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**ASSESSMENT OF AN ENTERPRISE EMPLOYEE PORTAL USING DASHBOARD
MONITORING SYSTEM: A CASE STUDY**

by

ADITI MISHRA

A THESIS

Presented to the Graduate Faculty of the

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Approved by

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ABSTRACT

A portal is a browser-based application that provides a web platform for users to improve inter-department collaboration and customer service. Portals are classified either as internal facing portals or external public facing portals.

This study addresses the problems facing an internal portal related to its contents, functions and usability and provides a list of essential contents and functions that it should include through integrating theories and industry best practices. The theory framework is based on literature review and the industry best practices are based on the analysis of a number of internal portals of companies used as case studies. These two were compared to develop an information mapping grid to identify gaps between theories and practices.

A case company was used to uncover additional insights on employee portal content and functionalities through the analysis of actual and perceived user portal usage. The results were then compared using an information mapping grid to derive a set of content and functionalities to improve usability of an internal employee portal.

Results of this study indicate that customization and personalization is an important feature of an employee portal, however, features pertaining to communication and collaboration support, search support, help system and employee self-services appear to be more important in practice.

The information mapping grid derived, the data warehouse architecture developed and the Dashboard Monitoring systems created to assess usability of an employee portal are applicable to similar enterprises.

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1. INTRODUCTION

An enterprise portal can be defined as a single point of access (SPOA) for pooling, organizing, interacting, and distributing organizational knowledge (Bock, 2001; Kendler, 2000). Portals may be internal or external. This research is focused on an internal portal. An internal portal helps to establish a common platform for all employees in a company for internal purposes such as search, communication and collaboration, document sharing, and information dissemination. This brings all the users in the company closer regardless of global diversity of location or culture.

There are many problems facing internal enterprise portals, mostly related to the integration of business processes and components, realizing the utility and usefulness of the portal, cost of implementation, and maintaining compatibility. Usability, scalability, reliability and platform independence of the portal are also very important factors to be kept in mind while implementing an internal portal (Urbach et al.,2010; Tojib et al. 2008; Hussein et. al, 2008; Bin Masrek, 2007). In order to address these issues, the right set of contents and functions must be identified and incorporated into the portal to improve its structure, navigation and usability. Furthermore, analyzing the raw data from portal logs and transforming it into meaningful information can help identify the true usage of the portal and help identify strengths and weaknesses in the portal.

The main objective of this research was to provide recommendations for the improvement of efficiency and effectiveness of an internal employee portal. An information mapping grid was developed by combining theory from the literature review and industry standards from the case study of various companies that currently use internal employee portals.

Literature was reviewed to develop different information categories under which the Contents and Functions of an internal employee portal were then categorized. The different information categories included “Personalization and Customization,” “Communication and Collaboration tools,” “Employee Self-Service,” “Search functionality,” “Help,” and “FAQ.” Furthermore, other information items were added under each information category. For example, “Blogs,” “Threaded Discussion,” “News,” “Policies and Guidelines,” “Document Sharing,” “Employee Directory,” were a few of the information items under the information category of “Communication and Collaboration tools.” The literature review was analyzed to determine what percentage of the documents supported each information item and each information category.

A number of company portals were used as case studies and the different information items and information categories in each case study was analyzed and documented. The portal contents and functions referenced in the literature and the contents and functions referenced in case studies were combined and summarized within an Information mapping grid to create a comprehensive list of Industry Standards and Best Practices.

The Industry Standards and Best Practices mentioned in the Information Mapping Grid were compared and contrasted with the Actual Portal usage and user-perceived portal usage of a case company in a three-pronged research methodology.

To determine the actual portal usage, the usage logs of the case company's portal were taken into consideration. The portal usage logs were difficult to interpret in their initial raw form, so the data was cleaned and a data warehouse was created and used to develop dashboard monitoring systems that were in turn used to monitor the actual usage of the portal of the case company. The dashboards identified which webpages, sections and subsections of the portal were visited most frequently, and which webpages, sections and subsections which were visited the least. These metrics were determined based on the number of page-views, the number of user logins and the number of unique users, which provided insight into the contents and functions of the company's portal and their usage.

The user-perceived portal usage was determined by on-site visits to the case company as well as the results from a third party evaluation of multiple target user groups. The goal was to gather user expectations of the employee portal in terms of how they perceived its contents and functions.

The contents and functions of the portal from the actual portal usage and user-perceived portal usage data were compared and analyzed with the Information mapping Grid and analyzed to derive a set of contents and

functions recommendations for the internal portal, which was presented to the case company.

The overall research framework has been schematically represented in Figure 1.1. The numbers in parenthesis located in each block indicate the corresponding section of this thesis.

This study provides a brief literature review, an overview of methodologies used, the results derived from the study, conclusions, contributions, and future research directions.

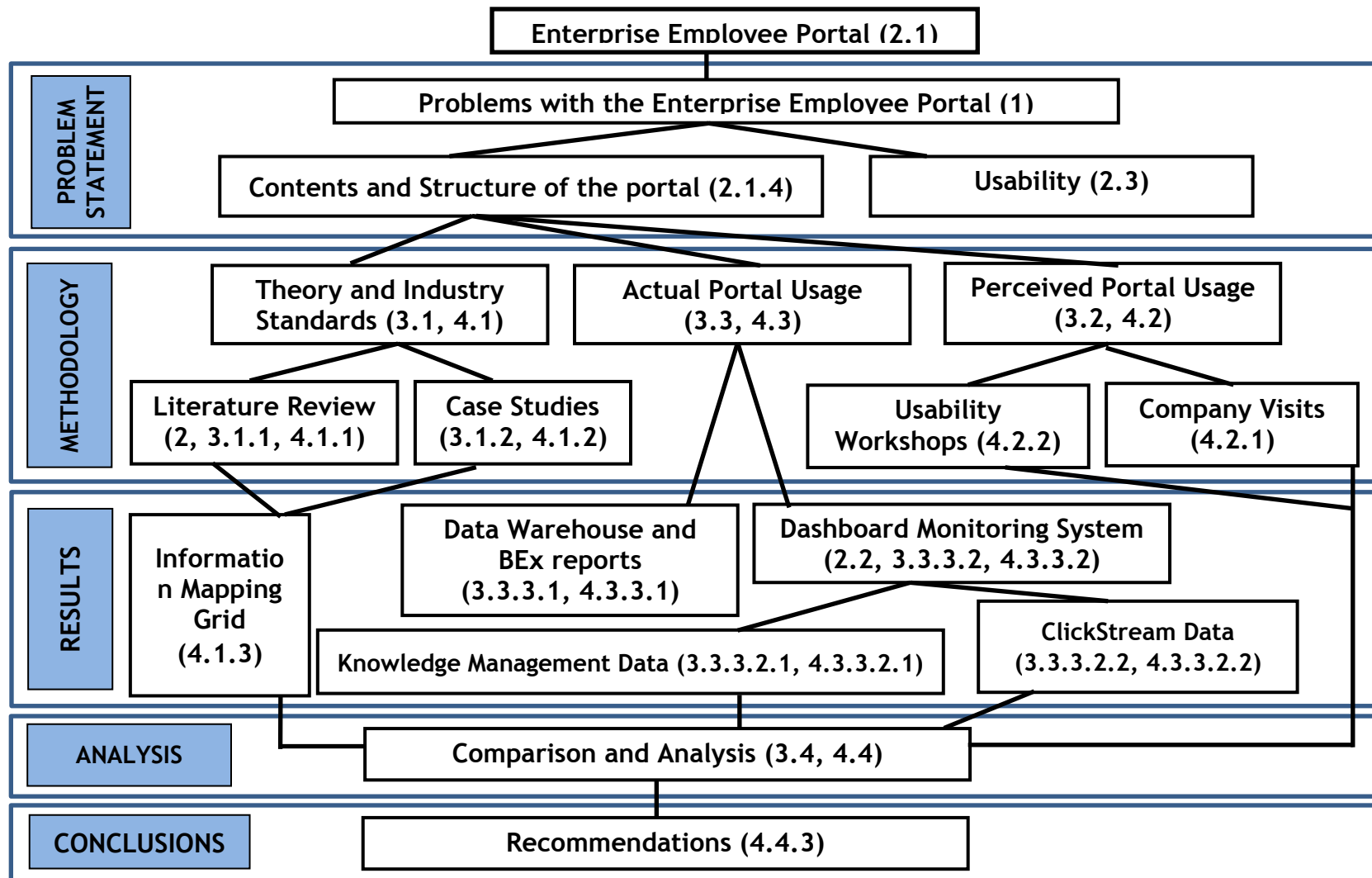


Figure 1.1. Research Framework

2. LITERATURE REVIEW

Literature review has been carried out on an Enterprise Employee portal with special focus on its contents and functions. This helps in establishing Industry Standards and Best Practices as suggested in the research framework (Figure 1.1). Literature has also been reviewed about Performance Dashboards because dashboards were selected as an effective way to develop a Portal monitoring system that transforms unstructured log data file into useful information to assess actual portal usage. Literature review on Usability was carried out to understand how it is very important to the portals to make them efficient and effective.

2.1. ENTERPRISE EMPLOYEE PORTAL

The following section provides a brief Literature review of a portal in terms of definition, history and evolution, architecture, contents, design and content-management. This is the first level in the research framework shown in Figure 1.1.

2.1.1. Definition. A portal is a browser-based application that allows knowledge workers to gain access to, collaborate with, make decisions, and take action on a wide variety of business-related information, regardless of the employee's virtual location or department affiliations, the location of the information, or the format in which the information is stored (Collins, 2002).

While it is true that enterprise portals are useful because this technology can bring about cost reduction, organized and structured information, and reduced access time, their competitive advantage is inherent in their abilities to filter, target, and categorize information so that users will get only what is needed (Eckel, 2000).

2.1.2. History and Evolution. Corporate and enterprise portals have grown exponentially in recent years. The corporate portal is customarily structured around roles found inside an organization; the enterprise portal expands to include customers, vendors, and other roles outside the organization. (Collins, 2001)

By delivering solutions and services over the Web, portal technology enables businesses to blur boundaries and “reach out to, and interact with its clients, partners, vendors, and employees.” The portal becomes “a single point of entry, a single point of access, and a single point of information interchange.” (Hazra, 2002)

Employees throughout an organization are responsible for making strategic and operational decisions every day. Many data sources, systems and applications need to be combined. Using the employee portal, employees are able to access corporate information using a web browser. It provides an interface to a multitude of applications and an exponentially growing number of documents [as well as] a central location to access specific screens or reports from applications or documents relative to work process at hand, and seamless integration to several enterprise systems. (Collins, 2002)

Computing power is no longer exclusively for IT experts. Since the 1980s, non-technology experts have been using the computer (Kastel, 2003) with increasing regularity. With the help of ongoing technology development, non-technical users have become more able to work with computers and related applications, taking charge of its information. This improvement has developed in four steps, as shown in Table 2.1 (Kastel, 2003).

Table 2.1. Evolution of Computing

Time	Means	Scope
1980's	PC	Personal
Early 1990's	Client server	Enterprise
Late 1990's	Internet	Global/Structured
2000's	Portals	Global/Structured

As the basis of value creation and success of organizations increasingly depends on the leverage of knowledge available internally, knowledge management systems (KMS) are emerging as vital tools for gaining competitive advantage. Among these KMS, corporate portals present the potential of providing organizations with a rich and complex shared information workspace for the generation, exchange, and use of knowledge. (Benbya *et al.*, 2004)

The employee portal service has continued to grow with the addition of time and attendance features, automatic policy management, electronic

forms, task management and most recently a custom database creation capability. (Business Wire, 2010)

The employee homepage should aggregate all content relevant to an employee in one place, like schedules, messages, polls, an avatar feature and/or other customizable widgets. It could also include weather forecasts from places like AccuWeather and also other optional features to give it a personalized touch. The design of the employee portal should aim at improving communication and recognition among employees. It could have a task feature with User specified permissions to Digital-Logbook which would allow managers to assign tasks to individuals and track them to completion. (Business Wire, 2010)

Portal technology is evolving rapidly to meet current requirements and anticipate the next wave of demands. New ideas, along with new vendors and business and deployment models, are entering the market. Companies want portals to provide richer, more-intuitive and engaging user experiences appropriate to their employees, customers and partners. They want social capabilities built in.

The next generation of the portal, and the technologies and vendors that will enable it, will cover the portal's role and relationship with the UXP (User Experience Platform), Emerging portal offerings in the cloud, Portal-less portal alternatives and open-source offerings that are beginning to exhibit success. (Phifer, 2011)

2.1.3. Architecture. Enterprise portals have fairly complex structures and features. However, their basic functions and elements are relatively easy to define. First, from an operational perspective, the strength of corporate portals lies in their ability to provide Web based access to enterprise information, applications and processes. Second, from a functional perspective, they leverage existing information systems, data stores, networks, workstations, servers and applications as well as other knowledge bases to give each employee in every corporate site immediate access to an invaluable set of corporate data anytime, anywhere (Kendler, 2000; White, 2000). These capabilities are made possible because the generic framework is essentially focused on delivering information to the users from disparate databases.

As seen in Figure 2.1, below, the enterprise portal framework essentially consists of two primary layers. At the core of any portal framework are the applications it supports. These applications can be quite diverse. They can range from unit specific to organizational wide capabilities, staff to administrative support functions, and individual to system-wide inquiries. Both internal and external stakeholders can access all of these applications. These stakeholders or users are located outside the second layer consisting of various Web-based drivers. These drivers are the means for the openness and easy access capabilities to the disparate databases and reports generated. (Raol et al., 2003)

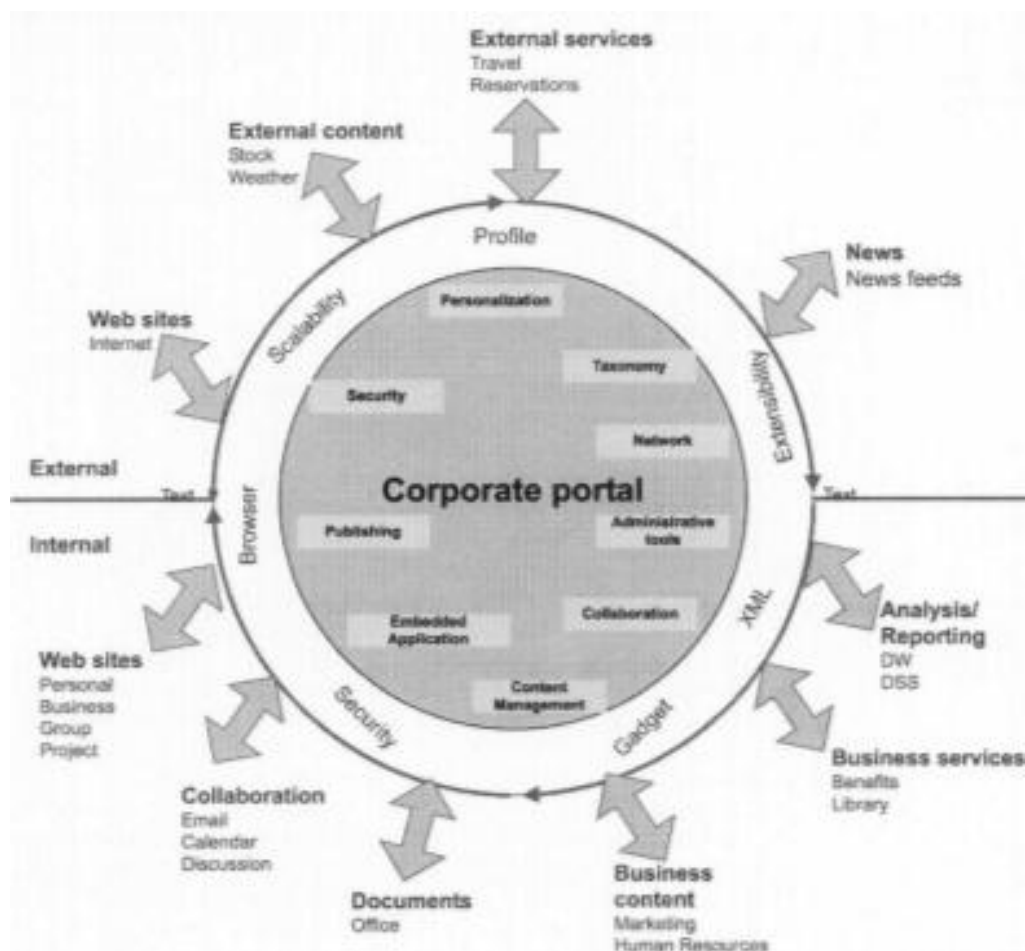


Figure 2.1. Corporate Portal Framework

Functions and features are fairly difficult to define separately because they may have inter-related macro and micro level components. In most corporate portals, features and functions co-exist at the same level because they are still in the maturing process. Typically, the more common functions are the components that provide access to the range of disparate enterprise databases and information resources and the ease with which users can set up personalized access to enterprise and external information resources (White, 2000). In most enterprise portals, these functions may include, but are not

limited to security, network, administrative tools, search, content management, collaboration personalization, extensibility, [ease of] use, and scalability (Eckerson, 2000; Gates, 2001; Rapoza, 2000).

An employee portal can be assessed from three broad perspectives; namely, “contents and functions,” “design,” and “implementation.”

2.1.4. Contents and Functions. Employee portals have been put to many uses. They are utilized by many companies to improve their information exchange, communication, employee collaboration, and to better support their business processes. Owing to limited IT budgets and the need to justify investments in employee portals, assessing the benefits of these is an important field in research and practice. (Urbach et al, 2010)

The contents and functions of an enterprise portal have many information categories. The most important ones include: “Customization and Personalization,” “Collaboration and Communication,” “Security,” “Search Function,” and “Employee Self-Service.” Each information category has information items associated with it.

The case company had major problems with determining the right set of contents and functions for their internal employee portal. This falls under the “Problem Statement” block of the research framework shown in Figure 1.1.

2.1.4.1. Information items associated with customization and personalization function. Customization and Personalization play a crucial role in the design of a portal functionality and content. It helps the users relate to the portal, allowing them to Personalize their work space, giving it their

own preferred look and feel by altering the layout, the color scheme, etc. (Tojib et al., 2006; Sugianto and Tojib, 2006; Bolu et al., 2012; Al-Zegaier and Barakat, 2012) The user can also select the resources and tools available on the homepage, including the Sort order for performing tasks and displaying the various components. Changing the look and feel of the portal, be it in terms of color scheme; applying a theme; arrangement of objects; selecting language of display; etc., make the portal more likeable and makes the portal more appealing for the user. (Tojib et al., 2006; Sugianto and Tojib, 2006; Bolu et al., 2012; Al-Zegaier and Barakat, 2012) The portal could be customized differently for different employee groups, keeping in view their expectations of the portal and their requirements. (Tojib et al., 2006; Sugianto and Tojib, 2006; Bolu et al., 2012; Al-Zegaier and Barakat, 2012) Social networking features may be added to the portal to provide for an [even more] personalized space in the portal. (Succendran et al., 2012; Hustad and Bechina, 2012) These can be considered as the softer aspects of the portal but they are still very important in making the portal appeal to its user group. An E-room digital workspace is another feature associated with this function, which allows a user to work online in a digital workspace as if they are in an office. (Al-Mudimigh *et al.*, 2011; Caya and Nielson, 2010; Valdes et al., 2010; Raol *et al.*, 2003; Gates, 2001; Eckerson, 2000; Rapoza, 2000)

2.1.4.2. Information items associated with communication and collaboration function. Collaboration and Communication is frequently considered the most important purpose of an enterprise employee portal. It

helps connect employees from around the globe, thus overcoming the barrier of geographical distance and creating a sense of community among the employees. Document sharing and collaboration is vital in communicating between the employees present in different locations at different points in time. (Tojib et al., 2006; Bolu, et al., 2012; Al-Zegaier and Barakat, 2012; Hustad and Bechina, 2012) It also saves time and effort needed to ensure that a certain document reaches everyone whom it should. Threaded discussion in e-forums can be claimed as one of the best features in a world of collaboration. (Tojib et al., 2006; Bolu, et al., 2012; Al-Zegaier and Barakat, 2012) Task management becomes easier. Task assignment and monitoring and regulation can be accomplished more centrally. Troubleshooting, sharing of new ideas, and holding a discussion involving people from different locations in the enterprise, without requiring them to be physically present, can be accomplished in a hassle-free manner. Blogging is another tool for allowing employees to express their views on various topics and publish them on the portal for the purpose of sharing information or gaining feedback from management or co-workers. (Bolu, et al., 2013; Hustad and Bechina, 2012) A separate non-blog feedback feature may be provided specifically for this purpose. (Tojib et al., 2006; Succendran et al., 2012) In fact, a feedback survey in the form of a Quick Poll or a text area where portal users can add their ideas may provide valuable information for portal improvement. (Tojib et al., 2006; Succendran et al., 2012) Streaming video and Web communication are also rapidly gaining popularity. Originating in the academic world and

spreading to the corporate world, the need for face to face video conferencing with people located in different geographical areas continues to grow. (Tojib et al., 2006; Al-Zegaier, 2012; Hustad and Bechina, 2012) Another important feature in today's business is the employee directory, which can be implemented in a portal in various ways, such as through the use of an employees' organizational chart and other interactive charts. (Tojib et al., 2006; Bolu, et al., 2012; Al-Zegaier and Barakat, 2012) The highly diverse category of communication and collaboration remains one of the most important elements of an enterprise employee portal. (Caya and Nielson, 2010; Sugianto *et al.*, 2006; Raol *et al.*, 2003)

2.1.4.3. Information items associated with the security and safety function. Security of a portal requires extra attention. Since the portal has a wide range of audience/user groups, it is vital to keep data segregated in a manner that makes the information available only to the people for whom it is intended. Authentication of users, controlling access of users, regular, periodic auditing of the system, etc. should be given high importance. Single sign-on is suggested as a Best Practice for employee portals. (Caya and Nielson, 2010; Sugianto *et al.*, 2006; Raol *et al.*, 2003)

2.1.4.4. Information items associated with the proactive search function. A search function seems to be an obvious function of any portal, but including efficient and effective search functionality in a portal makes a lot of difference in a portal. An enterprise portal caters to the need of the users enterprise wide, and generally holds enormous amounts of data. A strong

search function is required to aid employees in navigating all of the data and features of an enterprise portal. The search capability should be integrated. That is, various pieces of data in the enterprise should be properly linked, and the search engine should be embedded inside the portal to provide secure results. (Tojib et al., 2006; Al-Zegaier and Barakat, 2012) A good search function will avoid unnecessary replication of results. There are multiple types of search, differentiated by the content it will search: it may be Advanced, Federated, Drop down or Restricted. An Advanced search allows users to refine their search by entering more than a single keyword, thus providing more accurate results. A federated search draws its results from the widest possible result pool, the entire enterprise. A Drop Down search offers suggestions for letters/words that closely match those typed in the search field in a drop down box extending from the search box, while the search keyword is being entered. (Caya and Nielson, 2010; Sugianto *et al.*, 2006; Raol *et al.*, 2003)

2.1.4.5. Information items associated with Employee Self-Service.

Self-service is a main focus and expectation of an enterprise portal. Of the many aspects of self-service that can be satisfied by a portal, a few include features to automate sick-leave applications; record travel expenses; and apply for other positions, etc. (Caya and Nielson, 2010; Sugianto *et al.*, 2006; Tojib et al., 2006; Succendran, et al., 2012)

2.1.5. Design. The design can greatly impact all other functions within a portal. Efficiency is essential. A large, complex portal may require the integration of pre-existing sub-sites, creating a number of unique design issues

for the portal design team. These issues may be addressed by grouping them under the various information categories. Concepts such as canonical structure, the structure of the homepage, and the architecture used for grouping pages and information, etc., are an integral part of the design of an enterprise portal.

2.1.5.1. Canonical structure in portals. The review of numerous portal homepages revealed a common tendency toward the canonical layout structure, which has three major components. 1. A Top horizontal bar that has a colored background and is 100 pixels tall. It is typically used for logos, and global navigation tabs, as well as the search box and help link. 2. A left column that has a colored background and is 200-250 pixels wide. This area is typically used for a navigation bar with detailed navigation links and/or a site menu. 3. A middle area that normally has a white background and is 400-600 pixels wide. It typically features one wide column and frequently contains pictures or photos. (Caya and Nielson, 2010)

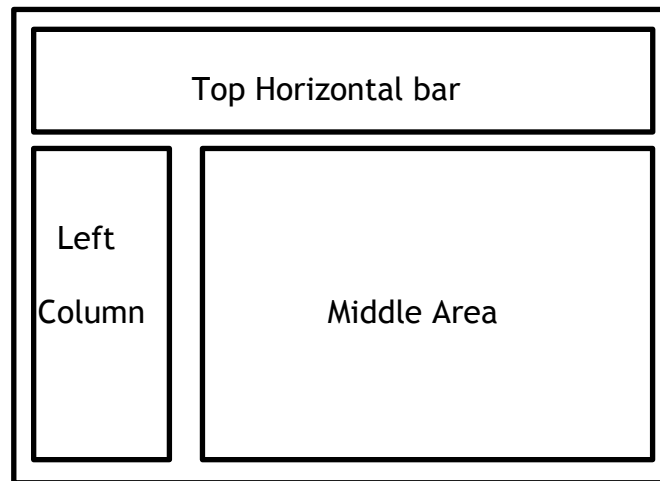


Figure 2.2. Composite Image of 10 Portal Homepages.

2.1.5.2. Structuring the homepage for an enterprise portal. The homepage is the page that appears when a user logs into the portal. All employees across the enterprise may share one homepage, or the company might choose to have different homepages for different user groups. Either way, most homepages use one or more of the following variations: Simple and highly functional - A homepage should be structured so that the users can find most items and functionality on the homepage itself without having to drill down through the hierarchies of portal navigation. The functionality of a portal should also be covered on the homepage to the maximum extent possible. New users find less complex portals easier to learn, and it has been observed that the simpler a portal homepage is, the more users it draws.

No Homepage - At times, companies may not have a homepage at all, but instead every user has a custom page which they use to log on. In this case,

there is no need for uniformity among the homepages. This option usually works well in a company with geographically dispersed and diverse workgroups.

Different Languages - The homepages may be provided in different languages. This helps bridge any language gap that may exist in companies with employees who speak different languages and/or operate in different parts of the world, and prevent different languages from becoming a hindrance to performance. (Caya and Nielson, 2010)

2.1.5.3. Grouping of pages in a portal. There are various methods for grouping pages within a portal. No one way is the one “right way,” instead, a company’s requirements and structure determines the best method for organizing the portal content, applications, and other resources accessible to users. However, a few types of grouping are commonly used.

Simple Hyperlinking: This model does not restrict the location or source referenced by the hyperlink. That is, any page or resource can provide links to any other within the structure of the portal. The advantage of this model lies in the fact that content can be added to any part of the intranet at any time, because the arrangement of links is completely decentralized. The disadvantage of this model is that there are no reference points, so all pages are equally important with respect to navigation.

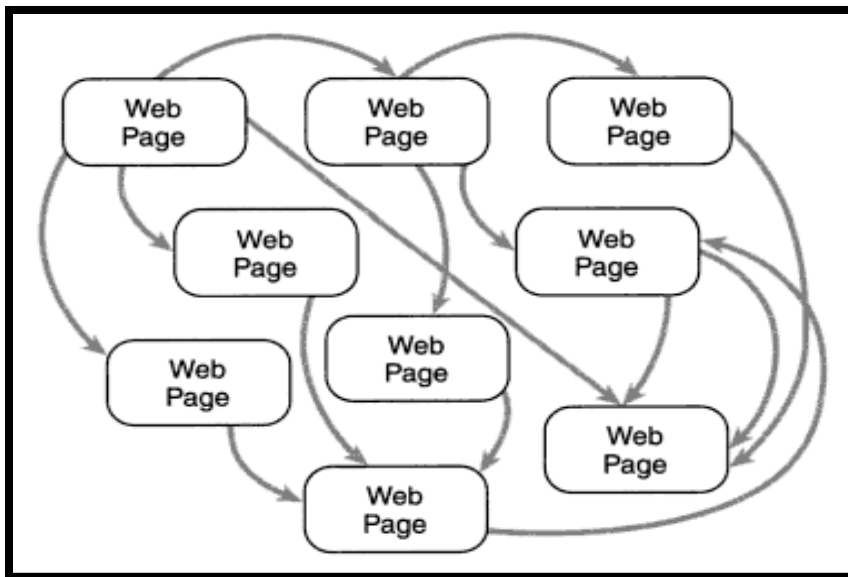


Figure 2.3. Simple Hyperlinking Scheme.

Hierarchical pattern - Most portals and websites no longer use the less organized model of simple hyperlinking, but instead use more structured models such as hierarchical organizational schemes, which provide an organization structure with one or more levels of content with a top-level starting point. The hierarchical categorization is mostly intuitive and depends upon the context of search. Multifaceted organizational models built on hierarchical patterns provide the flexibility of free-form linking within a controlled framework.

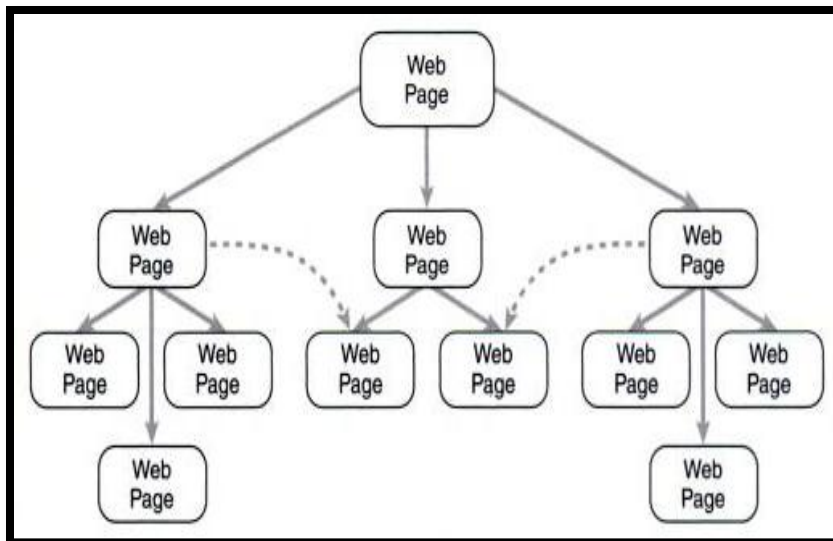


Figure 2.4. Hierarchical Patterns.

Navigation sets - Navigation Sets and other Design Patterns work well for flexible organizations (where there is flexibility in rules and regulations) by using a hybrid of the hierarchical and free-form hyper linking approaches. This structure allows some dimensions (not always the top level dimension as in hierarchical patterns) to be more important than others. The dimensions form the basis of the hierarchy, thus helping users to find high-level topic areas, while still allowing the site designer to customize links between related pages.

