



# Enterprise Content Management: Supporting Knowledge Management Capability

**Dr Rod Dilnutt, Director, William Bethwey & Associates  
Senior Fellow, The University of Melbourne**

---

## **Abstract**

*The ability to manage explicit information is a key knowledge management capability. Moreover, the capability to manage information is increasingly recognized as a core organisational need. Contemporary organizations are driven by the need to improve productivity and to mitigate business risk.*

*This study investigates vendor claims to be able to deliver integrated enterprise content management (ECM) through commercial product offerings as an enabler of knowledge management capability. In order to substantiate these claims, various technology components are identified and discussed in terms of functionality and value within ECM architecture.*

*The existing literature provides a theoretical background of ECM technologies specifically and technology convergence in general. Analysis of ECM functional attributes identifies the creation, storage and access to documents as the common focus of available technologies.*

*The findings have enabled the development of an ECM model that enables the assessment of technologies within an architectural framework.*

---

This paper was presented as a plenary presentation at the 5<sup>th</sup> International Conference on Knowledge, Culture and Change in Organisations, 19-22 July 2005, The University of the Aegean, Rhodes, Greece.

The article will be published in the forthcoming *International Journal for Knowledge Culture and Change Management*.

Contact: [rod.dilnutt@williambethwey.com.au](mailto:rod.dilnutt@williambethwey.com.au)

Phone: +61(0)3 9505 4133





# **Enterprise Content Management: Supporting Knowledge Management Capability**

## **Introduction**

Observations of product offerings in the commercial marketplace indicate that the term Enterprise Content Management (ECM) is being increasingly used by technology vendors to describe their software products. The vendor's claim of being able to manage unstructured information in the form of documents, web pages and drawings is a relatively recent phenomenon (Rylatt, 2003; Asprey & Middleton, 2003; Gartner, 2004; Becerra-Fernandez et al., 2004).

This study investigates vendor claims to be able to deliver ECM capability through their product offerings. It is noted that academic research into technologies that deliver enterprise wide capability has been significant, particularly in relation to Enterprise Resource Planning and office based authoring and communication tools (Davenport, 2000; Koch, 2001; Luan & Serban, 2002; Markus et. al., 2003).

If we accept that ECM is becoming an organisational capability then we need to understand the business and technology architecture that enables the delivery of ECM. This paper assesses candidate ECM components that would contribute to ECM and develops an ECM architecture capability that supports Knowledge Management capability.

This study establishes an understanding of ECM as an enabler of knowledge management capability. This is important as we need to understand and define what exactly is being conveyed by the term ECM and what impact this has on existing information technology infrastructures.

The convergence of technology as an ongoing phenomenon has previously been the subject of academic investigation (Tinkler et. al., 1996; Dista, 2003; Asprey & Middleton, 2003; Collins, 2004). The patterns of convergence, particularly in relation to Enterprise Resource Planning systems as now mature technologies, can inform us of what we can potentially expect as ECM vendors and technologies continue to evolve (Luan & Serban, 2002).

## **Enterprise Content Management and Knowledge Management**

Davenport & Prusak (1998) discuss knowledge management as being beyond the management of information captured in documents, databases and repositories. Knowledge is described as a blend of experiences, values, context, insight and grounded information (Davenport & Prusak, 1998). This view is widely supported in the literature relating to knowledge management. Further, there is a common view that technology has a contribution to make to knowledge management as a key enabling infrastructure (Leonard-Barton, 1995; Nonaka, & Takeuchi, 1995; Stewart, 1997; Sveiby, 1997; Boiset, 1998; Fahey, 1998; Hansen et. al., 1999).

The emergence of Enterprise Content Management as an integrated approach to building organisational capability enabling the management of explicit, documented information is an important infrastructure supporting knowledge management practice.

For the purposes of this paper we will accept that knowledge management is concerned with providing people with current and accurate information within the context of their roles (Davenport & Prusak, 1998; Dilnutt, 2002). The effective management of document based knowledge relies on technology infrastructures enabling people to create, store and access documentation in a timely manner.

From a knowledge management perspective we must recognize that ECM or any other technology is only able to provide management of explicit knowledge, i.e. written information. Technology tools have a limited ability to address the need to manage tacit or people based information which by nature is retained in the heads of employees.

At the organisational level Information Technology (IT) Architecture is the organisation of, applications, data and infrastructure technologies. The business capabilities (Ross, 2003). It is noted that the term (IT) architecture suffers from a lack of definition and sometimes is used interchangeably with the term (IT) Infrastructure (Weill & Vitale, 2002). For the purposes of this study the term architecture will be adopted to describe an integrated model of ECM applications.

