Requirements elicitation and planning of a knowledge portal: Case Study of a property management division in a housing organization

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Abstract

Enterprise Knowledge Portals offer, among other characteristics, a centralized access point for information as well as a wide range of tools and content for individual knowledge workers to personalize to suit their daily tasks. Such tasks often include the collection, aggregation, and analysis of data/information as well as collaborative work among workers to solve problems and make decisions. Leveraging on a quantiative-qualitative research approach including the use of a prior research instrument developed for the elicitation of requirements for collaboration tools, this paper seeks to identify the primary and secondary functions of a knowledge portal for knowledge workers in the property management division of a housing organization in Hong Kong. Though portals are often treated as a kind of standalone enterprise knowledge management systems, proper planning and deployment of a portal with appropriate functionalities and a widely agreed content classification scheme can also help to enhance the navigation and presentation of knowledge assets in a knowledge-leveraged organization. In particular, the introduction of a federated search engine can save considerable time in conducting

(multiple) searches; selective Web 2.0 tools can help to foster collaborative work as well as help knowledge workers to reduce time spent on search but keep pace with nominated topics on a timely basis. Drawing on the existing literature as well as the authors' experience in working with many other organizations to deploy portals and relevant tools in the Asia Pacific, the initial recommendations are further consolidated to form a two phases deployment with the aim of enhancing the probability of success for the knowledge journey in the housing organization.

Introduction

The current transformation of the industrial economy into the knowledge based economy results in workers who are increasingly challenged with cognitive collaborative and cognitive analytical work (Autor *et al.*, 2003), or knowledge work (Kogan and Miller, 2006) as it is commonly called. Knowledge work is generally non-linear, highly unstructured, non-repetitive and hard to predict (Swensen, 2010). Collaborations among workers is often needed in order to jointly solve problems and make individual or group decisions (Malone, 2004; Lee *et al.*, 2007). However, up to now, tools for supporting knowledge work have been inadequate as they tend to be administrative, transaction processing systems supplemented by, more recently, document management and process management systems (Tsui, 2002). While accomplishment of knowledge work is not entirely dependent on the use of enterprise IT applications, nevertheless, appropriate systems for presenting data/information, orchestrating and managing processes, as well as fostering collaboration and stimulating idea generation add significant value to supporting knowledge work. In this regard, years and sometimes decades of organization development have left many organizations with multiple (often redundant), disparate and

distributed systems. Information needed for problem solving and decision making is often stored in various different systems or worse, much of this may not be in an electronic form. Besides, for many organizations, there does not exist a standard information classification scheme for the storage and retrieval of information (Hedden, 2010). Today's knowledge workers often have to logon to redundant, non-integrated systems in order to, among other tasks, identify and extract the necessary data and information. The result – time wasted in searching material, required information cannot be located, work may be repeated, and, as a result, productivity is compromised. Addressing precisely these shortfalls and more, the "portal" (Collins, 2001; Collins, 2003; Jafari and Sheehan, 2003; Sullivan, 2004; Terra and Gordon, 2003) as a concept emerged back in the late 90s and was very well received as evidenced by very strong adoption (White, 2003). The firstly type of portal to be developed was commonly referred to as the Enterprise Information Portals (Firestone, 2003; Shilakes and Tylman, 1998) .

Shilakes and Tylman (1998) define *"Enterprise Information Portals" (EIPs) are applications that enable companies to unlock internally and externally stored information, and provide users a single gateway with personalized information needed to make informed business decisions."* From this definition, there we can identify four principal characteristics of an EIP:

- The ability to access/display internal and external data and information
- The provision of a single entry point to access all the needed data, information and applications
- The support of user customization to tailor the content, tools and presentation style to suit individual needs
- The alignment of the above three characteristics with business decision making

To the extent that an EIP has these characteristics knowledge workers will be able to rely on an EIP as their primary Knowledge Management System to store, search, retrieve and present data

and information for decision making and problem solving (Duffner, R. 2003) . EIPs provide support to knowledge workers in accessing enterprise applications (including process, document management systems and collaboration tools). Furthermore, a full implementation of an EIP also allows each and every knowledge worker to customize the sourcing of content, tools and interface layout thereby truly delivery a customizable KMS adapted to each individual knowledge worker. Many researchers and organizations have developed portal evaluation, development and deployment frameworks (Detlor, 2009; Mack *et al.*, 2001; Smith, 2004). Although other definitions of portals exist (Collins, 2001; Collins, 2003; Jafari and Sheehan, 2003; Sullivan, 2004; Terra and Gordon, 2003; White, 2003) ,invariably, these definitions also emphasized a single entry point as well as the collection of tools which are integrated with portal.

