

December 2005

Factors Influencing the Implementation and Use of a Portal for Knowledge Management in Higher Education

Brian Corbitt
Shinawatra University

Tim Bradley
Deakin University

Theerasak Thanasankit
Mahidol University

Follow this and additional works at: <http://aisel.aisnet.org/pacis2005>

Recommended Citation

Corbitt, Brian; Bradley, Tim; and Thanasankit, Theerasak, "Factors Influencing the Implementation and Use of a Portal for Knowledge Management in Higher Education" (2005). *PACIS 2005 Proceedings*. 12.
<http://aisel.aisnet.org/pacis2005/12>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2005 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Factors Influencing The Implementation And Use Of A Portal For Knowledge Management In Higher Education

Brian Corbitt
Shinawatra University,
Thailand
Deakin University, Aust
bcorbitt@shinawatra.ac.th

Tim Bradley
Deakin University,
Australia

Theerasak Thanasankit
Mahidol University,
Thailand
jua@tezza.com

Abstract

This study investigates the factors affecting the implementation and use of a portal to assist knowledge management objectives in higher education. The study explored factors influencing knowledge distribution by deriving a conceptual framework consisting of four (4) dimensions: knowledge volume, knowledge quality, knowledge dissemination, and information system management. This study found that there are many factors influencing the selection and structure of information and knowledge. The importance of information quality was also addressed and the study found that while it is imperative for a portal to focus on quality information, accountability for quality assurance of information rests with organizational policy imperatives. The study explored knowledge dissemination techniques available via portals and identified that personalisation of knowledge is a high priority. The characteristic of a portal to integrate many systems into one central repository and provide users with their personal view of many systems was acknowledged as a productive means to distribute information within a higher education institution.

Keywords: Knowledge management, portal, higher education, dissemination, quality, information systems.

Introduction

The ability to create, share, obtain and better manage knowledge is becoming of increasing importance for organisations. Knowledge and intellectual capital are seen as assets which can provide competitive advantage over rivals. As a result much work has gone into the building of formal channels for organisations to share knowledge internally as well as obtain quality external knowledge, to ensure that employees can be enriched with current practices. Technology has been a support tool, which assists the formal knowledge exchange process. There are many information technologies available to exchange and manage knowledge. However it is imperative that the correct information technology is implemented for the right situation.

Portal technologies have become more prominent in recent times as these information technologies provide many benefits and can leverage the underlying infrastructure of the Internet. Portal technologies are personalised gateways to sets of information, applications and services. Typically, portals are a layer above many underlying systems and group these systems together to provide a single point of access for the user. Many places of higher

education are implementing portal technologies to provide students with a personalised gateway to teaching, learning and administration facilities in a web environment. Using a case study of a higher education institution, this paper focuses on the factors that influenced the implementation and use of a portal for knowledge management (KM).

Knowledge Management And Portals

The first shift towards sharing knowledge came in the mid 1990's when organisations began to think seriously about managing what they know (Davenport and Volpel 2001). Lim and Klobas (2000) note that the interest to create formal channels to share knowledge has grown with the sophistication of technology for sharing knowledge. This led to substantial research that focuses on the importance of creating formal ways to exchange knowledge within computerised systems. Knowledge management is not solely associated with technology but uses technology as a support device to aid the capture, archiving and retrieval of information and knowledge. For successful knowledge transfer, an organisation must support a knowledge sharing culture (Lim and Klobas 2000). However, the dissemination of knowledge through an organisation has many difficulties. Firstly, how do the users know where and how to locate the knowledge or information they desire? Secondly, how does the receiver of the knowledge know if the information reliable and of a high quality? These problems impact upon organisations that are trying to provide relevant and reliable knowledge to system users. For example, Alavi and Leidner (2001) express a concern that organisations need to be cautious about not overloading users with masses of information. Information overload has become a more prominent issue since the increased popularity of the Internet (Collins 2001).

Some organisations use the Internet as a mechanism to gather and acquire external information and knowledge to better their knowledge assets. Rowley (1999) states that one of the four primary objectives of KM projects is to include external knowledge, such as competitive intelligence. The inclusion of external knowledge sources can dramatically increase the amount of knowledge that an organisation wishes to disseminate. When introducing external knowledge sources organisations need to be strategic or their internal systems could become overloaded with too much information and data. Portal technologies are built on the same infrastructure as the Internet and so it is important to understand knowledge management issues surrounding Internet and web use.