## **Method**

Observations of the commercial marketplace provide the basis for concluding that there is a general convergence of technology offerings relating to ECM. This study, conducted during first half calendar year 2005, examines the academic and commercial literature relating to technology convergence with particular attention being paid to technologies providing ECM capability.

There are numerous product offerings in the ECM space. This investigation has focused on the most prevalent of those offerings and is not intended to be an exhaustive evaluation of the marketplace or of the products themselves.

Selection of products that have been included within the scope of this analysis was on the basis of identified presence in the Australian marketplace. The products that have informed this research are identified at appendix A to this report.

The data that has informed this research is drawn from three primary sources: existing published literature, scrutiny of publicly available information sourced through product documentation, industry journals and internet sites; and interview data (obtained from users and product vendors). Analysis of the functional attributes of each product enabled the identification of similarities and differentiating features of the products.

It is not the intention of this study to evaluate specific product offerings however, the functional offerings of these technologies are assessed to determine how these fit into a commonly applicable ECM architecture.

## **ECM Convergence**

Observations of the commercial marketplace provide the basis for concluding that there is a general convergence of technology offerings which supports ECM. The broad objectives of ECM Architecture are to enable knowledge management capabilities which in turn support business strategy. However, there is no common definition or model that clearly identifies what would constitute an integrated ECM.

Gartner Group (2004) has recognised that this convergence is in its infancy and will take several years to reach maturity. The positioning of vendors and the incidence of mergers and acquisitions in this space reflects the industry's recognition of the demand for simplified and integrated product suites.

Predictions from industry research institutions including Gartner Group (2004), Delphi Group (2004), Forrester (Bartels, 2004) and MetaGroup (Alvarez, 2002) are consistent in their expectations of significant growth. The MetaGroup predicts that the ECM market will exceed \$US 10 billion in 2004 with more than 90% of 'Global 2000' companies having formalised electronic record management policies and technologies in place by 2006. Similarly Gartner Group (2004) predicts a fourfold expansion in the marketplace during the period 2002 – 2006.

It is observed that current vendors have built ECM capability based on their historical strengths and are responding to business demands for integrated solutions to manage the ever increasing volumes of documents found in contemporary organisations.

For example, the 2003 acquisition of Documentum by EMC provides integration of established web based records, document management and workflow capability with long-term and high volume digital storage capacity. Vignette's web content management capability has been augmented by the addition of records and document management capability through the 2003 acquisition of Tower Technologies. In 1995 Hummingbird acquired the records and document management capabilities of PC Docs.

## **Why is Convergence Occurring?**

There are a number of factors that are creating the environment for technology convergence. Rylatt (2003) identifies a number of trends that will impact knowledge management practice. These trends include smarter knowledge platforms and a move towards the adoption of common standards and protocols. Implicit in this discussion is the convergence of technology and need for greater accessibility and availability of digitally based resources.

Examination of the academic literature augmented by the various marketing material offered by the vendor community reveals that the benefits of ECM can be categorised under the broad headings of compliance, efficiency, consistency, customer service and consolidation (Luan & Serban, 2002; Asprey & Middleton, 2003).

Further, there is an increasing focus on corporate governance in the light of high profile corporate transgressions which have been associated with inadequacies in control over corporate records.

The absence of management discipline governing corporate information and records creates significant business risk (Asprey & Middleton, 2003). Consider this quote: *"It might be useful to consider reminding the (Enron) engagement team of our document retention policy. It will be helpful to make sure that we have complied with the policy. Let me know if you have any questions"* (Nancy Temple, in house Attorney, Arthur Andersen, 2001). In June 2002 Arthur Andersen was found guilty of obstruction of Justice, was fined \$US50,000,000 and no longer exists as a global financial services firm.

Promulgation of the Sarbanes-Oxley legislation in the United States in 2002 is a direct response to Enron and other corporate transgressions. This is having a global impact on business operations and is forcing organisations to exercise greater rigour over their records management practices (Khan & Blair, 2004). This flows into the records, document and content management areas as the need to manage information in order to provide audit trails and corporate reporting becomes mandatory.

## **Candidate Enterprise Content Management Applications**

When discussing ECM it is important to define what capabilities offered by the technology vendors constitute ECM. Observations of the marketplace and examination of the literature provide the following list of candidate ECM applications for consideration. Each of the following candidate architectural components is assessed in relation to its role and contribution in ECM architecture.

- Content Management;
- Document Management;
- Records Management;
- Collaboration;
- Portal;
- Workflow;

- Search & Retrieval;
- Imaging;
- Enterprise Resource Planning; and
- Customer Relationship Management.

Each of the above architectural components will be discussed first in terms of functionality provided and then its role in supporting knowledge management capability.

As the wider research programme progresses and the marketplace evolve it is anticipated that other applications will require assessment within the context of the architecture.