Portals and their changing landscape.

A comprehensive review of deployed portals (Tatnall, 2007) reveals that there are at least the following common types of portals

Internet/Web Portals – These are portals that are publicly hosted and any user can create an account and customize the portal for individual use. Many of these portals are set up by e-commerce companies (see Consumer/Customer portal below) for buy/sell activities but there are also several offered by Web companies (e.g. Yahoo, Google, PageFlake etc.) that are entirely for individual knowledge workers to configure for information management, peer collaboration, task lists, learning, tasks lists and more (Sampson and Manouselis, 2005; Granic *et al.*, 2011, Zhou, 2003).

Personal Portals – There are several interpretation of what constitutes a personal portal. Firstly, the portal which results from a user's customisation of an Internet/Web portal is one kind of personal portal. If an individual knowledge worker sets up and manages his/her own portal (both infrastructure and content), this is the second type of personal portal. A third interpretation of personal portal refers to a collection of personal devices powered by Peer-to-Peer (P2P) computing operating on a distributed set of resources, content and tools (Metz, 2008; Pena-Lopez, 2007). Increasingly, by leveraging on Web 2.0 tools, personal portals are being established not just for information sharing and collaboration but personal and social learning purposes with a group of trusted peers (Garner, 2010; Peng *et al.*, 2009; Wright, 2005).

Enterprise/Corporate Portals – Nearly two thirds of the world's implementation of portals belong to this category. Enterprise/Corporate portals are internally focused and designed for employees to use. As such, commonly provided functionalities for these portals include search, forms library, calendar, news/announcement, links, as well as access to various information or knowledge repositories and more (Benbya, 2004) . Tsui, Yu and Lau (2007) have previously identified that the five core application areas for enterprise portals are content management, information and communication, e-learning, business intelligence, and collaboration and the development of communities. (The case study organization covered in this paper adopts the business intelligence (BI) category of portal.)

Based on the authors' and other researchers' observations (Dias, 2001; Maier and Hadrich, 2007; Van Brakel, 2003) with respect to industry trends and monitoring the research publications, the first era is the Enterprise Information Portals (1998-2002) was followed by Enterprise Knowledge Portal (EKP) (2002-present) era. These two sub-categories of portals mainly

differentiate in the degree of personalization (EIPs is much closer to an Intranet) and collaboration (EKPs offer more advanced and flexible collaborative functions including Web 2.0 features. Please refer to a later section of this paper for selective Web 2.0 features being recommended for the portal to be adopted by the case study organization.)

Project Portals – As the names implies, this kind of portal (Goyal, 2001) is designed to support all stages of a project lifecycle right from location of expertise to project planning, execution and reporting. Considering that many organizations are indeed project-based institutions and projects typically generate a considerable of issues, some organizations have further expanded their project portals (Sher *et al.*, 2010) to support knowledge processes as well as incorporate the harnessing and reuse of Lessons Learnt (LL) and After Action Reviews (AARs) from previous projects.

Business Intelligence (BI) Portals (or Dashboards) - This type of portals serves to retrieve, aggregate and present data and information for decision making and/or reporting purposes. Also commonly referred to as a Dashboard, Business Intelligence portals offer tools for the user to carry out real time analysis on the data as well as customize the format of a report. Furthermore, BI portals present aggregated data that is in accordance with the user's role, seniority, and designated security access privileges. Depending on the nature of the backend systems and the business needs, data feeds may be either real time, pooled or a combination of the two (Onley, 2006; Papadopoullos, 2004).

Government Portals - This refers to the type of portals that involves governments (G) (Aitkenhead, 2005; Gengatharen and Standing, 2003). Under this category, there are Government to Employees (G2E) portals (which are analogous to Enterprise/Corporate Portals),

Government to Citizens (G2C) portals (which typically provide E-government services and promote citizens engagement), Government to Business (G2B) portals which serve as platforms for information exchange between government and various industry parties and associations, and Government to Government (G2G) portals which are E-Business portals specifically cater for respective government employees to use. Typical applications of G2G portals include trade information, policy formulations, bilateral relationships, taxation matters.

Mobile/Wireless Portals - As the name implies, these portals are typically scaled down version of a project or enterprise portals to operate on handheld mobile devices. They support mobile workers to perform work, often by serving as a lightweight front end for the uploading and fetching of data for decision making purpose.