Lim and Klobas (2000) suggest that two key factors for good knowledge management practices are 1) the extent that external knowledge changes the environment and 2) the extent that internal knowledge affects organisational specific requirements. Organisations that wish to distribute knowledge to their employees need to assess what type(s) of knowledge they want to distribute, external and/or internal, and to what extent. Smaller organisations will generally have a larger focus on external knowledge as they have less human resources generating quality internal knowledge, while larger organisations will concentrate more on internal knowledge (Lim and Klobas 2000).

Organisations need to be cautious not to deliver inaccurate and misleading information to individuals as decisions could be made by the recipient of the information that could lead to harmful consequences (Parker 1997; Cooke 2001). The quality of information and knowledge distributed by an organisation is of paramount importance. Previous research suggests that organisations wanting to obtain innovative quality should consider implementing reforming policies to make KM processes formal (Simatupang and White 1998). Total Quality Management (TQM) policies are generally implemented when an organisation wishes to stipulate what it does and why it does it (Flood 1993). Simatupang

and White (1998) argue for the need for senior managers to develop policies that enable employees to capture and disseminate the collective knowledge base that corresponds to competitive edge and provide a formal, documented KM practice.

When organisations look to disseminate this knowledge, they need to be confident that the user will not be overloaded with masses of information or inaccurate facts. Housell and Bell (2001) state that IT can assist KM if two key principles are followed: 1) use mainly procedural knowledge; and 2) embed knowledge that could be lost if employee's leave the company. However, Sallis and Jones (2001) and Housell and Bell (2001) warn of the complexities that can occur if too much emphasis is placed on using technology for knowledge management, and recommend that companies should be selective in what they wish to capture and store. Until a computer can be programmed with an algorithm to be creative, KM cannot be solely technology dependant (Housell and Bell 2001). Conversely, many authors such as Liebowitz and Wilcox (1997) stress technology should be a focus point and describe the many benefits of knowledge-based systems (KBS), highlighting the various functionalities that they provide. Knowledge-based systems both assist the quality or results returned and the time required to perform knowledge tasks (Liebowitz and Wilcox 1997).

Many higher education institutions have explored the possibilities of going beyond the physical campus and looking toward new, online markets since first mooted by Burton-Jones (1999). UCLA pioneered the first online campus portal in 1999 and since then many higher education institutions have developed environments where university students can locate teaching materials and collaborate online (Raol, Koong, Liu and Yu, 2002). Through the provision of technical advancements, distance learning is becoming a more prominent focus with facilities such as online campuses. It is not a new paradigm for universities to use technology to manage data and information. However, researchers question their ability to act upon what they collect. Education institutions are good at capturing data and processing information but are yet to identify how they can add value to the student (Sallis and Jones 2001). Educational institutions should be focusing on knowledge management to '*integrate studies*' through both courseware and technology (Liebowitz and Wilcox 1997). This integration of studies is seen as a strategic goal by a large majority of educational institutes with many propriety software applications available to universities to manage courseware via technology (Tortora, Sebillio, Vitiello and D'Ambrosio 2002).

The capability of portals to offer a single, gateway for people within an organisation to obtain personalised and customised information from both external and internal sources seemed alluring to many organisations and offered a solution to overcome the impersonal nature of websites (Shilakes and Tylman 1998). Additionally, the movement for organisations to embrace portals was further enhanced by the difficulties and constraints associated with intranets. White (2000) highlights that intranets require large staff resources to maintain the currency of the content, which is not always feasible. Furthermore, the ability for an intranet to obtain external information is difficult as the original notion of the intranet was to only access information locally (Collins 2001). However, sometimes companies wish to access information external to the organisation and information that is not available on the company's intranet, therefore staff would have to use another way to retrieve external information. As Shilakes and Tylman (1998) note in their research, a major benefit of portals is that they can provide access to all, both internal and external information making this technology appealing to many organisations.

Portals are viewed as support tools for university personnel and should not disrupt the individual's work performance or the overall strategic goals of the university, but rather should assist university functions and goals (Robert-Witt 2003; Murray 2003). Murray (2003)

suggests that the adoption of a portal must fit into the overall strategic objectives of institution and not affect the outlaid objectives. Portals are perceived to be beneficial for the distribution of information and knowledge. Building on previous research this study focused on exploring the factors that influence the management of a portal during planning, design, implementation and use.