The technology market that supports Knowledge Management is observed to be converging towards the concept of ECM. Vendor definitions of ECM generally flow along the lines that ECM is an integrated set of content, compliance and collaboration solutions. These solutions enable people to collaboratively create, manage, deliver, store and archive information during everyday business operations. This digitized information is found in, but is not limited to the following explicit information formats: documents, records, emails, web pages, photographs, drawings, video and pictures.

The following discussion summaries the candidate applications that claim to deliver ECM capability and their value as a component of an integrated ECM architecture.

## Content Management

Content Management is focussed on managing web-based information with the intention of publishing for mass consumption (Pastore, 2004). The advent of the World Wide Web has provided the ability to publish content for universal consumption and a web presence has become a fundamental business publicity and marketing tool (Rylatt, 2003). As such, an organisations' webpage has a significant impact on internal staff and external public perception of the quality, effectiveness and attractiveness of a product or brand. The website can play a role of attracting or deterring customers. With this in mind management of web content and its presentation is an increasingly important organisational capability.

The emergence of Web services and standards such as XML helped lead content management to the forefront of the software market in 2003 (Pastore, 2004). XML brought the ability to store content independently of application format and protocol considerations. Consequently, XML content can be re-used, reformatted and leveraged to create output documents either in printed form or as common office applications, i.e. Word, Power Point and Excel or as PDF files.

Just as it is important to get documents into a system, it is critical to retrieve documents for dissemination, either for specific uses or on specific media. Organizations have a wide range of options for publishing information. This simplifies the challenge of making the most current information available, and provides a level of control and monitoring of user access and use of this information.

Previous research has investigated how content can be structured within a web environment can be viewed as another class of document with a life-cycle that requires management (Rosenfeld & Morville, 1998). Although we need to recognise that the purpose of web content can be quite different than that of business documents the life-cycle management process need not be dissimilar to any other document management process regardless of purpose.

## Document management

Documents are recorded communication with recognizable structure, on any medium which are intelligible without any further processing except for on the screen or on the printed page (Asprey & Middleton, 2003). Consequently, Document Management is concerned with the

management of document based information which is largely unstructured and involves the process of managing this recorded communication through a life cycle which can be generally described by the processes of creation, storage, access and use of documents.

Document management applications address common organizational limitations in retrieving and managing electronically generated and unstructured information in an efficient manner. These applications offer the ability to manage electronically created files for fast and easy retrieval and to exert a level of control over document access, authenticity and security (Duck, 2001).

Documents can be in many formats including electronic documents authored in MicroSoft Office products and other Office tools, web pages, drawings, pictures, e-mails, photographs, video, reports, graphics and may be in physical or electronic form. From a knowledge management perspective, these documents represent the explicit information that individuals or organisations need to manage to pursue their business purpose (Davenport & Prusak, 1998).

Consistent with Rylatt's (2003) discussion of emerging themes in the digital environment there are evolving standards influencing document management applications. Integrated Document and Content Model Solution Architecture represents a management framework prefaced on the relationships between business planning and strategic business applications (Asprey & Middleton, 2003).

Further, The Association for Information and Image Management has led the development of a number of standards including The Open Document Management API and the Document Management Alliance. These standards provide for document management applications to operate within desktop environments and for different document management applications to work together without the need for middleware or interface programming.

The management of documents at an organisational level represents one way of sharing and disseminating document based information and is a fundamental capability for effective knowledge management (Wiggins, 2000). As such, any enterprise wide architecture must include a document management component.

## Records Management

Records management, as distinct from document management has an administrative focus on structuring, organising and protecting an organisations' recorded information (Wiggins, 2000). The management of recorded evidence of an organisation's activities or transactions from creation through to disposal is an important function that is required to be able to validate due process in business management.

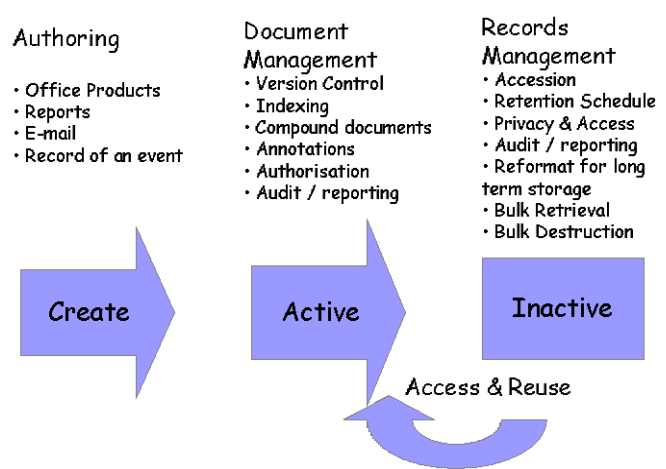
The primary purpose of records management is to manage the risk and cost created by an organization's information whether this is in hard copy or electronic form. Any type of business document as discussed in relation to document management earlier can be classified as a "record" and forms part of the auditable history of the organisation.