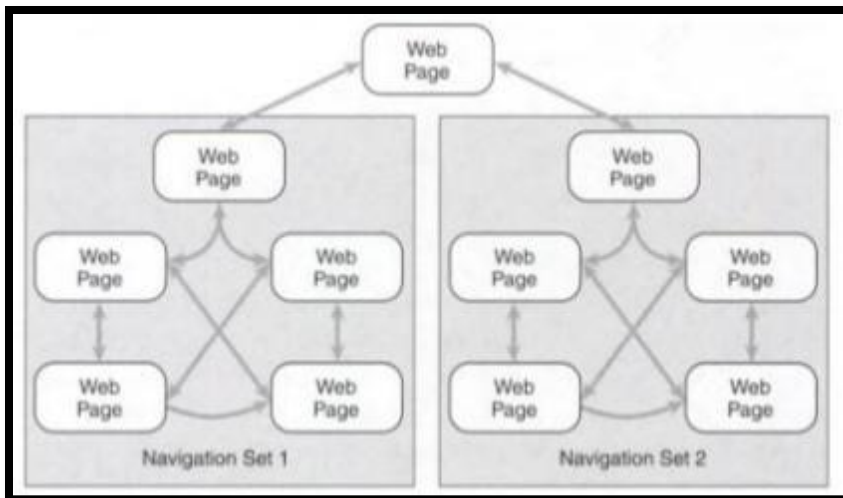


Figure 2.5. Navigation Sets Grouping Highly Linked Pages.

2.1.5.4. Information Architecture in a portal system. Information Architecture in a Portal system refers to the arrangement of information in the portal. The three most common architectures are discussed below.

Wide and relatively shallow navigation refers to an architecture in which information is arranged in many links placed on the page with relatively few links buried inside each link. As the name indicates, this architecture offers a wide variety of information on the portal, but the information is shallow, i.e., the user does not have to drill down through multiple links to access additional information about the subject. This structure may be especially useful for new portal implementations because it can encourage increased portal use by enabling users to find information quickly and easily on the homepage, thus building comfort and confidence with the portal content and navigation.

Narrow and Deep Navigation describes an architecture that displays relatively few links or sections on a page, but each link or section leads to more sections and links within it. This architecture is particularly useful for an organization that uses “information silos” to segregate its information so that people interested in a certain section could drill down for more details. It is a better option for more for technically-adept users. As its name implies, the upper level offers a narrow range of sections, but it is supported by a deep (large) selection of hierarchical navigation options.

Deep in some aspects describes a hybrid architecture that provides deep hierarchical navigation options for some sections or links, but shallow navigation options for others. The depth depends on factors such as the target user group, interests of the user group, needs of the audience, and the portal content of that section. (Caya and Nielson, 2010; Sugianto *et al.*, 2006; Sullivan, D.; 2003)

2.1.5.5. Classifying content with taxonomy. Taxonomy of a portal can play a crucial place in the efficiency of a portal. Indeed, a portal can be rendered ineffective and inefficient if the users cannot relate to the taxonomy used. Taxonomy refers to the terminology used in the portal, and it should reflect the terminology and jargon of its users so that it is easy to understand. A variety of techniques are used to classify taxonomy:

Starting with existing third-party taxonomy is generally considered the fastest way to classify content. There are numerous publicly available taxonomy schemes, such as the “Library of Congress Subject Headings,” which

offers a myriad of topics. It is important to consider the company's business needs as well as discipline and industry when choosing taxonomy.

Use of enterprise structures refers to using a directory structure, in which large shared directories are organized around business process, organizational structures and/or ad hoc practices. This method generally links pre-existing directory structures, which follow the business processes within the organization's structure.

Use of automated clustering is used when the designer lacks familiarity with the content being grouped. Here, patterns are analyzed within documents and documents with similar patterns are grouped. This provides a logical grouping of documents. Generally, automated clustering should not be the only technique used to define taxonomies. (Sullivan, 2004)

2.1.6. Implementation. How a portal is implemented can directly impact any organization. Portal implementation requires addressing Critical Success Factors (CSF), which are four perspectives to consider: strategic, tactical, organizational, and technological. (Remus, 2006)

2.1.6.1. Content management. Generally, a portal should offer high-quality, reliable, and user-friendly content. More recently, timely availability of ontological data and the ability to facilitate web repository management have been added to these expectations. (Chung, 2012) The latter categories fall under the heading of Content Management System (CMS), and include flexibility of content, integration of contents, and the assumption that features would be included to address the factors which hinder efficient Content

management. (Raol *et al.*, 2003; Sugianto and Tojib, 2006; White, 2003; Caya and Neilson, 2010)

2.1.6.2. People and processes. Enterprise portal ownership is an important element in providing users with the most meaningful and relevant information. Frequently, people who were involved in the project design, development, and implementation may have moved to new positions or may have left the organization entirely, and therefore are not available to help manage the portal, and the new portal managers may not be as familiar with the portal or feel the same sense of ownership. This shift in ownerships may contribute to less than optimal portal implementations, or even implementation failure.

The authorship of an enterprise portal can be centralized or decentralized depending on the company structure and environment. In a situation containing large amounts of specialized information from different divisions, which must be handled separately to maintain the integrity of the information and limit access, a decentralized approach may be the best solution. However, this option limits the content providers to their own “silo,” thus preventing a more comprehensive understanding of the organization as a whole. Fujitsu Siemens uses a decentralized authorship structure within their portal. (Sullivan, 2003; Caya and Neilson, 2010)

Centralized authorship helps the company maintain a more accurate and comprehensive view of the corporate data. A centralized Corporate Portal Management group sits on top of the ownership hierarchy, and groups of

departmental content providers report to it. The Corporate Management group is in charge of administration of the portal, development of guidelines and policies, management of the Content Management System (CMS), and creation and implementation of Web-readable pages. HP Europe follows this pattern of ownership. (Sullivan, 2003; Cay and Neilson, 2010)

The size of the organization must be considered when determining the ownership of a portal. A decentralized structure is frequently used in smaller organizations where each unit or division is ultimately responsible for their own content. Centralized authorship is encouraged in larger organizations to ensure the correct enforcement of policies, guidelines, and integrity of information. The greater the diversity of information requirements across an enterprise, the greater is the challenge to content-management. An Enterprise portal strives to provide a customized and personalized content gateway to each user in any size organization. (Scheepers, 2006; Caya and Neilson, 2010)

2.1.6.3. Consulting users. Users should be consulted and involved throughout the implementation of an enterprise portal, from the inception of the idea all the way to the final go-live date and beyond. User feedback should be gathered periodically throughout the project via multiple sources, such as user trials, testing, and prototyping; and users should always be consulted while deciding on adding or removing functionalities and features. Involving users instills feelings of ownership in the new system in addition to building familiarity, which in turn leads to easier acceptance and ultimately contributes

to a successful portal implementation with reduced learning curve and less resistance from users. (Caya and Nielson, 2010; Al-Mudimigh *et al.*, 2011)

Table 2.2. Contents and Function of the Enterprise Employee Portal

INFORMATION CATEGORIES	INFORMATION ITEMS	PEER REVIEWED JOURNAL ARTICLES
Customization and Personalization	Social Networking	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Raol et al. (2003), Rapoza(2000), Succendran et al.(2012), Hustad and Bechina(2012)
	Customized for Specific Clients	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Valdes et al.(2010), Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zegaier and Barakat(2012)
	Personalized homepage	Caya and Nielson (2010), Eckerson(2000), Gates(2001), Valdes et al.(2010), Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib (2006), Bolu et al.(2012), Al-Zagaier and Barakat (2012)
	Personal Stuff tab	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Raol et al.(2003), Rapoza(2000), Bolu et al.(2012), Al-Zagaier and Barakat (2012)
	Layout and Color	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Valdes et al.(2010) Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zagaier and Barakat (2012)
	Selecting Resources	Caya and Nielson(2010), Raol et al.(2003), Bolu et al.(2012), Al-Zagaier and Barakat (2012)
	E-Room Digital Workspace	Caya and Nielson(2010), Raol et al.(2003), Succendran et al.(2012), Bolu, et al. (2012), Hustad and Bechina (2012)
Communication and Collaboration Tools	Blogs	Caya and Nielson(2010), Raol et al.(2003), Bolu, et al. (2012), Hustad and Bechina (2012)
	Policies / Guidelines / Benefits	Caya and Nielson(2010), Raol et al.(2003), Sucendran et al.(2012), Bolu, et al. (2012)
	Events	Caya and Nielson (2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)
	News	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006) Raol et al.(2003), Succendran et al.(2012), Bolu et al.(2012), Al-Zagaier and Barakat (2012)
	My Links/ Popular Links/ Quick Links	Caya and Nielson(2010), Sugianto and Tojib(2006), Succendran, et al. (2012), Bolu, et al.(2012), Hustad and Bechina (2012)
	Feedback	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Seccendran et al.(2012)
	Quick Poll	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006)

Table 2.2. Contents and Function of the Enterprise Employee Portal (contd.)

INFORMATION CATEGORIES	INFORMATION ITEMS	PEER REVIEWED JOURNAL ARTICLES
	Community	Caya and Nielson(2010), Tojib et al.(2006), Raol et al. (2003), Sugianto and Tojib(2006), Bolu et al.(2012), Hustad and Bechina.(2012)
	Employee Directory/Information	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006) Succendran et al.(2012), Bolu et al.(2012), Hustad and Bechina.(2012)
	Calendar	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006)
	E-Mail	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Hustad and Bechina.(2012)
	Tools and Applications	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Succendran et al.(2012), Bolu et al.(2012), Hustad and Bechina.(2012)
	Streaming Video and Web Communication	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Al-Zegaier and Barakat (2012), Hustad and Bechina.(2012)
	85-85 Rule	Caya and Nielson(2010), Raol, et al.(2003)
	Document / File Sharing	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zegaier and Barakat (2012), Hustad and Bechina.(2012)
	Threaded Discussions	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Bolu et al.(2012), Al-Zegaier and Barakat (2012)
Search Function	Advanced Search	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zegaier and Barakat (2012)
	Federated Search Engine	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Al-Zegaier and Barakat (2012)
	Drop Down	Caya and Nielson(2010), Raol, et al.(2003)
FAQ		Caya and Nielson(2010), Raol, et al.(2003), Succendran et al.(2012), Bolu, et al.(2012)
Help		Caya and Nielson(2010), Raol, et al.(2003), Succendran et al.(2012), Bolu, et al.(2012)
Employee Self Service	Career	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)
	HR Self Service	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012), Bolu, et al.(2012)
	Medical Service/ Leave Balance	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)
	Travel Services	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)
	Training	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)

2.2. PERFORMANCE DASHBOARD

Performance dashboard is a performance management system that translates the organization's strategy into objectives, metrics, initiatives and tasks customized to each group and individual in the organization. It communicates strategic objectives and enables businesspeople to measure, monitor and manage the key activities and processes needed to achieve their goals. (Eckerson, 2010) Performance dashboards have been adopted as the major tool for determining and analyzing actual portal usage in this research. The large amounts of unstructured data obtained from the portal usage logs are unreadable and not comprehensible; as shown in figure 1.1. In this section literature review of the Performance dashboards has been done in terms of its definition, history and evolution, functionalities, advantages and classification.

2.2.1. Definition. A dashboard can be described as a visual display of the most important information required to achieve certain objectives, consolidated and arranged on a single screen so that the information may be monitored at a glance. (Few, 2006)

Managers are often overwhelmed with reports and information churned out from a multitude of organizational information systems such as Enterprise Resource Planning (ERP), performance scorecards, and business intelligence (BI) software. This phenomenon is generally known as information overload. The problem is further exacerbated when reports are poorly designed with

respect to how information is presented, often confusing rather than guiding the decision making process. (Yigitbasioglu and Velcu, 2012)

It must be noted that a dashboard's value is inextricably linked to which features are chosen and how they are used within the organization. There are no limits on how a dashboard should look or what capabilities it should address because those aspects should be tailored to an organization's unique requirements. In general, a dashboard is expected to collect, summarize, and present information from multiple sources such as legacy-ERP and BI software so the user can easily see how various performance indicators such as order-fill rates and sales returns are performing. Data represented on a single dashboard page represents a very small portion (the most important portion) of the data available. If desired, a user can drill down view more specific information and more details about the broad trends that were displayed on the first screen. There are many dashboard variations available in the software vendor market. Some solutions come with "full" features, i.e. interactive drill down capabilities, scenario (what-if) analysis, built-in automated alerts, customization options, etc., while others are more simple and static by nature. (Yigitbasioglu and Velcu, 2012)

2.2.2. History and Evolution. Dashboards have generally been accepted and interest continues to grow. Numerous success stories have been attributed to performance dashboards' implementation. To cite two: IBM's Business Objects Dashboard Manager at Edward Hospital helped in improving cash flow through the better management of account receivables (Schulte 2006) and

Unisys' marketing dashboard led to improved budget allocation, accountability, and performance management (Miller and Cioffi, 2004). No matter the purpose of the dashboard; whether it is to improve internal control or to monitor performance management in the midst of an economic downturn, it is essential that the dashboard have the ability to assess and quickly evaluate different aspects of a company's performance. (Hanoa, 2009)

2.2.3. Functionalities. Dashboards convey information through visualization. Information visualization refers to the “use of interactive visual representations of abstract, non-physically based data to amplify cognition” (Card *et al.*, 1999). The process of visualization involves two distinct phases: encoding and decoding, which are facilitated by the use of visual attributes such as shape, position and color, and textual attributes such as text and symbols, which themselves are represented with simple visual attributes (Wunsche, 2004).

The primary function of a performance dashboard is to monitor, analyze and manage. Dashboards can help in monitoring critical business processes and activities using metrics that trigger alerts when performance falls below predefined targets. They can help in analyzing the root cause of problems by allowing users to explore relevant and timely information from multiple perspectives at various levels of detail. Dashboards can also help in managing people and processes to improve decisions, optimize performance and steer the organization in the right direction. (Eckerson, 2010)

2.2.4. Advantages of Using a Performance Dashboard. Dashboards help in communicating strategies by translating corporate strategy into measures, targets, and initiatives that are customized to each group in an organization and sometimes to every individual. They help in refining strategies. They highlight performance measures and results. (Eckerson, 2010)

2.2.5. Classification of Different Types of Dashboards. Because we planned to use dashboards to assist in the evaluation of the portal of our case study, we reviewed different types of dashboards and their uses. Performance dashboards can be classified into three types based on how they emphasize the three layers of the dashboard framework and which applications they support. The three types of dashboards are described below.

Operational Dashboards enable frontline workers to manage and control operational processes using detailed data that are refreshed frequently. Operational dashboards emphasize monitoring more than analysis or management.

Tactical Dashboards monitor and manage departmental processes and projects. Executives use tactical dashboards to review and benchmark the performance of peer groups across the company, while managers use them to monitor and optimize processes. Tactical dashboards tend to emphasize analysis more than monitoring or management.

Strategic Dashboards monitor and manage departmental processes and projects. Executives use tactical dashboards to review and benchmark the performance of peer groups across the company, while managers use them to

monitor and optimize processes. Tactical dashboards tend to emphasize analysis more than monitoring or management. (Eckerson, 2010)

The dashboards that are used in this thesis can be classified as Strategic to Tactical and will be discussed in the Methodology section.

2.3. USABILITY AND EFFECTIVENESS

Usability and Effectiveness refers to the user-friendliness of a program or application. It is closely related to user satisfaction. The study of Usability and Effectiveness is a new science formed as an amalgamation of behavioral, psychological, and social sciences, and it is expanding into all fields. Recently, statistical and biometric evaluation tools have been added as well. (Abran *et al.*, 2003; Hertzum and Clemmenson, 2011) The study of usability is important here in this research as it is a problem to be dealt with in the assessment of an internal employee portal as suggested in Figure 1.1. Therefore a brief review of usability in terms of its definition, history and evolution has been discussed in this section.

2.3.1. Definition. The term “usability” refers to a set of multiple concepts, such as execution time, performance, user satisfaction and ease of learning (“Learnability”), taken together. But “usability” has yet to be clearly defined, by either researchers or by standardization bodies. (Abran *et al.*, 2003) Evaluation can be defined as a judgment of worth to ascertain a level of performance or value. (Chowdhury and Chowdhury, 2002)

Six different perspectives of usability have been brought into purview by Hertzum (2010), including Hedonic usability, Perceived usability, Situational usability, Cultural usability, Organizational usability, and Universal usability. Performance evaluation can be further broken down into “Effectiveness” - how well does a system perform the task for which it is designed; and “Efficiency” - at what cost (financial or time/effort). (Saracevic, 2000)

Usability was one of the major problem areas facing the case company’s enterprise employee portal. This falls under the “Problem Statement” block of the figure 1.1 depicting the research framework.

2.3.2. History and Evolution of Usability. The concept of Usability is embedded in the field of Human - Computer Interaction and can be dated back as far as the 1960’s when three threads of human factors, business computing, and personal computing were recognized as a unique segment of research in Computer Science. When ENIAC, the first electronic computer, came into being in 1946, computer projects employed people in roles of operation, management and programming, but they overlooked the design, development and usability aspect of the systems. (Grudin, 2005)

The emergence of National Usability Communities in various countries highlights the increasing demand and need for usability studies in the different parts of the world. Hertzum and Clemmenson (2011) have studied the trends in China, Denmark, and India. In China the usability field has been developing quickly. The usability groups in China can be placed into the three broad categories of: Industrial/Graphic designers who are employed by international

mobile-phone providers, Engineering Psychologists who are primarily involved in testing but not designing, and Usability Professionals educated in usability outside of China who work as leaders or department managers. (Chauhan, 2006) In Denmark, too, the usability profession has been growing very fast and it is comprised mostly of young people who have less than five years of work experience. Two thirds of the professionals are educated in social sciences or humanities rather than any technical field. Statistics indicate that India needs 60,000 usability professionals, but they currently only have 500-600, most of whom have been trained in the user experience and usability field at various technical universities in India that emphasize a user-centric design approach. (Yammiyavar, 2010) Similarly every country in the world is experiencing a shortage of usability professionals even as they recognize the importance of Usability studies.

In 2012; Hertzum *et al.* identified the following six components of user experience: sensorial, cognitive, pragmatic, lifestyle, and relational. The user experience can be further classified under four different categories.

Utilitarian vs. Experiential - The user experience can be classified as Utilitarian when it is related to the user's need of achieving behavioral goals which requires utility and usability. It can be classified as Experiential when the user experience is primarily related to user's self and consists of identification and stimulation.

ISO usability - Efficiency, Effectiveness and Satisfaction are the three facets of this category. Effectiveness refers to the accuracy and completeness

with which users achieve specified goals. Efficiency deals with the spending of resources in relation to the accuracy and completeness with which users achieve goals. Satisfaction is freedom from discomfort, and a positive attitude towards the use of the product.

Organizational Usability - This category addresses the dimensions of: User-system fit, Organization-system fit, and Environment-system fit. User-system fit refers to the fit between the user's psychological characteristics, including cognitive processes and training and the system. The Organization-system fit deals with the fit between the social attributes and the structural characteristics of an organization, including its norms, task allocation, and communication channels. The Environmental-system fit refers to the fit between system attributes and the environment of the organization in which it is used; including the home-work ecology.

User Experience - This is the fourth category and it addresses the Sensorial experience (which involves the senses, helps address sight, hearing, touch, taste and smell to arouse aesthetic pleasure, excitement, satisfaction, or appeal to a sense of beauty), Emotional experience (which involves the affective system through the generation of moods, feelings, emotions to generate an emotional experience and thereby create an affective reaction with the product, brand, or company), Cognitive experience (which involves stimulating thinking or conscious mental processes to engage customers to use creativity to solve problems, or to motivate consumers to revise their usual ideas or mental assumptions), Lifestyle experience (which involves the

affirmation of the user's beliefs and values system so that a product becomes the means of adhesion to certain values or of affirmation of a social identity or lifestyle), Relational experience (which involves the user's social context and relationship with other people and either encourages people to use a certain product together with other people, or causes the product to become the core of a common passion that may lead to the creation of a "community").

2.4. CHALLENGES FACING ENTERPRISE PORTAL

Enterprise portals currently face myriad problems. Most of the problems are related to integration of business process and components with the utility and usefulness of a portal, and its cost of implementation while maintaining compatibility.

2.4.1. Integration of Business Processes or Components. Ideally, business needs should be met by aligning the IT capabilities of the organization correctly. For this to happen, business automation, business processes and re-engineering must be clearly defined.

2.4.2. Usefulness. The utility of an Enterprise Portal is manifold. The full potential of the usefulness of an Enterprise portal can only be realized if it addresses the need of the organization which is implementing it, and the features that are useful for one company's portal may not be suitable for another company. The primary obstacle of realizing the maximum benefit from an Enterprise Portal lies in lack of understanding the true potential of the

platform and mapping the company's needs to it. Each implementation is unique and adopting the design of a pre-existing portal may not be the best solution.

2.4.3. Cost. The implementation of an enterprise is a complex and time-consuming endeavor for any company. The company has to balance their limited IT budget against the growing need for an enterprise portal. (Urbach et al., 2010) Of the budget portal implementation budget, a very small proportion is spent on licensing and initial set-up, while a larger portion of the budget is used later on support, maintenance and upgrades, etc. Hidden costs, such as loss of productivity as employees become used to the new portal, are more difficult to estimate, but account for another major portion of the implementation budget and must be calculated as accurately as possible. (Jafari, 2003) Portal benefit evaluations may be based on monetary indicators like return on investment (ROI), total cost of ownership (TCO), and other cost-benefit analysis methods (White, 2003), but as with many IT projects, benefits can be difficult to quantify. Apart from the financial benefits; there are a large number of intangible benefits that can be derived from an enterprise portal, such as user satisfaction, which cannot be easily measured but is a good indicator of an enterprise portal's success. There are several methods available for measuring a portal's benefits (Doll and Torzadeh, 1988), including the End-User Computing Satisfaction measure (EUCS), Sugianto et al. (2007) and Tojib et al. (2008) which is based on a formula called B2E (Business to Enterprise) Portal User Satisfaction (B2EPUS). Another approach to assess user satisfaction

proposed by Bin Masrek (2007) was based on an extract of the updated D&M IS (DeLone and McLean Information Systems) Success Model proposed by DeLone and McLean, 2003. Yang et al. (2005) developed an instrument based on several different conceptual models in the area of IS and technology that focused on the user-perceived service quality of web portals. De Carvalho et al. (2008) analyzed the effects of technological and organizational features on intranet and portal usage based on the Technology Acceptance Model (TAM) proposed by Davis (1989)

2.4.4. Compatibility. The compatibility of an enterprise portal refers to its ease of integration, platform independence, reliability, scalability and usability.

2.4.4.1. Ease of integration. This refers to how easily the new system can be integrated with the existing system. Portal installation should never interfere with some previously-existing functionality. The portal must be compatible with existing databases and Web Application services to allow for easy interfacing and integration between the two. Both Application Programming Interfaces (APIs) and Open Software Development Standards should be available to facilitate integration to the enterprise portal. (Jafari, 2003) To help ease the transition, integration may be conducted in phases.

2.4.4.2. Platform independence. Requiring that all products, operating systems, and hardware products come from a particular manufacturer can reduce the opportunity for compatibility between the portal and other vendors' products, and can ultimately limit the portal's full potential. A good portal

should be compatible across multiple vendors. Nevertheless, many companies still continue to purchase products only from one or two vendors despite the limitations inherent to this practice. This is frequently the case when a certain vendor's technology has been used by the company in the past and has gained loyalty from company management. Unfortunately, this greatly limits the company's ability to respond to changing market conditions. (Jafari, 2003)

2.4.4.3. Reliability. Portal performance is another area critical to the implementation's success. The portal must have the capacity to be able to support user traffic without slowing response times and reducing the quality of the user experience. With this in mind, portal performance should be tested during peak hours and levels of usage *before* the portal goes live. The system should be tested across three major points of contention, namely: the performance benchmarks of the hardware being used, the network capacity, and the system administrator's expertise in tuning the performance of the operating system on which the portal application will run. (Jafari, 2003)

2.4.4.4. Scalability. Otherwise known as expandability, scalability should be seriously considered before an investment is made toward the implementation of an enterprise portal in an organization. Over time, the users will come to rely more on the portal, and the scalability will become a major determinant of a portal's success. If the portal is incapable of scaling to meet user requirements, then the portal can easily become a "victim of its own success." Initially it might not have as much acceptance and traffic but with the advance of time and the dependence of more and more users it becomes

important to expand the scope of the portal and upgrade to newer technologies. (Jafari, 2003)

2.4.4.5. Usability. The research for this thesis focused on usability. In 2010, Hub and Zatlouk came up with a comprehensive list of criteria that affect the usability of web based portals, and this research focuses on the following areas from that list: accessibility - how easy it is to use and understand use the web site's content; information retrieval - how fast and easy it is to find information on the website; and navigation simplicity - how easy it is to use and understand the web site's navigation.

2.5. PORTAL EVALUATION MODEL

The Intranet Effectiveness and Efficiency model suggested by Jacoby and Luqi (2007) was adopted for this research after reviewing various Portal evaluation models.

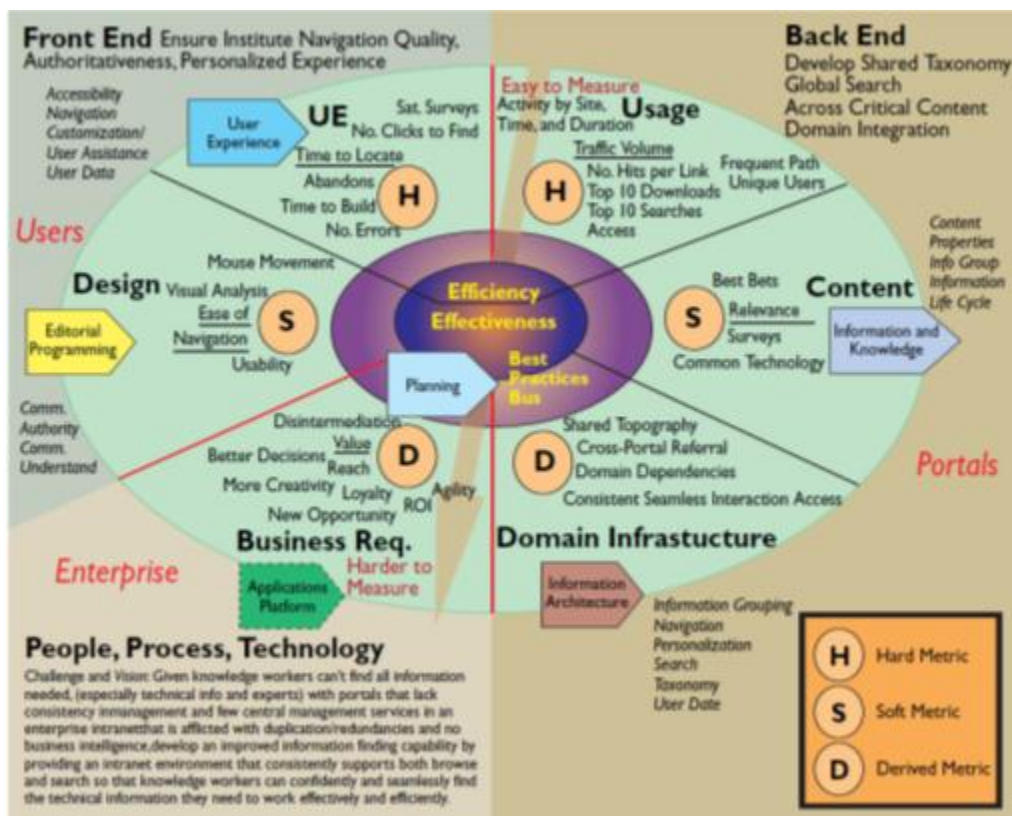


Figure 2.6. Intranet Effectiveness and Efficiency Model for Portal Evaluation

The portal was analyzed using three major domains: “Front-end,” “Back-end,” “People, processes and technology.” Front-end factors are the user based factors such as accessibility and site navigation. Back-end factors are the site based factors such as personalization, taxonomy, and information search. People, processes and technology are the knowledge worker based factors such as their vision, purpose and products or service, and how these factors support business requirements that promote productivity.

This model includes three categories for metrics: Hard, Soft, and Derived. Hard Metrics are quantifiable and they are mostly used to measure Efficiency. Soft or Derived Metrics are qualitative and they are generally used

to measure Effectiveness. Jacoby and Luqi consider using these categories to be a Best Practice, and suggest that management and business decision makers such as portal owners should further prioritize the metrics according to the companies' mission and immediate requirements.

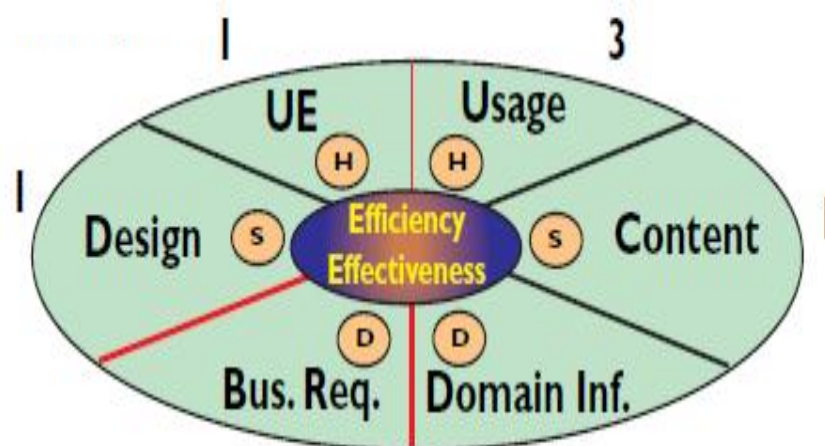


Figure 2.7. Basis of Evaluation of a Portal

Derived Metrics can be transformed into either Hard or Soft metrics. Once the key elements are known concretely and measured with precision, the derived metric can be categorized into one of the two. As the model in Figure 2.7 suggests, metrics can be organized into segments.