Learning Portals - Learning is a key part of all knowledge workers these days. Learning Portals offer a full range of services covering course authoring, instructional design, collaboration and knowledge transfer with other learners, webconferencing, grading, and e-portfolios. Learning portal can be established by academic institutions (Kotzinos *et al.*, 2005; Ling and Allison, 2002), by a state (Jafari, 2003) as well as by corporations in industry (Olszakm and Ziemba, 2008).

Process Portals - They provide tools for the creation, visualization, routing of activities/documents among workers as well as the measurement, analysis and reporting of process performance. These portals are especially suitable for organizations that have to deal with a large amount of processes (or instantiations of processes) that are executed in large volume. Obviously, in these situations, being able to visualize, analyze and identify the bottleneck of process efficiency as well as benchmarking process performance are of utmost

importance and typically these portals provide precisely these functions, the scheduling and tracking or processes, and more (Chaudry, 2004; Puschmann and Alt, 2004; Rozenfeld *et al.*, 2009).

Customer/Consumer Portals - The fine line between a consumer and a customer is the first transaction/purchase. Both groups of users can be tracked when they browse an e-commerce site that allows for personalization e.g. bookmarking favorite items and creating alerts etc. Customer/Consumer portals track user's web analytics to ascertain browsing behavior, preferences, past interactions and more. Such data is being used for customer segmentation with the ultimate goal of recommending cross and up-sell offers. Some organizations also offer customers to co-design the purchase item as well as track the delivery of the item during shipment (Bohe and Oviedo, 2008; Kramer, 2007).

Partner Portals - Partner portals are the "business" equivalent of the Customer/Consumer portals. Target users are also staff of partnering or allied organizations. Depending on the designated purpose of these portals, they may offer browsing and matching of product catalogs, sharing of project descriptions, expert directories, common tools, development platforms and standards for the allied parties to utilize (McHale, 2000).

Industry Portals - Focusing on one or more industry-specific processes, an industry portal provides, ideally speaking, all the necessary information, tools for every stakeholder to fulfill the knowledge needs and/or transactional activities involved in each step of the process. For example, case handling in the healthcare industry and claims processing in the insurance industry are two examples of common industry-specific processes. Typically, these processes involve multiple stakeholders (from various organizations, often from different industries), document and

possibly knowledge-intensive activities, sequential work with routing of documents as well as the need to comply with any applicable industry regulations (Cader, 2007; Didley, 2004; Scarso and Bolisani, 2007).

Two more observations can be made on the landscape of portals. Firstly, though the above categorization distinctly differentiates amoung portals based on their intended purpose, functions, and user group(s), as time progresses, an organization may extend its portal from one type to another type, thereby qualifying to be called a hybrid type of portal. This is most evidently in the expansion from an enterprise portal (a kind of B2E portal, the major group of portal in terms of portals already deployed) to cover customers (i.e. a B2E+B2C portal) and/or suppliers (partners) (i.e B2E+B2B portal). For example, the CSC Portal (Binney and Kjaer, 2003) expanded from a B2E to a B2E+B2B portal by allowing its customers (selective staff from client organizations) to access best practice material as well as participate in project workspaces. A second observation is on the evolution of social learning and its impact on learning portals. The traditional learning portal, as described above, is an institutional system. It is established, operated and governed by an organization, typically a university or a company. However, the emergence of knowledge work, combined with the impact of Web 2.0 tools, mean that access to the Web is now highly ubiquitous, pervasive, subject matter experts in almost any topics can be located/accessed, and user-generated content is abundant. Together these have fostered the development of personal learning environments and networks (PLE&N) (Ebner and Taraghi, 2010) (essentially a kind of personal portal) which is a self-configurable web interface for authoring, receiving and sharing of content with links to peers (including friends, teachers, experts etc.) as collaborators. Increasingly, PLE&N are complementing traditional Learning Portals as a newly emerged type of learner-centric web communities.

Case study – the organization

The case study organization is a housing company established in 1948 and incorporated by the Hong Kong Government Ordinance in 1951. The organization's objectives are to identify the housing needs of the community, develop housing options as well as to provide on-going property management services. In the last few decades, the organization has developed many housing schemes for the Hong Kong residents.