The disciplines of records management grew out of the business requirements externally imposed by industry regulations and to protect themselves from liability.

During the 1970's mainframe records management systems provided automated registries enabling indexing, search and retrieval of information related to records and to implement a file classification structure (Asprey & Middleton, 2003). During the 1990's those systems were migrated to client server environments taking advantage of Windows operating systems. More recently functionality has expanded in response to the availability of a Web environment.

The life cycle of record management parallels and extends the document management life cycle identified above. Additionally, the records life cycle must accommodate archiving storage needs and appropriate records destruction processes.

The combined document/record life cycle is presented in Figure 1.0 following.



**Figure 1.0 – Document and Records Management Life Cycle**

Similar to and highly aligned with document management applications, records management must be viewed as an integral component of an enterprise content management architecture.

## Collaboration

The ability for individuals and groups in organisations to collaborate is a fundamental concept of knowledge management (Leonard-Barton, 1995; Davenport & Prusak, 1998). The ability to collaborate requires systems and processes designed to support communication and collaboration across geophysical, organisational and functional boundaries.

Becerra-Fernandez et al. (2004) describe knowledge sharing systems as “systems that enable members of an organisation to acquire explicit and tacit knowledge from each other”. Collaborative systems and groupware are designed to support this communication between individuals and groups who may not be in the same place at the same time. Collaboration tools can include e-mail, discussion forums, chat-rooms, videoconferencing and workflow applications.

The need for collaboration systems has arisen from a number of social and resourcing factors including the need for people and organisational teams to work together virtually across multiple locations (Williams, 1996). Further, as technology has evolved, collaboration systems have become more widely available and affordable (Robertson et al., 2001).

Lotus Notes is a widely used example of groupware. Among many other functions it provides discussion databases, e-mail, shared databases with a level of workflow used to encourage people to share knowledge and have a common place to store, access and contribute explicit knowledge (Williams, 1996).

From a knowledge management perspective collaboration tools enable people to share knowledge which, in turn will improve productivity and quality of output (Chaffey, 1998). It is important to recognise that there is a heavy reliance on documents as the basis for collaboration. This indicates a close alignment between document management and collaboration systems.

## Portal

Portal technologies have emerged in response to the need for access to all organisational data, information and knowledge through a single desktop interface (Luan & Serban, 2002). The range of portal functionality varies from access to unstructured and structured information to supporting collaborative processes through workflow and communications.

The single entry point offered by portal technologies overcomes common organisational issues including a lack of standardized tools, content repositories, taxonomy, and common vocabulary across the organization's content. Further, portal functionality provides for higher productivity as users are able to access information without the need to logon to multiple applications and to maintain multiple applications and skill sets (Collins, 2001).

The fact that portal technologies are providers of access to both structured and unstructured information indicates that a portal capability should be considered an important component in any enterprise content management architecture.

## Workflow

The definition of a business process has generally been accepted as the description of 'how' work is done, rather than what work is done' (Davenport, 1993). Workflow applications are designed to automate and implement controls over business processes which typically rely on documents as a core means of creating and managing the process (Hollingsworth, 1995; Asprey & Middleton, 2003).

Workflow in the context of a unified content management strategy, defines how people and tasks interact to create, update, manage and deliver content. This content is structured as a document or form which transitions through various phases of processing and approval as determined by business rules.

Although workflow can be implemented as a manual system, greater benefits flow from the automation of the process where paper forms are eliminated and transition from one phase of activity is managed electronically (Fischer, 2002). These benefits stemming from automation of document based processes are identifiable in reduced time cycles, improved visibility of the process and availability of audit and management information.

Examination of ECM vendor solutions identifies that typically, there is the offering of some workflow capability. For example, vendors including FileNet, TRIM, Vignette, Hummingbird and others promote workflow as a product differentiation feature and provide anecdotal evidence of potential benefit realisation.

Workflow capability is therefore viewed as core component of enterprise content management architecture as many business processes are based on the flow of paper documents collecting information and gaining approvals.

## Search & Retrieval

Contemporary organisations are increasingly reporting problems in locating needed information (Luan & Serban, 2003). Part of the problem lies in the ad-hoc approach to document naming conventions and is exacerbated by the growing volumes of documents that are stored in various organisational network drives and repositories. Search and retrieval systems are navigation tools used to locate and retrieve information in an effective timely fashion (Rockley et. al., 2003).