Table 2.3. Example of Ranking of Key Metrics for Portal Evaluation

Pri.	Type	Metric	Segment	Constituent	Business Requirement
1	S	Relevance	Content	Content Properties, Search	New Opportunity, More Creativity, Better Decisions, Value
2	H	Traffic Volume	Usage		Reach, ROI, Loyalty
3	H	Unique Users	Usage		Reach, ROI, Loyalty
4	D→H	Cross-Portal Referral	Domain Infrastructure	Domain Information Infrastructure	Reach, Opportunity, Creativity, Disintermediation, Value
5	S	Ease of Navigation	Design	Navigation, Comm. of Understanding	Value, Loyalty
6	H	Top Downloads	Usage		Optimization, Value
7	S	Sat. Surveys	User Experience		Value, Loyalty, Reach, (Productivity)
-	H	Time to Locate	User Experience	Navigation	Value, Loyalty, (Productivity)
Must	S	Common Terminology	Content, Domain Infrastructure	Taxonomy	Value, Reach
Must	D→H	Shared Topography	Domain Infrastructure	Domain Information Infrastructure	Reach, Opportunity, Creativity, Disintermediation
(Business Rules Considered?)					
?	H	Accessibility	User Experience	Accessibility	Value, Reach, More Creativity, (Productivity), New Opportunity (confidential info. handled correctly)

Table 2.4. Examples of One Metric Breakdown for Unique Users using IEEM

WHAT: UNIQUE USERS (Priority No. 3)		WHERE: Enterprise		WHO: Portal Owner and Portal Manager Related		WHY: HOW:	
← BUSINESS PROCESS →		← BEST PRACTICES →		← IEEM Related →			
Business Issue - Metric Area	Business Question of Web Site Activity	Business Significance of Web Site Report Solution	Specific Metric Area - Specific Metric	Who Benefits and Why (User, Portal, Enterprise)	IEEM Segment(s) - IEEM Constituent(s)	Efficiency (E) or Effectiveness (F)	
Retention - Loyalty - Value	How effectively am I building loyalty with my visitors?	Determine how quickly you are building your user base to gain site audience enlargement and shrinkage over time and via a via other sites.	Return Visitor Rate - Top Visitors (Advanced) - Visitors by Number of Visits - Visitors Over Time - Top Visitors by Hits (Last) - Top Visitors by Hits Over Time - Top Visitors by Leads Completed - Visits by Length of Visits <i>* All of the above for Returning Visitors</i> - New vs. Returning Visitors	User - Gains familiarity to site which reduces overall frustration. Portal - Managers learn where return visitors come from and how many there are, which a partial indication that users find the site helpful. Enterprise - When users continue to return to the same site for information, it indicates that they find it helpful and as well as where the sources of richness lie.	Info Architecture - User Data	F	
Optimization - Loyalty - Value - Agility - Optimization	What do my visitors come back for?	Analyze the most popular content for my return visitors in order to feed and associate related information to meet demand.	Return Visitor Target Pages <i>Compare when and with whom</i> - Top Returning Visitors by Hits - Top Returning Visitors by Hits Over Time - Top Returning Visitors by Leads Completed - Returning Visitor Visits by Length of Visits - Returning Visitor Page Views Over Time - Top Document and Content Group for Returning Visitors Over Time Survey - Internal Returning Visitor Source Activity	User - Popular downloaded information remains as well as other information like it eventually being posted or better associated. Portal - Managers learn which pages are desired and can load related information to meet demand. Enterprise - As portals more accurately monitor what information is sought and add additional information that is related, the enterprise is doing a better job meeting the expectations and business needs of its users.	Info Knowledge - Survey Info Architecture - Info Grouping - User Data	F	

2.6. BALANCED SCORECARD

A balanced scorecard is a strategic performance measurement system created by Kaplan and Norton in 1992. It came into being as a performance measurement system but evolved into a Strategy-Focused-Organization (SFO) framework. The Balanced Scorecard is aimed at translating strategy into operational terms, helping align strategy and organizational units, communicating strategy to employees and providing learning and feedback. (Kaplan and Norton 2008) It was created to harness the multiple benefits of performance measurement and help companies to implement their strategies. The Balanced Scorecard can be a very reliable tool for identifying perceived benefits to an organization. (Shutibhinyo, 2013)

Balanced scorecards are widely used as a Performance Measurement System (PMS) today to evaluate performance levels within an organization and analyze their impact, and also helps the organization compare itself with its competitors, thus planning its future course of action to gain and maintain competitive advantage.

The balanced scorecard framework is composed of four different perspectives which can be described as the impact areas within an organization. Each perspective is broken down into a set of Objectives, and each objective is associated with Key Performance Indicators (KPIs), which can be used to assess how well the objectives are being met. This can greatly help

a company to assess and adjust its progress toward its goals. (Franceschini, et.al, 2013)

The four different perspectives of the balanced scorecard are the “Financial perspective,” “Customer perspective,” “Internal business perspective” and the “Learning and growth perspective.” (Shutibhinyo, 2013; Amiry and Kumaraswamy, 2013; Franceschini, et al., 2013)

3. METHODOLOGY

The methodology adopted in this research is to establish the Industry Standards and Best Practices of an internal employee portal based on theories derived from literature review and industry standards derived from case studies. An information mapping grid is established by bringing together Industry Standards and Best Practices as suggested by literature and uses in case studies.

This research uses a case company to validate the Information Mapping Grid derived from literature review and industry best practices. This is done by determining actual portal usage of the case company and user-perceived portal usage of the case company. Actual portal usage was determined by using data warehouse and dashboard monitoring systems. User-perceived portal usage was determined by the results of a third-party evaluation and occasional company site visits.

Finally, comparison and analysis was done on the actual and user-perceived portal usage with the Information mapping grid to derive meaningful results and formulate useful recommendations. The figure below shows a Venn diagram which graphically depicts the methodology used for this research. It shows how the three universes of “Industry Standards and Best Practices,” “Actual Portal Usage” and “User-Perceived Portal Usage” were all considered when developing the “Recommendations.”

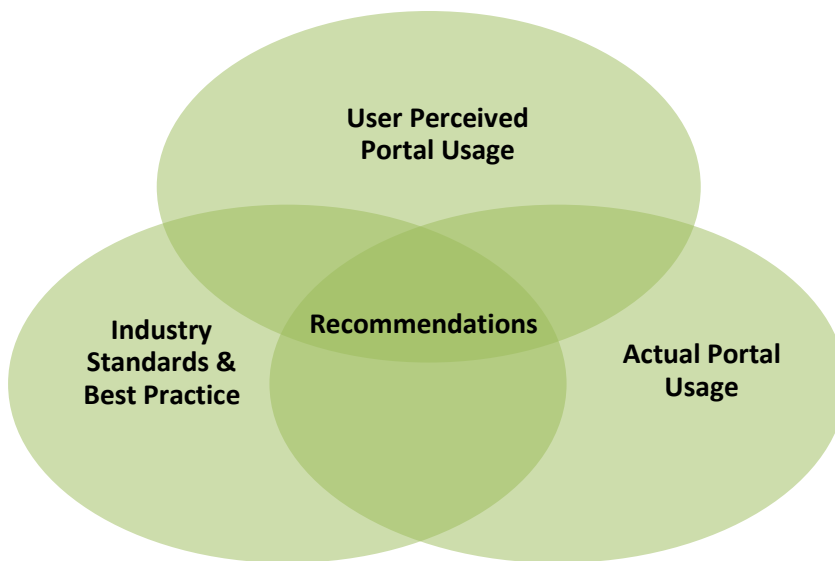


Figure 3.1. Solution Approach Overview

The different methodologies used are detailed in the following section.

3.1 INDUSTRY STANDARDS AND BEST PRACTICES

The research on Industry Standards and Best Practices was primarily accomplished through an in-depth review of peer reviewed journal articles and case studies. These two methods together provided an information mapping grid, which helped establish the Industry Standards and Best Practices as described in the following subsections.

This was the first of the three methods adopted for this research as depicted in Figure 1.1.

3.1.1. Literature Review. An literature review was carried as a part of this research, which provided a thorough overview of exactly which information

items were most vital to the structure of an effective employee enterprise portal, and which features were required for each information item; all of these were combined into a comprehensive list of the key contents and functions required for a successful enterprise employee portal. The literature review mentioned in section 2 helps to establish the Industry Standards and Best Practices as shown in the research framework of Figure 1.1.

3.1.2 Case Studies. A number of real companies' employee portals were studied as a part of this research. Company portals are very confidential and are not readily available to study and analyze, therefore, licensed reports about various companies' portals were purchased and the researcher and advisor's personal experiences were used along with information from the Literature Review to construct this section. The contents and functions of the companies' portals were used as case studies, which were then compared with the comprehensive list of the contents and functions of an employee portal that was developed in the Literature Review. The findings from the case studies generally supported those found in the Literature Review and were used to form the information mapping grid created to document "Industry Standards and Best Practices" used for an Employee Enterprise Portal. The case studies explained at length in section 4.1.2 are a method used to establish Industry Standards and Best Practices as suggested by the research framework of Figure 1.1.

3.2 USER PERCEIVED PORTAL USAGE

The second method used in this research measured the users' perception of the utility and usage of an employee portal through feedback from users in the Case Company. This is one of the three solution approaches used in this research as suggested in the research framework (Figure 1.1). Two methods were used to assess the user-perceived Portal Usage:

3.2.1. Company Visit. Intermittent visits to the company headquarters provided an opportunity to interact with the IT/Portal team and gather their feedback on user-perceived Portal Usage. The portal team experts were able to provide insight into the current stage of portal implementation within the company. They provided valuable information about the goals the company wanted to achieve by implementing the portal, and this helped identify the areas in which research was needed most, which in turn helped in drive the design of the monitoring system. Their requirements and expectations for their portal helped establish the Key Performance Indicators used in the dashboard monitoring system, which was used to monitor the actual portal usage. Most of this information was gleaned via the exchange of e-mails and online meetings, in addition to periodic on-site visits to the company headquarters. The face-to-face conversations, discussions, brainstorming sessions and interviews with the IT portal have proved to be the most helpful and productive. This is one of the methods used in this research to establish user-perceived portal usage as suggested by the research framework in figure 1.1.

3.2.2. Third - Party Evaluation. Since this research was conducted off-site from the Case Company, direct interaction with the users was extremely limited, and company policy prevented the research team from conducting research-specific surveys and interviews. However, the company employs a third-party consulting agency that was able to conduct this research on our behalf, to include five usability workshops on-site and one remote usability workshop via video conference in order to include members of multiple target user groups. Their evaluation reports were provided to the research team for reference and were used in this study. This is one of the methods used in this research to establish user-perceived portal usage as suggested by the research framework in figure 1.1.

3.3. ACTUAL PORTAL USAGE

The third approach sought to gain an understanding of the current actual usage of the portal in the company, which was accomplished by monitoring the portal using two dashboard monitoring systems built specifically for this purpose. The dashboard helped visualize the utilization of the portal, thereby giving the executives of the company easy to read and understand metrics to aid in analyzing portal usage in terms of number of views, number of user logins, number of file downloads, etc. The results from the dashboards were matched against the goals and objectives that the company wanted to achieve through this research. The usage data was then compared to the list of Industry

Standards and Best Practices that had been developed via literature review, and the results were used to formulate recommendations for improvement. The two dashboard monitoring systems are described in the following sections. This is one of the three solution approaches used in this research as suggested in the research framework (Figure 1.1).

3.3.1. Knowledge Management Data. This data includes the Web Content management data that forms the backbone of the portal and was obtained from the portal usage log. It addressed the usage of the files and folders stored in the portal. Knowledge of the subject areas of the files accessed helped identify areas of interest within the portal, and provided valuable insight into how the portal is used and what files are used most. It also highlighted which areas or files were not being accessed. Once the data was cleansed and structured, it was fed into a dashboard monitoring system that operated on a data warehouse, which helped analyze and support conclusions about the portal usage from the Knowledge Management perspective.

3.3.2. ClickStream Data from Sweetlets. Sweetlets is an SAP application that captures ClickStream data. That is, it gathers details about what users click on in the portal as well as tracking the sequence of clicks required to access a certain page on the portal. The tabs on the portal home are considered 'sections' at the highest level and they contain subsections, which in turn contain other subsections, etc., until a user reaches a webpage at the lowest level of the organizational hierarchy. Tracking the ClickStream

can highlight which sections, subsections, web pages, tabs, etc., are accessed most and least frequently by portal users, thereby providing valuable insights into portal usage from a user's perspective. Once it is displayed in a graphical format, it can be especially useful in helping company executives to understand if the users are using the portal as they had intended. This data was also very helpful to the research team to compare against the Industry Standards and Best Practices before drafting recommendations for the improvement of the Case Company's portal. Like the Knowledge Management Data, this data was processed with the use of a dashboard monitoring system and Data warehouse.

3.3.3 Technical Implementation. The technical implementation of this research included the creation of Data Warehouses (SAP InfoCubes) using SAP BW 7.0 and creation of Dashboard Monitoring systems using Xcelsius 2008, which are addressed in the following subsections.

3.3.3.1. Data warehouse creation. Data Warehouses (SAP InfoCubes) created using SAP BW 7.0 was one of the technical methods used to analyze the data for this research. The two sets of data used to assess portal usage, Knowledge Management Data and ClickStream Data, were fed into data warehouses (called InfoCubes) and then queries were built and run against the InfoCubes using Business Explorer - Query Designer to derive meaningful information from the large data set. The query results organized the numbers into a tabular format, which could be displayed in graphical format on the dashboard monitoring systems for quick and easy interpretation by company

executives. Data Warehouse is one of the tools used to study the actual portal usage and brought meaningful information as suggested in the research framework shown in Figure 1.1.

The technical details of the Data warehouse and its creation can be seen in Appendix A.

3.3.3.2. Dashboard implementation. This section addresses the actual portal usage monitoring by the dashboard monitoring system. The dashboard helped in deriving meaningful information out of the raw, unstructured portal usage logs obtained from Knowledge Management and ClickStream.

The dashboards were created using Xcelsius 2008, which is a product of SAP Business Objects Suite, and they were designed to monitor areas of interest to the Case Company.

The dashboards dealt with departmental as well as enterprise-wide data which was presented in a summarized format. The dashboards were built on top of one or more Data Warehouses, and they were designed to help the portal team and top management (managers and executives) make informed decisions about the structure and content of the employee portal. The main purpose of these performance dashboards was to optimize process and manage strategy by allowing the portal team and top management of the Case Company to analyze trends and study the changes and behavior of the users accessing the portal before taking appropriate action, to help the company gain strategic and competitive advantage over other companies in their sector. So based on the lessons learnt from literature review in section 2.2; the dashboard created

in this research can be classified as strategic-to-tactical dashboard. The trends obtained from the dashboard were compared to the Industry Standards and Best Practices so that various areas of improvement could be identified before changes were discussed and implemented.

3.3.3.2.1. Knowledge management monitoring dashboard. This was the first dashboard that was created for this research and it monitored the Content management data of the portal. The resulting data showed which files were accessed most by portal users as well as where the files resided in the folder structure of the Content management system. The location of the files provided insight about which folders contained the most frequently accessed files as well as identifying which files were not being used. Less ‘popular’ files could be deleted or moved to a more strategic location where the users are more likely to use them. This dashboard also provided a record of which types of files were downloaded (eg, .doc or .pdf). The information obtained by this dashboard is especially meaningful because it reflects the actual usage of the portal by users. This gave us meaningful results as suggested by the research framework in Figure 1.1. This is not discussed at length here in this study as this was a part of different research whose results are used here.

3.3.3.2.2. ClickStream data monitoring dashboard. This second dashboard was built to analyze the ClickStream data captured by Sweetlets and help identify the most used and least used pages, sections, and sub-sections within the portal. The dashboard measured how long each page, section and subsection of the portal was viewed. Assuming that users spend more time

viewing the items which they consider important and less time on pages they either don't find useful or happen to come across unintentionally, this can help rate the usefulness of portal content. Once this data was placed in a graphical format and compared to the Industry Standards and Best Practices and Perceived portal usage, it aided in the development of a set of recommendations for making the portal more user-friendly, efficient and effective.

The data used gathered by this dashboard was built on a data warehouse created using SAP BW 7.0, which was filled with the ClickStream data obtained from Sweetlets. The warehouse was then queried to obtain relevant sets of data that were then displayed in meaningful visualized form to highlight the trends of data usage. This gave us meaningful results as suggested by the research framework in Figure 1.1. The technical details of this dashboard and its creation can be seen in Appendix B.

3.4. COMPARISON AND ANALYSIS

After the results were gathered as described above (shown under the analysis section in figure 1.1), they were then compared. This analysis brought together Industry Standards and Best Practices - Literature Review and Case Studies, the Perceived Portal Usage - Company Visit and Third Party Evaluation; and Actual Portal Usage - Knowledge Management data and ClickStream data analysis. By comparing the different sets of data in different combinations,

meaningful information was obtained to help establish recommendations for improvements to the Case Company's enterprise employee portal.

4. RESULTS AND DISCUSSIONS

The multiple methodologies adopted in this research provided a rich set of results. All the results were then combined and analyzed to derive a set of recommendations for the Case Company to aid in its portal usability improvement decisions.

4.1. INDUSTRY STANDARDS AND BEST PRACTICES

The Industry standards and Best practices were established through literature review of peer reviewed journals and case studies, addressing the three aspects of: “Contents and Function,” “Design,” and “Implementation,” but focusing most on the “Contents and Function” aspect. The resulting information was used to create a comprehensive list of Industry Standards and Best Practices which can be used as a yardstick to measure an enterprise portal’s efficiency and effectiveness in terms of the functionality it provides, and its contents and functions.

An information mapping grid was developed as a complement to the standards list, which addressed on all the information collected from literature review and the case studies of real companies.

4.1.1. Literature Review. Numerous peer reviewed journal articles were included in the literature review to compile information regarding the contents and functions of an enterprise employee portal. Based on this

research, a comprehensive list of information items was created relating to the “Contents and Functions” of the employee portal and features of each information item as shown in table 2.1, which matches the features of every information item with the source journals.

4.1.2. Case Studies. To bolster the information collected from Literature Review, several actual companies’ employee portals were studied and their contents and functions were analyzed to establish a connection between literature and practice. The real companies’ portals studied included Dell, NAVSEA, Fijutsu Siemens, Sprint, Verizon, Eversheds, Point Loma, ABB, Idaho Lab and Piper Jaffray.

Company portal layout and structure is very confidential so licensed copies of high-standard reports were purchased for this research. No confidentiality has been breached or boundaries crossed in the creation of this document.

The commonalities of structure, layout, and navigation were analyzed across multiple companies. The literature and the case studies tied in well and similar themes were discovered in most sources, as shown in Table 4.2, which combines the findings of the case studies with the findings from the literature review to provide an even more comprehensive picture.

Contents and Functions of an Enterprise portal are the most visible portion of the portal, and they determine how useful the portal is to its users. With this in mind, contents and functions should cater to the needs of the company and its users as discussed in the following subsections.

4.1.2.1. Customization and Personalization. Customizing a portal or adding personalization features helps users relate to the portal and connect to it on a more personal level. The company may customize portals for different target user groups or they can allow individual users to personalize their own portal experience. Customization and personalization can include the ability to change the color and layout or it may be limited to the ability to rearrange selected components and tools within a static framework. Users may also be given a personal work space (a sub-section of the portal) to customize as they wish.

Social networking features are being incorporated into enterprise portals more than ever. Figure 4.1 shows a social networking page in an Enterprise Portal which allows employees to create their own profile. In this example, users can add a profile picture and even populate their profile with personal details (like hobbies, interests, etc.), which can help their co-workers relate to them on a personal level. Referring back to the literature review, Caya and Nielson (2010), Eckerson (2000), Gates (2001), Raol et al. (2003), Rapoza (2000), Succendran et al. (2012) and Hustad and Bechina (2012) recommended enterprise employee portals be either customized for specific target user groups or they must allow users to personalize the look and feel of the portal, since the portal aesthetics can add a level of comfort to the employees and add to the usability of the portal.

My Home Trading Post **My Profile**

Swanson, Kathy

Project Mgr 6, Marketing Admin
6000 2000000000

My Profile

- Details
- Links
- Colleagues
- Memberships

Details

Responsibilities: Internet and Web strategy.
 Skills: piperjaffray.com, Trading Post, and Piper Jaffray Online Services
 Past projects: PJC.COM, Trading Post, PJOS, COS
 Interests: Consultative volunteer work for non-profits interested in furthering Internet and Web-related initiatives.

Contact Information

Assistant: [blurred]
 Work e-mail: [blurred]
 Mobile phone: [blurred]
 Fax: [blurred]

Organization Hierarchy

Swanson, Kathy, Project Mgr 6

Custom Properties

CostCenter: [blurred]
 OfficerTitle: Vice President
 MailStation: [blurred]
 BranchNumber: [blurred]
 FaxNumber: [blurred]
 NickName: Kathy
 StateAddress: MN
 CityAddress: Minneapolis
 CountryAddress: United States

[Edit Details](#)

Figure 4.1. Social Networking

Figure 4.2 shows a customized page for the clients of Eversheds, which provides every client that logs in to the portal a customized view of the data as it pertains to their unique legal activity with Eversheds such as the latest versions of their very own the latest ECA (Early case Assessment) Documents. Referring back to the literature review, Caya and Nielson (2010), Eckerson (2000), Gates (2001), Valdes et al. (2010), Raol et al. (2003), Rapoza (2000), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al.(2012) and Al-Zagaier (2012) all have suggested that Social Networking could be used to enhance an enterprise employee portal.

home > case > demo caseroom

The screenshot shows the Eversheds CaseRoom interface. At the top, there is a navigation bar with buttons for 'home', 'know how', 'project', 'case', 'deeds', and 'library'. Below this is a breadcrumb trail: 'home > case > demo caseroom'. On the left side, there is a vertical navigation menu with the following items: '[Go Back]', 'Instructions', 'Early Case Assessment', 'Key Documents', 'Key Dates And Deadlines', 'Statements Of Case', 'Orders', 'Witness Evidence', 'Disclosure', 'Expert Evidence', 'Counsel's Opinion', 'Working Documents', and 'Authorities And'. The main content area on the right has a title 'Welcome to the Supplier Plc -v- User Limited Case Rc' and a sub-header 'Supplier Plc -v- User Limited Case Rc'. Below the title, there is a paragraph: 'Here you will find all the documents relevant to this matter. To get started, please see the table of content on the left.' Another paragraph follows: 'You can go back to view other cases by clicking the [Go Back] link in the table of content. If you have any questions or problems please do not hesitate to contact your extranet manager: **Karen White** on 020 7919 4839 or **Tracey Fields** on 020 7919 4523'. At the bottom of the main content area, there is a link 'Download the latest ECA Document' and a button labeled 'Eversheds CaseRoom.tif'.

Figure 4.2. Customized for Specific Users

Figure 4.3 is a screenshot of the University of California - Irvine's homepage, which is personalized for every user, based on her/his activity and preferences. The "Top 5 Searches" channel on the left side of the page will be different for each user because it lists the top 5 searches for each individual user. The "Bookmarks" channel located above the "Top 5 Searches" is not on all homepages since it is one of the customizable features that can be changed by each user by using the "Personal Profile" channel, which allows users to customize the items on their homepage. Referring back to the literature review, Caya and Nielson (2010), Eckerson (2000), Gates (2001), Valdes et al. (2010), Raol et al. (2003), Rapoza (2000), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al.(2012) and Al-Zagaier (2012) all suggested

customization of the portal page be incorporated in an enterprise employee portal so that there is more of relevant information for the user on the portal homepage which would attract the user.



Figure 4.3. Personalized Homepage

Figure 4.4 shows screenshot of Sprint's employee enterprise portal, which allows each user to change the layout of the portal homepage. The change layout button on the portal screen allows users to choose from three pre-set layout formats. They include: a narrow-wide 2 column layout (as shown in Figure 4.5), a wide-narrow 2 column layout, and a thin-wide-thin 3 column

layout (as shown in Figure 9). Sprint has a reputation as a company that pays a lot of attention to employee options such as these options for modifying the layout and enhancing usability and user-friendliness. Referring back to the literature review, Caya and Nielson (2010), Eckerson (2000), Gates (2001), Raol et al. (2003), Rapoza (2000), Bolu et al.(2012) and Al-Zagaier (2012) have recommended customization options as a way to enhance enterprise employee portals.



Figure 4.4. Change layout Functionality

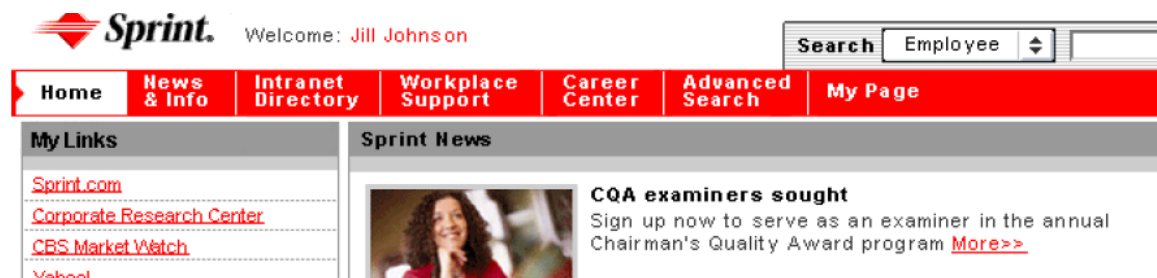


Figure 4.5. Change Layout Functionality

Figure 4.6 shows the SAP Corporate Portal top-level navigation, which is both a personalized and role-based, E-room/Digital Workplace. The only elements that stay common to all homepages are the company and portfolio

information. The location of tabs can be moved per each users' preference. It also provides the unique and elegant feature of visual focus, which enables the main content to dim around a highlighted dialog box. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Bolu et al. (2012), Succendran et al. (2012) and Hustad and Bechina (2012) have recommended customization features as a method to improve enterprise employee portals.

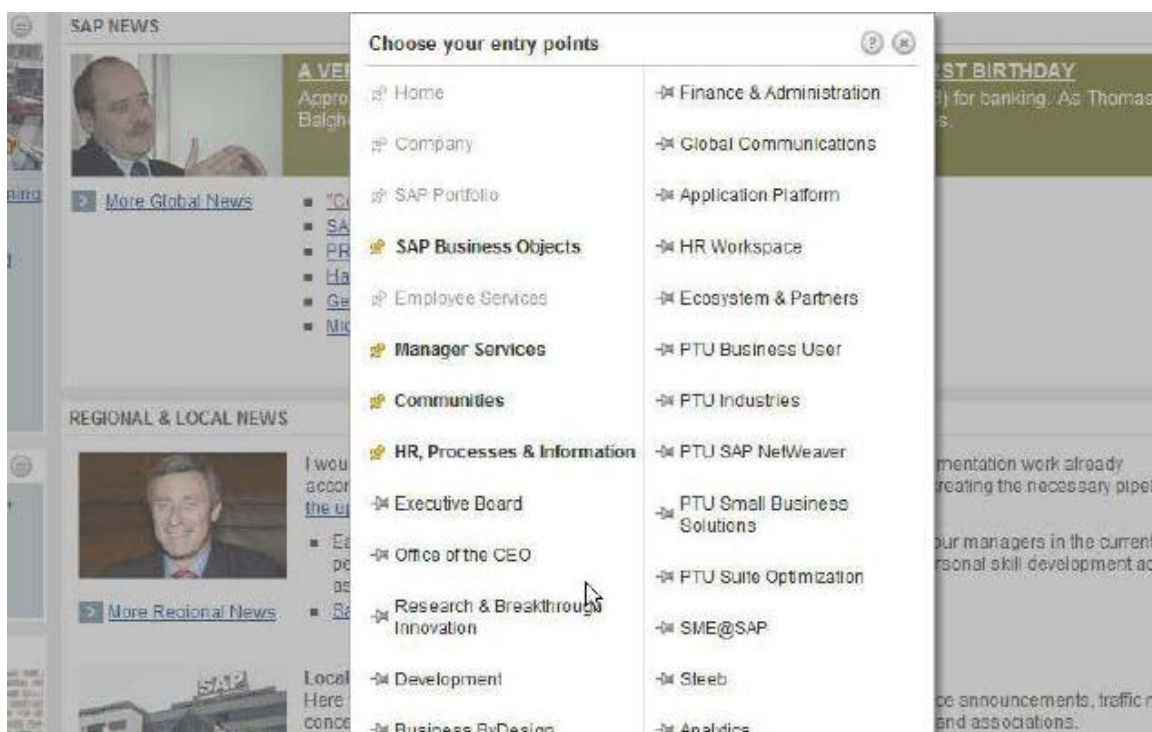


Figure 4.6. E-room/Digital Workspace

4.1.2.2. Communication and Collaboration. Communication and collaboration has frequently been dubbed the backbone of an organization. The seamless and timely flow of information between users and user-groups is vital

to any company. Companies today are more aware of this concept and try to bridge the gap between functional silos and try to encourage communication and collaboration at all levels. A majority of companies today are moving toward a more centralized structure and away from the decentralized structure which has been more prevalent in the past. Blogging, Collaboration rooms, threaded discussion, file sharing, and web-based communication are just a few ways organizations are integrating communication and collaboration into their daily business processes.

Figure 4.7 provides an example of a Blog written by a company's director and posted on the company's portal. This blog feature helps the Director disseminate his views on a various topics in an informal format. Similarly, other employees can also write blogs. Reading blogs, writing blogs and posting comments on co-workers' blogs can help improve communication between employees and management within an organization. Referring back to literature review, Caya and Nielson (2010), Raol et al. (2003), Bolu et al.(2012) and Hustad and Bechina (2012) have suggested blogs as a feature that may be useful for an enterprise employee portal.

The screenshot shows a web portal interface. At the top left, it says "HID Den". Below that is a navigation bar with "Crossroads PeaceHealth" logo and "Michael's Blog" title. A search box labeled "All Sites" is on the right. The navigation menu includes "HID Den", "HID Central", "Teams", "Cross-HID", "Blogs", "Feedback", and "Help".

The left sidebar contains several sections:

- Categories:**
 - HID Operations
 - HID Budget
 - Michael's family, friends, and fun
- Other Blogs:**

There are no items in this list.
- Links:**
 - Photos
 - Archive
 - Archive (Calendar)
- RSS Feed:** (with an RSS icon)

The main content area shows a breadcrumb trail: "HID Den > Blogs > Michael's Blog". Below this is a heading "Welcome to Michael's Blog". A date separator "5/14/2008" is followed by a post title "CareCast Lessons Learned". The post content is a block of Lorem Ipsum text. At the bottom of the post, it says "Posted at 10:00 AM by Michael" followed by links for "Permalink", "Email this Post", and "Comments (0)".

Figure 4.7. Blogging

Figure 4.8 shows a screenshot of NAVSEA’s portal. It includes a separate section for “Policies and Guidelines,” which contains the policies and guidelines for each page in a highly visible format. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Bolu et al.(2012) and Succendran et al. (2012) have suggested important information may be placed in highly noticeable locations for a more effective user experience on enterprise employee portals.

The screenshot displays the 'INSIDE NAVSEA CITY' website. At the top, there is a search bar with the text 'SEARCH' and a dropdown arrow. Below the search bar is a navigation menu with tabs for 'EMPLOYEE INFO', 'DIRECTORY', 'NEIGHBORHOODS', 'COMMUNITIES', and 'CALENDAR'. The current page is titled 'NEIGHBORHOOD LEADERS COMMUNITY'. The main content area includes a header with the title 'NEIGHBORHOOD LEADERS COMMUNITY' and a paragraph describing the community's purpose. Below this is a photo of three people and the text 'COMMUNITY LEADERS: Kave Walters, Matthew White and Kim Newton'. A yellow box highlights the 'POLICY & GUIDELINES' section, which contains four links: 'Neighborhood Leader Agreement & Access Plan', 'Guidelines for Developing Neighborhoods (please read)', 'Content Provider Guide', and 'Neighborhood Leader/Manager Guide'. To the right, there are two sidebars: 'NEWSLETTER' with a list of dates from July 15, 2002, to Sept. 6, 2002, and 'SURVEY' with the title 'How Many Center Providers Does Your Neighborhood Have?' and a bar chart showing four categories with varying lengths of bars.

Figure 4.8. Policies and Guidelines

Figure 4.9 shows three other communication and collaboration features used here on the customizable Sprint homepage. The first is a “My Links” channel, on the left panel of the page, which is a time-saving and convenience-enhancing feature that provides a list of the links they frequently visit. Next, we find the “News” channel. In the screenshot below it is labeled “Sprint News” and located in the center panel of the page. It allows the company to broadcast its news to the users and communicate with the company via their customized portal pages. Many companies place similar features on their employee portal homepages to catch viewers’/users’ attention. Last, but not least, is the “Events” channel located on the right panel of the Sprint portal page below, and it allows users to view a list of all of upcoming events in the organization at a glance. Referring back to the literature review, Caya and

Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006) and Succendran et al. (2012), Bolu et al. (2012), Al-Zagaier (2012) have suggested incorporating similar features into enterprise employee portals.