The authors' study focused on the Property Management Division (PMD) of the organization. PMD is branch of the housing organization that is responsible for managing the developed properties. PMD's principal activities include vetting of tenancy applications, tenancy and property management and services. The core work carried out in the PMD includes security, routine maintenance, and associated operations. PMD staff takes pride in their work especially in providing up-to-date quality information to its users as well as balance the interest of the owners and the tenants. PMD also operates a Quality Management System which has been certified to meet ISO 9001:2000 and ISO 14001:2004 international standards.

Apart from needing to provide up to date information, PMD also has many out-posted staff and overall consensus is that there needs to be stronger collaboration, partly supported by IT tools, among out-posted and central office staff.

The following project objectives were set for the study:

1. To identify the existing nature of collaborative work at PMD

2. To identify information access behavior of PMD staff

3. To review the existing IT infrastructure and systems for supporting collaborative work

4. Based on good practices and lessons learnt from other projects, recommend a blueprint for the deployment of collaboration tool(s) for PMD

In the housing development area, Teo *et al.* (2006) describe the use of various Customer Relationship Management (CRM) tools to help the collection and analysis of customer data, to assist collaboration, and to enhance search of assets for staff in the Singapore Housing and Development Board.

In the construction, building and property management area, El-Gohary and El-Diraby (2010) describe the development of an industry-based portal serving a consortium of companies on raising the awareness of innovative building technologies and projects. Their portal provides rapid exchange of knowledge as well as garners a community of practitioners for effective ongoing knowledge sharing. Challenges for handling the integration of knowledge processes among various stakeholders, disciplines and projects in collaborative construction are discussed by Pollalis and Walleisa (2003). Diraby and Wang (2005) describe the development of a portal for supporting urban highway construction projects in a knowledge city.

Methodology

A combined quantitative and qualitative approach has been adopted for this study (see Figure 1). A previously developed survey instrument to identify the major functions for a collaboration tool (Tsui *et al.*, 2007) has been adopted. Once the primary and secondary functions are identified, follow-up discussions were held with the stakeholders in PMD to tabulate the result of the survey as well as clarify the observations and abnormalities.

In addition, a knowledge café was created involving the intended users to obtain in depth and contextual knowledge about past operational experience in their collaborative knowledge work. This is done in the form of narratives. An independent review of the existing IT enterprise applications was also been conducted to ascertain the baseline of the existing systems and technical infrastructure for PMD. Special care has been paid when it comes to identifying appropriate stakeholders to participate in the survey, discussions and in the knowledge café. As the immediate beneficiaries of the ultimate collaboration tool(s) will invariably be those workers who are expected to be heavy users of the system as well as those who constantly engage in knowledge-intensive activities. More specifically, targeted stakeholders were:

- *Subject Matter Experts/Champions* - These people are specialists in specific topics. They often act in the capacity of offering advice to other colleagues as well as assume ownership of certain core domain-specific documents.

- *Content Managers* – These are knowledge workers who are responsible for uploading, publishing, locating and retrieving knowledge assets in a repository e.g. forms library, projects database. Presumably this group of workers needs to be very clear about where information is stored as they often bear the bulk of the work in classifying and searching for material.

- *Communications officers* – These are workers who help to compile and send out regular communications in the department and they help in the change management journey of an organization.

- *Research-oriented individuals* – Research is a high value knowledge creation task. A researcher needs to access to wide range of information from diversified sources. He/she also

needs to apply judgment and experience to absorb and articulate published material, as well as present findings/projections in a specified context. A researcher often needs to collaborate with other workers, inside and outside of the organization, in order to accomplish his/her duties.

- *Staff who perform highly unstructured and/or knowledge-intensive tasks* – Other staff that engage in unstructured (i.e non-linear and non-repetitive) and knowledge-intensive (requiring a lot of decision making) tasks, whether in an *ad hoc* fashion or a regular basis, are also asked participate in this study.

A balanced proportion of senior management, supervisors and operational staff is maintained throughout the study.

Findings and recommendations

We utilized a survey instrument (which consisted of 42 questions) (Tsui *et al.*, 2007) designed to identify the primary and secondary purposes of a desired collaboration tool. Altogether there were 232 respondents to the survey and the data collected are further analyzed according to the different divisions that comprised PMD (Table 1), job types and staff working experiences (Table 3). The overall results provided by the survey is presented in Table 4.