Search and retrieval systems have been fundamental tools in libraries and legal systems for many years and can potentially address one of the biggest problems of knowledge management: helping users find the information they need.

The more sophisticated search and retrieval systems, including Autonomy and Verity also feature such capabilities as natural language searching, heuristics, and summarization, which make the systems easier to use and improve searching precision. Taxonomy structures and metadata can be used to narrow the search focus (Rockley et. al., 2003).

As discussed in relation to content, document records and collaboration systems the focus of search and retrieval systems is on documents as the primary storage format making search and retrieval capability a primary component of the ECM architecture

## Imaging

Digital imaging evolved in the 1980's in parallel with database technologies and the concept of the 'paperless office' was promoted (Asprey & Middleton, 2003). Its purpose is to create electronic images of documents and records thereby eliminating manual effort and time lags associated with reliance of physical media.

Imaging is usually applied in high transaction situations where processing is triggered by the receipt of a paper document, for example, claims processing, patient records, cheque processing. Typically these processes require a workflow capability to provide efficiency and quality benefits.

For the purposes of our discussion on ECM it is important to recognise digital imaging is but one of many methods of inputting data and information into an application or database. Other methods include: on-line entry, input from other applications, Electronic Data Interchange, manual keystrokes and telephony integration.

Lyman et. al. (2000) estimate that 93 percent of information produced annually is in digital form and that this is growing exponentially at a rate of 22% per annum. This is decreasing the importance of imaging as an input technique.

As the functional role of digital imaging of physical documentation is relatively minor it is not considered a core component of ECM architecture. Similar argument can be applied to the recognition technologies such as barcode reading and optical character recognition.

## Enterprise Resource Planning

There is widespread adoption of Enterprise Resource Planning (ERP) solutions that have an emphasis on automating transactional processes within the supply chain and are focussed on the collection of data relating to those transactions (Koch, 2001). These solutions are not generally regarded as knowledge management solutions as the focus is not primarily on the management of content or documents as is the case for ECM (Newall et. al., 2003).

Consultation of the literature relating to the convergence of ERP systems tells us that consolidation of stand-alone applications has created integrated systems support supply chain and back office functions including finance, human resource management and supply chain logistics (Newall et. al., 2003)

We note that ERP solutions including SAP, PeopleSoft, J. D. Edwards, Oracle etc. which offer the capability to store search and retrieve business documents (Davenport, 2000; Koch, 2001). However, ERP functionality is primarily focussed on the documentation relating to core business process that is being managed (Koch, 2001).

ERP solutions are therefore considered to outside of the ECM Architecture. However, the parallel capabilities offered by ERP solutions need to be recognised and should be included as components for delivery of the ECM architecture in many organisations.

## Customer Relationship Management

Customer Relationship Management (CRM) systems are designed to collect and manage information and data relative to an organisation's customer base (Luan & Serban, 2002). As discussed in relation to ERP systems CRM systems are considered to be outside the scope of the ECM architecture, although it is recognised that CRM is a complementary business capability to that of knowledge management.

CRM systems are concerned with the collection and aggregation of primarily transactional data relating to specific customer for access through a number of reporting and analysis tools. Products such as Seibel have the capacity to store documents related to the customer but rely primarily on the data collected through transactional processing as the basis of reporting and analysis.

## Findings

There is a high degree of overlapping functionality across Content Management, Document Management and Records Management (Asprey & Middleton, 2003). Further the functionality offered in collaboration tools focuses on sharing knowledge that is document based and placed in shared repositories. Workflow tools focus on automating activities that often rely on a document that supports a business process through various stages of its receipt, investigation and approval. Search and Retrieval tools are concerned with the navigation and location of primarily document or unstructured information.

Finally, Portal tools are concerned with the provision of a single facility for users to access both document based, i.e. unstructured information, and data constructed i.e. structured information created through transactional processing. The portal offers the means by which all explicit knowledge held in an organisation's repositories and databases can be accessed and manipulated through a single user interface.

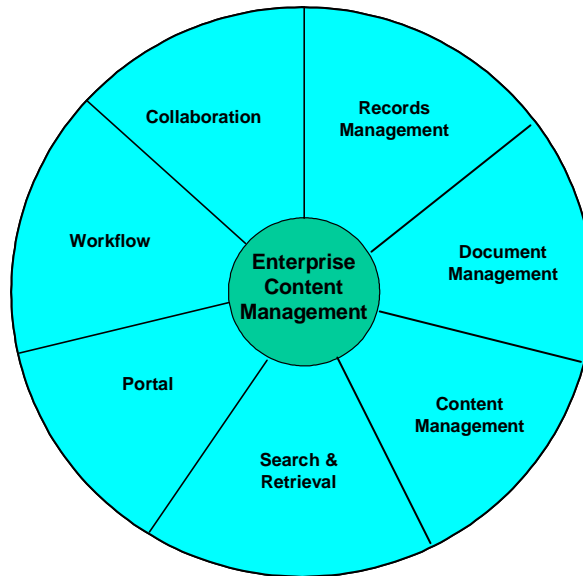
Both ERP and CRM applications have been considered to be outside of the ECM Architecture because of the transactional data foundations of the information. The primary purpose of both ERP and CRM Applications is to manage and report on data relating to a business process and not to primarily manage documents. Although, some products offer the ability to manage documents this is a core function that would define an ERP or CRM application. Similar arguments relating to business intelligence and data warehousing system would prevail.