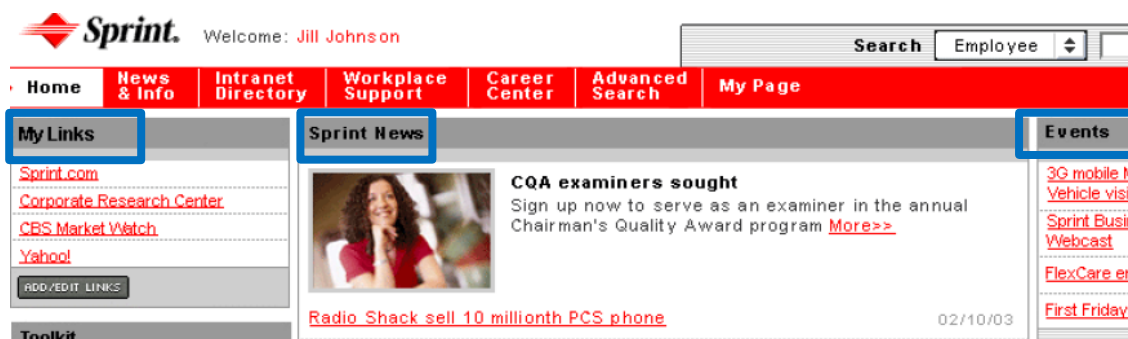


Figure 4.9. My Links, News and Events

Figures 4.10 and 4.11 are examples of a Portal feedback form and Suggestion Box. Employee feedback features are being used more frequently in today's business world. They allow employees to post suggestions, comments, and questions to the portal, which in turn can help the portal team to identify usability issues and or suggestions for improvement, in addition to making the employees feel that their opinions are valued by the company. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006) and Succendran et al. (2012) have suggested incorporating employee feedback mechanisms into enterprise employee portals.

The screenshot shows the Dell Employee Storm portal. At the top, there is a navigation bar with links for 'Ideas Employee Storm', 'Blogs One Dell Way', and 'Resources Simplify IT'. A welcome message for 'eric_moorehead' is visible. The main header features the text 'EMPLOYEE STORM WHERE YOUR IDEAS REIGN' and a statistic: 'The Dell Community has contributed: 4005 ideas | promoted 209266 times | 16309 comments'. A process flow diagram titled 'How Employee Storm Works:' includes four steps: 'POST...' (your idea for a new Dell product/service), 'PROMOTE...' (interesting ideas you want to see), 'DISCUSS...' (with Dell and other users), and 'SEE...' (what we are planning to develop). Below this, there are tabs for 'popular ideas', 'recent ideas', 'comments', and 'ideas in action'. A specific idea is highlighted: 'Create Public WiFi for customers, partners...and employees.' with 260 points, posted to 'IT - Internal Tools' by 'eric_moorehead' on Apr 10. The idea is marked as 'UNDER REVIEW'. A sidebar on the right shows the user's profile 'eric_m' with 2 ideas, 47 votes, and 19 comments.

Figure 4.10. Portal Feedback

The screenshot shows a 'Suggestion Box' form for 'Elly*'. The form includes a header with the text 'We value your opinion and welcome your suggestions' and a sub-header 'Edens&Avant will continuously improve based on your input. We look forward to hearing your questions, comments, and ideas.' Below this, there is a 'Subject:' field with a dropdown menu currently set to 'Company'. There are two checkboxes: 'Mark my comments anonymous:' and 'Mark my comments confidential:'. At the bottom, there is a 'Comments (required)' field with a text area for input.

Figure 4.11. Suggestion Box

Figure 4.12 shows a Communities feature of a portal; this example uses the SAP portal, but many other portal vendors use similar features. This community feature enables multiple users with similar interests to “meet” and collaborate. Communities typically have an owner and members must apply for membership and be accepted before they can join the group. This can be a very useful feature, particularly for large global companies where the workforce is spread across the globe. Within the communities page, documents may be posted and discussions conducted based on the community interests. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al. (2012) and Hustad and Bechina (2012) have suggested incorporating a communities feature into enterprise employee portals.



Figure 4.12 Communities

Figure 4.13 illustrates a feature that allows an employee to view themselves or other employees in a flowchart of the organizational. This can help a user understand exactly where other employees fall within the company's organization structure and it allows the user to drill down to view the organizational chart for each of the employees who were included in the first chart. Referring back the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al. (2012), Succendran et al. (2012) and Hustad and Bechina (2012) have suggested incorporating organizational chart mapping features into enterprise employee portals.



Figure 4.13. Employee Information Organizational Chart

Figure 4.14 shows an Interactive organizational chart, meaning the chart shows the employee's position relative to other sections of the company's organizational chart, depending on the employee's search criteria. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al. (2012), Succendran et al. (2012) and Hustad and Bechina (2012) have suggested incorporating an interactive organizational structure feature into enterprise employee portals.

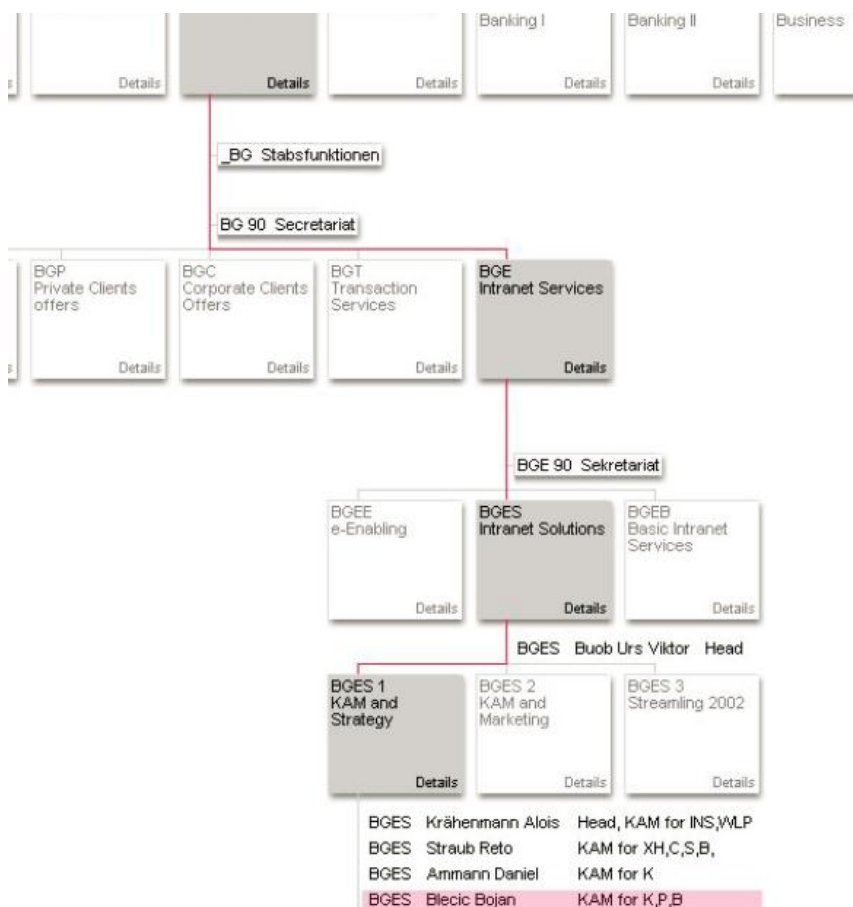


Figure 4.14. Interactive Organizational Chart

The presence of a calendar, as shown in Figure 4.15, is a ubiquitous part of almost every portal. It helps a user keep track of their obligations and commitments and allows the organization to communicate different events or holidays in the calendar year. This is a very important piece of communication as it keeps employees informed in a user-friendly, easy-to-understand, and non-intrusive manner. The calendar can be placed at different places on the portal page depending upon the company's or the user's preference depending on whether the page is customizable. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006) and Sugianto and Tojib (2006) recommended incorporating a calendar feature into every enterprise employee portal.

The screenshot displays a web portal with several sections. On the left, there are three vertical panels: 'SURVEY' with the title 'WHAT IS YOUR INTERNET PROVIDER OF CHOICE?' and links for 'Internet Explorer', 'Netscape', and 'Other'; 'CORNER' with the title 'BELLINGS SCORE SCIENCE SCHOLARSHIPS' and a snippet about 'Twin brothers Alan and Andre Menino'; and 'COGNITION' with the title 'L. CANTERBURY'. The main content area features a 'MY STUFF' section with a 'QUICKLINKS' and 'LIBRARY' tab. Below this is a 'CALENDAR' widget for 'NOVEMBER 2001' showing a grid of dates from 1 to 30. To the right of the calendar is a 'MY WEATHER - ALEXANDRIA VA US' widget. It includes 'TODAY'S WEATHER:' with 'HI 49°' and 'LO 35°', a weather icon, and a table for 'SAT' and 'SUN' with their respective high and low temperatures. At the bottom of the weather widget, it lists: 'Temperature: NA° - Visibility: NA mi - Dewpoint: NA° - Wind: IIA/NA mph'. An image of the USS Mobile Bay (CG 53) is shown to the right of the text, with a caption: 'USS Mobile Bay (CG 53), one of two Pacific Fleet ships participating in the Navy's Optimal Manning Project (BA)'. A 'READ MORE' link is located below the text.

CALENDAR

NOVEMBER 2001						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

MY WEATHER - ALEXANDRIA VA US

TODAY'S WEATHER:	SAT	SUN
HI 49°		
LO 35°	HI 43 LO 32	HI 45 LO 27

Temperature: NA° - Visibility: NA mi -
Dewpoint: NA° - Wind: IIA/NA mph

Figure 4.15. Calendar

Figure 4.16 illustrates the use of a separate link to access the company e-mail (in this case called ZotMail), which may be provided on the portal page to facilitate communication between users. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006), Sugianto and Tojib (2006), Bolu et al. (2012) and Hustad and Bechina (2012) suggested incorporating link to e-mail service into enterprise employee portals.



Figure 4.16. E-mail ZotMail

The Figure 4.17 is a screenshot of the Navsea employee portal, which uses a separate channel for organizing a user's various communication and

collaboration Tools and Apps. Using this option, employees can select and display all the tools and apps that they find useful in an easily accessible location right on their homepage. Referring back to the literature review, Caya and Nielson (2010), Raol et al. (2003), Tojib et al. (2006), Bolu et al. (2012), Succendran et al. (2012) and Hustad and Bechina(2012) suggested incorporating a separate tab or small section where all the tools and applications chosen by the user can be organized together, into enterprise employee portals.

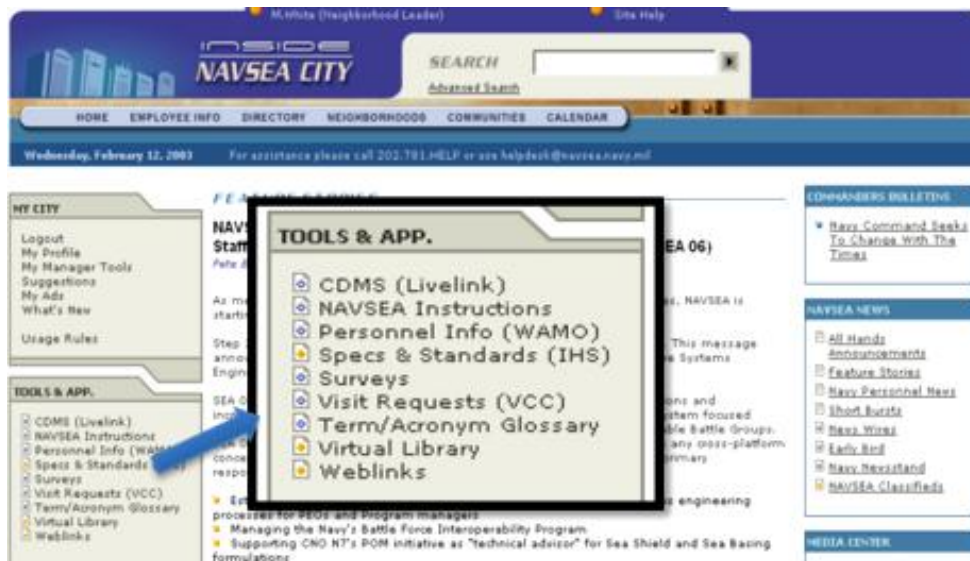


Figure 4.17. Tools and Applications

Figure 4.18 shows a state-of-art technology known as Live Video. Companies can stream live video on the portal to all members of the organization unfettered by geographic boundaries. This tool can help communicate a single message to all locations at the same time, which can be

especially helpful in global organizations. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), Al-Zegaier and Barakat (2012) and Hustad and Bechina (2012) have suggested incorporating Live Video into enterprise employee portals.



Figure 4.18. Live Video

Figure 4.19 shows a web communication tool that allows management or company executives to post a pre-recorded clip to the employee portal. Many CEOs use online web communication to disseminate important sound bites from eminent persons within the organization. This tool is especially useful since the information can be recorded so that it can be retrieved and watched as needed in the future. It can greatly enhance communication among employees in

different locations in a global company. Today, there are many service providers helping companies get into web communication. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), Al-Zegaier and Barakat (2012) and Hustad and Bechina (2012) have suggested incorporating online web communication into enterprise employee portals in one form or another.



Figure 4.19. Web Communication

Figure 4.20 is a screenshot of a collaboration page on Colgate's employee portal. This page is the homepage of the collaboration section, which has been titled "Teamwork Resources." As the name suggest, the page gathers all the collaboration tools in this one location for the employees. This is a

classic example of usability. The various tools like eTeamRoom, Networks, Profiles, eMeeting and Communities can all be accessed from one page. This page also includes links to a short description of each tool or application. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Raol et al. (2003), Sugianto and Tojib (2006), Bolu et al. (2012) and Hustad and Bechina (2012) have suggested incorporating collaboration tools into enterprise employee portals.



Figure 4.20. Collaboration

The 85-85 rule is a rule used by Boeing in its portal communities. It is used to ensure that the portal community is useful to the employees, and it

appeals to the users. Ultimately, this technique makes portal adoption much easier. According to this rule, 85 percent of the information appearing on the portal must apply to every member of that community, *and* 85 percent of their online tools should be available there. Figure 4.21 shows Boeing's portal developers' community. With the 85-85 rule in effect, the community works very efficiently for almost every user of the portal development team. There are a few exceptions, especially for groups such as the portal developer's team who include a few specialists that require a specialized set of products, but the 85-85 rule ensures that the portal is relevant to the majority of users. Referring back to the literature review, Caya and Nielson (2010) and Raol et al. (2003) have suggested incorporating the 85-85 rule into enterprise employee portals.

The screenshot displays the Boeing portal interface for the 'CORE TEAM'. The top navigation bar includes 'My Pages', 'Customizations', 'Documents', 'Tools & Services', and 'Total Access'. The main content area is organized into several columns:

- Quick Reference:** Lists tools like ETS, TEAMS, Paging Tool, RCPS Tool, Virtual Office Reservations, SNAP (Outage) Record, LEAD, Inside Boeing, NSP Vacation Calculator, eBTC, eBTC Engagement & Deployment, and eBTC Solution Development.
- Collaboration Tools:** Includes Communications (Instant Messenger, Outlook Web Access), File Sharing (File Transfer Services Information, BPN-File Transfer Service, FTP Dropbox), Conferencing (Audio Conferencing Request, Conference Room Resources, WebEx Meeting Center), and Virtual Team Rooms (Windows SharePoint Services Help).
- Welcome Portal Team - It's just a click away...!:** Features Team Tools (Contact List, BCA Community Index, BCA Portal Website, ClearQuest (CR System), Get Started-For Business Partners, Get Started-For Developers, Team Org Chart, Vacation Scheduler (2005), Vacation Scheduler Tip Sheet, Balanced Scorecard) and What's Up! (See Celebration Photos!, BPET - January 20, 2005, BCA Internal Portal Product Strategy, 2004, What's up with 5.0?, Go to BU Dev, Go to 5.0 Pre-Prod, Go to 5.0 Prod, Issues/Action Items (SharePoint), Portal SharePoint site - Home, IT Transition to SSG).
- Boeing Search Everything:** A search interface with a dropdown for 'Select a search category...', a search criteria input field (Example: Lastname, First init), and Search/Help buttons.
- Release Schedules:** Lists February (R54, R55, R56, R57) and March (R58, R59, R60, R61) releases, along with links for Past Releases, Balanced Scorecard & Metrics, Plumtree 5.0 Daily Status Archive, and Skills & Training for Plumtree 5.0.
- Community Status:** Links to Community Engagement Status and Business Unit/Process Council Matrix.
- Business Analyst Tools:** Links to Executive Training Materials, Agenda Tool User Guide, Core Gadget User Guide, and CAT Process.
- Developer Tools:** Links to For Developers Page in Get Started.
- Standard Processes:** Links to BCA Portal Logistics, Change Mgmt Procedure-P032, and Configuration Mgmt. Plan.

At the bottom, there is a section for 'Copy of Meeting Manager Administration (CP)' with a link to 'BCA Portal Core Team Meeting List'.

Figure 4.21. 85-85 Rule

The feature of Threaded Discussion shown in Figure 4.22 is available in most of the portals today. Discussion threads allow users from different

locations to post comments and replies about one subject (or thread). This can be useful in gathering input and feedback from users on a certain topics, and may be an effective tool for troubleshooting problems since it records every step of the communication in a single thread. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Raol et al. (2003), Al-Zegaier and Barakat (2012) and Bolu et al. (2012) suggested incorporating threaded discussions into enterprise employee portals.

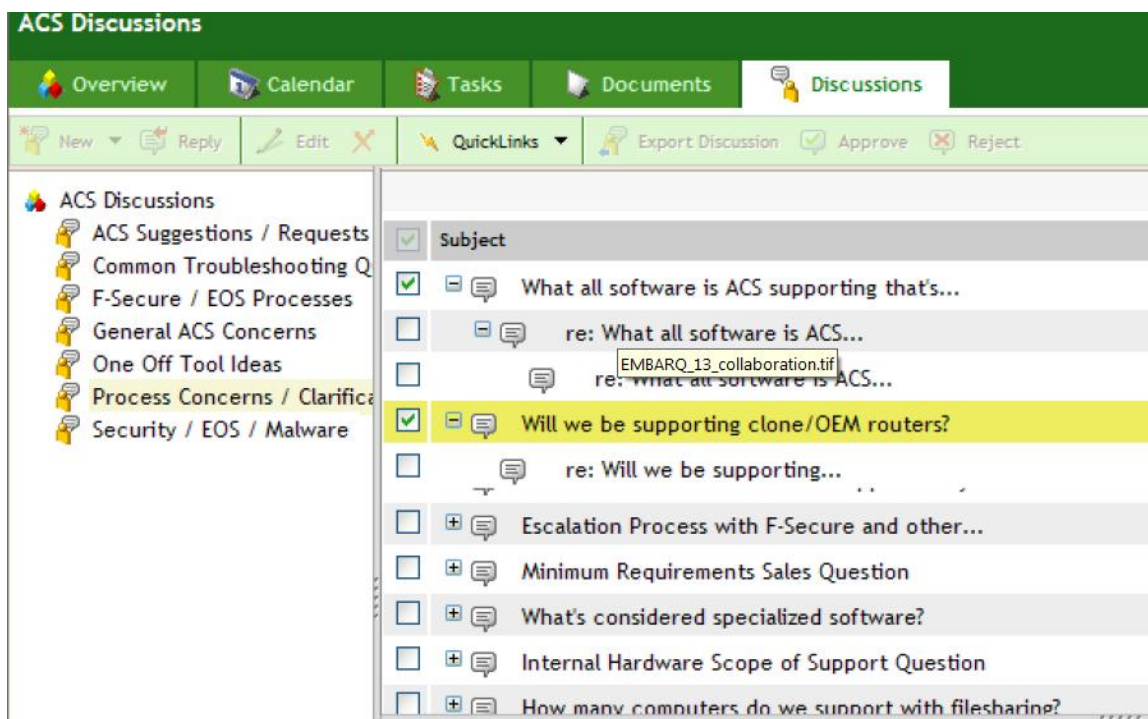


Figure 4.22. Threaded Discussion

4.1.2.3. Search Function. A search function may be incorporated into an organization's portal in many different formats, including Drop-Down,

Advanced Search, or Two-Box drop down, just to name a few. Figure 4.23 displays the Drop-Down form of the Search functionality. As the user types a keyword into the search box, a drop down is populated with suggested terms from which the user can select. Referring back to the literature review, Caya and Nielson (2010) and Raol et al. (2003) suggested incorporating this search feature into enterprise employee portals.

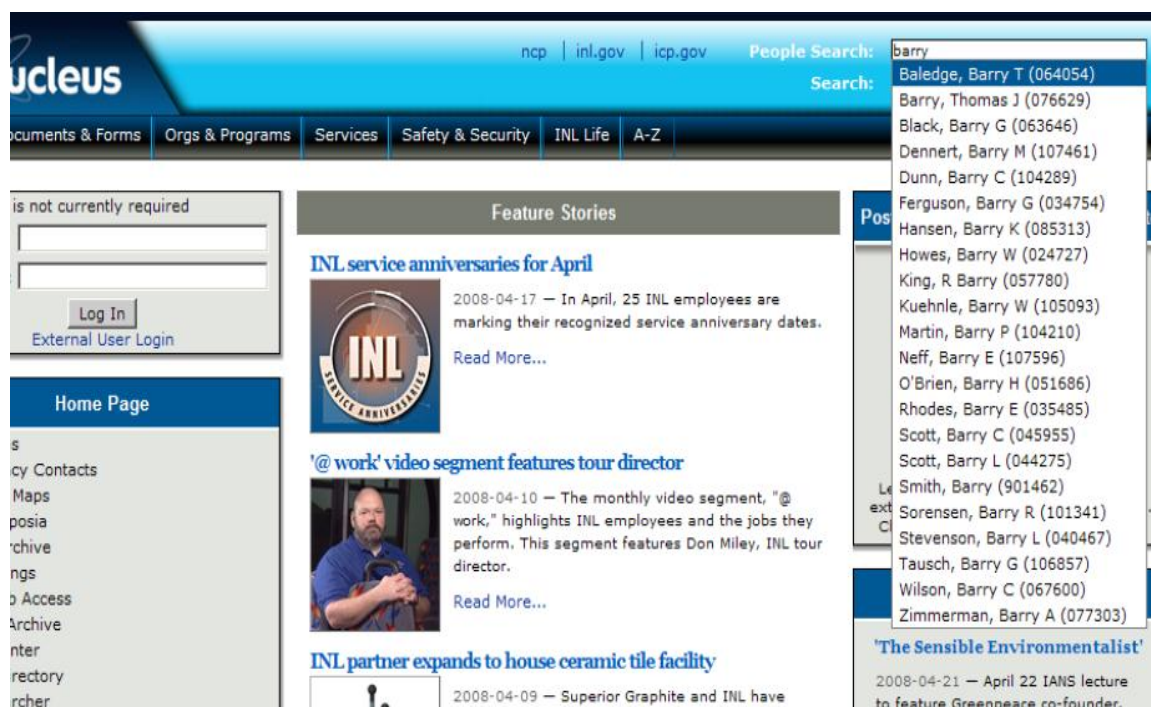


Figure 4.23. Drop-down search

An advanced search is a function that allows the user to refine search results by including more criteria rather than just the single keyword allowed in a general search. This is a good option when the user has more details about the search subject, which can provide a more relevant result. Figure 4.24

illustrates ABB's advanced search page. In this example, the advanced search functionality reduced the returned search results from 240 (from the general search) to 122 (advanced search). Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), Raol et al. (2003), Al-Zegaier and Barakat (2012) and Bolu et al. (2012) suggested incorporating advanced search into enterprise employee portals.

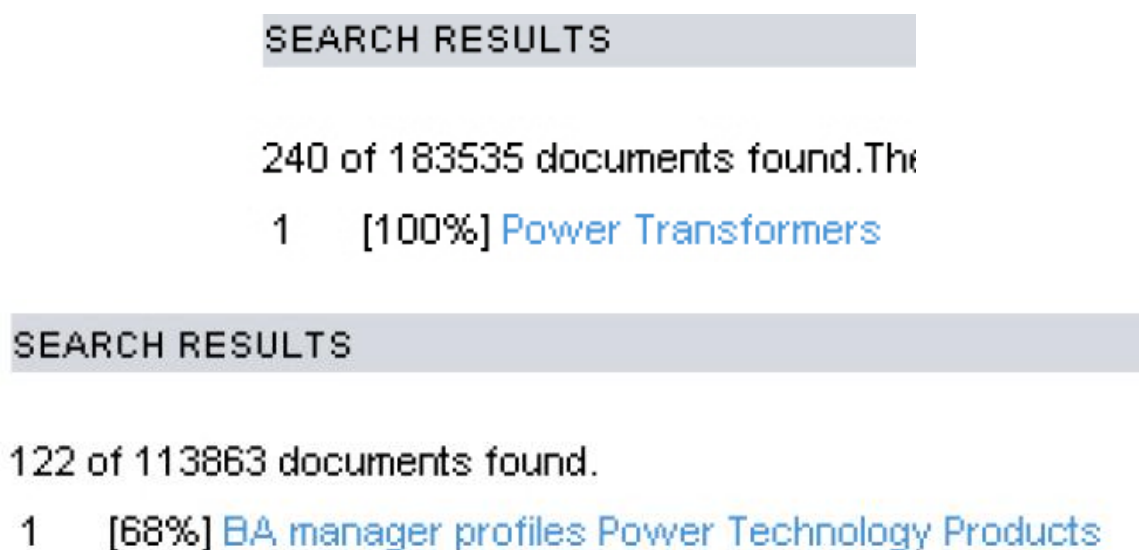


Figure 4.24. Advanced Search

4.1.2.4. Help and FAQ. Help and FAQ are standard functions on almost every enterprise portal. They help the user become comfortable with the portal more quickly, and reduce the learning curve required to use the enterprise portal. Referring back to literature review, Caya and Nielson (2010),

Raol et al. (2003), Succendran et al. (2012) and Bolu et al. (2012) suggested incorporating Help section and FAQ section into enterprise employee portals.

As stated above, the Help functionality present on most portals and its utility is frequently taken for granted. It is extremely important for a company to offer high quality assistance and information via the Help function, to prevent user frustration, and reduce the calls to the IT help desk for items which could be easily solved by the user. Figure 4.25 shows the Help link at the top right of the University of California - Irving's portal page. A Help function is so common that it is frequently considered a standard requirement.

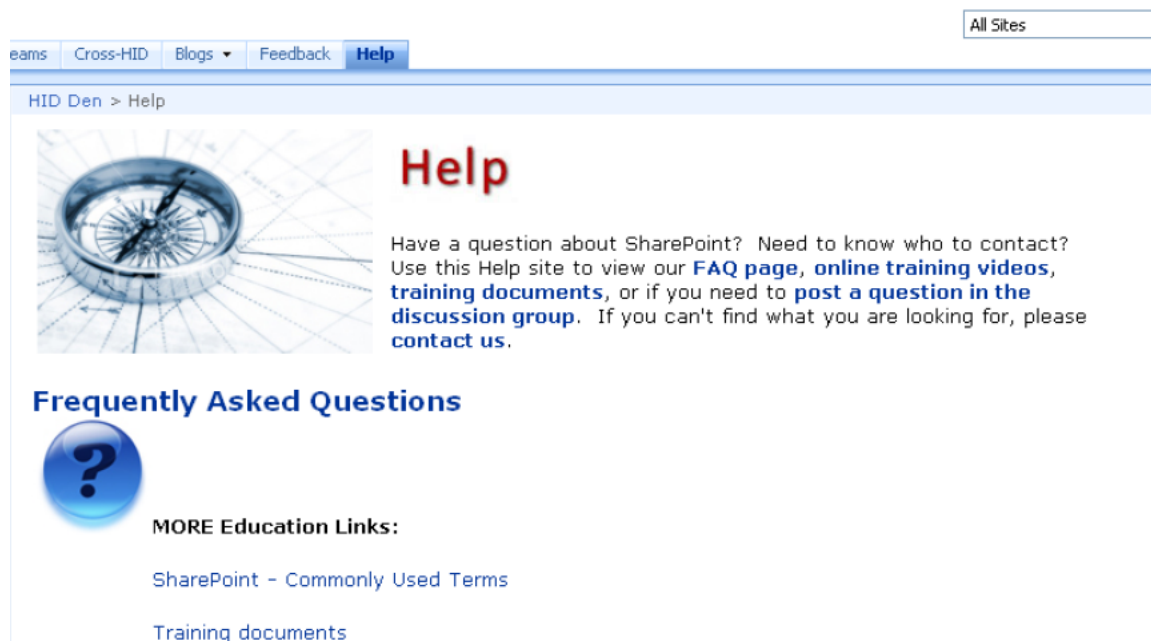


Figure 4.25. Help

Figure 4.26 illustrates the Frequently Asked Questions (FAQ) link on the Sprint portal. Like the Help function, a FAQ section must be loaded with high quality information and must be updated regularly by the organization to make it most beneficial for its users.



Figure 4.26. FAQ

4.1.2.5. Self Services. As Enterprise portal can provide many self-service options, which allow employees to accomplish tasks that may have been delegated to other employee groups in the past. For example, HR self-service allows employees to monitor their pay statements and manage their pay online without assistance from HR personnel. Similarly, self-service travel and expense management options can allow employees to report their expenses and manage reimbursements online via an application without involving HR or the expense department. Similarly, self-service sick-leave options allow employees to apply for and track sick leave. Additionally, training and workshops are frequently offered online in a self-service format,

eliminating the need for presenters or trainees to be physically present. Many training and workshops are now offered in a recorded format that allows users to access them when it is convenient, thus avoiding scheduling conflicts. Self-service streamlines the system and reduces the risk of human-induced errors by reducing the number of people who handle information before it is entered into the system, and also reduces the time and human labor requirements for many functions.

Figure 4.27 shows the HR Self-Service page of ABB's employee portal, which allows employees to post their resume, search new internal job opportunities within the company, and apply for jobs. Depending upon the company, a self-service section may include a resume editing service, HR information regarding pay statements and taxes, career development opportunities, and other HR essentials which the employees may require from the HR department. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), Succendran et al. (2012) and Bolu et al. (2012) suggested incorporating self - service for Human Resource purposes into enterprise employee portals.

The screenshot displays the ABB HR Self Service portal. At the top left is the ABB logo. A navigation bar contains links for 'ABB Group', 'Divisions', 'Countries', 'News', 'Our Profile', 'Organization', 'Customer Focus', 'Tools & Services', and 'Working with ABB'. A dropdown menu under 'Working with ABB' lists 'Employee Services', 'Careers & Development', 'News & Information', 'HR Essentials', and 'HR Portal'. The main content area features a banner with a group of diverse employees and the text 'Welcome to ABB's CV Posting Site'. Below this are four buttons: 'Post your CV', 'Edit your CV', 'View your CV', and 'Delete your CV'. A 'Did you know?' section includes a small image labeled 'ABB cvs.tif' and a bullet point: 'You can use your CV/resume to apply for jobs in ABB? Just click the "Reuse your CV/R' (partially cut off).

Figure 4.27. HR Self Service

Figure 4.28 shows a Medical Services' page on Boeing's portal, which automates the process of applying for leaves, checking leave balance, and balancing pay and leaves. Managing leaves on the portal helps reduce the users' dependency on the HR department by allowing them to perform these functions without assistance via the portal. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), and Succendran et al. (2012) suggested incorporating leave management self-service into enterprise employee portals.