Considering that the primary and secondary functions identified by the survey tool to be the most important requirements for PMD staff were business intelligence (BI) and collaboration and the development of communities respectively, the authors set out to gather more in depth information about the needs, current shortfalls and desired information access behavior

expressed by PMD staff. To this end a knowledge café session in the form of narrative inquiry was carried out with 9 PMD staff and organized in 2 groups. Narratives (Callahan and Drake, 2008; Connell *et al.*, 2004; Snowden, 2002; Zou and Lee, 2007) enable rich contextual background on the gathered information to be conveyed. The knowledge café began with the participants seated in a circle of chairs. Each group was led by a facilitator, who began by explaining the purpose of knowledge cafés and the role of conversation in providing rich and effective knowledge transfer. Open ended questions relating to access to and the handling of data for report compilations were posed in order to solicit thoughts, past incidents, and ideas on the topic from the participants.

All the input provided by the participants was transcribed and themes were identified. Some of the identified themes include data retrieval, data accuracy, data consolidation, data visualization format, alerts and subscriptions, ad hoc reporting and competitive intelligence. A round up of the collected themes (leaving out those which are sensitive to the organization) is shown in Table 5. Some of the major issues that surfaced during the session include

- Lack of a proper data management and governance model – This compromised data integrity and lead to duplicated efforts as well as timeliness in compiling and consolidating data. Proper security access profiles can be established for enabling groups of staff to access certain reports depending on their seniority, project involvement, need-to-know, and other factors
- Lack of user tools for the compilation of reports – Users often needed to rely on their own skills or those of the IT staff in order to generate custom reports. This lead to non-uniformity in team performance and time lag in report generation

- Poor search engine and taxonomy support – Needed data and information might not be found despite being there. There was a lack of consensus among staff on where to store and retrieve specific knowledge assets. The fact that there was no coding of meta-data made searching and retrieval of knowledge assets more difficult. Multiple navigational paths (e.g. by data, subject, project, client etc.) were needed to be provided to facilitate access to data/information

- Under-utilization of Web 2.0 tools – For example, alerts, subscription and RSS (Rich Site Summary) could be set up so that update and customized information is delivered to each user instead of knowledge workers spending time looking up new information regularly. These tools can be deployed to PULL corporate information, relevant industry news, competitive intelligence (e.g. prevailing rental rates) and other information to PMD staff thereby saving them a lot of time spent on manual searching.

A review of the existing IT infrastructure and systems supporting the PMD staff further revealed that while there is a "PMD Portal", it is more of an intranet than a true portal (as defined above). PMD staff constantly access their intranet for information. However, the intranet is largely a one way communication tool which provides no support for user-submission of new content. PMD also has an Electronic Document Management System (EDMS) which facilitates the scanning and routing of documents for processing and approval purposes within the department. However, no coding of metadata is being conducted and hence all search engines rely on full-text searches. While they use several search engines (e.g. in EDMS and in portal), these engines are considered to be ineffective due to the lack of agreement with respect to a standard vocabulary among staff. There is no collaboration nor are any Web 2.0 tool available in the PMD in spite of the fact that

many PMD business processes require input and decision to be made by various staff members in sequences of structured activities.

Discussions with PMD staff further revealed that at present there are staff dedicated to locating, reading, documenting and sharing external news, regulatory and government information, housing and property management news relevant to PMD's operations on a daily basis. While the gathering and processing of this information by humans ensures accuracy and relevancy, it is nevertheless felt to be costly, tedious. In addition, there is considerable latency between the first availability of the information to users' being notified of such information. Furthermore, with limited human resources and escalating information overload (e.g. the surge of social media in particular), it is not possible to monitor and customize the gathered information to suit individual knowledge workers in the PMD.

After much discussion and in consultation with PMD stakeholders, the following knowledge management tools/systems were recommended for PMD to consider:

- **Business Intelligence Portal/Dashboard** – With all the data collection, aggregation, analysis to support regular formal and ad hoc reports (e.g. financial, major improvement works, shop portfolios, arrears listing, rental listing, term contracts etc.) provided by many PMD staff, a BI Portal/Dashboard is expected to deliver significant productivity gains and improvements with respect to collaboration and collaborative opportunities. Furthermore, such a portal also provides the tools for the user to facilitate the organizing of data, trends and reports and their presentation in a visually expressive way. Various levels/groups of data can also be presented depending on, among others, user's access right, seniority and personal preferences.

- **Project Workspaces** – At present, there is no centralized place for PMD staff to work on projects. Information/documents are scattered on personal and shared drives, as well as transmitted via email attachments. This makes information difficult to locate as well as making it hard to version-manage. A project workspace can help to provide, among other things, document templates, project plans, reports, as well as provide an opportunity to codify and share lessons learnt from previous projects. Together, these capabilities will help PMD to enhance collaboration, save time by reusing existing assets, as well as access to learning gained from past projects.