Having said this we need to be cognisant of the fact that ERP and CRM applications represent a grey area of functionality in the definition of ECM and that both can provide a level of support for knowledge management capability. Therefore, the context of some organisational environments the ECM architecture may include both ERP and CRM components to support knowledge management capability.

Commercial offerings of ECM capability are based on the vendor's historical strengths in one or more components of ECM and are responding to business demands for integrated solutions to manage the ever increasing volumes of documents found in contemporary organisations.

There are a number of identified solutions in the marketplace that are moving toward the central goal of ECM from different directions. Historically, each product started off its life with a particular functional focus (e.g. workflow, document management) and has expanded its capabilities through a process of development, integration and acquisition, to encompass some of the other functionalities.

We can present the model of an ECM architecture as per Figure 2.0 following.

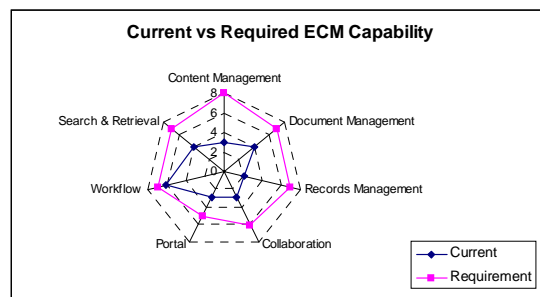


**Figure 2.0 - The ECM Architecture**

The ECM architecture model has practical application as an assessment tool for organizations considering developing ECM capability. Identification of product functionality enables benchmarking against the ECM architecture and organisational requirement. Using the ECM architecture also provides a benchmark to assess suitability. This model can be applied as an assessment model for organizations considering investment in ECM solutions or to benchmark current capability.

For example; an organization's functional requirement for component of the ECM architecture can be measured on a scale of 0 – 10. This can be plotted in radar-graph format as presented in Figure 3.0.

The visual picture created enables identification of where the gaps in capability exist, which, in turn, will inform where we need to focus attention to complete the picture.



**Figure 3.0 - ECM Architecture Gap Assessment**

## Conclusion

Enterprise Content Management is an emerging discipline resulting from the convergence of specific purpose software applications. These applications are undergoing a process of alignment and integration in response to an increasing business demand. ECM represents the convergence of a number of technologies as integrated components offering a capability to store, access and manage document based information. These specific purpose applications that have led to the emergence of ECM include records management, document management, portal technologies, content management, workflow, collaboration and search and retrieval technologies (Gartner, 2004).

Asprey & Middleton (2003) observe that when selecting a solution there should not be an over-concern whether it is a content management or a document management solution. Luan

& Serban (2002) discuss content and document management without making any apparent differentiation between the two concepts. It is this similarity between the various components of ECM that provides the basis for considering ECM as an overarching architecture governing the management of documents regardless of purpose.

From an architectural perspective there is limited requirement for different enabling technologies for document and content management. In an integrated ECM the functionality would cater for the management of content and documents within a common governing framework without the need to differentiate the purpose of these document types. All the components we have considered to be within the scope of ECM Architecture are concerned with access, storage or retrieval of document based information.

This study concludes that although there is an identifiable ECM architecture, commercially available applications have yet to achieve full convergence of the ECM components into a single integrated solution capable of satisfying all ECM functional requirements.

To achieve the goal of ECM a vendor must have credible capabilities in all the technology areas identified. Most of the solutions identified above have variable capabilities in each technology area, few have properly reached the goal of ECM, and some are closer to the goal than others. Many of the products perform well in their areas of core competency, but less well in the technologies that they have added in an attempt to move toward ECM. It is therefore essential that any technology assessment looks in detail at the capabilities of these tools in all the technology areas, as well as the non-functional aspects such as usability, integration, scalability and security.

The purpose of this paper has not been to assess current applications that claim to provide ECM capability. However, it was considered important to identify and collate the marketing claims of the vendor community with observations of the ECM functionality provided by the products. These observations have contributed to the development of the ECM architecture.