The screenshot displays the Boeing TotalAccess portal interface. At the top, there is a navigation bar with the Boeing logo and 'TotalAccess' text. Below this is a menu with 'My Pages', 'Communities', 'Documents', 'Tools & Services', and 'TotalAccess'. A secondary navigation bar includes links for 'HOME', 'MY PROFILE', 'MY WORK', 'MY PAY & INCENTIVES', 'MY CAREER', 'MY SAVINGS & PENSION', and 'MY HEALTH & Y'. The main content area is divided into several sections:

- Paycheck:** A section with a dollar sign icon, a date dropdown set to '2004/06/03', and a 'View' button.
- Pay Actions:** A section with a message: 'Your browser must be Internet Explorer 5.x or better to perform Pay Actions.' It includes links for 'Direct Deposit and e-Stub Election' and 'W-4 Employee's Withholding Allowance Certificate'.
- W-2 Annual Wage Reporting Form:** A section with a 'W' icon, a message: 'Select the year desired and click View.', a year dropdown set to '2003', and a 'View' button.
- Overtime Summary:** A section titled 'as of May 27, 2004' containing a table:

Shift	YTD	Quarter	Current Pay Period	Current Week
1	0	0	0	0

 Below the table are 'Hide' and 'Help' buttons.
- Vacation & Sick Leave:** A section titled 'As Of: 06/03/2004' containing:

Vacation Eligibility Date	08/19/1986
Vacation Balance	61.6
Sick Leave Eligibility Date	08/19
Current Sick Leave Balance	26.0

Figure 4.28. Leaves Balance

Figure 4.29 depicts a Travel services page on a portal, which helps users manage their travel. Much of the information has been grayed out due to confidentiality issues, but most of the basic functionalities are still visible. This page automates many travel related issues, which otherwise would require significant support from the HR or travel departments. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006), and Succendran et al. (2012) suggested incorporating travel expense reporting and management self-service into enterprise employee portals.

PiperJaffray TradingPost

People Search

Home Corporate Information Business Support My HR Departments

Home / Business Support / Travel Services

Travel Services

NEW FEATURE

Piper Jaffray recently implemented a new [online travel](#) management tool that allows you to make your own air, hotel and car arrangements. The service, provided by [Travelocity](#), searches public and corporate fares to find you the greatest savings. It also stores your travel history so you can easily book a new trip based on previous travel information.

[Log in](#)

Once the account is created, login and enter your profile information and book travel.

[Register](#)

For a new travel account, either for yourself or for someone for whom you manage travel.

[View online demo](#) (35 mn) for travelers and travel arrangers.

For technical questions, please contact [PiperJaffray Travel](#) help desk via [e-mail](#) or by calling [888.738.8888](#). The help desk is available 24 hours a day, seven days a week.

[Who to call for help in travel services](#)

Figure 4.29. Travel Services

Figure 4.30 shows a Training page on a portal. This state-of-art feature helps to reduce time spent in physical classroom training, as well as human capital and resource requirements. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006) and Succendran et al. (2012) suggested incorporating online web based training into enterprise employee portals. Computer based training is gaining popularity in every company because it reduces training time and effort. It may be a video based training, an interactive presentation or just a repository of company specific online help documents.

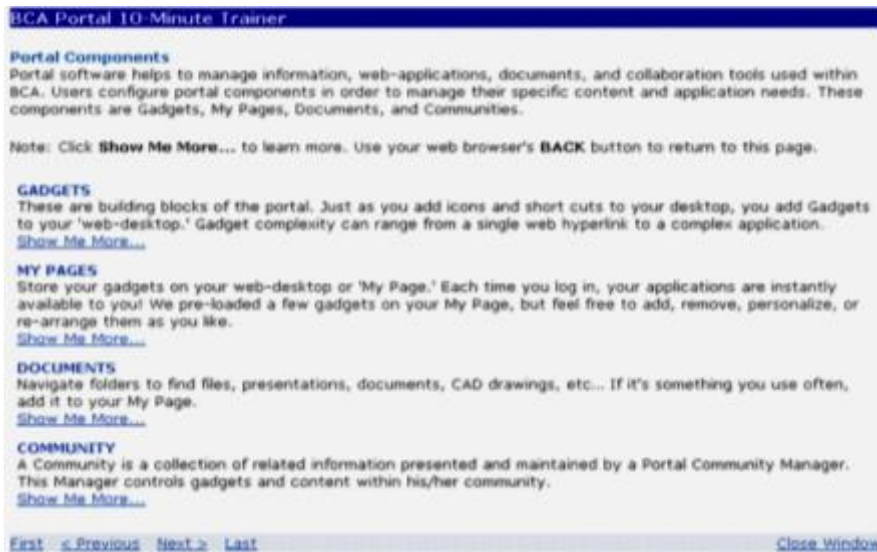


Figure 4.30. Training

Figure 4.31 shows a link to a dashboard tab on the Colgate portal. The addition of a dashboard helps provide executives with insights into company trends. In this case, the dashboard has not been displayed in the screenshot because of confidentiality issues. As discussed earlier in this document, a dashboard can be very motivating and informative for both employees and management. Referring back to the literature review, Caya and Nielson (2010), Tojib et al. (2006), Sugianto and Tojib (2006) and Succendran et al. (2012) suggested incorporating executive dashboards into enterprise employee portals.



Figure 4.31. Dashboard

4.1.3. Information Mapping Grid. This is the comprehensive result obtained by tying together results of Literature Review and Case Studies with respect to the Contents and Functions of an Enterprise Employee Portal. The information mapping grid is defined to make analysis easier as shown in Table 4.1 below. This is one of the most important results of this research, as suggested in the research framework in Figure 1.1.

Table 4.1. Information Mapping Grid

INFORMATION CATEGORIES	INFORMATION ITEMS	PEER REVIEWED JOURNAL ARTICLES	APPLICATION IN COMPANIES/INDUSTRY PRACTICES
Customization and Personalization	Social Networking	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Raol et al. (2003), Rapoza(2000), Succendran et al.(2012), Hustad and Bechina.(2012)	Piper Jaffray, Eversheds, Verizon
	Customized for Specific Clients	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Valdes et al.(2010), Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Verizon
	Personalized homepage	Caya and Nielson (2010), Eckerson(2000), Gates(2001), Valdes et al.(2010), Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib (2006), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Piper Jaffray, Fijitsu Siemens, Boeing, ABB
	Personal Stuff tab	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Raol et al.(2003), Rapoza(2000), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	UC Irvine, Sprint, Point Loma University
	Layout and Color	Caya and Nielson(2010), Eckerson(2000), Gates(2001), Valdes et al.(2010) Raol et al.(2003), Rapoza(2000), Tojib et al.(2006), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	Sprint, Fijitsu Siemens
	Selecting Resources	Caya and Nielson(2010), Raol et al.(2003), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	NAVSEA, UC Irvine, Sprint, Dell
	E-Room Digital Workspace	Caya and Nielson(2010), Raol et al.(2003), Succendran et al.(2012), Bolu, et al.(2012), Hustad and Bechina.(2012)	Sprint, Point Loma University, Boeing
Communication and Collaboration Tools	Blogs	Caya and Nielson(2010), Raol et al.(2003), Bolu, et al. (2012), Hustad and Bechina.(2012)	Dell
	Policies / Guidelines / Benefits	Caya and Nielson(2010), Raol et al.(2003), Sucendran et al.(2012), Bolu, et al. (2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Dell, Idaho Lab, ABB
	Events	Caya and Nielson (2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)	NAVSEA,UC Irvine, Sprint, Point Loma University, Idaho Lab, ABB
	News	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006) Raol et al.(2003), Succendran et al.(2012), Bolu et al.(2012), Al-Zagaier and Barakat (2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Dell, Idaho Lab, ABB, Fijitsu Siemens, Piper Jaffray, Boeing
	My Links/ Popular Links/ Quick Links	Caya and Nielson(2010), Sugianto and Tojib(2006), Succendran, et al. (2012), Bolu, et al.(2012), Hustad and Bechina.(2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Dell, Idaho Lab, Fijitsu Siemens, Piper Jaffray, Boeing
	Feedback	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Seccendran et al.(2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Dell, Fijitsu Siemens, Boeing
	Quick Poll	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006)	NAVSEA, Sprint, Point Loma University, Dell, Idaho Lab, ABB
	Community	Caya and Nielson(2010), Tojib et al.(2006), Raol et al. (2003), Sugianto and Tojib(2006), Bolu et al.(2012), Hustad and Bechina.(2012)	NAVSEA, UC Irvine, Point Loma University, Eversheds, Dell, Idaho Lab, Boeing, ABB

Table 4.1. Information Mapping Grid (contd.)

INFORMATION CATEGORIES	INFORMATION ITEMS	PEER REVIEWED JOURNAL ARTICLES	APPLICATION IN COMPANIES/INDUSTRY PRACTICES
	Employee Directory/Information	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006) Succendran et al.(2012), Bolu et al.(2012), Hustad and Bechina.(2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Dell, Idaho Lab, ABB, Fijutsu Siemens, Piper Jaffray, Boeing
	Calendar	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006)	NAVSEA, UC Irvine, Point Loma University, Eversheds, Idaho Lab
	E-Mail	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Hustad and Bechina.(2012)	UC Irvine, Point Loma University, Fijutsu Siemens, Idaho Lab, ABB
	Tools and Applications	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Succendran et al.(2012), Bolu et al.(2012), Hustad and Bechina.(2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Dell, Idaho Lab, ABB, Piper Jaffray, Boeing
	Streaming Video and Web Communication	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Al-Zegaier and Barakat (2012), Hustad and Bechina.(2012)	NAVSEA, Piper Jaffray, Boeing
	85-85 Rule	Caya and Nielson(2010), Raol, et al.(2003)	Boeing
	Document / File Sharing	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zegaier and Barakat (2012), Hustad and Bechina.(2012)	NAVSEA, Piper Jaffray, Boeing, Fijutsu Siemens, Idaho Lab, ABB
	Threaded Discussions	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Bolu et al.(2012), Al-Zegaier and Barakat (2012)	Dell
Search Function	Advanced Search	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Bolu et al.(2012), Al-Zegaier and Barakat (2012)	NAVSEA, Sprint, Point Loma University, Eversheds, Dell, Idaho Lab, ABB, Fijutsu Siemens, Piper Jaffray, Boeing
	Federated Search Engine	Caya and Nielson(2010), Tojib et al.(2006), Raol, et al.(2003), Sugianto and Tojib(2006), Al-Zegaier and Barakat(2012)	Fijitsu Siemens, ABB
	Drop Down	Caya and Nielson(2010), Raol, et al.(2003)	
FAQ		Caya and Nielson(2010), Raol, et al.(2003), Succendran et al.(2012), Bolu, et al.(2012)	NAVSEA, UC Irvine, Eversheds, Dell, Idaho Lab, ABB, Fijutsu Siemens, Piper Jaffray
Help		Caya and Nielson(2010), Raol, et al.(2003), Succendran et al.(2012), Bolu, et al.(2012)	NAVSEA, UC Irvine, Sprint, Point Loma University, Eversheds, Dell, ABB, Fijutsu Siemens
Employee Self Service	Career	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)	NAVSEA, Sprint, Eversheds, Dell, Idaho Lab, ABB
	HR Self Service	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012), Bolu, et al.(2012)	NAVSEA, UC Irvine, Sprint, Eversheds, Dell, Idaho Lab, ABB, Piper Jaffray, Boeing
	Medical Service/ Leave Balance	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)	Dell, Boeing
	Travel Services	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)	UC Irvine, Sprint, Piper Jaffray, Dell
	Training	Caya and Nielson(2010), Tojib et al.(2006), Sugianto and Tojib(2006), Succendran et al.(2012)	NAVSEA, UC Irvine, Boeing, Eversheds, Idaho Lab, ABB

4.2. USER PERCEIVED PORTAL USAGE

As mentioned in section 3.2, the perceived usage of the portal was measured using two approaches; one being company visits and direct interaction with the IT portal team experts, and the other from the results of a third-party evaluation. The results from each approach are explained in the following sub-sections.

4.2.1. Company Visits. A great deal of information was collected about the way the company wanted to use the portal during visits to the Case Company and direct interaction with the portal team. Several perceived problems were also brought to our attention and addressed in the research questions used. The result of this methodology was not a deliverable but rather a method of data collection which helped us identify the key performance indicators (KPI) used in this research.

KPIs form a base for evaluation and therefore should be selected very carefully. Poorly chosen KPIs do not address the needs of the organization, and can render the entire purpose of the research worthless. In addition to providing a basis for evaluation, KPIs also help in Charting Business processes with Industry Best Practices, Determining Portal Benefits to different User Groups, and Determining Metric Areas. A KPI table template was used in this research, which identified the major aspects of Key Performance Indicators as: Dimension, Measure, KPI Type, KPI Description, Computation Formula, Planned/budget value, Target/benchmarking, Data Source, Notes and guided

analysis. It takes into account that there may be multiple objectives for each Dimension and multiple KPIs for each objective.

For Knowledge Management Data Analysis; the following dimensions were identified: Financial Perspective, Customer Perspective, and Learning and Growth Perspective.

4.2.1.1. Financial Perspective. The goal of this perspective is to create a collaborative work environment.

The KPIs used to measure this objective are:

Total Downloads: This determines if users view the portal as a resource in sharing files. Total Download type: This determines the preferred format used for collaboration and monitors formats of increased size and functionality. Least Downloaded: This determines if users are uploading documents of value. It helps assess if Knowledge Management (KM) is being filled with trivial documents, and provides data to justify deletion.

4.2.1.2. Customer Perspective. The goal of this perspective is to measure Employee Job Satisfaction.

The KPIs used to measure this objective are:

Top 10 Downloaded files: This helps to determine the top 10 documents that are most frequently downloaded. Downloads by Tier/Path Length: This measures the depth at which the document is located in the folder hierarchy. Pass/Fail Downloads: This helps to determine user behavior when accessing files. It helps the analyst to develop applicable questions about user behavior.

4.2.1.3. Learning and Growth Perspective of KM data. The goal of this perspective is to observe the pattern of document access.

The KPIs used to measure this objective are:

Daily Usage: This determines when documents are most frequently accessed, which helps to analyze user behavior based on internal and external business factors.

KPI Table (table 4.2) was compiled based on this data. It includes details about the Key Performance Indicators which have been identified and grouped by various dimensions to provide a better understanding of the Case Company's business needs.

Table 4.2: KPI table (Knowledge Management data)

Corporate Strategy: Collaborative work environment / Employee Job Satisfaction								
Dimensions	Measure	KPI Type	KPI Description	Computation Formula	Planned value	Target values	Data Source	Notes and Guided analysis
Objective 1: Collaborative Work Environment								
Financial Perspectives	Total Downloads	Lagging	Measures usage: determines if users view the Portal as a resource in sharing files	# Passed Dwnlds/Time Period			KM Logs	Initial Page - Bar graph (2011 chart) & Trendline (2010 - check box) by month; # of Folders
	Total Download Type	Lagging	Determines the preferred format to collaborate and monitor formats of increased size and functionality.	# of Download Types/Total Pass Downloads			KM Logs	Initial Page - Pie Chart Type Breakdown overall; Bar Graph with Previous Year; Increase/Decrease Percentage (Gauge)
	Least Downloaded		Determines if users are uploading documents of value, assess if KM is being filled with trivial docs, and provide data to justify deletion.	# times accessed/ (Present Time - Posted Time)		if access 0 times in 6 months, = email to owner for deletion	Need to Determine Data Source Inventory of KM Portal Folders & Docs Requires keeping a Monthly Tally	Initial - Total # of Doc meeting criteria (Bar Graph), List Box of Path & Doc Names, # of Docs deleted in Past & File Sizes (show storage saved)
Objective 1: Employee Job Satisfaction								
Customer Perspective	Top 10 downloaded	Leading	measures the top 10 documents that are most downloaded	Top Ten highest Total PASSED downloads			KM Logs	2010/2011 Top 10 by Yr (Radio Buttons) Bar chart (Radio buttons for each month); Drill down to By File Type or Dept_Owner (pie chart);
	Downloads by Tier/Path Length	Lagging	measures the depth by which users must take to access desired documents	# of passed downloads per Path Length			KM Logs	2010/2011 Side Bar Graph - Radio Buttons with Options Total, Top Ten Tier_1, Top Tier_2;
	Pass/Fail Downloads	Leading	help to discover user behavior when accessing files; helps analyst to ask questions about user behavior	((Total - Fail)/Total) + ((Total - Pass)/Total)			KM Logs	Initial Total - Stacked Trend Line; 2011 - stacked bar chart by month w/ 2010 stacked line graph (check boxes for 2010 trendlines);
Objective 1: Pattern of documents' access								
Learning & Growth (Innovation) Perspective	Daily Usage	Leading	Determine when documents are most frequently accessed to analyze user behavior based on internal and external business factors	Total # of PASS/FAIL downloads			KM Logs	Yearly Overview - By Month
								Accordian Drop Downlist - Month & Day
								Accordian Drop Downlist - graph by Day

The following two dimensions were identified for the ClickStream Data Analysis: Learning and Growth (Innovation) Perspective, and Internal Process Perspective

4.2.1.4. Learning and growth perspective. Three Objectives were assigned to the Learning and growth perspective: the first was to make the Navigation more Intuitive, the Second was to identify the areas that the users visit most often, and the third was to determine what information the users access most frequently.

The KPIs used to measure the first objective are:

Clicks: Average number of clicks to reach the important pages.

Clicks: Average number of clicks to reach pages with highest view times.

The KPIs used to measure the second objective are:

PageViews: Average number of PageViews to a certain section of the homepage. PageViews: Average number of PageViews to a certain sub-section of the section.

The KPIs used to measure the third objective are:

PageViews: Average number of PageViews to the different pages of the portal.

4.2.1.5. Internal Process Perspective. This perspective has one objective: to meet the needs of this geographically disperse workforce.

The KPIs used to measure this objective are:

Logins: Number of logins in a certain period of time. Users: Number of unique users accessing the portals in a certain period of time. PageViews: Number of

PageViews in a certain period of time. Server-load: Load on the various servers at different geographic locations.

The KPI Table (tables 4.3 and 4.4) was compiled based from the data mentioned above. It provides details about the Key Performance Indicators which have been identified and grouped by various dimensions to provide a better understanding of the Case Company's business needs.

Table 4.3. KPI table (ClickStream Data) - Learning and Growth Perspective

Dimension	Measure	KPI Type	KPI Description	Computation Formula	Planned/ budget value	Target/ Benchmarking	Data source	Notes and Guided analysis
Learning and Growth (Innovation) Perspective	Objective 1: Make the Navigation more intuitive							
	Clicks- Average number of clicks to reach an important page		Average number of clicks required to reach a certain page gives an idea of how deep is the page located in the navigation hierarchy of the portal	Click Paths	Important pages should be reached with an average 2-3 clicks for their navigation to be intuitive	To reduce the number of clicks to reach the important pages to 3-4 clicks at max.	The list of important pages from the company The average number of clicks from the ClickStream reports	We could drill this information down through different Sections - Subsections
	Objective 2: The areas (sections) that users visit often							
	Clicks - Average number of clicks to reach pages with highest view times		Average number of clicks required to reach a certain page gives an idea of how deep the page is located in the navigation hierarchy of the portal	Number of clicks	The pages with highest view times are the important pages and must be reached within 2-3 clicks	To reduce the number of clicks to reach the important pages to 3-4 clicks at max.	The list of pages with highest view times (duration of view) from ClickStream The average number of clicks from the ClickStream reports	We could drill this information down through different Sections - Subsections
	Objective 3: The information users access frequently							
	PageViews: The average number of PageViews to the different pages of the portal		The frequency of PageViews of the various pages help us understand which are the popular pages and which are the dead pages	Number of PageViews	The popular pages should be brought up on the hierarchy to reduce unnecessary clicks and the important pages which have to be made popular have to be strategically positioned.	The arrangement of pages should be made such that there should not be the need of more than 2-3 clicks to reach a certain page.	The number of PageViews of a certain page The date information linked with PageViews The section information of every page The sub-section information of every page	Drill down is possible in the following ways - Sections - SubSections - Time Frame

Table 4.4. KPI table (ClickStream Data) - Internal Process Perspective

Dimension	Measure	KPI Type	KPI Description	Computation Formula	Planned/ budget value	Target/ Benchmarking	Data source	Notes and Guided analysis
Internal Process Perspective	Objective 1: Meeting the needs of the geographically disperse workforce							
	Logins: Number of logins in a certain period of time		The number of logins across different geographical divisions tell us how many times the portal has been accessed in a certain time frame at different locations	Number of logins	To increase the number of logins	The number of logins/users should be same across all geographic divisions (that must be comparable to the value at the location with highest logins/users value)	ClickStream reports	We could drill down this information across various Geographic Regions
	Users: Number of users in a certain period of time		The number of users tell us how many users have access to the portal in a certain period of time at different geographical locations	Number of users	To maximize the number of users to reach the number of employees of the company who can access the portal	The number of users/potential users should be same across all geographic locations (that must be comparable to the value at the location with highest users/potential users)	ClickStream reports	We could drill down this information across various Geographic Regions
	PageViews: Number of PageViews in a certain period of time		It tells us how much has the portal been used and how many pages have been visited in a certain time frame at different geographic locations	Number of PageViews	To increase the number of PageViews, to ensure that the users are actually using the portal extensively	The number of PageViews/ users should be same across all geographic locations (that must be comparable to the value at the location with highest PageViews/users value)	ClickStream reports	We could drill down this information across various Geographic Regions
	Server Load: Server Load on the various servers at different geographic locations		It tells us how much load is on the server at the different geographic locations at different time frames	The server load	The server load should be optimized where it can give its best performance efficiency	The server load should not be more that its prescribed value	ClickStream reports	More servers could be installed to reduce servers' load and provide better performance efficiency at locations where servers tend to get overloaded. Could be drilled down across different geographic locations.

4.2.2. Third-Party Evaluation. Valuable insights into users' opinions about the portal, their needs and expectations from the portal, and improvement they would like to see, were gathered via Third-party evaluation.

In this research, a usability study was performed to determine ways to improve the user experience of the employee portal. In all, five usability workshops were conducted on-site and one usability workshop was conducted remotely via video conferencing with 25 participants, which addressed user requirements regarding content, navigation, presentations, and tasks. A wide range of employees participated in these studies, including portal administrators, Human Resources personnel, Corporate Communications, Managers, and Global users.

4.2.2.1. Methods of study. Two different methods of study were adopted to provide a fair consensus about the participants'/users' opinion.

The first method was **Roundtable Discussion**. Here the users were asked to state their name, job role, and overall use of the portal. Then they were asked to list the most frequent things they did on the portal, and the three things that they would like to change on the portal if they could. This method highlighted variation of portal usage among different user groups, patterns of portal usage in different user groups, the most important items on the portal, and recommended changes - all from the users' perspective.

The second method was **Brainstorming and Affinity Clustering**. Here the users were asked to express their expectations for the case company Portal. The users were given sticky notes and markers and asked to write one item on

each note and place it on a white board, one at a time. While doing so, the participants were asked to read their note out loud and subsequent participants were to add notes close to notes with similar contents. At the end of the process, the groups of similar notes were circled and named.

4.2.2.2. Inference. Meaningful inferences were obtained from Roundtable discussions, Brainstorming, Affinity Clustering and Face-to-Face Interviews with the employees.

The employees stressed the need for an improved search feature for the portal. Browsing and searching the portal to find even basic information was difficult for many employees, and most wanted to reduce the number of clicks required to reach a certain location on the portal. Because of these navigation issues, HR received many calls from users trying to find information on the portal.

Employees requested a standard to provide global consistency with respect to images, icons, fonts and colors. The portal site appeared cluttered, inconsistent, and it lacked visual appeal. According to the employees, the site was so wordy that it deterred many users from using the portal. The site lacked consistency due to many different developers contributing to it.

Communication and Safety were also identified as important to the portal. The general perception was that most information on the portal applied more to the company headquarters than to its geographically diverse workforce. Therefore, a focus should be on adding more communication and

collaboration geared toward the users within the portal, and as with any portal changes, safety of confidential information was the first priority.

Employees needed easy access to key information such as IT systems, pay-statements, vacation request forms, business card order forms, performance review documents, and other self-service functionalities on the portal.

Employees also requested place-specific information about the organizational structure of their work environments, that is, other employees working at their location, how their location or department is performing compared to other departments in the company as well as time zone, currency, and weather information, etc. They suggested the portal include news, articles, and pictures of their location that reflect the culture, and provide information about office logistics, such as parking, directions, meeting rooms, seating charts, etc.

It was observed that employees were interested in finding more information about other people on the portal, that is, they requested more than just a phone number and email address, but also a picture, office location, position or role within the organizational structure, expertise, and accomplishments, etc.

The Case Company's portal lacked a calendar option and the employees expressed great interest in this type of feature that would help keep them informed of the internal company events, promotions, current events,

community events sponsored by the company, holidays, and even training and development deadlines and opportunities.

Employees wanted easy access to relevant and timely news and announcements including performance and financial news; local, regional and global company news; regional announcements; news on production and safety; internal company communications; internal announcements; press releases; news about projects, mergers, acquisitions, company growth and strategic plans, etc.

Employees recommended a myriad of other functionalities, some of which were not as obvious but would add functionalities that would encourage users to visit the portal, such as a careers/jobs portal within the employee portal, the ability to add photos, videos and other user-generated personal information to help users feel more connected to the portal and thereby to the Company. The users also mentioned the possibility of accessing the portal outside of the confined corporate firewall.

The results obtained from this study are summarized in table 4.5, below.

Table 4.5. Third - Party Evaluation Results

Section	Subsection	Contents
Employee	Forms, Procedures, polices	Travel, Expense report, Submitting time, Filing an expense report, Ordering Special soft-wares, etc.
	Benefits	Holiday schedule, -Benefits checklist, HR contacts
	Training and Instruction	New hire checklist, Tutorials, etc.
	Communicators toolkit	Ordering business cards, Ordering stationery, Download templates for presentations and documents.
Place Specific	Place logistics information	Map, Directions, Parking, Transportation options, Food, Lodging, Floor plans, Meeting room locations, Building access, Weather, Time Zone, currency, Amenities, etc.
	Place people information	Contact information, Seating charts, Organizational charts
	Place, News and Events	Safety, Production, Performance, Company event calendar, Community event calendar, Photos, News.
People Directory	Basic Information	E-mail, Phone number
	Employee profile	Photo, Employment anniversary, Job title, Department, Position in Org Chart, Location
	Consolidated lists	By Location, By Department
	Contact people by	Function (example: building maintenance),Expertise (example: analysis)
	Contact people by employee attributes	School attended, Languages spoken, Country of residence/birth
Calendar events	Internal corporate events	Holiday schedule, Key dates for benefit enrollment.
	Place-specific events	Key date, Community events, Company events, Holiday schedule.
	Community events	Promotions, Volunteering, Campaigns.
	Calendar can be filtered by	Date of Event, Place of Event, Type of Event
News and Announcements	Place-specific news	Performance, Safety, Production, Press releases, News articles
	Place-specific announcements	Benefits enrollment, Community events, Company events
	Also accessible through	Consolidated news section, Archive
	Company-wide news	Financial performance, Strategic plans, Acquisitions, Mergers, New contacts, Press releases, Community involvement, Awards and recognition, News article
	Company-wide announcements	Financial performance, Policy information, Organizational announcements
Training and Career development	New Employee Orientation	
	Software Training	
	Safety Training	
	etc.	
Content management	Employees should be able to see content metadata: author, author contact information, date of last update	
	Adding and Updating content should be allowed	
Security	User name and password authentication should correctly be in place	

4.3. ACTUAL PORTAL USAGE

As discussed in Section 3.3, portal usage was studied from two aspects: Knowledge management data and the ClickStream data captured by Sweetlets.

The two sets of data loosely are related, but they do not have the exact same structure. The Knowledge Management files are organized into folders and sub-folders based on functional area, while the ClickStream data is organized according to how the sections and subsections on the portal homepage relate to the portal front-end's structure. In the ClickStream data, the tabs on the homepage are considered sections containing one or more subsections. A webpage is displayed at every level. An in-depth study of the two data sets was able to relate the two via comparison and analysis.

4.3.1. Knowledge Management Data. The knowledge management data provided insight about which files and folders users accessed from the portal. The fundamental unit of measure here is the number of downloads. This raw data was collected and fed into a data warehouse which was then queried to obtain meaningful information, which was then visually represented in a dashboard monitoring system. The raw data cannot be published here as it contained potentially sensitive information, however, the visualization of the summarized data can be seen in Section 4.4.1.

4.3.2. ClickStream Data. The ClickStream data was collected using Sweetlets. It provides insight to the various sections and subsections of the portal as seen both on the surface (number of clicks on portal links) and deeper

in the portal's structure with information about how each item is accessed by users. The fundamental units of measure here are *number* of PageViews and *duration* of each PageView. Activity on all sections, sub-sections, and pages within the portal were measured. The raw data was fed into a data warehouse and queried before being graphically displayed using a dashboard monitoring system. As with the Knowledge Management Data, the raw data of ClickStream data was also specific to the Case Company and so cannot be published, but the summarized data as presented in the dashboard is displayed in Section 4.4.2.

4.3.3. Technical Implementation. The technical implementation of this research is considered from two perspectives: “data warehousing” and “dashboard monitoring system.”

4.3.3.1. Data warehouse creation. Two sets of data were used for this research (Knowledge Management data and ClickStream data). The first set of data was housed in one InfoCube and the other set of data needed two InfoCubes. The data were fed into the InfoCubes, all of which were built on a logical structure called a star-schema. This data in the InfoCubes was then queried to obtain meaningful information regarding portal usage. The query results were then visualized in two dashboard monitoring systems. This gave us meaningful information as suggested by the research framework in figure 1.1.

4.3.3.1.1. Knowledge management InfoCube. This was created by other team members who were a part of this research. Only the information from this is being used in this study.

4.3.3.1.2. ClickStream data InfoCube. The ClickStream data was stored in two InfoCubes. One contained data about the number of PageViews, user logins to the webpages and sections of the portal (this is named as CLICK_TP) while the other InfoCube contained data regarding the duration of PageViews and section-views within the portal (this is named CLICK_VT). Figure 4.33 shows the Star Schema of CLICK_TP and Figure 4.35 shows the Star Schema of CLICK_VT. Figure 4.34 shows the data flow in CLICK_TP and Figure 4.36 shows the data flow in CLICK_VT.

The Star Schema of CLICK_TP has 5 dimensions - “Data Package,” “Time,” “Unit,” “Webpages,” and “Time of Day.” The Star Schema of CLICK_VT has 3 dimensions - “Sections and SubSections,” “Page Names” and “Month and Year.”

The data warehouses (CLICK_TP and CLICK_VT) are created in SAP BW by following the Extraction, Transformation, and Loading (ETL) process, which is described in detail in **Appendix A**.

4.3.3.2. Dashboard implementation. Two dashboards monitoring systems were created to monitor the two separate data sets, namely: the Knowledge Management data, and the ClickStream data. This gave us meaningful information in the form of data visualization as suggested by the research framework in figure 1.1.

4.3.3.2.1. Knowledge management data monitoring dashboard. This dashboard provides insight into the folder structure and the files that it

contains. This dashboard is displayed in figures 4.37 and 4.38. This has not been discussed at length here in this study as this was done by a different researcher in the team and only its results are being used here.

Figure 4.37 shows the first tab of the dashboard, which contains two bar graphs that display the trends from September 2010. The horizontal bar graph on the left side of the screen shows the top ten *folders* that were downloaded in September, and the vertical bar graph on the right side of the page shows the top ten *files* downloaded in the same month. The selection panel on the left side of the page displays the folder hierarchy. “Folder 1” represents the top-most level of folder organization; “Folder 2” is the set of folders in the second level of hierarchy and so on. In this figure, “Folder 1” has been selected under September 2010, which brings up the top ten folders whose constituent files have been downloaded most frequently (horizontal bar graph) and the top ten files in that level in that hierarchy that have been downloaded the most frequently (vertical bar graph).