Research Methodology

This research uses an interpretivist case study methodology, capturing and analyzing rich descriptive data associated with individuals' perceptions, attitudes and views (Hakim 1987) and explores the descriptive features that affected the decision making process of implementing a higher education portal. The researcher used a single case organisation to collect the data. Yin (1994) states that a case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The research aimed to investigate what factors influenced implementation and use of a KM portal in higher education.

The higher education case study organisation had already implemented a portal and provided a gateway for the researcher to capture real world data and past experiences. Furthermore, since only a small adoption of higher education portals has occurred in the Australian market, this case organisation could be considered revelatory and thus align with Yin's (1994) guidance for selecting a single case study. Case studies have the advantage of investigating areas of hindsight and record passed experience that could prove relevant for the future (Merriam 1988).

Semi-structured interviews were used as the primary data capture instrument as they can capture rich, descriptive data and enable the researcher to explore what factors impact on the use of the portal (Williamson 2000). Fourteen interviews were undertaken with the key internal stakeholders of the higher education institution to gain insights from as many different perspectives including senior management to technical developers. Each interview lasted over an hour and was then transcribed and checked with interviewee for accuracy. A textual analysis of the interviews was undertaken to identify those factors that influenced use of the portals for knowledge management in this case study.

Case Study Analysis

The data was used firstly to identify the factors that were considered important by the interviewees and then secondly, to map when each of the factors became significant in the portal life cycle. The research framework is based on three time dimensions: 1) planning, 2) design and implementation, and 3) ongoing use and maintenance. Each of these time phases occurs in sequence with no time lags in between the phase. Factors that influence the portal can occur in one or more of these phases. Additionally the data was explored in relation to when the organisation indicated, in hindsight, that they would have liked the factors to have been considered. From the first analysis four groups of factors emerged as important in acceptance and use of the portal.

a. Methods of Knowledge Access

Personalisation is a key issue in acceptance and use of this higher education portal. The main objective of a portal is to provide content that relates specifically to the user, allowing them to identify with the content. Since a portal, based on user credentials, will provide the user with information and knowledge of importance to them, large amounts of information, data and knowledge will be filtered out reducing concerns about overloading the user with too much content. One interviewee noted that "personalisation was pretty much the basis..." and

another stated that "... I think we will see a lot more of that [personalisation] as we go forward...". An analysis of the data collected suggested that this factor influenced the acceptance and use of the portal in this HE institution across all three (3) of the time periods identified in the research framework. This confirms previous research that personalisation is critical to portal success (Bannan 2002). It is important here to differentiate between personalisation of content and customization of structure, 'look and feel'. This HE institution's portal was intended to enable staff to personalise knowledge from many existing systems. The analysis demonstrated that the integration of many existing systems assisted knowledge dissemination, as the portal has become the centralised point for access to a variety of systems.

Integration with systems and single sign-on were identified as factors that influence the entire development of the portal. The inability to obtain single sign-on does not affect quality of knowledge or the volume of knowledge, rather it is just the frustration of signing in multiple times to systems. However, unsuccessful single sign-on affects the ability to distribute knowledge, mainly when trying to push information and knowledge to the user once they have signed in. If the user signs in and single sign-on is not implemented then the portal cannot retrieve information other systems want to push up to the top level. The analysis of the interview data acknowledges that pushing snippets of content can reduce information overload of content and assist in the reduction of knowledge volume. Additionally, pushing content to users assists knowledge distribution as portals can push key and important information to the top level, foremost in the users view (Collins 2001; Prashker and Goldberg 2002; Goff 2001). This also confirms previous research that push abilities and drill-down capabilities are complementary. Portals push information to users that they do not request, but they have shown an interest in the subject matter, with the portal providing the information in a timely way (Goff 2001; Prashker and Goldberg 2002). While pulling information is where users drill down to see more detail from the top-level from which information was pushed (Radding 2000). This case study demonstrates that pushing and pulling information are complimentary components of the portal to assist knowledge distribution.

Another issue relating to knowledge distribution is to employ a formal, common, structured way to represent knowledge (Alavi and Leidner 2001). In the case study organisation common file formats were not supported. Staff used the portal to link (drill down) to any type of file format available via a web browser via a network. The interviewees stressed the importance of having standards to support system interoperability. The interviewees also acknowledged the need to be open to reviewing standards as information technologies can change rapidly. This allows for the portal to embrace new information technologies, be flexible and not be tied down to old standards. The case study data showed that standards are important and should be planned for, but should also be reviewed after initial implementation.