This study has been an initial discovery step in an ongoing research programme focusing on ECM. Further research into the application of ECM in business environments and investigation of any improvements in service quality and efficiency will further validate the need for organisations to invest in ECM capability to provide discipline and control over enterprise content. This control over enterprise content as the basis of explicit knowledge provides an important foundation upon which an organisation can build its knowledge management capability.

## **Bibliography**

- Alvarez, G., (2002) *New Horizons in Consumer Product Technology Trends*, MetaGroup.
- Asprey, L.. & Middleton, M., (2003), *Integrative Document and Content Management*, Idea Group Publishing, Hershey, Pennsylvania.
- Bartels, A., (2004) *IT Spending Outlook 2004 – 2008 and Beyond* Forrester Research
- Becerra-Fernandez, I., Gonzalez, A., & Sabherwal, R. (2004). *Knowledge Management: Challenges, Solutions and Technologies*, Pearson Prentice Hall, New Jersey.
- Boiseot, M. H., (1998), *Knowledge assets: securing competitive advantage in the information economy*, Oxford University Press, Oxford.
- Chaffey, D., (1998), *Groupware, workflow and Intranets: Reengineering the Enterprise with Collaborative Software*. Boston, Digital Press.
- Collins, H., (2001), *Corporate Portals*, American Management Association, New York.
- Davenport, T. H., (1993), *Process Innovation*, Harvard Business School Press, Boston.

- Davenport, T., & Prusak, L., (1998), *Working knowledge: how organisations manage what they know*, Harvard Business School Press, Boston,
- Davenport, T. H. (2000), *The Future of Enterprise System-Enabled Organizations*, Information Systems Frontiers, Vol. 2, No. 2, pp. 163 – 180
- Delphi Group, (2003), *Enterprise Information Integration: Leveraging ontologies and semantic metadata management to enable actionable information and composite applications*, Boston.
- Delphi Group, (2002), *Taxonomy and Content Classification Market Milestone Report: A Delphi Group White Paper*, Boston.
- Dilnutt, R., (2002), 'Knowledge Management: Three Case Studies'. International Journal for Accounting Information Systems, Spring Edition, Boston.
- Ditsa, G., Editor, (2003), *Information Management: Support systems and Multimedia technology*, IRM Press. Hershey, Pennsylvania.
- Dollar, C., (2002), *Authentic Electronic Records: Strategies for Long Term Access*, Chicago: Cohasset Associates.
- Duck, J. D., (2001), *The Change Monster*, Crown Business, New York.
- Fahey, L. 1998, 'Business Process Design: The Implications of Tacit Knowledge', *Knowledge and Process Management*, June, pp. 110 - 117.
- Fischer, L., (Ed.), (2002), *Workflow Handbook 2002*, Future Strategies Inc., Florida.  
[www.wfmc.org](http://www.wfmc.org).
- Gartner Group, (2004), *Magic Quadrant for the Smart Enterprise Suite*, 2004, Gartner Group.
- Gartner Group, (2004), *Content Management, Collaboration and Portals Converge*, Proceedings of Gartner Symposium ITExpo, Sydney.
- Hansen, M. T., Nohira, N. & Tierney, T. 1999, 'What's Your Strategy for Managing Knowledge?' *Harvard Business Review*, March - April, pp. 107 - 116.
- Hollingsworth, D., (1995), *The workflow reference model*, Issue 1.1, Workflow Management Coalition, Hampshire, U.K.
- Kahn, R. A., & Blair, B. T., (2004), *Information Nation: Seven Keys to Information Management Compliance*, AIIM International, Chicago.
- Koch, C. (2001), "BPR and ERP: Realizing a Vision of Process With IT", *Business Process Management Journal*, Vol. 7, No. 3, pp. 258 – 265
- Leonard-Barton, D. 1995, *Wellsprings of Knowledge*. Harvard Business School Press, Boston.
- Luan, J., & Serban, A., (2002), Technologies, Products and Models Supporting Knowledge Management, *Wiley InterScience, New Directions for Institutional Research*, No. 113.
- Lyman, P., et al., (2000), *How much Information?* School of Information Management and Systems, University of California. Retrieved 01/08/05, [www.sims.berkeley.edu/how-much-info](http://www.sims.berkeley.edu/how-much-info).
- Markus, M. L., Petrie, D. & Axline, S. (2000), Bucking the Trends: What the Future May Hold for ERP Packages, *Information Systems Frontiers*, Vol. 2, No. 2, pp. 181 – 193
- Newell, S., Huang, J. C., Galliers, R. D. & Pan, S. L. (Jan 2003), Implementing Enterprise Resource Planning and Knowledge Management Systems in Tandem: Fostering Efficiency and Innovation Complementarity, *Information and Organization*, Vol. 13, Issue 1, pp. 25 – 52
- Nonaka, I. & Takeuchi, H. 1995, *The Knowledge Creating Company*, Oxford University Press, Oxford.
- Pastore, M., (2004), CMS to Mature in 2004, *IT Trends*. Retrieved 01/08/05, [www.cioupdate.com/trends/article.php/3295931](http://www.cioupdate.com/trends/article.php/3295931)
- Robertson, M., Sørensen, C. & Swan, J., (2001) 'Survival of the leanest: intensive knowledge work and groupware adaptation', *Information Technology & People*, 14 (4), 334-352.