Figure 4.38 shows trends regarding the *types* of files downloaded. The pie chart displays the percentage of the total downloaded files that are .doc, .xls and .pdf. The area chart on the top right quadrant of the screen displays the trends of downloaded files over the months. The stacked column chart on the bottom right quadrant of the screen shows the number of downloads of each type of file per month. Furthermore a user can use the radio buttons below the pie chart to select which time period is displayed.

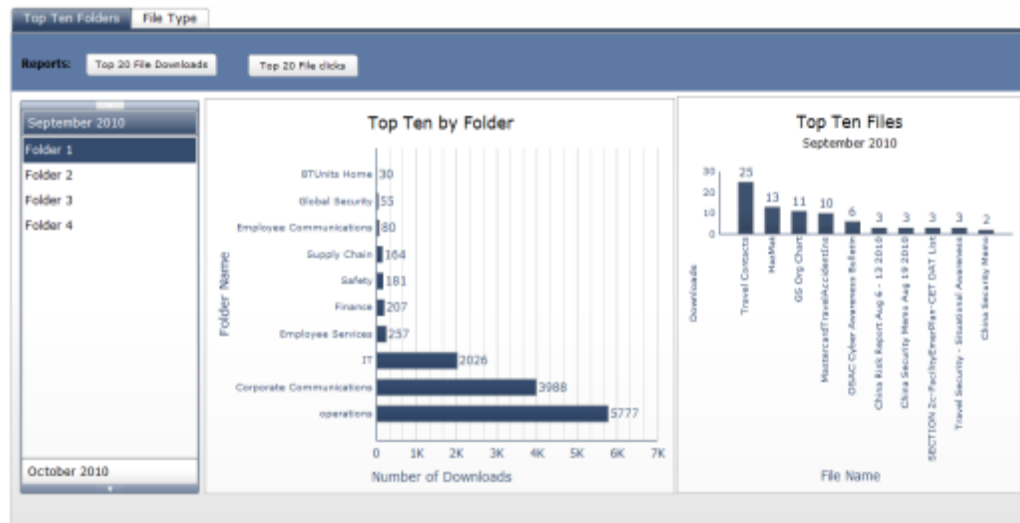


Figure 4.37. First Tab of the KM dashboard

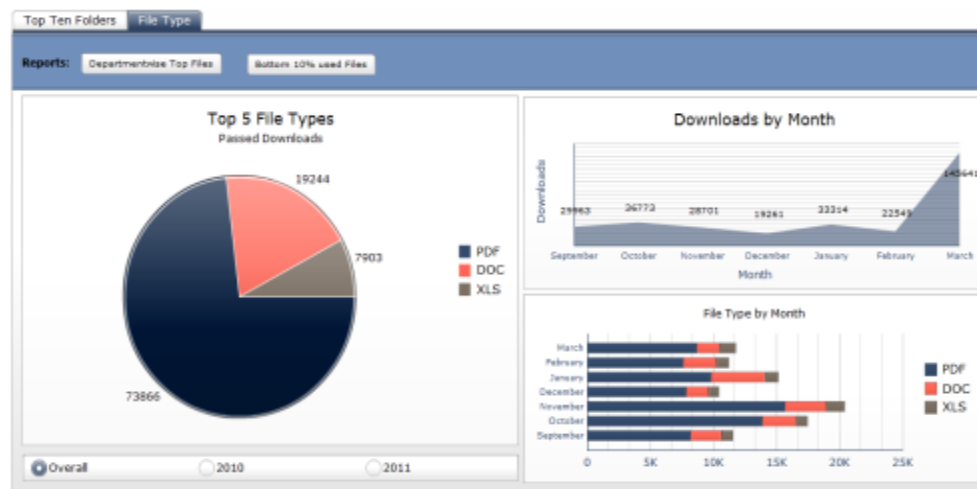


Figure 4.38. Second Tab of KM dashboard

4.3.3.2.2. ClickStream data monitoring dashboard. The objective of this dashboard was to identify the areas of interest to the employees by analyzing the number of times the webpages were visited, the number of logins, the number of times each page was accessed, and the number of

different users who visited the page within a certain time frame. The portal is divided into various sections and each section is further divided into subsections. So, the dashboards also ranked the sections and subsections with respect to the number of PageViews as well as monitoring the time each user spent viewing a certain page, which helped gauge the importance of the webpage to the users. (More time spent viewing a page was interpreted to mean that the page was more important.)

The performance dashboard proved to be a useful tool for the Case Company. It helped identify strong and weak features and areas on the portal, and highlighted services and pages that were or were not being used as much as the company intended. It also provided feedback about users perceptions of the portal and their recommendations concerning the services on the portal.

As stated earlier in this document, this dashboard falls into the “Tactical to Strategic” type category. Table 4.6 below highlights the tactical and strategic aspects of the dashboard.

Table 4.6. Overall design of the dashboard - Tactical to Strategic

Category	Characteristic of Tactical Dashboard	Characteristic of Strategic Dashboard
Purpose	Optimize process	Manage strategy
Scope	Departmental	Enterprise
Users	Managers	Executives
Focus	Past	Future
Information	Detailed/Summarized	Summarized
Architecture	Data Warehouse	

This level of dashboard is appropriate for the scope of the performance dashboard because it is designed to be used for more in-depth analysis as opposed to real-time monitoring, which would be more indicative of an Operational dashboard. As with most dashboards at the tactical and strategic level, the dashboard monitoring systems used in this research were designed to help study trends and identify variations of different metrics related to different KPIs and to aid in making decisions about the portal structuring in the future.

The dashboards dealt with departmental as well as enterprise-wide data which was presented in a summarized format. The dashboards were built on top of one or more Data Warehouses, and they were designed to help the portal team and top management (managers and executives) make informed decisions about the structure and content of the employee portal. The main

purpose of these performance dashboards was to optimize process and manage strategy by allowing the portal team and top management of the Case Company to analyze trends and study the changes and behavior of the users accessing the portal before taking appropriate action, to help the company gain strategic and competitive advantage over other companies in their sector. The trends obtained from the dashboard were compared to the Industry Standards and Best Practices so that various areas of improvement could be identified before changes were discussed and implemented.

The dashboard to monitor the ClickStream data collected by Sweetlets was displayed in two iterations.

First Iteration: The first iteration had three tabs. The first tab concentrated on the analysis of sections, subsections, and web-pages according to the number of PageViews. The second tab concentrated on analysis of sections, subsections, and web-pages according to the duration of view-time. The third tab concentrated on a combined analysis of the sections, subsections and web-pages according to both the number of PageViews and the duration of view-times. The third tab also takes in to account the time period during which the data was collected.

The first tab contains four bar charts. The first one (top left) shows the overall sections' ranking by number of users, logins, and PageViews. The second chart (top right) shows the ranking of subsections within whichever section has been selected in the first chart. The third chart (bottom left) shows the least visited pages of the particular sections according to PageViews. And

the fourth chart (bottom right) shows the most visited pages of a particular section according to PageViews. This first tab is shown in Figure 4.39.

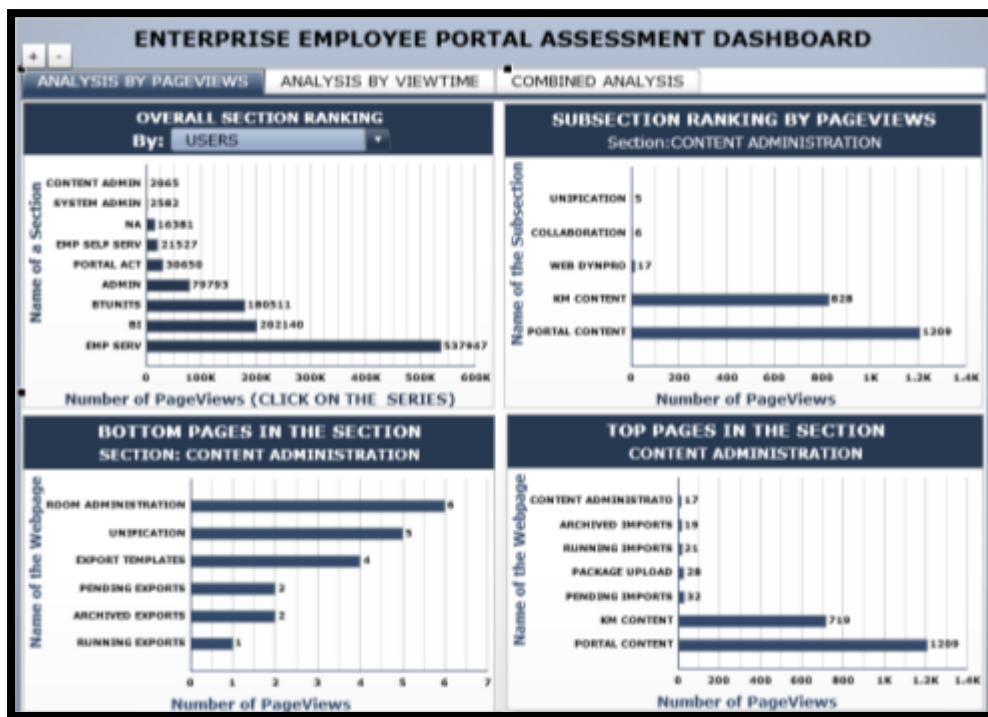


Figure 4.39. Tab 1 of First Iteration

The second tab (Figure 4.40) also contains four charts. It deals with the analysis of sections, subsections, and web-pages according to the duration of PageViews. The top left shows the sections' ranking by duration of page-view, the top right shows the associated subsections' ranking by the duration of PageViews. The bottom left and right shows the bottom and top pages of a particular section by PageViews associated with the the section, subsection, or web-page selected in the two charts at the top of the page.

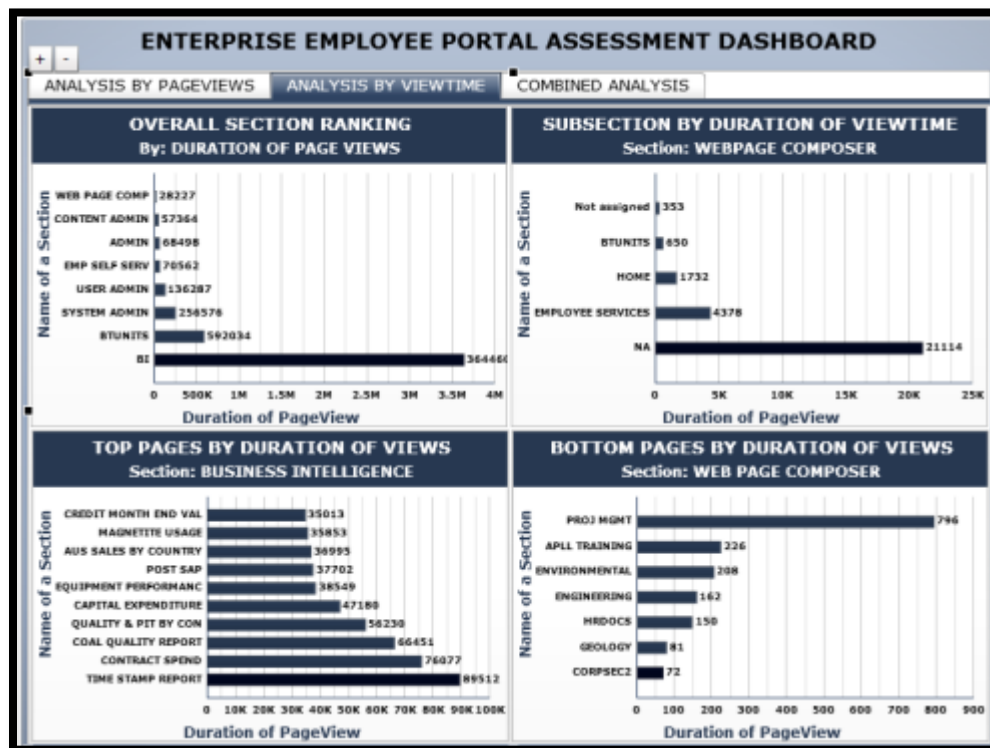


Figure 4.40. Second Tab of First Iteration

The third tab (Figure 4.41) shows the combined analysis (by number of PageViews and duration of PageViews) of the sections, subsections, and web-pages within a certain time frame (designated by month and year).

The two charts located at the top of the page are column charts and the two charts at the bottom of the page are combination charts. The top left chart displays the number of PageViews for each section within a certain month and year, which may be selected from the combo box. The top right chart shows the duration of PageViews of different sections within a certain month and year as selected from the combo box.

The bottom left chart displays the top pages within whichever section is selected from the combo box, and maps their number of PageViews against their duration of PageViews. The bottom right chart shows the bottom pages within whichever section is selected from the combo box, and maps the number of PageViews against the duration of PageViews.

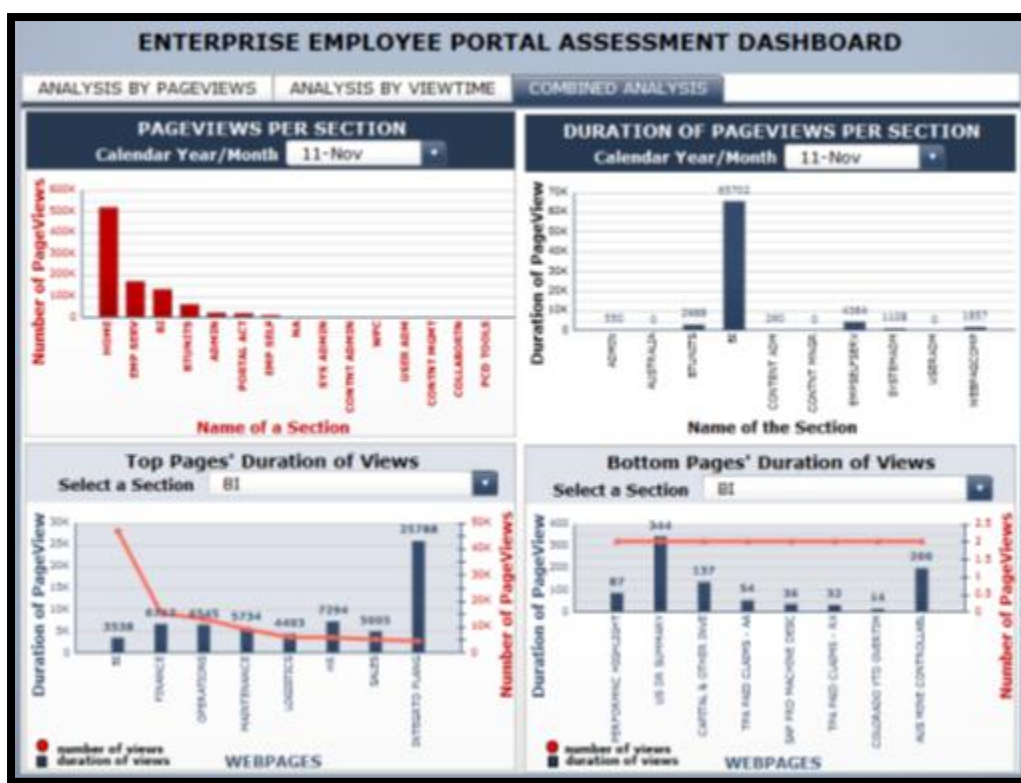


Figure 4.41. Third Tab of First Iteration

Second Iteration: The second iteration displays trends over a period of time: months and years. This aspect was missing from the first iteration despite the fact that trend analysis is a very important part of most dashboards; therefore, the second iteration was added to resolve this oversight.

The second iteration has two tabs. The first one is entitled “PageViews trend analysis” and the second is “number and duration of PageViews.”

The first tab (Figure 4.42) displays the overall trend of a section with respect to number of PageViews over a period of time (months of the years). It also shows the section ranking based on number of users, logins and PageViews, and the subsection rankings based on the number of PageViews. The second tab displays the combined analysis of sections and web-pages with respect to the number of PageViews and duration of PageViews over a period of time.

The first tab has a radio button panel from which the user can choose a section. The trends associate with that section with respect to the number of PageViews over a period of time is then displayed in a Line Chart. In the bottom portion of the tab there are two bar charts. The bottom left displays the overall section’s ranking by number of users, logins and PageViews, while the bottom right shows the ranking of subsections within the particular section, which was selected in the first chart.

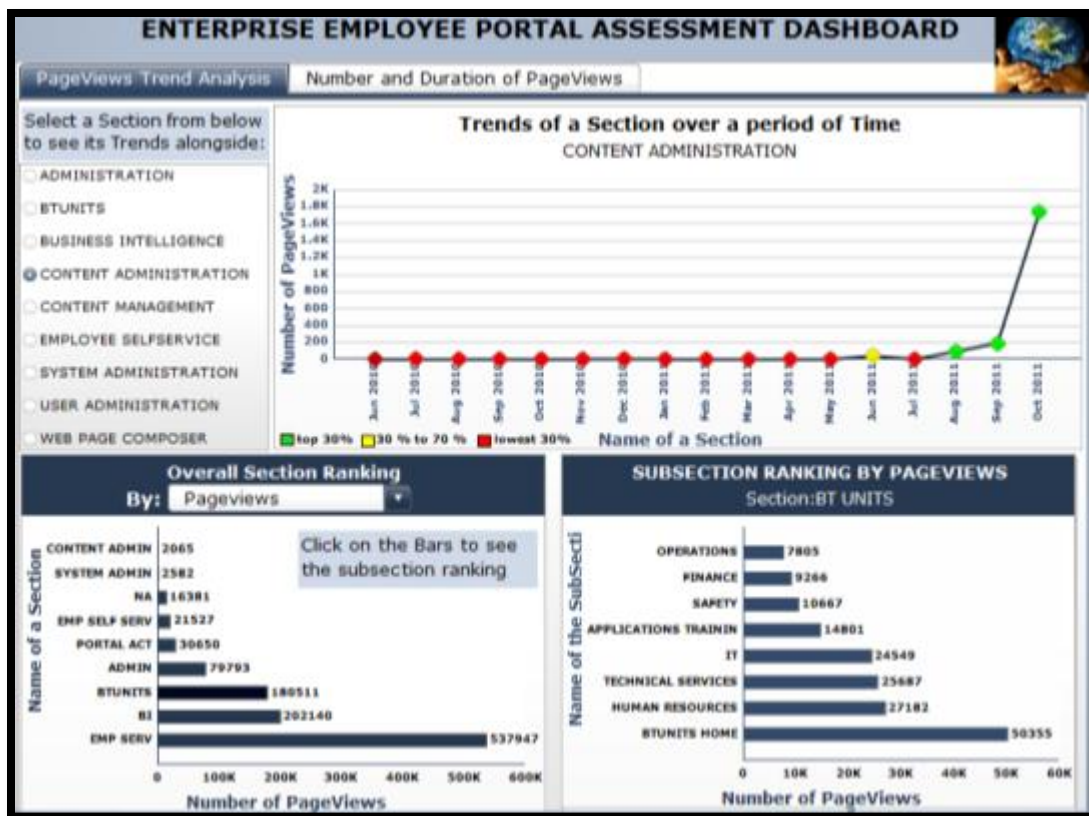


Figure 4.42. Tab 1 of Second Iteration

The second tab (Figure 4.43) displays the combined analysis of the sections, subsections and web-pages (by number of PageViews and duration of PageViews) within a certain time frame (month of a year).

The two top charts are column charts and the two bottom charts are combination charts. The top left chart displays the number of PageViews for each section in a certain month and year that is selected from the combo box. The top right chart displays the duration of PageViews of different sections in a certain month of a year as selected from the combo box.

The bottom left chart displays the top pages of a section which has been selected from the combo-box and maps the number of PageViews against the

duration of PageViews. The bottom right chart displays the bottom pages of a section which has been selected from the combo box and maps their number of PageViews against their duration of PageViews.

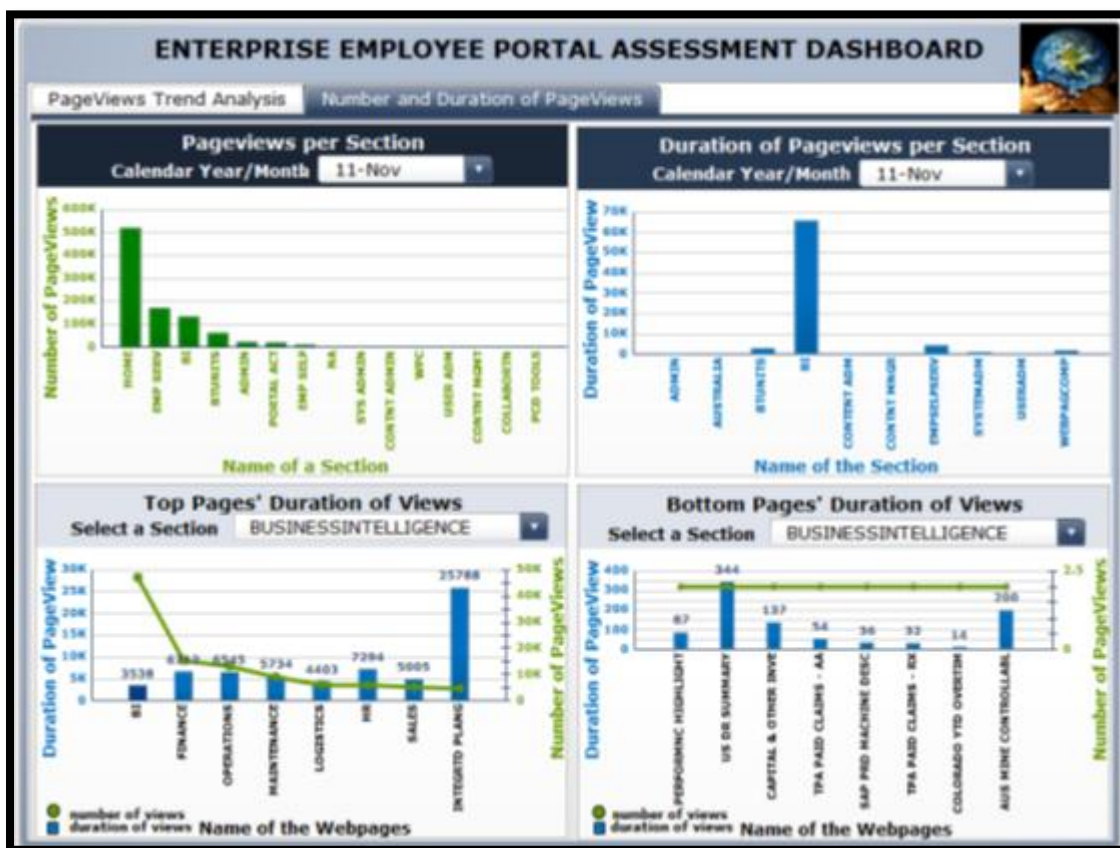


Figure 4.43. Second Tab of Second Iteration

4.4. COMPARISON AND ANALYSIS

As stated in Section 3, this research was conducted in accordance with a three-pronged approach: industry standards and best practices, actual portal usage and user-perceived portal usage. After the results were collected via different methodologies, they needed to be compiled in order to create recommendations for the Case Company. This brought together results from three different approaches used as suggested by the research framework in figure 1.1.

4.4.1. Industry Standards and Best Practices. Table 4.7 displays the comparison and analysis conducted on the Industry Standards and Best Practices. The analysis of each information category revealed several interesting trends. An area with a high volume of available literary recommendations indicates that a great deal of research is currently being conducted in this area, while a lower volume of literary recommendations is indicative of an area with less active research. We calculated the percentage of sources that made various recommendations as related to each information category and will address the trends in the next paragraph.

The first Information category, Customization and Personalization, was recommended by 92.30% of the literature reviewed and 90.91% of the case studies. This clearly shows that this Information category is of high importance in an enterprise employee portal.

The second information category, Communication and Collaboration, was recommended by 61.53% of the literature but the percentage of companies that have adopted communication and collaboration tools in their portals (in our case studies) is 100%, thus every company has adopted this information category in one form or the other and yet significant research is still being conducted to discover more effective methods of communication and collaboration within a portal. From an industry standpoint, this information category is the most important in a portal. This difference is because Communication and Collaboration was one of the drivers of the concept of portal as it came into existence and is a mature information category within a portal so not every literary article studied as a part of this research mentioned it. This category includes: e-mail, blogs, calendar, video communication, document sharing, threaded discussion and other such information items.

The third information category, Search function, was recommended by 46.15% of the literature reviewed and was supported by 90.91% of the case studies. A Search function is a standard function for nearly every portal today as highlighted by the fact that 90.91% of the case companies have this functionality in one form or another. They may have an advanced search, federated search, double word search or drop down search. A considerable amount of research is still actively being conducted in this area in order to improve this functionality, such as optimizing search functions and making them more efficient and effective for internal search purposes within the portal.

The next two information categories, Help and FAQ are both recommended by 30.77% of the literature. Like the Search function, the Help and FAQ are present in almost every portal. They are usually placed in the top right corner of every portal page. Because they are so prevalent, it seems that not a lot of research is actively being conducted in this area. They have become mature information categories and almost standard in every internal portal. Nevertheless some research is still being conducted with the goal of continuing improvement in this area. Between 63.64% and 72.73% of the Case Companies have implemented Help and FAQ features. This probably should be 100% but some companies place these functions in places other than on their homepages which could not be verified in this research due to confidentiality issues.

Employee Self Service is the next information category and its presence and acceptance has been seen in 81.82% of the case companies. In terms of active research, 38.46% of the literature recommended this. This indicates a stark disconnect between theory and industry application. More research should be done in this area as industry cases clearly show that this information category is being actively adopted by industries.

Table 4.7. Industry Standards and Best Practices - Comparison and Analysis

INFORMATION CATEGORIES	Percentage of literature that recommend this feature	Percentage of case companies which have this feature	INFORMATION ITEMS	Percentage recommended by literature	Percentage recommended by Case studies
Customization and Personalization	92.30%	90.91%	Social Networking	53.84%	27.27%
			Customized for Specific Clients	76.92%	54.55%
			Personalized homepage	79.92%	81.82%
			Personal Stuff tab	38.46%	27.27%
			Layout and Color	76.92%	18.18%
			Selecting Resources	30.76%	36.36%
			E-Room Digital Workspace	38.46%	27.27%
Communication and Collaboration Tools	61.53%	100%	Blogs	30.76%	9.09%
			Policies / Guidelines / Benefits	30.76%	72.73%
			Events	30.76%	54.55%
			News	53.84%	100.00%
			My Links/ Popular Links/ Quick Links	38.46%	90.91%
			Feedback	30.76%	63.64%
			Quick Poll	23.07%	54.55%
			Community	46.15%	72.73%

Table 4.1. Industry Standards and Best Practices - Comparison and Analysis (contd.)

INFORMATION CATEGORIES	Percentage of literature that recommend this feature	Percentage of case companies which have this feature	INFORMATION ITEMS	Percentage recommended by literature	Percentage recommended by Case studies
			Employee Directory/Information	53.84%	100.00%
			Calendar	30.76%	45.45%
			E-Mail	53.84%	45.45%
			Tools and Applications	46.15%	81.82%
			Streaming Video and Web Communication	38.46%	27.27%
			85-85 Rule	15.38%	9.09%
			Document / File Sharing	53.84%	54.55%
			Threaded Discussions	38.46%	9.09%
Search Function	46.15%	90.91%	Advanced Search	46.15%	90.91%
			Federated Search Engine	38.46%	18.18%
			Drop Down	15.38%	0.00%
FAQ	30.77%	72.73%	FAQ	30.76%	72.73%
Help	30.77%	63.64%	Help	38.46%	72.73%
Employee Self Service	38.46%	81.82%	Career	30.76%	54.55%
			HR Self Service	38.46%	81.82%
			Medical Service/Sick Leave Balance	30.76%	18.18%
			Travel Services	30.76%	36.36%
			Training	30.76%	54.55%

4.4.2. Actual Portal Usage. Dashboard monitoring systems were designed to use the Case Company’s actual portal usage logs. The usage data came directly from actual click-stream access logs and, once it was compared with the theory, will provide a fair idea of where functionality is lacking, what design principles could be followed, and what implementation strategies could be used to improve company processes.

Two approaches were used to assess the actual portal usage and two dashboards were used to monitor the portal data usage. The first approach was to study the Knowledge management data. The top folders accessed from the portal were determined by analyzing this data. Table 4.8 below summarizes these findings.

Table 4.8. Actual Portal Usage - Knowledge Management Perspective

Folder Name	# of Downloads	% of Downloads
Human Resources	12710	32.70
Employee Services	5167	13.29
Corporate Communications	4643	11.95
Australia	3886	10.00
IT	3626	9.33
Operations	2867	7.38
BTUnits Home	2536	6.52
Finance	1267	3.26
Supply Chain	1249	3.21
Safety	403	1.04
Community Relations	170	0.44
Global Security	158	0.41
Law	116	0.30
United Way	45	0.12
WesternTrainingCenter	12	0.03
Human%20Resources	5	0.01
Employee Communications	4	0.01
Employee%20Services	3	0.01

The second approach was to analyze the ClickStream data. This data captured the activity on the portal. Unlike Knowledge Management data which shows the folders and documents accessed, ClickStream data shows which sections of the portal were clicked on, the number of users who accessed each section, the number of logins that led to the access of each section, the number of pages that were viewed in each section of the portal, and the time spent on each page. Table 4.9, below, provides a summary of these findings.

Table 4.9. Actual Portal Usage - ClickStream data perspective

Top Sections	Subsections	Pages	% of PageViews	% of Logins	% of users
Employee Services	-Personal Information and Benefits payments	-Benefits -Personal information -Benefits Participation -Enrollment -W4 -Bank Information	52.11%	61.67%	17.52%
Company Units	-Human resources -Technical Services -Information Technology -Applications' Training -Safety -Finance -Operations	-Applications' training -HR home -Safety Home -IT home -Operations Planning -Benefits and Compensation -Employee Development	18.33%	13.38%	31.20%
Business Intelligence	-Finance -Operations -Maintenance -Sales -Logistics -HR -Integrated Planning	-Finance home -Operations home -Maintenance home -HR home -Logistics home -Integrated Planning home -Sales home	18.69%	18.69%	36.74%
Content Administration	Company Specific	Company Specific	0.19%	0.15%	N/A
System Administration	Company Specific	Company Specific	0.24%	0.22%	N/A
Portal Activity	Company Specific	Company Specific	2.85%	3.48%	9.17%
Administration	Company Specific	Company Specific	7.43%	0.93%	N/A
Unclassified			1.53%	1.47%	5.37%

After individually studying the Actual Portal Usage from the Knowledge Management and ClickStream perspectives, the two sets of data were compared wherever possible in table 4.9, below. The correlations are highlighted in the table. As stated earlier; the two sets of data are only loosely related to each other, which made comparison difficult.

In table 4.10, the “Employee services” section of the ClickStream data is compared to the “Human Resources” folder and the “Employee Self-Service folder” together as this seemed to provide the best match between the data contained in these folders. So, in this case, the HR and Employee Self Service folders together address the same information as the repository for “Employee Services” section on the portal page.

Similarly, the “Company Units” section is compared with the “Operations,” “BT units,” “Finance” and “Supply Chain” folders combined.