Another feature incorporated in the case study portal was customisation. The case study organisation itself considered cosmetic customisation, which is the modification of the cosmetic appearance of the portal (Mendel 1999; Collins 2001; Picket and Hamre 2002), to be important in promoting use of the portal. However, the case study organisation's staff viewed customisation as something more powerful than purely changing the look and feel of the portal. The interviewees noted that customisation could also be seen as a content reduction facility to assist overload issues. The case study organisation plans to use customisation of channels and content within channels so that users can turn elements of information on and off. The ability for users to remove unwanted information sources helps reduce unnecessary information for that particular user. The interviewees did however

express the view that customisation should not be included in the early stages of the portal's development as too much customisation could confuse users and lead to training issues. This study suggests that customisation should only be considered after initial implementation and phased in during use. In Stages 2 and 3 of implementation there was no attempt to introduce customisation but in Stage 4, eighteen months after implementation of the portal, customisation has been introduced for most of the 27 channels in the portal.

b. Selection of Knowledge

The senior executive responsible for portal development in the case study organisation believed that the knowledge required by the portal already existed in an electronic form and the portal only had to incorporate this knowledge. The research results did not indicate that the portal was going to attain new knowledge from their internal staff. These findings suggest that the case study organisation only wanted to use the portal as a knowledge distribution mechanism, not for knowledge acquisition or creation. This is not uncommon as it is difficult to find one single system to perform all knowledge management functions (Tiwana 2002). The analysis showed that the organisation examined their current web based offerings, their lack of structure and continuity and then scoped what should be incorporated in the portal. Prior information and knowledge was used as the basis of the portal and factored heavily in the requirement process. The portal shaped a hierarchal view of the information, knowledge and services available in the university and provided a means of retrieving required information. The new structure of the portal was to overcome problems associated with the masses of knowledge already in existence (knowledge volume) and provide a better way to locate required knowledge (knowledge dissemination).

Feedback sessions were used to obtain user's views on how the structure should be organized. Management and users did not severally impact upon the amount of knowledge that the portal incorporated, but they did assist in validating and verifying requirements. Both stakeholder groups influenced the requirements in the planning stage and there was expectancy that their feedback would be incorporated in the future. In this portal implementation, management and users had little involvement during the technical implementation. The organisation was particularly concerned with finding a better structure to manage their internal content rather than gathering and including external sources in the portal. However, one interviewee did express the view that "... if the portal is to be perceived to be a one-stop-shop for information it ought to bring in preferred external sources of external information as well."

External information was noted as being beneficial as it could assist teaching and learning, and would appeal to system users and keep them going back. If teaching staff knew what types of information were contained in the portal they could align teaching with what the portal provides, rather than having to find external links. External information has been shown to be beneficial, accepting that much information on the Internet is inaccurate and useless, so the inclusion of quality external information is difficult (Huang, Lee and Wang 1999; Buckland 1991; Cooke 2001). One interviewee suggested that if external information was brought in, it could overload things and the portal could lose its structure. Therefore, whether to include external knowledge is a contentious issue. This case study suggests that internal process should be planned and implemented first and that the inclusion of external knowledge should occur through use over time, during the portal's progressive growth and enhancement.

There was some concern in the data about knowledge hoarding. The University was of the opinion that all departments had to share their knowledge. However, one interviewee described that there was some reluctance because the portal was challenging the traditional

way of thinking "... bringing together and integrating [all divisional web sites] was something that they never thought of before, never had to do. So we did have reluctance and we still do...". Generally it is organisational culture that instigates knowledge hoarding (Clarke and Rollo 2001). The analysis of the data showed that traditionally departments within the university were reluctant to release content, as they believed that the content was owned by the department and they should not have to share it to avoid any gaps in the knowledge on the institution's portal. The findings of this study could not determine with certainty if knowledge hoarding was or would be present in the future. Hoarding can be apparent at any point of time and previous research suggests that organisations should always be aware of and responsive to a hoarding culture (Dunford 2000; Tiwana 2002).