- **Blogs and Wikis** – Blogs provide PMD staff the opportunity to share personal and/or project-related information frequently. Such kind of bottom-up knowledge sharing has proved to be beneficial in enhancing organization's corporate communications. Wikis provide collaborative editing of document(s) among authorized users. The use of wikis will help to reduce the time lag in waiting (sequentially) for document review as well as help to reduce the efforts in reconciling different versions of the same document. Both Blogs and Wikis belong to the Web 2.0 category of tools and are commonly provided in Enterprise Knowledge Portals. Figure 2 shows a Wiki populated with content from the case study organization.

- **Communities** – Knowledge communities help to link together a group of people with common passion and interest. Through the staged activities and communications, tacit knowledge is shared and, over time, members gain a better understanding of the individual and group expertise of the community. Knowledge communities, which often been manifested in the form of communities of practice, communities of interest, know-how networks, learning communities and more, function as helping groups, knowledge

stewardship, harnessing of good practices, and ideas generation (i.e. innovation). Communities are appropriate for PMD as up to now most of the staff are operationally and project-focused; cross-project or cross-division sharing can be much enhanced through the establishment and governance of a community model. Besides, online forums (or discussion boards), a common tool for online sharing among community members, are readily available as portlets within enterprise knowledge portals. (However, discussions boards alone, or more general IT tools cannot, by themselves alone, lead to a vibrant and sustainable community.)

- **EDMS & coding of meta-data** – PMD already operates an Electronic Document Management System (EDMS) and for the sake of truly relying on a portal as a single gateway or entry point to other applications, access to the EDMS should be via a portlet as a component of the recommended portal. Doing so would involve more in depth study of the chosen portal framework and the associated integration issues. Coding of meta-data for PMD knowledge assets, however, is perceived to be of good value as once encoded, such meta-data can assist the calibration of the search engines (e.g. EDMS, intranet, portal etc.), the provision of meta-data search and navigation.

- **Alerts and Subscriptions** – These refer to enabling mechanisms for information to be automatically delivered to users, as opposed to requiring users to behave in a reactive way to carry out searches for needed information. Subscriptions refer to a list of topics that the user can, with prior approval, declare interest on and thereby having a system to monitor any change or new information (e.g. announcements, documents, pages etc.) Alerts refer to the automatic notification of new/changed information generated by a system for a user. Alerts and subscription services are now commonly offered in knowledge repositories, EDMS and

enterprise portals. These services are expected save users time by not needing to constantly check for the availability of updated/new information.

- **Federated Search Engine** – In order to search information in a comprehensive way, the existing practice in PMD is to repeat the search on the Internet, Intranet, EDMS, E-mail, shared and personal drives etc. These repetitive search sessions represent duplicated efforts and should be eliminated. Federated Search, an advanced type of search engine, allows such searches to be conducted in only one instance. When properly configured, the Federated Search Engine will populate the search across all the pre-assigned search spaces (in the Internet, within the firewall, personal storage devices, network drives etc), collect the results, reduce the duplicated links, ignore the dead links, and combine the presentation of the results, with respective sources for each hit, in an unified format. Figure 3 shows the experimental result of a Federated Search Engine in action.

- **RSS feeds** – Considering PMD has to assign staff to manually monitor the media's coverage of the organization as well as keep up to date with other relevant information, regulatory guidelines, seminars and training, it is recommended for PMD staff to subscribe to appropriate RSS feeds from approved sources. Similar to the use of Alerts and Subscriptions mentioned above, RSS will help to automatically pull information to individual knowledge workers in PMD. RSS is primarily designed to monitor new information published on web pages whereas alerts and subscriptions are more designed to track documents in a repository. RSS feeds belong to the Web 2.0 category of tools. Table 6 contains a list of the sites that PMD staff commonly bookmarked; Table 7 show the RSS feeds for 2 of the sites which can be incorporated into a portal. Figure 4 shows a sample of information delivered by the selected feeds.

- **Mashups** – As PMD is part of a housing organization hence they have a need to deal with a lot of geographical data (e.g. property location, address of tenants, occupancy/vacancy rate in a district etc.). At present all such information is stored, analyzed and reported via manipulations with databases consisting of structured data columns. Mashups, another category of Web 2.0 tools, allows two or more datasets (not necessarily geospatial data but often involves one or more of these) to the combined (i.e. superimposed) and the result of the overlay is presented in a multi-dimensional layout which generally communicates a stronger visual impact to the user. For example, one can produce a mashup of a geographical information map of Hong Kong with rental prices or tenancy occupancy rates. In this way, the reader can instantly gain an understanding of the rental prices in various districts or the level of occupancy in rented flats offered by the organization throughout Hong Kong.