The “Business Intelligence” section is compared to the “Information Technology” section. The subsections and pages of the Business Intelligence section are similar to those in the “Company Units” section because Business Intelligence touches all the company units.

The other sections of the portal cannot be compared to the folders. For example, the folder named “Australia,” does not match any sections on the portal. Similarly, the “Corporate Communication” folder contains all the news and announcements of the company, but this information would be displayed on the homepage of the portal rather than being associated with any specific section of the portal.

Table 4.10. Actual Portal Usage

Data from ClickStream				Data from KM	
Top Sections	Subsections	Pages	% of PageViews	% of files accessed	Top Folders
Employee Services	-Personal Information -Benefits and Payments	-Benefits -Benefits Participation -Enrollment Bank Information	52.11%	45.99%	Human Resources + Employee Self Services
Company Units	-Human resources -Technical Services -Information Technology -Applications' Training -Safety -Finance -Operations	-Applications' training -Safety Home -IT Home -Operations Planning -Benefits and Compensation -Employee Development	18.33%	20.37%	Operations + BT units + Finance + Supply Chain
Business Intelligence	-Finance -Operations -Maintenance -Sales -Logistics -HR -Integrated Planning	-Finance home -Operations home -Maintenance home -HR home -Logistics home -Integrated Planning home	18.69%	9.33%	Information Technology
Content Administration	Company Specific	Company Specific	0.0019%	11.95%	Corporate Communications
System Administration	Company Specific	Company Specific	0.0024%	10%	Australia
Portal Activity	Company Specific	Company Specific	0.0285%	2.36%	Safety + Community Relations + Global Security + Law + United Way + Western Training Center
Administration	Company Specific	Company Specific	0.0743%		
Unclassified			0.0153%		

4.4.3. User Perceived Portal Usage. The user-perceived portal usage is obtained from the company visits and third party workshop results which involved interviews and interactions with target user groups. The problem areas cited by the users can be summarized as follows under the same information categories established in the Information Mapping Grid:

- Search Function: The users expressed difficulty in finding very basic information. Browsing and searching for the right information or document is cited as painstaking.

- Usability of the portal: The users stated that site was visually cluttered, inconsistent and lacked visual appeal. The site was called out to be too wordy. Further, inconsistency in icons, fonts, images and colors were pointed out.

- Communication and Collaboration tools: The users requested more information on performance, safety, finance, company growth and strategic plans of the company. They wanted news from headquarters to reach the other global locations through the internal employee portal. They expected more communication of internal company news and announcements through the portal. They wanted local, regional and global company news, information about press releases, new projects, mergers and acquisitions of the company. They want to see employee information like their picture, their role in the organization, their duration of service with the company, their location of work, their knowledge expertise/skill set and their accomplishments. A need for a calendar to keep track of internal events and promotions has been cited.

The calendar also needs to be able to display community events, location specific events. The users also showed interest for a separate “holiday calendar” and a separate “learning and development calendar.” The need for a more intuitive and streamlined way of updating content was mentioned.

- Employee self-service: The users expressed the need to have easy access to key information and tasks like accessing the IT systems, accessing paystubs, requesting vacation time, submitting time sheets, entering the building after hours, ordering business cards, ordering stationery, store items, planning for the performance review, and much more. This could also be further bolstered by the fact that the HR department gets a lot of phone calls asking “why” and “how” questions. Thus, incorporating employee self-service could drastically reduce this load on the HR department. The employees said that training and career development was very important to them, so it needs to have a strong presence on the portal.

- Personalization and Customization: The users wanted place-specific information related to their location of work. They wanted information about who works there, their time zone, currency, weather, photos and the like. They would also like to know stories about their current location, the culture around that place, office logistics like parking, directions, meeting rooms, seating charts and the like. This can be possible with the help of personalization and customization feature. If the users were able to choose and select resources to display in their portal homepage they could incorporate any of this information on their portal page. The users also liked the idea of

providing more people focused and personal content, like photos and videos that are user generated.

- Help and FAQ: The employees have expressed the need for help sections so calls to the HR department could be reduced.

4.4.4. Recommendations. The Industry Standards and Best Practices provide a comprehensive list of information categories and information items related to each information category as represented in the Information Mapping Grid.

The current usage of the Case Company's portal is very low and appears to be limited to the Employee Services, Business Intelligence, and Functional unit sections. There are many unused sections that should either be changed or removed from the portal page.

The users' suggestions that were collected at a workshop held by a third-party to determine the user-perceived portal usage go hand-in-hand with the information mapping grid.

So, the set of recommendations for the case company used to validate the Information mapping Grid shown in Table 4.11 can be summarized and explained as follows:

"Customization and Personalization" should definitely be incorporated into the portal. This is supported by almost every company used as a part of the case studies and very active research is being done in this area, as suggested in section 4.4.1. The user-perceived portal usage also recommends this heavily. This information category can be implemented in the portal by

enabling the users to be able to select the information they want to see on their homepage like the weather, currency, zone and the like. They should also have the ability to select the tools and applications they want to keep handy on the homepage. A social network application would also be appreciated by the users.

“Communication and Collaboration tools” is incorporated by the companies that are a part of the case study and a significant amount of research is also being carried out in this area, as suggested in section 4.4.1. The user-perceived portal usage study also portrays the need to leverage communication and collaboration in the internal portal. This feature is highly recommended for being implemented in the portal in the form of news - global, local and regional, announcements, press releases, calendars to show holidays and company events, community and discussion forums, employee directory, policies, guidelines and benefits.

“Employee Self-Service” is being actively considered by the companies used as case studies and some research is still being done in this area. Irrespective of the lower percentage of research being carried out in this area (as suggested in section 4.4.1), the user-perceived portal usage expresses high need of this feature in various ways. This feature should be incorporated in the portal to provide HR self-service, training, career assistance and the like.

“Search function” has a very high acceptance by the case studies and also a considerable amount of research is being carried out in this area as suggested in section 4.4.1. The user-perceived portal usage has expressed this

as the first and foremost concern, which makes the portal completely non-user-friendly. Document and information search has also been cited as a major concern of the portal as the employees feel that it is very frustrating for them not to be able to find information they seek from the portal. The portal should incorporate a good search strategy in the form of advanced search.

“Help and FAQ” have both been seen to have been significantly incorporated in the case studies and some research is still going on in this area. In this study not every page of the portal could be studied due to confidentiality issues. The “Help and FAQ” feature could be an area of further research as it is a very important part of every portal. It is recommended that “Help and FAQ” should be incorporated in the portal of the case company used in this research.

Table 4.11. Combined 3 Pronged Approach

Information Categories	Percentage of literature that recommend this feature	Percentage of case companies which have this feature	INFORMATION ITEMS	Percentage recommended by literature	Percentage recommended by Case studies	Case company Actual Usage Monitor	Case Company Perceived Usage (Workshops)
Customization and Personalization	92.30%	90.91%	Social Networking	53.84%	27.27%	No	Not Recommended
			Customized for Specific Clients	76.92%	54.55%	No	Not Recommended
			Personalized homepage	79.92%	81.82%	No	Recommended
			Personal Stuff tab	38.46%	27.27%	No	Not Recommended
			Layout and Color	76.92%	18.18%	No	Not recommended
			Selecting Resources	30.76%	36.36%	No	Recommended
			E-Room Digital Workspace	38.46%	27.27%	No	Recommended
Communication and Collaboration Tools	61.53%	100%	Blogs	30.76%	9.09%	No	Not recommended
			Policies / Guidelines / Benefits	30.76%	72.73%	Yes	Recommended
			Events	30.76%	54.55%	No	Recommended
			News	53.84%	100.00%	No	Recommended
			My Links/ Popular Links/ Quick Links	38.46%	90.91%	No	Recommended
			Feedback	30.76%	63.64%	No	Recommended
			Quick Poll	23.07%	54.55%	No	Not Recommended
			Community	46.15%	72.73%	No	Not Recommended

Table 4.1. Combined 3 Pronged Approach (contd.)

Information Categories	Percentage of literature that recommend this feature	Percentage of case companies which have this feature	INFORMATION ITEMS	Percentage recommended by literature	Percentage recommended by Case studies	Case company Actual Usage Monitor	Case Company Perceived Usage (Workshops)
			Employee Directory/Information	53.84%	100.00%	Yes	Recommended
			Calendar	30.76%	45.45%	Yes	Recommended
			E-Mail	53.84%	45.45%	Yes	Recommended
			Tools and Applications	46.15%	81.82%	Yes	Recommended
			Streaming Video and Web Communication	38.46%	27.27%	No	Not Recommended
			85-85 Rule	15.38%	9.09%	No	Not recommended
			Document / File Sharing	53.84%	54.55%	Yes	Recommended
			Threaded Discussions	38.46%	9.09%	Yes	Recommended
Search Function	46.15%	90.91%	Advanced Search	46.15%	90.91%	No	Recommended
			Federated Search Engine	38.46%	18.18%	No	Not recommended
			Drop Down	15.38%	0.00%	No	Not recommended
FAQ	30.77%	72.73%	FAQ	30.76%	72.73%	No	Recommended
Help	30.77%	63.64%	Help	38.46%	72.73%	Yes	Recommended
Employee Self Service	38.46%	81.82%	Career	30.76%	54.55%	No	Recommended
			HR Self Service	38.46%	81.82%	No	Recommended
			Medical Service/Sick Leave Balance	30.76%	18.18%	No	Not Recommended
			Travel Services	30.76%	36.36%	No	Recommended
			Training	30.76%	54.55%	No	Recommended

Table 4.12 summarizes the recommendation for improving “contents and functions” for an internal employee portal in general, irrespective of any case company. The recommendations were derived from literature review, Industry Standards and Best Practices, Actual Case Company verification (i.e., results of Actual Portal Usage Monitoring derived from the Dashboard Monitoring system and the results derived from the user-perceived portal usage derived from Third-part workshop), and researchers’ analysis for the case company and for the employee portal design in general.

Table 4.12 Summary of Recommendations.

Information Category	Information Items	Derived Recommendation	
		For Case Company	For Employee Portal in General
Personalization and Customization	Social Networking		
	Customized for Specific Clients		
	Personalized Homepage	X	X
	Personal Stuff Tab		
	Layout and Color		X
	Selecting Resources	X	X
	E - Room or Digital Workspace	X	X
Employee Self Service	Career	X	X
	HR Self-service	X	X
	Medical service/ Sick Leave Balance		X
	Travel Service	X	X
	Training	X	X
Search Function	Advanced Search	X	X
	Federated Search		X
	Drop Down Search		X
Communication and Collaboration	Blogs		X
	Policies/Guidelines/Benefits	X	X
	Events	X	X
	News	X	X
	My Links/Popular Links/Quick Links	X	X
	Feedback	X	X
	Quick Poll		
	Community		X
	Employee Directory/ Information	X	X
	Calendar	X	X
	Email	X	X
	Tools and Applications	X	X
	Streaming Video and Web Communication		X
	85-85 Rule		X
	Document Sharing/File Sharing	X	X
Threaded Discussions	X	X	
Help & FAQ		X	X

5. SUMMARY, CONCLUSION, CONTRIBUTIONS AND FUTURE DIRECTIONS

This section is used to summarize the results of this research, draw meaningful conclusions of this study, and discuss the contributions and potential future research directions.

5.1. RESEARCH SUMMARY AND CONCLUSION

The objective of this research was to provide recommendations for the improvement of efficiency and effectiveness of an internal employee portal. The problems were mostly related to its contents and function and usability. Based on the research framework, an information mapping grid was developed to provide a comprehensive listing of all the information categories and information items within the information categories relating to the “Contents and Functions” of the portal. The information categories and information items constituting them were determined by studying theory from literature and actual usage via case studies.

A case company was used to validate the information mapping grid. The research was carried out using a three pronged approach as shown in Figure 5.1. (Same as figure 3.1), which includes: formulating the Industry Standards and Best Practices, determining the actual portal usage, and determining the user-perceived portal usage.

The major findings from Literature Review and Industry Case Studies categorize the contents and functions of an employee portal into five Information Categories, which are: “Customization and Personalization,” “Communication and Collaboration,” “Search function,” “Employee Self Service,” and “Help and FAQ.” “Customization and Personalization” has been mentioned as an important feature by both Literature and Industry Cases. “Communication and Collaboration” was recommended by a significant portion of the literature reviewed and it was adopted by all Industry cases studied. “Search functionality” is a mature information category, so while only approximately fifty percent of the literature mentioned its importance, it has been widely adopted by almost all of the Industry Cases. Likewise, the “FAQ” and “Help” and “Employee self-service” categories are rarely mentioned by the literature reviewed, they have also been adopted by a significant percentage of Industry cases examined. It is worth noting that “Employee Self-Service” needs further research, since this is an evolving Information Category.

The second prong of this approach studied the actual portal usage, which was accomplished by using dashboard monitoring systems, which present data from portal usage logs of the case company. The results showed that the portal was still in the early stages of integration into the company environment and far from being widely used by employees in the case company. The only group that used the portal regularly was the Information Technology group, partly because the portal lacked employee-oriented features such as

“Personalization and Customization,” “Communication and Collaboration” tools, “Employee Self-Service,” and “Help and FAQ.”

The third prong of the approach determined the usage of the portal as perceived by the target users. For this purpose, workshops and interviews were conducted with the users by a third-party company to ascertain their perceptions and expectations of the portal. Results of those workshops helped determine which areas of the portal needed improvement - from the users' perspective. The results obtained from those workshops were closely related to the Information Mapping Grid. The major problem users cited was that information was difficult to find on the portal, and they provided a list of information they needed. They wanted more “Communication and Collaboration” in the form of News and announcements, calendars showing holidays and company events, an employee directory, and location-specific information such as weather gadgets, etc. Users also expressed a desire for better “Employee Self-Service,” and “Help” and “FAQ,” which could reduce frequent calls to the HR department for basic support. Those workshops also highlighted the need for a better search strategy for the portal as well as personalization and customization features.

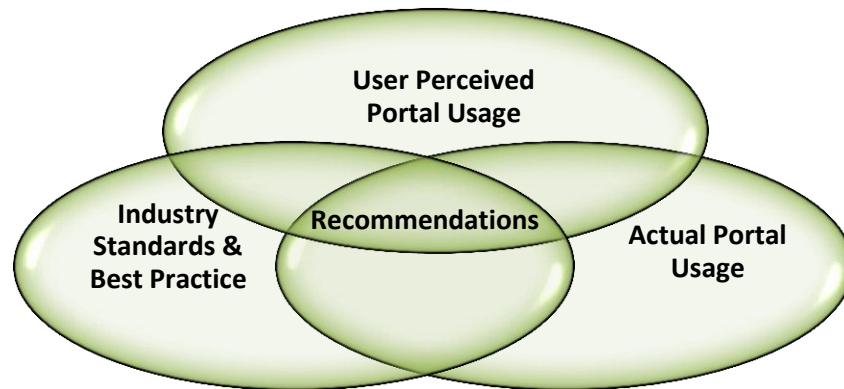


Figure 5.1. Solution Approach

Finally, the three solution approaches were combined with “actual portal usage,” “perceived usage” and “Industry Standards and Best Practices” to analyze the case company’s internal enterprise employee portal as displayed in figure 5.1.

There were five major recommendations based on the three pronged solution approach used in this study. The first recommendation was to implement “Customization and Personalization.” This Information category has been highly recommended by both literature and case studies. There are many ways in which this feature can be implemented, including via social networking, customizing the portal for specific clients, providing a digital workspace, offering a personalized homepage, or allowing users to change layout and colors, select resources, etc. Each company should tailor the set of information items that they incorporate in their employee portal to their own employee and business needs. This study recommends the following information items for Employee portals in general: “personalized homepage,”

“layout and color,” “selecting resources,” and having a “Digital workspace.” All of these information items except for “Color and layout” were also provided to the case company as recommendations for improving its current portal.

The second recommendation of this study was to provide a set of “Communication and Collaboration” tools in an employee portal. All industry cases studied implemented these tools and a significant portion of the literature recommended the communication and collaboration feature, indicating that it is both an important and mature information category of an employee portal and one which is still evolving. News, Quick links, popular links, personal links, community, employee directory, streaming video, and web communication are the most common methods use to implement “Communication and Collaboration” features, while Blogs, Events, Document Sharing, and Threaded Discussions are not quite as popular (yet) according to both industry cases and literature. The actual portal usage revealed that the case company does offer a few of these features but the perceived portal usage suggests that employees would like even more of these features incorporated into the portal. As a result, incorporating more communication and collaboration tools was strongly recommended to the case company.

The third recommendation was to incorporate “Employee Self-Service” in an employee portal. Employee self-service has been widely adopted by the industry cases studied, although literature research has yet to catch on. HR self-service, which allows employees to manage pay statements and taxes, is one of the most popular self-services. Career self-service has also been deemed

especially useful in managing internal job postings and recruiting from within the organization and it has been extended to help in recruitment as well. Medical self-service helps employees manage medical reimbursements. Travel-service allows employees to manage travel expenses. Training self-service, which is widely used in today's business world, allows employees to obtain training with the aid of online computer based training programs. A considerable percentage of literature mentions "Employee Self services," though not enough to be significant. Although research is on-going to find new ways to incorporate self-service features into employee portals, the full impact is yet to be determined. This discrepancy could be a topic for further research as self-service is rapidly evolving, with a significant amount of future research expected. The actual portal usage suggests that this feature was not present in the case company's portal even though the user-perceived portal usage suggests that this feature is very important to the employees. With this in mind, this feature was strongly recommended both for employee portals in general as well as for the case company.

The fourth recommendation of this study was to include search functions in an employee portal. The search function has been widely adopted among industry cases studied, but it was not frequently mentioned in the literature reviewed. This research recommends including an Advanced and/or Federated search feature in every employee portal, including the case company's portal.

The fifth recommendation was to provide an FAQ section and a Help section. These are two of the more mature information categories of an

enterprise portal as evidenced by the very high rate of implementation within industry cases, combined with the low number of times it is mentioned in the literature. FAQ section and Help sections are a highly recommended part of any employee portal implementation. These have also been recommended by the perceived portal usage though they were not present in the current portal of the case company.

Table 5.1 provides a brief summary of research findings and recommendations. The summary table consists of the information categories along with their associated information items as they relate to the “contents and functions” of an internal employee portal. An “X” represents “recommended.” “Low” indicates less than 33% support; “med” indicates 33-66% support and “high” indicates more than 66% support.

Table 5.1 Research Summary

Information Category			Information items			Derived Recommendations	
Description	Theory Support	Industry Support	Description	Theory Support	Industry Support	For Case Company	For Employee Portal in General
Personalization and Customization	High	High	Social Networking	Med	Low		
			Customized for Specific Clients	High	Med		
			Personalized Homepage	High	High	X	X
			Personal Stuff Tab	Med	Low		
			Layout and Color	High	Low		X
			Selecting Resources	Low	Med	X	X
			E-Room/Digital workspace	Med	Low	X	X
Help and FAQ	Low	Med		Med	High	X	X
Search Function	Med	High	Advanced Search	Med	High	X	X
			Federated Search	Med	Low		X
			Drop Down Search	Low	Low		
Communication and Collaboration tools	Med	High	Blogs	Low	Low		
			Policies and Guidelines	Med	High	X	X
			Events	Low	Med	X	X
			News	Med	High	X	X
			My Links/ Popular Links/ Quick Links	Med	High	X	X
			Feedback	Low	Med	X	X
			Quick Poll	low	Med		
			Community	Med	High		X
			Employee Directory/ Information	Med	High	X	X
			Calendar	Low	Med	X	X
			E-mail	Med	Med	X	X
			Tools and Applications	Med	High	X	X
			Streaming Video and Web Communication	Med	Low		X
			85-85 Rule	Low	Low		X
			Document/File Sharing	Med	Med	X	X
Threaded Discussion	Med	Low	X	X			
Employee Self-Service	Med	High	Career	Low	Med	X	X
			HR Self-Service	Med	High	X	X
			Medical Service/Sick Leave Balance	Low	Low		X
			Travel Service	Low	Med	X	X
			Training	Low	Med	X	X

5.2 RESEARCH CONTRIBUTIONS

This research made significant contributions to the world of research pertaining to portal evaluation. First, the methodology used in this research is very complex and novel as it involved three different approaches of “Industry Standards and Best Practices,” “Actual Portal Usage Monitoring,” and the study of “User-perceived Portal Usage” to assess an internal employee portal.

This is the first time that these three approaches have been combined and compared in this manner to derive a set of recommendations with regards to implementing “Personalization and Customization,” “Communication and Collaboration,” “Search functionality,” “Employee Self-Services,” and “Help and FAQ.” The recommendations are applicable for most global companies with a diverse workforce. Companies will be able to use the comprehensive list of “Industry Standards and Best Practices” as derived in the “Information Mapping Grid” to evaluate their portals by comparing and analyzing actual and perceived portal usage against these standards.

Another contribution is that the architecture and framework of data warehouses and dashboard monitoring systems developed by this research are applicable to companies using the same portal systems (i.e., SAP portal). The data logs, which are extremely complicated and unreadable or comprehensible in their raw form, can be used to develop meaningful information, which is very significant given the fact that SAP has been adopted by more than 85% of

Fortune 500 companies and by more than 80% of Fortune 1000 companies. The portal logs from Knowledge management can be fed into the Knowledge Management dashboard and the logs from the ClickStream data can be fed into the ClickStream data warehouses and eventually the ClickStream dashboard.

5.3 RESEARCH LIMITATIONS

The actual portal usage was studied based on data provided by the Case Company as collected from their portal usage logs, sourced from SAP Knowledge Management and ClickStream. The data was unstructured and required significant time and effort in cleansing, which involved discarding some figures and counts and potentially reduced the level of accuracy to some extent.

Data logs, on which the actual usage was based, only covered a short period of time, thus limiting our ability to discover long term trends and patterns.

Also, this research did not consider demographics such as the average age group of the users and the company culture (old-school or state-of-art) of industry cases or the case company due to time constraints.

The creation of the data warehouse in SAP and the design of the dashboard monitoring system encountered many technical difficulties. The initial prototype required several re-design iterations, and the dashboard suffered from multiple user experience and usability issues in the dashboard,

ranging from simple font and color choices to the type of graphs, and selection options that would be used in the dashboard. The data warehouse creation was also a challenging task, given the technical complexities that go into the Extraction-Transformation-Loading (ETL) process. (Appendix A)

Communication with the Case Company was another limitation. Since most of the research was conducted off-site far from the Case Company location, day-to-day direct communication and access to the Case Company's environment were both extremely limited. The Case Company was visited three times over ten months to gather periodic deliverables for the research. During those visits, the company's portal team and the research team met and discussed future courses of actions. Otherwise, most of the communication was carried out through e-mails and occasional phone/conference calls. Access to general users was not an option.

Finally, this research was carried out amidst the regular academic schedule and was to be completed in a definite time frame, which made this research even more challenging.

5.4 FUTURE DIRECTIONS

In the future, it would be interesting to implement the changes recommended and assess the user acceptance once the new features have been incorporated into the portal.

It would also be exciting to study how the actual usage of the portal changes after the recommendations are incorporated to determine if it improves, deteriorates, or remains the same. This future research would be easier to conduct than this initial study since dashboards and warehouses have already been created and could be used to organize raw data from data logs into valuable information about how the portal usage has changed.

Portals are an ever-growing field today, so the Industry Standards and Best Practices will change continuously and this set of recommended employee portal features may need to be revisited periodically.

Additional research is warranted to determine the reason for the inconsistency between the actual industry adoption and theory research with regards to the “Employee Self Service” information category. Further, different methods of industry implementation for the information categories: “Help” and “FAQ,” which could not be conducted in this paper due to the limited number of available case studies, offers another opportunity for future research.

APPENDIX A

TECHNICAL DETAILS OF THE DATA WAREHOUSE IN SAP

TECHNICAL DOCUMENT

Data Dictionary
INFOCUBE: CLICK_TP

Characteristics:

Technical Name	Long Description	Data Type	Output Length
AM_PAGE	Webpages	CHAR	60
AM_SEC	Name of a Section	CHAR	60
AM_SUB	Name of the Subsection	CHAR	60
TIMEDAY	Time in a Day	TIMS	06

Key Figures:

Technical Name	Long Description	Data Type	Output Length
PAGEVIEWS	Number of PageViews	FLTP	08
PAGELOGIN	Number of Page Logins	FLTP	08
PAGEUSERS	Number of Users	FLTP	08

Time Characteristics:

Technical Name	Long Description	Data Type	Output Length
OCALYEAR	Calendar Year	NUMC	04
OCALMONTH	Calendar Year/Month	NUMC	06
OCALWEEK	Calendar Year/Week	NUMC	06
OCALDAY	Calendar Day	DATS	08

The data was extracted from the ClickStream - Sweetlets. Various data cleaning were done on the raw data so as to make the upload file compatible with the SAP-BW and the format used for the flat file upload was - Name of the Webpage, Name of the Section, Name of the Subsection, Time in a Day, Calendar Date, Number of Page Logins, Number of Users, Number of PageViews.

Data Dictionary
INFOCUBE: CLICK_VT

Characteristics:

Technical Name	Long Description	Data Type	Output Length
SECNAMES	Name of the Section	CHAR	60
SUBNAMES	Name of the Subsection	CHAR	60
WEBPAGES	WEBPAGES	CHAR	30
MONTH	Month Name	CHAR	10
YEAR	Year it is	CHAR	10

Key Figures:

Technical Name	Long Description	Data Type	Output Length
VIEWTIME	Duration of PageView	DEC	09
PAGEVIEWS	Number of PageViews	FLTP	08

The data source was the ClickStream data usage logs. There were unstructured and not comprehensible. It looked like the illustration shown below.

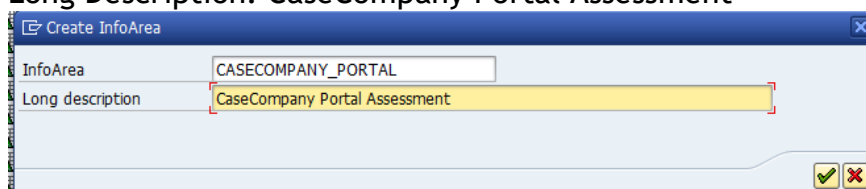
31/10/2010 08:20:51-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20434.pdf-47202
31/10/2010 08:20:52-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch4.pdf-61577
31/10/2010 08:20:52-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch4.pdf-61577
31/10/2010 08:20:52-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20147.pdf-39231
31/10/2010 08:20:52-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20147.pdf-39231
31/10/2010 08:20:56-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/11724.pdf-484146
31/10/2010 08:20:56-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/11724.pdf-484146
31/10/2010 08:20:56-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/15654.pdf-333130
31/10/2010 08:20:56-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/15654.pdf-333130
31/10/2010 08:20:58-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20330.pdf-75345
31/10/2010 08:20:58-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20330.pdf-75345
31/10/2010 08:21:01-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18087.pdf-749258
31/10/2010 08:21:01-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18087.pdf-749258
31/10/2010 08:21:01-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/13163.pdf-287232
31/10/2010 08:21:01-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/13163.pdf-287232
31/10/2010 08:21:02-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18132.pdf-343340
31/10/2010 08:21:02-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18132.pdf-343340
31/10/2010 08:21:04-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/17024.pdf-950307
31/10/2010 08:21:04-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/17024.pdf-950307
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/06.0	SAP PROJECTS SYSTEM/6.3 Business Process and Procedures (BPP)/CJ88 Indi	
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/06.0	SAP PROJECTS SYSTEM/6.3 Business Process and Procedures (BPP)/CJ88 Indi	
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18025.pdf-456552
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/18025.pdf-456552
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch8.pdf-111807
31/10/2010 08:21:06-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch8.pdf-111807
31/10/2010 08:21:07-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/introd2_0_.pdf-1
31/10/2010 08:21:07-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/introd2_0_.pdf-1
31/10/2010 08:21:07-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20707.pdf-488058
31/10/2010 08:21:08-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/20707.pdf-488058
31/10/2010 08:21:08-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19059.pdf-199291
31/10/2010 08:21:09-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19059.pdf-199291
31/10/2010 08:21:09-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/12036.pdf-214968
31/10/2010 08:21:09-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/12036.pdf-214968
31/10/2010 08:21:11-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19699.pdf-114488
31/10/2010 08:21:11-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19699.pdf-114488
31/10/2010 08:21:12-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19044.pdf-234059
31/10/2010 08:21:12-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/19044.pdf-234059
31/10/2010 08:21:12-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/13842.pdf-917879
31/10/2010 08:21:13-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/13842.pdf-917879
31/10/2010 08:21:14-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch18.pdf-65074
31/10/2010 08:21:15-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/ch18.pdf-65074
31/10/2010 08:21:15-operations/Engineering	Technical Services/Project	Development/11.0	CONSTRUCTION SPECIFICATIONS/11	-U.S. Standard Construction Specification
31/10/2010 08:21:15-operations/Engineering	Technical Services/Project	Development/11.0	CONSTRUCTION SPECIFICATIONS/11	-U.S. Standard Construction Specification
31/10/2010 08:21:15-operations/Engineering	Technical Services/Project	Development/09.0	COST ENGINEERING KNOWLEDGE/8.1	AACE - Cost Engineering/17024.pdf-950307

Step 1: Create an InfoArea

Menu path: SAP Menu → SAP Business Information Warehouse → Modeling → - Data Warehousing Workbench: Modeling - Double Click - Right Click - Create InfoArea - Enter following details:

InfoArea: CASECOMPANY_PORTAL

Long Description: CaseCompany Portal Assessment



Step 2: Create an InfoObject Catalog

Right click on CaseCompany Portal Assessment InfoArea and click Create InfoObject Catalog

Enter following details:

InfoObjCat: CLICKSTREAM_CHARACTERISTICS

Clickstream Characteristics

InfoObject Type: Char.
Create - Activate - Back

Edit InfoObject Catalog

InfoObjCat: Clickstream_Charact... Clickstream Characteristics

InfoArea: CASECOMPENY_PORTAL CaseCompany Portal Assessment

Copy From: [] []

InfoObject Type:

- Char.
- Key Figure

System Type (Namespace):

- SAP (Delivered by SAP)
- CUS (Generated by User)
- PAR (Partner)

Namespace: []

Similarly create another InfoObject Catalog named CLICKSTREAM_KF and select InfoObject Type: Key Figures and use this InfoObject Catalog to organize all the Key Figures

Step 3: Create InfoObjects

Right click on the InfoObject catalog created for characteristics - ClickStream Characteristics

Click create InfoObject - enter the following details

Char: AM_PAGE; Long Description: Webpages; Continue (green check)

Create Characteristic

Char.: AM_PAGE

Long description: Webpages

Reference Characteristic: []

Template: []

[] []

General Tab:

Data Type: CHAR - Character String, Length: 60, Save, Activate, Return

Version Comparison | Business Content

Characteristic: AM_PAGE

Long description: Webpages

Short description: Name of the Webpage

Version: Active (Saved)

Object Status: Active, executable

General | Business Explorer | Master data/texts | Hierarchy | Attribute

Dictionary

Data element: /BIC/OIAM_PAGE

Data Type: CHAR - Character String

Length: 60

Lowercase letters:

Convers. Rout.: ALPHA

Output length: 60

SID table: /BIC/SAM_PAGE

Other

Attribute Only

Person Respons.:

Content release:

Characteristic Is Document Property

Constant:

Transfer Routine

Transfer routine exists

Last change

By: RSRCH-09

On: 11/14/2011 00:30:03

Similarly create all the characteristics needed. The details of the characteristics are given in the data dictionary.