The interviewees in the case study revealed that it was not a function of the portal to assure the quality of knowledge that it incorporates (Collins 2001). However the management of the HE organisation did stipulate that certain measures be undertaken to ensure that the quality of the knowledge was reliable. These measures included moderation of knowledge by a senior staff member, the inclusion of expiry dates, prevention of the removal of content by unauthorised users and mandatory checks for the legality of content. In the case study institution this was driven by a published policy. These measures align with previous research on successful measures to deal with content management to assist improving knowledge quality (Rowley 2002).

c. Communication

One goal of this HE portal was to move away from global email toward a news and announcements facility within the portal. The interviewees explained that this shift had enhanced the way that the university communicated globally to both its staff and students. The portal was seen as the tool that people had to use if they wanted to know what was happening at the university. There were numerous reasons expressed for this decision. Technically the decision to move away from global email was undertaken to create savings in terms of data storage costs. One interviewee noted that email has a requirement that the recipient has to keep the messages if they wish to access them again. Some users may prematurely delete important email messages that at a later date they may need to access again. In the portal messages were stored once for all staff. This policy shift to provide the strategic global communication through the portal influenced the university's knowledge dissemination capability. The news and announcements facility was considered to be crucial to the institution and was the key to internal communication. The portal facility became the primary way to share new global information and knowledge.

Secondly, the facility assisted some knowledge volume issues. The portal was perceived to help reduce the problem of information overload as the user only sees new information but allows the mechanism to easily retrieve old information. The senior executive responsible for the portal said that strategic global communication was a major factor in the design of the portal to support the university's knowledge management requirements. However, communication between system users was not seen as an important factor. Global communication that was moderated was considered vital. The majority of the interviewees supported this, noting that communication between individuals using the portal, as a two-way resource was inappropriate. The major concern was that general communication through the portal could not be moderated and so it was seen as a lower priority. Interviewees particularly noted that there were existing communication channels that would be better suited for individuals rather than the portal.

The KM literature highlights the importance of archiving knowledge to prevent knowledge loss (Tiwana 2002). The findings of this study indicate that the executive of the university and those interviewed considered that archiving is important to ensure that no information or knowledge is lost. However, the findings only specified that archiving news and announcements is necessary, as everything else would be previously archived according to the university's existing IT policy. The degree to which other portal information needs to be archived is questionable, and requires clarification for consistency. The ability to archive knowledge was originally considered a knowledge volume issue, as it is important to store organisational knowledge to ensure knowledge loss does not occur. However, the case study data indicates that archiving is also a knowledge dissemination issue because, if systems users need to recall this archived knowledge, they need to be able to do so with minimal difficulty. Therefore the portal needs to be structured in a way where the archived knowledge can be easily accessible to users.

d. Information System Management

Previous research highlights the important role of a business sponsor in success of portal implementation. (Earl 1989; Alter 2002). In Australia public universities are funded to some extent by governments and one of the roles of government is to sponsor and promote innovation. This HE institution was funded by the Australian to assist in the development of online services, including a portal. Therefore the usual internal funding constraints associated with IT projects were not present. Hawryszkiewicz (2001) notes that before systems are implemented they are usually measured to ensure that they are financially viable and can ensure some return on investment. This is usually linked to internal competition for resources. In this case study that was not the situation. Funding was externally provided and whilst the normal evaluation of viability and return on investment were considered, there was no obvious concern about the opportunity cost of the investment internally.

The second issue relating to information systems was concerned with ongoing maintenance costs. Collins (2001) notes that corporate portals must be maintained and will incur costs but considers that portals require less maintenance costs than traditional systems. This indicates that portals are considered not to be as expensive to maintain as traditional systems. In this case study an evaluation of the software used to build the original portal resulted in additional investment to re-build the backend infrastructure and develop a new framework for the portal as a means to significantly reduce long-term maintenance costs. In relation to the legacy infrastructure one interviewee said that "... at the time, when we implemented [the portal], we thought that everything would be okay, that we would stick it into the current infrastructure. But since we implemented it, we have actually noticed that the infrastructure required to support the portal is much more labour intensive than what we thought originally." The planning for the portal to be supported on the legacy infrastructure was not entirely comprehensive. There was a premise that an open sourced portal could be employed and just work. However, that was not the case. The data in the case study shows that the legacy infrastructure needed to be addressed at every stage in a portal's development, particularly during the planning stage, supporting the argument by Collins (2001) of success being related to the need to align portal implementation and use with good system maintenance.

