electronic records: An overview of the UBC-MAS research project." *Archivaria* no. 42:46-67.

ECM Maturity Model. 2012. *8,500 downloads to date!* , 4th April [cited 19th September 2012]. Available from http://ecm3.org/2012/04/04/8500-downloads-to-date-3/.

Foscarini, Fiorella, Yunhyong Kim, Christopher A. Lee, Alexander Mehler, Gillian Oliver, and Seamus Ross. 2010. On the notion of Genre in digital preservation. Paper read at Automation in Digital Preservation, July 18-23, at Dagstuhl.

Galloway, Patricia. 2009. "Digital Archiving." In *Encyclopedia of Library and Information Sciences*, edited by Marcia J. Bates and Mary Niles Maack, 1518-1527. Boca Raton, FL: CRC Press.

Gartner. 2003. *Magic Quadrant for Integrated Document Management* [cited 5th March 2011]. Available from http://www.project-consult.net/Files/Gartner_QM2003_IDM.pdf.

Gillies, Alan. 2000. "Information support for general practice in the new NHS." *Health Libraries Review* no. 17 (2):91-96.

International Council on Archives. 2008. *Principles and Functional Requirements for Records in Electronic Office Environements: Module 2 - Guidelines and Functional Requirements for Electronic Records Management Systems*. International Council on Archives [cited 17th September 2012]. Available from http://www.adri.govt.nz/products/ICA-M2-ERMS.pdf.

International Monetary Fund. 2012. *Archives of the International Monetary Fund* [cited 2nd August. Available from http://www.imf.org/external/np/arc/eng/archive.htm.
InterPARES 2 Project. 2007. *Terminology Database* [cited 11th March 2012]. Available from http://www.interpares.org/ip2/ip2_terminology_db.cfm

Jordan, Paul. 2011. *Speech for SAA Chicago*. Society of American Archivists. Available from http://saa.archivists.org/Scripts/4Disapi.dll/4DCGI/events/eventdetail.html?Action=Events_Detail&Time=226188967&InvID_W=1916.

Kampffmeyer, Ulrich. 2004. *Trends in Record, Document and Enterprise Content Management*. Project Consult, 28th September 2004 [cited 4th October 2011]. Available from http://www.project-consult.net/Files/ECM_Handout_english_SER.pdf.

———. 2006. *Enterprise Content Management*. Project Consult [cited 4th October 2011]. Available from http://www.project-consult.net/Files/ECM_White%20Paper_kff_2006.pdf.

Katuu, Shadrack. 2012a. Enterprise Content Management– using maturity models to improve the quality of implementation.

———. 2012b. "Enterprise Content Management (ECM) implementation in South Africa." *Records Management Journal* no. 22 (1):37-56.

Kerzner, Harold. 2001. *Strategic planning for project management using a maturity model*. New York: John Wiley & Sons.

Kroll, Matthew, David Minor, Bernie Reilly, and Michael Witt. 2012. ISO 16363: Trustworthy Digital Repository Certification in Practice. In *7th International Conference on Open Repositories*. Edinburgh, Scotland, UK.

Lazorchak, Butch. 2011. *Digital Preservation, Digital Curation, Digital Stewardship: What's in (Some) Names?* [cited 20th September 2012]. Available from http://blogs.loc.gov/digitalpreservation/2011/08/digital-preservation-digital-curation-digital-stewardship-what%E2%80%99s-in-some-names/.

Lee, Christopher A. 2009. "Open Archival Information System (OAIS) Reference Model." In *Encyclopedia of Library and Information Sciences*, edited by Marcia J. Bates and Mary Niles Maack, 4020-4030. Boca Raton, FL: CRC Press.

Lee, Christopher A., Richard Marciano, Chien-Yi Hou, and Chirag Shah. 2009. Mainstreaming preservation through slicing and dicing of digital repositories: Investigating alternative service and resource options for ContextMiner using data grid technology. In *iPRES 2009: the Sixth International Conference on Preservation of Digital Objectives*: UC Office of the President: California Digital Library.

Lee, Christopher A., and Helen Tibbo. 2011. "Where's the archivist in digital curation? Exploring the possibilities through a matrix of knowledge and skills." *Archivaria* no. 72:123-168.

Liu, Richard Y L. 2002. *Capability maturity model integration: origins and applications*. Masters dissertation, California State University, Long Beach.

MacNeil, Heather. 2000. *Trusting Records: Legal, Historical and Diplomatic Perspectives*. Dordrewcht: Kluwer Academic Publishers.

———. 2002. "Proving grounds for Trust II: The findings of the Authenticity Task Force of InterPARES." *Archivaria* no. 54:24-58.

McRoberts, H A , and B C Sloan. 1998. "Financial management capability model." *International Journal on Government Auditing* no. 25 (3):8-11.

Melikhova, Irina. 2010. *Long-term preservation (LTP) of digital information: City of Toronto case study* [cited 17th September 2012]. Available from http://www.verney.ca/assets/file/MIPS2010presentations/3A.pdf.