With 9 recommended tools/systems and PMD being part of an organization with no prior experience on Knowledge Management, the above is clearly too much for PMD to take on in one rollout. Absorbing the reported lessons learnt (Benbya *et al.*, 2004; Hazra, 2001) and the authors' experience (Tsui, 2011) on the deployment of Knowledge Management Systems and Portals, and applying careful examination of each of the above tools/systems and their respective development reveal that some of the above tools should be embedded inside the portal deployment and some tools (e.g. development a taxonomy and introducing communities) need to progress in stages and more business input are invariably needed to ensure success. As a result, a two stage rollout of the above tools/system has been planned for PMD and is encapsulated in Figure 5. Blue components in the figure are designated for second phase of deployment. Reasons for their deferred introduction are provided below.

The recommended deployment roadmap (see Figure 5) has been presented and agreed by the PMD stakeholders. A few points are worthy of discussion here. Firstly, the figure does not include the typical/mandatory features one would expect to be provided in the Business Intelligence Portal/Dashboard (e.g. data analysis and visualization tools, report generation functions, contact information, calendar, forms library, links etc.). The recommended deployment is to separate the rollout of the various tools/functions in 2 phases. As increasingly portal applications provide features likes alerts and subscriptions, project workspaces, blogs, wikis, and RSS feeds, these tools can be targeted in the first phase of the rollout. A Federated Search Engine is generally an add-on (or replacement) component to the standard search engine provided in a portal and having this search capability is expected to reduce search times with immediate benefits therefore this engine is also recommended to be included in the first phase of the rollout. While an online forum is a standard feature for a portal, it is better that it be rolled out in the second phase. Online forums are merely one support tool in a knowledge community and the organization first needs to enhance its knowledge sharing culture as well as develop a governance model for communities. It is not advisable to launch online forums without having a thorough plan for the purpose and deployment of communities as well as a governance model.

The development of a taxonomy is an ongoing journey and business input is needed during the development process. Besides, while taxonomies need to be developed to cover the knowledge assets stored inside the portal, other taxonomies (which cover assets that are not stored in the portal e.g. intranet, EDMS) may also need to be developed. Hence, for taxonomy creation and maintenance, it is recommended to start with the assets stored inside the portal and then gradually extend the taxonomy or taxonomies to cater for assets elsewhere in the organization. As mentioned above, PMD already operates an EDMS and it is a core operational system.

Integrating the EDMS into the portal so that it can be accessed centrally along with other applications will need in depth study, planning and implementation. Hence, its integration is also recommended to be in phase 2. The recommended tools and systems are highly aligned to PMD's knowledge work and it is expected that when they are fully deployed, PMD will gain considerable benefits in terms of work productivity, enhanced collaboration, especially around document-centric activities, reuse of existing assets, and improved agility in dealing with data extraction, analysis and compilation of ad hoc reports.

Conclusion

This paper introduces the framework of a portal with a proposed taxonomy of the various types of common portals. By applying a combined quantitative and qualitative approach with a case study organization, various collaboration requirements, data analysis and information access behaviours have been identified. Recommendations have been made with respect to the adoption of KM tools/system which include a business intelligence portal/dashboard, project workspaces, taxonomy and meta-data, alerts and subscriptions, federated search engine, as well as Web 2.0 tools like RSS feeds, blogs, wikis and mashups. Finally, the suggested tools/system have been allocated to a 2 phases deployment plan taking into consideration of the nature of the component, the dependency among them, and the people aspect of the knowledge management journey in the organization.