Project management issues were also considered as important in the success of the portal in the case study. Every deadline was met throughout implementation. Four reasons were identified for this. Firstly, the project was implemented in a staged/phased approach. Secondly, not every functionality was implemented at once. Thirdly, while developing the portal, available skilled human resources were required to implement and configure the

portal. The case study organisation did not have any employees familiar with the portal's technological backend and sought the assistance from an external company. This external company assisted during initial implementation and helped train the internal developers. Fourthly, finance was available because of the external funding. One interviewee noted, "...well the re-sourcing comes out of the finances. If you've got the money, you will always have the resources ...". This aligns with Frenzel (1999) who argues that when more money is available sub-contractors become a viable option. This was the situation in the case study organization. The availability of these resources meant that more people familiar with the technological backend were employed.

Discussion

Three (3) significant time periods were identified in the portal implementation process: 1. *Planning and pre-implementation (Stage 1)*: this time period involved gathering and defining requirements, outlining the purpose of the portal and planning how the portal will be implemented, adopted and used. The overall feasibility of a KM portal was explored and documented. 2. *Design and Initial Implementation (Stage 2)*: this time period involved structuring the technical layout of the portal and constructing the computer code for the portal to operate. It also involved the initial implementation of the portal and the issues surrounding implementation of a new system. 3. *Use, maintenance and further enhancements (Stage 3)*: this time period involved adding extra functionality to the portal via system use. It also addresses issues surrounding maintenance and fixing errors.

The results of this case study identify several important factors when implementing and using a portal for knowledge management. A graphical representation of the factors identified in this research and their relative importance in each of the time periods though implementation is shown in Figure 1. The framework was developed from the research findings, and measured against time intervals during the development and use of the portal in the case study institution.

Factors that influence the portal occur in one (1) or more of these phases. The factors which occur in more than one phase and cross over the time lines are shown in the figure by using arrows, moving left-to-right. The key conclusions that emerge are that knowledge management issues relating to archiving, communication and content were key issues at all stages in the implementation of the portal. They emerged again as issues after implementation when evaluation of the performance of the portal occurred. The issue of knowledge hoarding was only an issue in the planning stage. The issue was addressed throughout that stage via policy discussion and enactment to ensure transparency of knowledge and the elimination of both hidden and duplicated knowledge. Knowledge distribution became a key issue when the portal began operation. The model in Figure 1 shows that the issues change in each of the time phases and suggests that modeling of knowledge management projects based on only one time period can distort the impact and importance of key issues at various stages. Finally, this framework could prove to be useful to other institutions of higher learning wishing to implement a portal to assist with knowledge management and dissemination of information.