- Rockley, A., Kostur, P., & Manning, S., (2003), *Managing Enterprise Content, A Unified Content Strategy*, New Riders, Indiana
- Rosenfeld, L., & Morville, P., (2002), *Information Architecture and the World Wide Web: Designing Large Scale Web Sites*, 2<sup>nd</sup> Edn, O'Reilly.
- Ross, J. W., (2003), Creating a Strategic IT Architecture Competency: Learning in Stages, *MIS Quarterly Executive*, Vol. 2, No. 1, pp 31-43.
- Rylatt, A., (2003), *Leveraging Digital Technology, Winning the knowledge game: A smarter strategy for better business in Australia and New Zealand*, Sydney, McGraw Hill.
- Sarbanes-Oxley Act, 2002, Sections 302 and 404, United States.
- Stewart, T. A. (1997), *Intellectual Capital: The New Wealth of Organisations*, Nicholas Brealey Publishing, London.
- Svieby, K. 1997, *The New Organisational Wealth: Managing and Measuring Knowledge Based Assets*, Berrett-Koehler, San Fransisco.
- Tinkler, D. E., Lepani, B., & Mitchell, J., (1996), Education and Technology convergence: A survey of technological infrastructure in education and in the professional development and support of educators and trainers in information and communication technologies, *Australian Government Publishing Services*, Canberra.
- Weill, P., & Vitale, M., (2002), What IT Infrastructure Capabilities are Needed to Implement E-Business Models, *MIS Quarterly Executive*, Vol. 1, No. 1, pp 17-34.
- Wiggins, B., (2000), *Effective Document Management: unlocking corporate knowledge*, Gower, Aldershot.
- Williams, A., (1996), 'Groupware: the next ware of office automation' *Industrial Management & Data Systems*, Vol. 96, No. 6, pp 11-13.

## Appendix A

Product	Website Reference
80-20 Software	<a href="http://www.80-20.com">www.80-20.com</a>
Association for Information & Image Management.	<a href="http://www.aiim.org/standards">www.aiim.org/standards</a>
Autonomy	<a href="http://www.autonomy.com">www.autonomy.com</a>
Content Manager	<a href="http://www.ibm.com">www.ibm.com</a>
Lotus Notes	
Tarian eRecords Engine	
DataWorks	<a href="http://www.Advdata.com.au">www.Advdata.com.au</a>
Documentum	<a href="http://www.Documentum.com">www.Documentum.com</a>
DocuShare	<a href="http://Fuji-Xerox.com">Fuji-Xerox.com</a>
FileNet Paragon	<a href="http://www.Filenet.com">www.Filenet.com</a>
FileSurf	<a href="http://www.mdy.com">www.mdy.com</a>
Hive	<a href="http://www.harvestroad.com.au">www.harvestroad.com.au</a>
Hummingbird	<a href="http://www.Hummingbird.com">www.Hummingbird.com</a>
iManage Workdocs	<a href="http://www.iManage.com">www.iManage.com</a>
Intergraph	<a href="http://www.intergraph.com">www.intergraph.com</a>
LiveLink	<a href="http://www.Opentext.com">www.Opentext.com</a>
Objective EDM	<a href="http://www.Objective.com">www.Objective.com</a>
OracleDB Content Management	<a href="http://www.oracle.com">www.oracle.com</a>
Plumtree Portal	<a href="http://www.plumtree.com">www.plumtree.com</a>
Recfind	<a href="http://www.gmb.com.au">www.gmb.com.au</a>
Sharepoint Portal Server	<a href="http://www.Microsoft.com">www.Microsoft.com</a>
Siebel	<a href="http://www.siebel.com">www.siebel.com</a>
Stellent Content Management	<a href="http://www.stellent.com">www.stellent.com</a>
TeamDoc	<a href="http://www.interwoven.com">www.interwoven.com</a>
TRIM	<a href="http://www.Towersoft.com.au">www.Towersoft.com.au</a>
Verity	<a href="http://www.verity.com">www.verity.com</a>
Vignette	<a href="http://www.Vignette.com">www.Vignette.com</a>