MIKE2.0. 2010. *ECM Maturity Model (ecm3)* [cited 19th September 2012]. Available from http://mike2.openmethodology.org/wiki/ECM_Maturity_Model_%28ecm3%29.

Miles, Doug. 2009. *State of the ECM Industry 2009*. AIIM [cited 27th September 2012]. Available from http://www.aiim.org/PDFDocuments/36031.pdf.

———. 2010. *State of the ECM Industry 2010*. AIIM [cited 22nd April 2011]. Available from http://www.aiim.org/Research/Industry-Watch/ECM-State-of-Industry-2010.

———. 2011. *State of the ECM Industry 2011*. AIIM [cited 27th May 2012]. Available from http://www.aiim.org/Research-and-Publications/Publications/Industry-Watch/State-of-the-ECM-Industry-2011.

Moore, C, and R Markham. 2003. *Market leaders emerging in Enterprise Content Management* [cited 5th March 2011]. Available from http://www.forrester.com/rb/Research/market_leaders_emerging_in_enterprise_content_management/q/id/30139/t/2

Mumma, Courtney C., Glenn Dingwall, and Sue Bigelow. 2011. "A first look at the acquisition and appraisal of the 2010 Olympic and Paralympic Winter Games Fonds: or, select *From VANOC_Records As Archives WHERE Value="true"; ." *Archivaria* no. 72:93-122.

Murray, A, and M Ward. 2007. *Improving project performance using the PRINCE2 maturity model (P2MM)* Norwich: The Stationary Office.

National Archives of Australia. 2007. *Guidelines for Implementing the Specification for Electronic Records Management Systems Software* [cited 5th March 2011]. Available from http://www.naa.gov.au/records-management/publications/ERMS-guidelines.aspx

Nguyen L T, Swatman P M C, and B Fraunholz. 2007. *EDMS, ERMS, ECMS or EDRMS: Fighting through the acronyms towards a strategy for effective corporate records management*, 5-7 December 2007 [cited 25th March 2011]. Available from http://acis2007.usq.edu.au/assets/papers/132.pdf

Pearce-Moses, Richard. 2005. *A Glossary of Archival and Records Terminology*. Chicago: Society of American Archivists.

Pelz-Sharpe, Alan , Apoorv Durga, David Smigiel, Erik Hartman, Tony Byrne, and Jarrod Gingras. 2010. *ECM 3 - ECM maturity model* (2nd), June [cited 5th April 2011]. Available from http://ecmmaturity.files.wordpress.com/2009/02/ecm3-v2_0.pdf.

Peterson, Trudy Huskamp. 2008. *Temporary courts, permanent records*. Wilson Center [cited 20th July 2012]. Available from http://www.wilsoncenter.org/sites/default/files/TCPR_Peterson_HAPPOP02.pdf.

Scott-Jones, David. 2002. "Implementing EDRM in the Ministry of Defence." *Information Management and Technology Journal* no. 35 (4):159-162.

Seles, Anthea. 2012. *Digital records preservation*. National Archives of Thailand [cited 23rd September 2012]. Available from http://student.netdesign.ac.th/web553708/images/Anthea.pdf.

Shegda, Karen. 2001. *Integrated Document Management Software: Perspective*. Gartner, 4th April 2001 [cited 4th April 2011]. Available from http://www.emory.edu/BUSINESS/et/552fall2001/collaboration/int2.pdf

Shegda, Karen M, Kenneth Chin, Debra Logan, and James Lundy. 2004. *Building the Magic Quadrant for ECM 2004*, 12th November 2004 [cited 5th April 2011]. Available from http://www.gartner.com/DisplayDocument?doc_cd=124032.

Spiro, Linda. 2009. *Archival Management Software: A Report for the Council on Library and Information Resources*. Council on Library and Information Resources [cited 23rd September 2012]. Available from http://www.clir.org/pubs/reports/spiro/spiro_Jan13.pdf.

Sprehe, J Timothy. 2005. "The positive benefits of electronic records management in the context of enterprise content management." *Government Information Quarterly* no. 22 (2):297-303.

Van Garderen, Peter 2002. *Electronic Records Strategy: Final Report* [cited 24th September 2012]. Available from http://siteresources.worldbank.org/EXTARCHIVES/Resources/WB_ERS_Phase_1.pdf.
———. 2012. *Archivematica at the City of Vancouver Archives* [cited 17th September 2012].

Ward, Bob. 2001. "Enterprise Content Management." *Information Management and Technology* no. 34 (4):179-181.

Waugh, Andrew. 2007. "The design and implementation of an ingest function to a digital archive." *D-Lib Magazine* no. 13 (11/12).

Wilhelm, Philipp. 2009. "An evaluation of MoReq2 in the context of national EDRMS standard developments in the UK and Europe." *Records Management Journal* no. 19 (2):117-134.

Wilkins, Linda, Paula M C Swatman, and Duncan Holt. 2009. "Achieved and tangible benefits: lessons learned from a landmark EDRMS implementation." *Records Management Journal* no. 19 (1):37-53.

Yakel, Elizabeth. 2007. "Digital Curation." *OCLC Systems and Services* no. 23 (4):335-340.