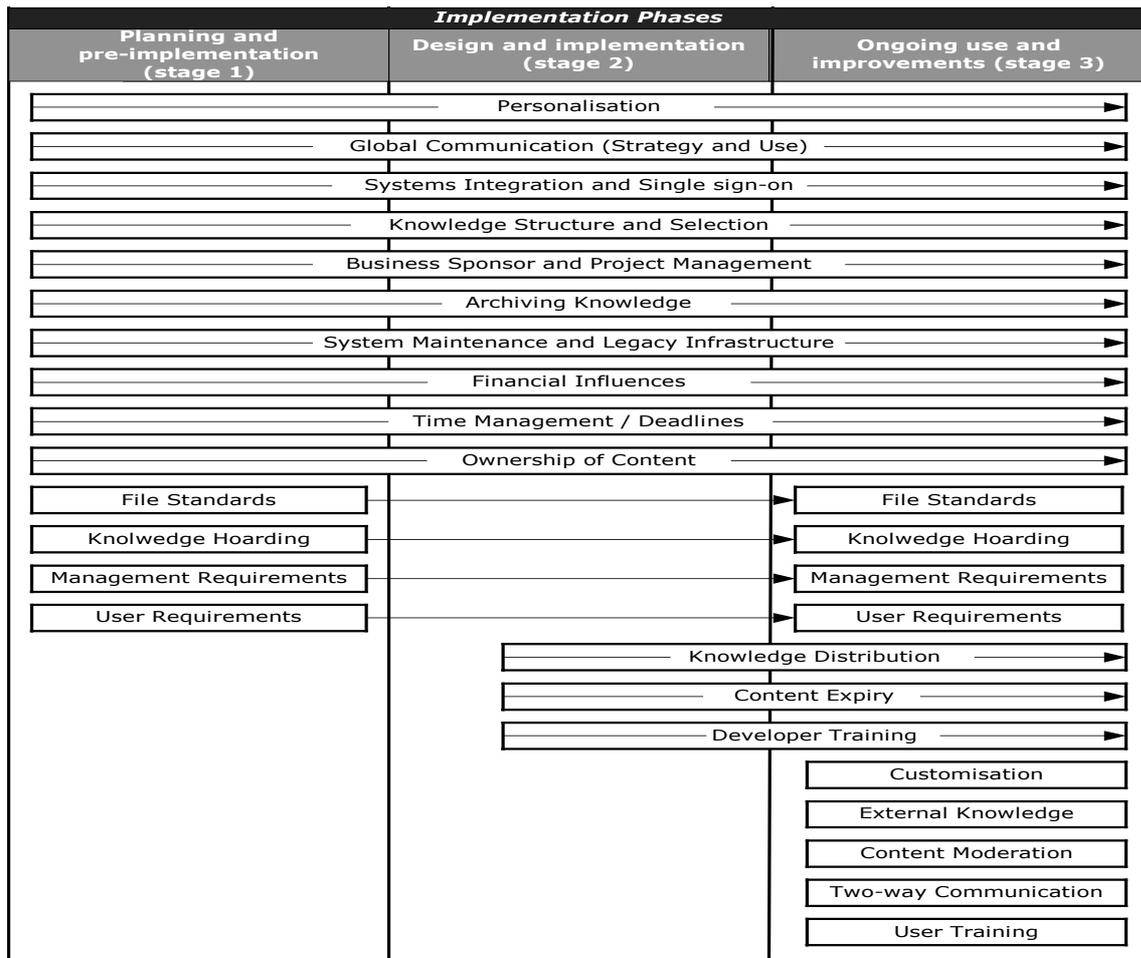


Figure 1: Factors influencing university KM portals by implementation phase

Knowledge Management is complex and its implementation in this case study through a portalised structure proved to be so. What was important in the case study was that key attributes of the portal itself became significant in the acceptance and use of the portal. Users wanted to be able to personalize the portal so that knowledge and information could be effectively managed. There was a serious concern about knowledge and information ‘push’ and the subsequent effects that on work load. Knowledge Management systems in higher education can support staff to complete work, to teach and interact both internally and externally. Without proper management and a clear understanding of what factors affects acceptance and use of that KMS over time, staff will be faced with the problems of information overload and could reject using the system, rendering it ineffective.

References

- Alavi, M. and Leidner, D. E. 'Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues', *MIS Quarterly*, vol. 25, no. 1, 2001, pp. 107-136.
- Alter, S. *Information Systems: The Foundation of E-Business*, 2002, Pearson Education Inc, Upper Saddle River, NJ.
- Bannan, K. 'Personalization and Portals: If You Build It (Right) They Will Come', *EContent*, vol. 25, no. 10, 2002.
- Brown, M. 'EIPs could propel e-commerce', *Computer Dealer News*, vol. 15, no. 46, 1999, p. 36.