Acknowledgements

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Table 1: Identified first and second preferences for the collaboration tool based on respondents from divisions of PMD

By Departments	No. of Participants	1st preference	Score	2nd preference	Score
MPS	37	Business Intelligence	3.1	Collaboration and Communities	2.93
RHS	53	Business Intelligence	3.19	Collaboration and Communities	2.81
PMAC	44	Business Intelligence	2.81	E-learning	2.79
Applications	5	Business Intelligence	3	E-learning	2.69
TPS/PMA	8	Business Intelligence	2.94	E-learning	2.92
HSC	1	E-learning	3.04	Collaboration and Communities	2.92
WTC	10	Collaboration and Communities	2.94	Business Intelligence	2.92
PMM	74	Collaboration and Communities	2.82	Business Intelligence	2.77

Table 2: Identified first and second preferences for the collaboration tool based on job types of respondents

By Job Types	No. of Participants	1st preference	Score	2nd preference	Score
Support	24	Business Intelligence	2.97	Content Management	2.75
Officer	125	Business Intelligence	2.99	Collaboration and Communities	2.82
Assistant Manager	41	Business Intelligence	2.86	Collaboration and Communities	2.8
Manager	35	Business Intelligence	2.86	Collaboration and Communities	2.83
Senior Manager	7	Collaboration and Communities	3.24	Business Intelligence	3.21

Table 3: Identified first and second preferences for the collaboration tool based on respondents' years of working experience

By years of work	No. of Participants	1st preference	Score	2nd preference	Score
less than 2 years	78	Business Intelligence	2.8	Collaboration and Communities	2.77
2-5 years	49	Business Intelligence	2.97	Collaboration and Communities	2.85
5-10 years	41	Business Intelligence	2.99	Collaboration and Communities	2.8
over 10 years	64	Business Intelligence	3.1	Collaboration and Communities	2.82

Table 4 Overall results after applying the 2-tier survey tool for elicitation of collaboration requirements

Overall	No. of Participants	1st	Score	2nd	Score
All Respondents	232	Business Intelligence	2.95	Collaboration and Communities	2.82

Table 5: Themes identified from the narrative session with PMD stakeholders (duplicate themes are omitted)

	Theme	Problem
Group 1		
Interviewee 1	Data Retrieval	Cannot retrieve the Stored files. Taxonomy is inconsistent
Interviewee 2	Ad Hoc Reporting	Checking for data accuracy urgently is a problem
	Dashboard	Time spent to reconcile raw data and analytical reports
	Data Consolidation	Inability to obtain data swiftly leads to difficulties in data consolidation
	Newspaper archive (RSS and Alerts)	The newspaper is scanned and sorted only by date (with title) without any analysis. No content or keywords can be located by search engine.
	Corporate News	Duplicated effort spent collecting and locating information (e.g. press release) in various portals (intranets)
Interviewee 3	Counting the no. of events	Tedious effort on counting no. of events held
	Presentation/ Visualize the data/ Charts	User needs to build his/her own excel files to present
	Access right for amending the "Date" for generating the business result	Cannot amend the incorrect entry of "Date". Need to seek other officers to amend.
Interviewee 4	EDMS (Electronic Document Management System)	Need to customize the user interface for easier access
Group 2		
Interviewee 1	Policy for ad hoc reporting	Need to establish a policy for extracting data from past reports
Interviewee 2	Lead time for generating reports	"Peace Bell Incident" The lead time for generating report after going through the administrative process exists. Ample lead time between effective date and pay date is important
	Generate Budget Manually	To generate individual reports for planning the budget in next fiscal year. Some reports need to generate manually and this is time consuming
	Competitive Intelligence reports of Rents / Car parks / Arrears	Need to manually dig out the competitive intelligence reports. For novices, this step involves lots of financial data (e.g. arrears)

Interviewee 3	Competitive Intelligence reports of Rents / Car Parks / Arrears	Nobody tells the staff the source / level of the competitive intelligence data
	Update News / Court Case search and archive	Need to pdate the court case (newspaper) and upload to the portal and circulate to colleagues. Only arranged by dates and categories. No real time update search from the Internet / other methods need to be used.
Interviewee 4	Instantaneous Update on the system's data	Fill in a form to update the data but not on the system. Staff worry about the accuracy of data update by the officer and the extra workload imposed to the Officers.
Interviewee 5	Lack of automatic generation of Monthly Report for Senior Management's Policy Making/ Reviewing, Forecasting and SWOT analysis	After interviewing with the elders, officers need to fill in a form manually. Then the senior management request the officers to analyze and report to them for forecasting/ policy making . Since the management want to change the allocation standard on the flat size , living condition of the elders, officers need to retrieve and consolidate a lot of data in a large site (e.g. no of people in the waiting queue). They generate the detailed monthly report but it is done manually which is difficult to check and feel uncertain about the accuracy on the report when dealing with thousands of households. Officers expect the system can generate the descriptive statistics automatically. As this is a monthly task, the officers have to repeat the manual checking with the raw data and the reports. This is very tedious.