- Buckland, M. K. *Information and Information Systems*, 1991, Praeger Publishers, New York.
- Burton-Jones, A. *Knowledge Capitalism*, 1999, Oxford University Press Inc, New York.
- Clarke, T. and Rollo, C. 'Corporate initiatives in knowledge management', *Education and Training*, vol. 43, no. 4/5, 2001, pp. 206-214.
- Cloete, M. and Snyman, R. 'The enterprise portal - is it knowledge management?' *Aslib Proceedings*, vol. 55, no. 4, 2003, pp. 234-242.
- Collins, H. *Corporate Portals: Revolutionizing Information Access to Increase Productivity and Drive the Bottom Line*, 2001, Amacom, New York, NY.
- Cooke, A. *A guide to finding quality information on the Internet*, 2001, Library Association Publishing, London.
- Davenport, T. H. and Volpel, S. C. 'The rise of knowledge towards attention management', *Journal of Knowledge Management*, vol. 5, no. 3, 2001, pp. 212-221.
- Drucker, P. 'The Coming of the New Organisation', *Harvard Business Review*, vol. 66, no. 1, 1988, pp. 45-53.
- Dunford, R. 'Key challenges in the search for the effective management of knowledge in managing consulting firms', *Journal of Knowledge Management*, vol. 4, no. 4, 2000, pp. 295-302.
- Earl, M. J. *Management Strategies for Information Technology*, 1989, Prentice Hall International (UK) Ltd, Hemel Hempstead.
- Flood, R. L. *Beyond TQM*, 1993, John Wiley & Sons Inc, Chichester.
- Frenzel, C. W. *Management of Information Technology*, 1999, Course Technology, Cambridge, MA.
- Goff, J. 'Business Tools Enterprising Portals', *Pharmaceutical Executive Supplement*, vol., no., 2001, pp. 6-10.
- Hakim, C. *Research Design: Strategies and Choices in the Design of Social Research*, 1987, Allen & Unwin Hyman Ltd, London.
- Hawryszkiewicz, I. *Introduction to Systems Analysis & Design*, 2001, Pearson Education, NSW, Aus.
- Housel, T. and Bell, A. H. *Measuring and Managing Knowledge*, 2001, McGraw-Hill, Boston.
- Huang, K.-T., Lee, Y. W. and Wang, R. Y. *Quality Information and Knowledge*, 1999, Prentice Hall Inc, Upper Saddle River, NJ.
- Liebowitz, J. and Wilcox, L. C. *Knowledge management and its integrative elements*, 1997, CRC Press, Boca Raton, Fla.
- Lim, D. and Klobas, J. 'Knowledge management in small enterprises', *The Electronic Library*, vol. 18, no. 6, 2000, pp. 420-432.
- Mendel, B. 'The Portal Panacea', *Info World*, vol. 28, no. 31, 1999, pp. 28-29.
- Merriam, S. B. *Case Study Research in Education*, 1988, Jossey-Bass Publishers, San Francisco.
- Milton, N., Shadbolt, N., Cottam, H. and Hammersley, M. 'Towards a knowledge technology for knowledge management', *International Journal Human-Computer Studies*, vol. 51, no.1, 1999, pp. 615-641.
- Murray, R. 'Information Portals: casting a new light on learning for universities', *Campus-Wide Information Systems*, vol. 20, no. 4, 2003, pp. 146-151.
- Olsen, F. 'Sharing the Code', *Chronicle of Higher Education*, 2003, vol. 29, no. 47.
- Parker, C. R. *Guide to Web Content and Design*, 1997, MIT Press, New York.
- Pickett, R. A. and Hamre, W. B. 'Building Portals for Higher Education', *New Directions for*

- Institutional Research*, vol., no. 113, 2002, pp. 37-55.
- Prashker, A. and Goldberg, M. 'Creating Clinical Portals', *Pharmaceutical Executive*, 2002, pp. 98-108.
- Radding, A. "Internet Portals Get Personal", <<http://www.informationweek.com/816/eip.htm>> (accessed September 18 2003).
- Raol, J. M., Koong, K. S., Liu, L. C. and Yu, C. S. 'An identification and classification of enterprise portal functions and features', *Industrial Management & Data Systems*, vol. 102, no. 7, 2002, pp. 390-399.
- Roberts-Witt, S. L. 'The University of Louisville portal is making centralized services and communications a reality', *Portals*, vol. 3, no. 21, 2003, pp. 26-29.
- Rowley, J. 'What is Knowledge Management?' *Library Management*, vol. 20, no. 8, 1999, pp. 416
- Rowley, J. 'Reflections on customer knowledge management in e-business', *Qualitative Market Research: An International Journal*, vol. 5, no. 4, 2002, pp. 268-280.
- Sallis, E. and Jones, G. *Knowledge Management in Education: Enhancing Learning & Education*, 2001, Kogan Page Limited, London.
- Shilakes, C. C. and Tylman, J. "Enterprise Information Portals", 1998, Merrill Lynch & Co,
- Simatupang, T. M. and White, A. 'A policy resolution model for knowledge acquisition in quality management', *Total Quality Management*, vol. 9, no. 8, 1998, pp. 767-779.
- Skyrme, D. J. 'Knowledge Management Solutions - The IT Contribution', *ACM SIGGROUP Bulletin*, vol. 19, no. 1, 1998, pp. 34-39.
- Tiwana, A. *The Knowledge Management Toolkit*, 2002, Pearson Education Inc, New Jersey.
- Tortora, G., Sebillo, M., Vitiello, G. and D'Ambrosio, P. "A Multilevel Learning Management Systems", *Proceedings of the 14th international conference on Software engineering and knowledge engineering*, Ischia, Italy, 2002, pp. 541 - 547.
- White, M. 'Enterprise information portals', *The Electronic Library*, vol. 18, no. 5, 2000 pp. 354-362.
- Williamson, K. *Research Methods For Students And Professionals: Information Management And Systems*, 2000, Centre for Information Studies, Charles Sturt University
- Yin, R. K. *Case study research: design and methods*, 1994, Sage Publications Ltd, Thousand Oaks, California.