Right click on the InfoObject catalog created for Key figures - ClickStream Key Figures

Key Figure: PAGEVIEWS, Long Description: Number of PageViews

Continue

Type/Data Type: Number

Data Type: FLTP - Floating Point number

Save, Activate, Back.

Version Comparison | Business Content

Key Figure: PAGEVIEWS

Long description: Number of PageViews

Short description: Number of PageViews

Version: Active (Saved)

Object status: Active, executable

Type/unit | Aggregation | Additional Properties

Type/Data Type

Amount Number Date

Quantity Integer Time

Data Type: FLTP - Floating point number, accurate to ...

Currency/unit of measure

Fixed currency:

Fixed Unit of Meas.:

Similarly create all the key figures required and its details are provided in the data dictionary.

Step 4: Create InfoCube:

Data warehouse Workbench → Infoprovider → Select your Infoarea (CaseCompany Portal Assessment) → (Right click) Create Infocube

Enter the description and Technical name; example:

Long Description: CLICK_TP Technical Name: CLICK_TP

On the Infocube window on the right

(Right click) on Dimension → InfoObject Direct Input

Select all the characteristics required in the InfoCube. Similarly add all the Key figures required for the Infocube

STAR SCHEMA OF CLICK_TP

The Star Schema of CLICK_TP includes the following **5 dimensions**:

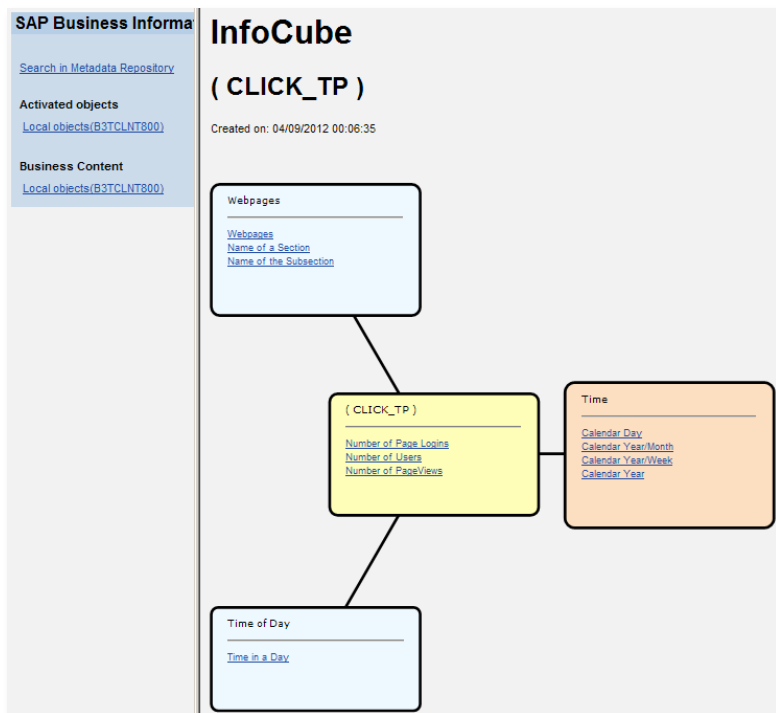
- Data Package: It has the following SAP pre-defined characteristics:
 - Change Run ID (OCHNGID)
 - Record type (ORECORDTP)
 - Request ID (OREQID)
- Time: It has the following characteristics:
 - Calendar Year (OCALYEAR)
 - Calendar Year/Month (OCALMONTH)
 - Calendar Year/Week (OCALWEEK)
 - Calendar Day (OCALDAY)
- Unit: It does not have any characteristics assigned to it.
- Webpages: It has three characteristics:
 - Webpages (AM_PAGES)
 - Name of a Section (AM_SEC)
 - Name of the Subsection (AM_SUB)
- Time of Day: It has the following characteristic:
 - Time in a Day (TIMEDAY)

It has **3 Navigation Attributes**, namely:

- Name of the Webpage: associated with the characteristic, “AM_PAGE.”
- Name of the Section: associated with the characteristic, “AM_SEC.”
- Name of the Subsection: associated with the characteristic, “AM_SUB”.

The fact table includes the following **3 key figures** as shown in figure 4.33:

- Number of PageViews (PAGEVIEWS)
- Number of Page Logins (PAGELOGINS)
- Number of Users (PAGEUSERS)



Star Schema of Click_TP

STAR SCHEMA OF CLICK_VT

The Star Schema of CLICK_VT includes 3 dimensions:

- Sections and SubSections: It has the following characteristics assigned to it:

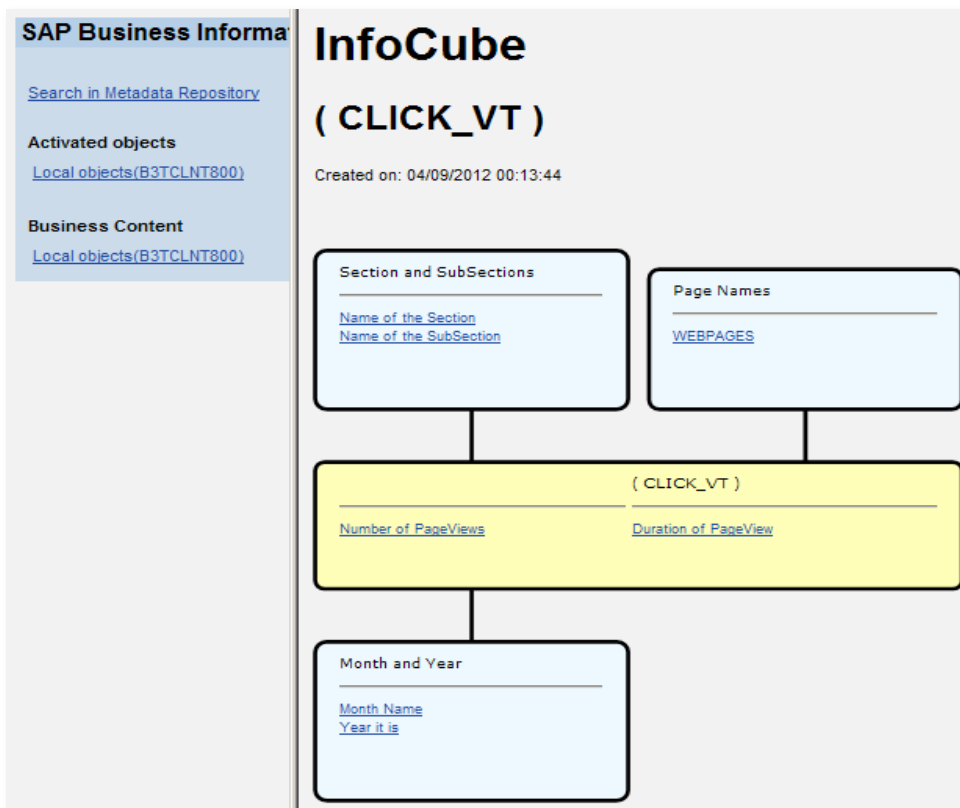
- Name of the Section (SECNAMES)
- Name of the SubSection (SUBNAMES)
- Page Names: It has the following characteristic assigned to it:
 - WEPAGES (WEBPAGES)
- Month and Year: It has 2 characteristics assigned to it, namely:
 - MonthName (MONTH)
 - Current Year (YEAR)

There are 3 other default dimensions which are used but not displayed on the Star Schema diagram. They are:

- Data Package: It has the following SAP pre-defined characteristics:
 - Change Run ID (OCHNGID)
 - Record type (ORECORDTP)
 - Request ID (OREQID)
- Time: It does not have any characteristics assigned to it.
- Unit: It does not have any characteristics assigned to it.

The InfoCube CLICK_VT does not have any navigation attributes, though it does include 2 key figures. They are shown in the fact table of the Star Schema of CLICK_VT (Figure 4.35) as:

- Duration of PageView (VIEWTIME)
- Number of PageViews (PAGEVIEWS)



Star Schema of Click_VT

APPENDIX B

TECHNICAL DETAILS OF THE DASHBOARD MONITORING SYSTEM

Enterprise Employee Portal Assessment Dashboard:

This dashboard contains two tabs. The “PageViews Trend Analysis” tab displayed the trends of pages viewed, and the ranking of sections and subsections by the number of PageViews. The “Number and Duration of PageViews” tab displayed the trends of sections and subsections based on number of PageViews and duration of PageViews.

First Tab of the Dashboard:

This tab has been divided horizontally into two halves. The upper segment of the tab contains a line chart which shows the trends of a section over a period of time and is controlled by the radio buttons located to its left. The radio buttons provide the selection criteria. The lower segment of this tab contains two bar graphs. The first bar graph on the left displays overall section ranking and it is controlled by a combo box that offers the following options: number of PageViews, number of users, and number of logins. The second bar graph on the bottom right quadrant addresses the subsection ranking by number of PageViews. Selecting a bar in the bar graph on the right hand side of the tab displays the ranking of the subsections within that section in the bar graph on the on the left.

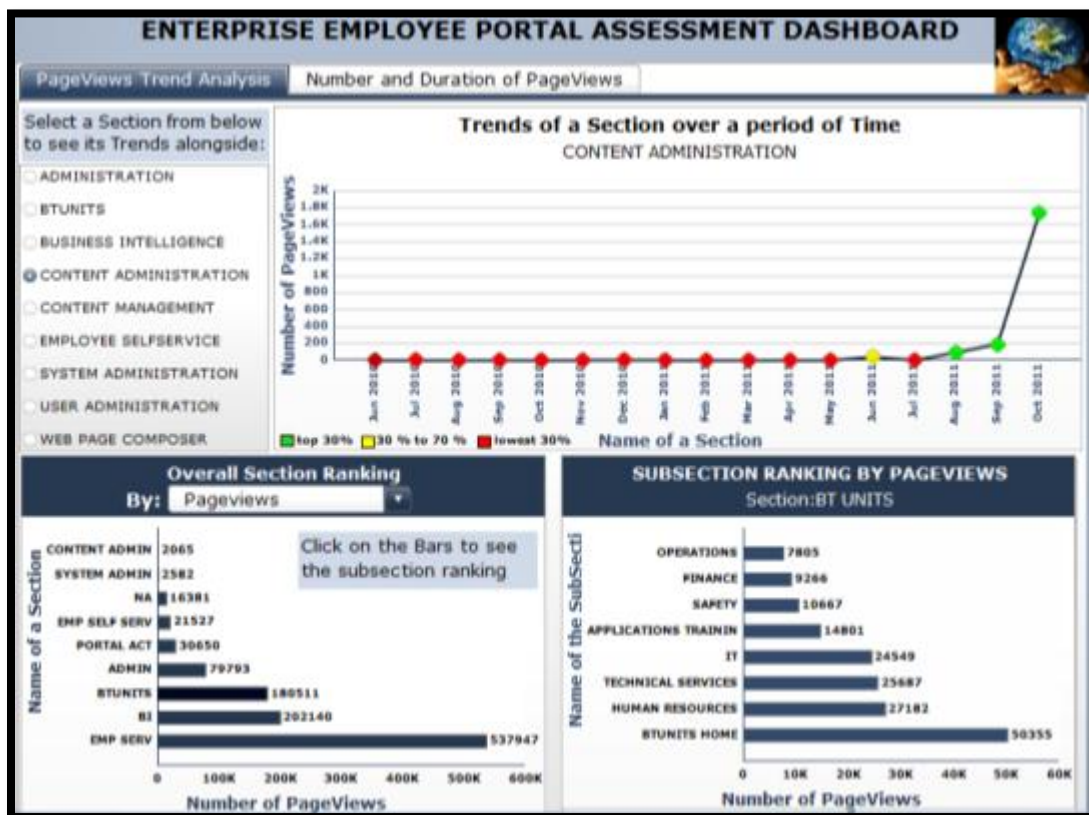


Figure B.1. First tab of the dashboard

Radio Button set:

The set of radio buttons is used as a selection structure. It provides a list of all of the sections of the portal. When a dashboard user selects a particular radio button, the corresponding section is displayed in the associated line chart.

The set radio buttons has a label above it which instructs the user to select an option from the radio button set, as shown in Figure B.2.

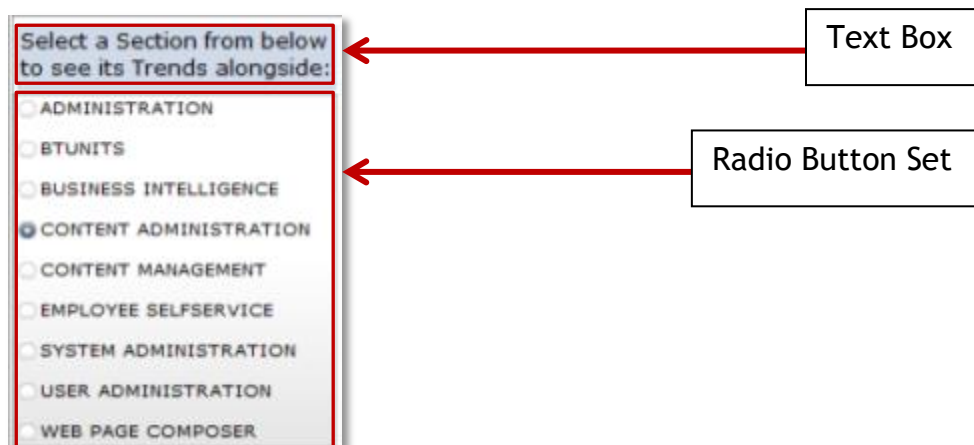


Figure B.2. Label and Radio Button Set

The code behind the radio button configuration is shown in Figure B.3. The Radio button labels are highlighted in yellow, the Data selection is shown in the white area with numbers, and the Destination cells are highlighted in green.

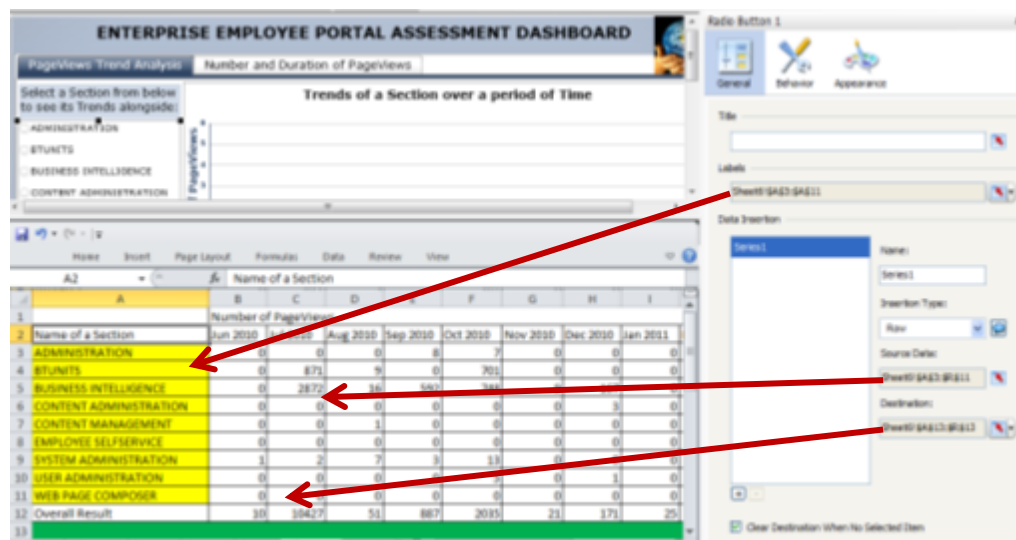


Figure B.3. Configuration of the Radio Button Set

The line graph triggered by the set of radio buttons displays the number of times a section has been viewed within a certain time period. In this case, the time period is monthly. The line chart maps the Name of a section to the number of PageViews. The Line chart is shown in Figure B.4.

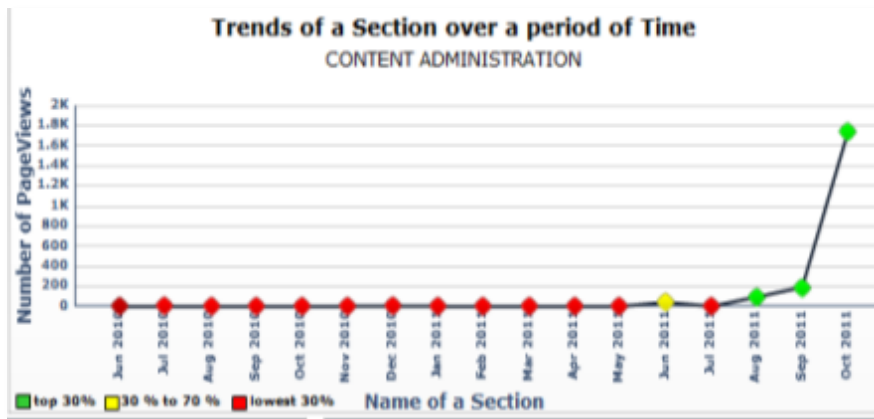


Figure B.4. Line Chart

The configuration of the line chart is shown in figure B.5 and B.6. The bar graph on the bottom left displays different data sets based on the selection from the combo box. Figure B.5. maps the number of PageViews to the section. There are alerts associated with this information. The alert configuration is shown in figure B.6.

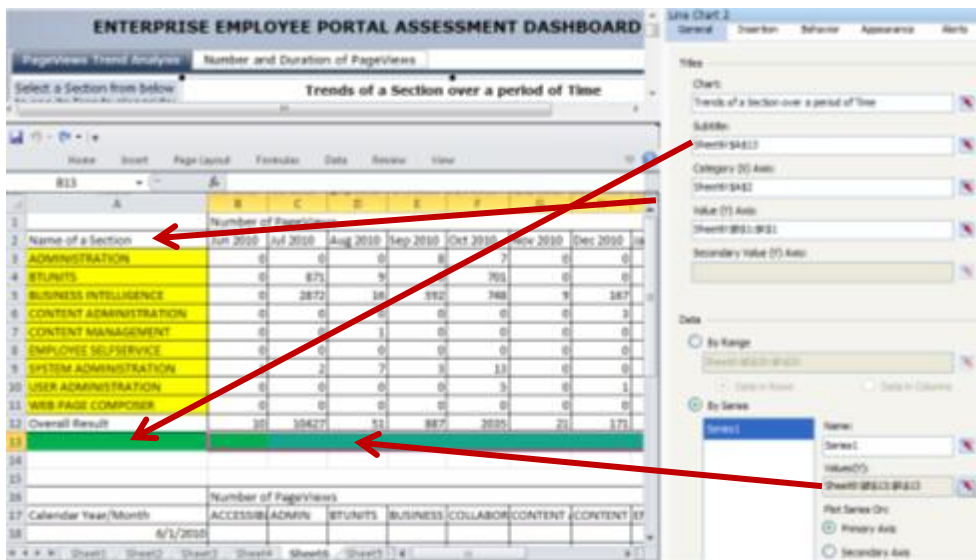
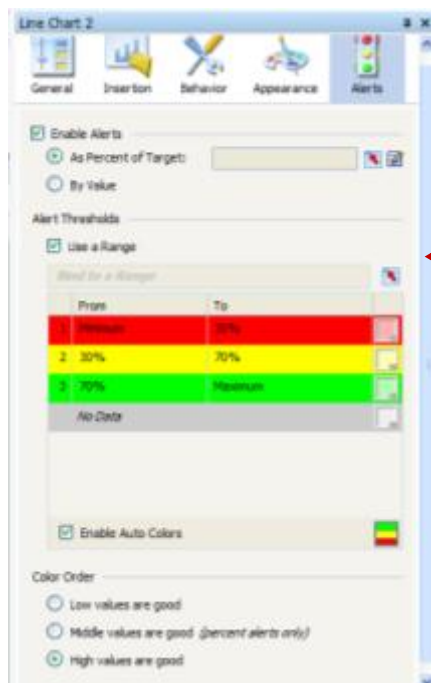


Figure B.5. The line graph configuration



Alerts have been set up for this line chart. Green has been used to indicate pages which have had 70% of the PageViews in that month, yellow indicates 30% to 70% of the PageViews, and red indicates pages with only 30% of the PageViews.

Figure B.6. Alerts set up in the line chart

The bar graph in the bottom left corner will display one of three bar graphs based on the value selected from the Combo box. Figure B.7 shows the bar graph with “PageViews” as the selected value from the combo box. The two other values are Logins and users. So, depending upon the value selected the bar graph will display the ranking of the various sections of the portal.



Figure B.7. Bottom Left Bar Graph in First Tab

The configurations of the bar graph shown in Figure B.7 are displayed in Figures B.8 and B.9.

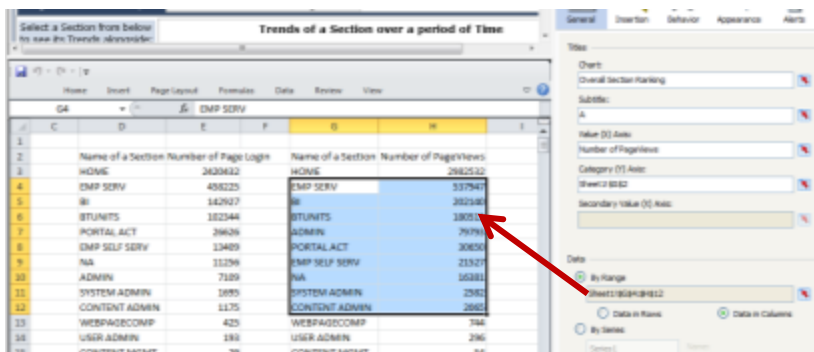


Figure B.8. The configuration of the bottom left bar graph in first tab

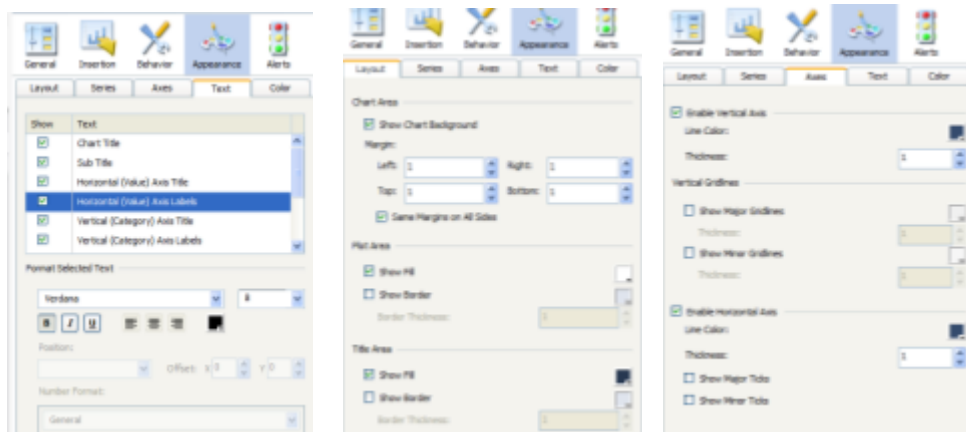


Figure B.9. More configurations of B.7.

The bar graph shown in the bottom right quadrant of the first tab shows the ranking of the subsections of a particular section. The section can be selected by clicking on the corresponding bar of the bar graph in the bottom left quadrant.



Figure B.10. The Bar graph in the bottom right quadrant on the first tab

The configurations of the Bar graph shown in Figure B.10 are displayed in Figure B.11.

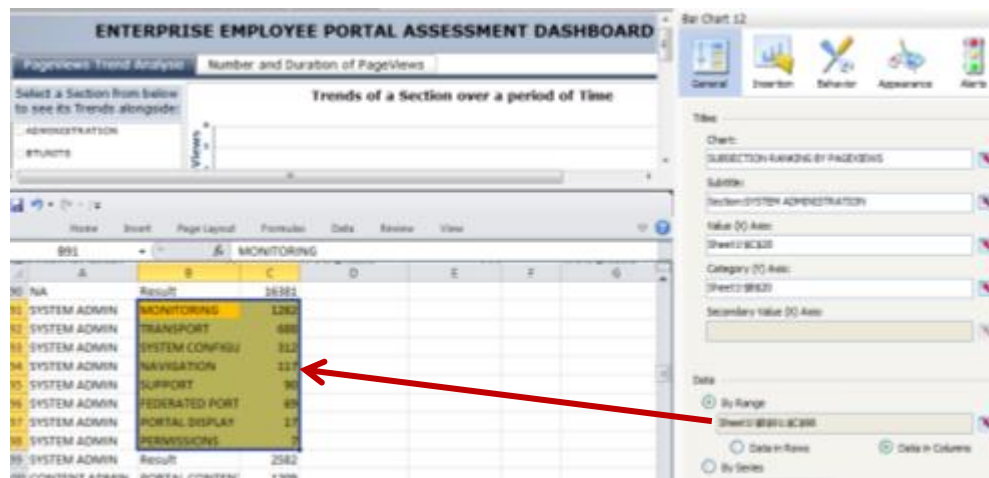


Figure B.12. Configuration of the bottom left bar graph on first tab

Second Tab of the Dashboard:

The second tab is named, “Number and Duration of PageViews.” This tab presents trend analysis of another very important key figure: “Duration of PageViews,” which measures how long a certain webpage has been viewed. This is an important measure because it helps us estimate how much importance users give to a certain page, assuming that users spend more time web pages which they feel are important. This tab has been divided into four quadrants. The top two quadrants contain column charts and the bottom two quadrants contain Combination Charts as shown in Figure B.13.



Figure B.13. Second tab of the dashboard.

Column Charts:

The two column charts on the first and second quadrants display the ranking of sections in a particular month of a year based on the number and duration of PageViews. Both the column charts are driven by the user selection from the combo box associated with it.

First Quadrant:

The first quadrant includes a column chart and a combo box. The column chart shows how the ranking of different sections of the portal changes over the months based on the number of PageViews. A specific month can be selected from the combo box that is located in the same quadrant as the column chart. The components of the first quadrant are shown in figure B.14. (The first quadrant is magnified.)



Figure B.15. Components of the first quadrant

The configuration of the combo box is shown in Figure B.16, below.

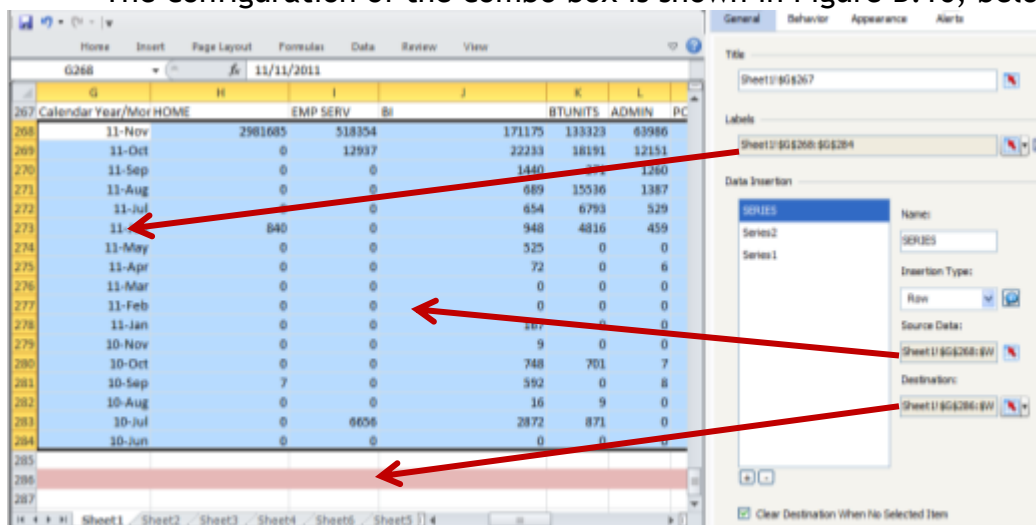


Figure B.16. Configurations of Combo box in first quadrant.

The configuration of the column chart is shown in figure B.17.

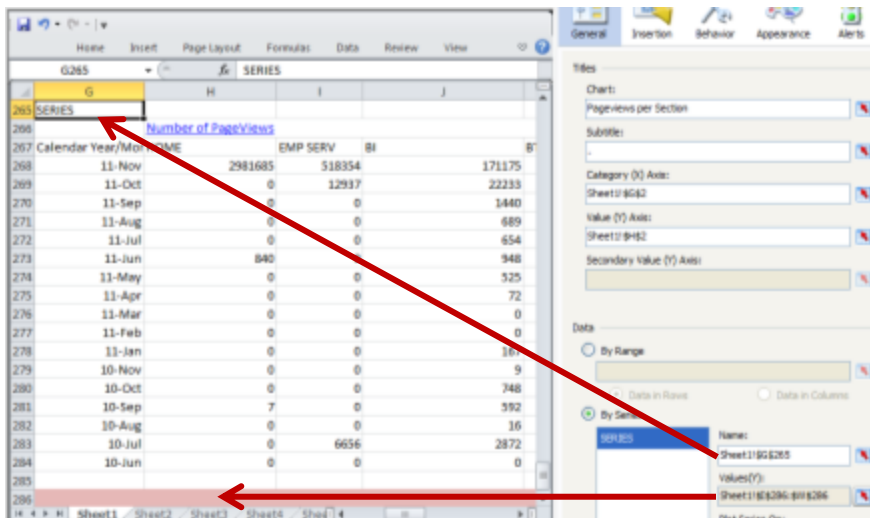


Figure B.17. Configurations of the column chart in the first quadrant of the second tab.

Second Quadrant:

The second quadrant also contains a column chart and a combo box. The column chart shows how the ranking of different sections of the portal changes over the months based on the duration of views. A specific month can be selected from the combo box that is located in the same quadrant. The components of the second quadrant are shown in figure B.18 where the first quadrant is magnified.

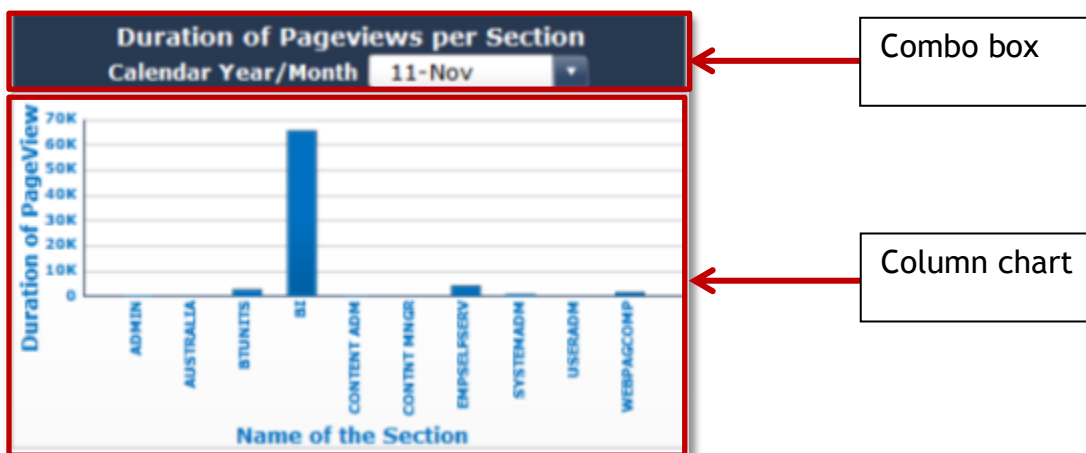


Figure B.18. Second quadrant of the second tab of the dashboard.

The configuration of the combo box is shown in figure B.19.

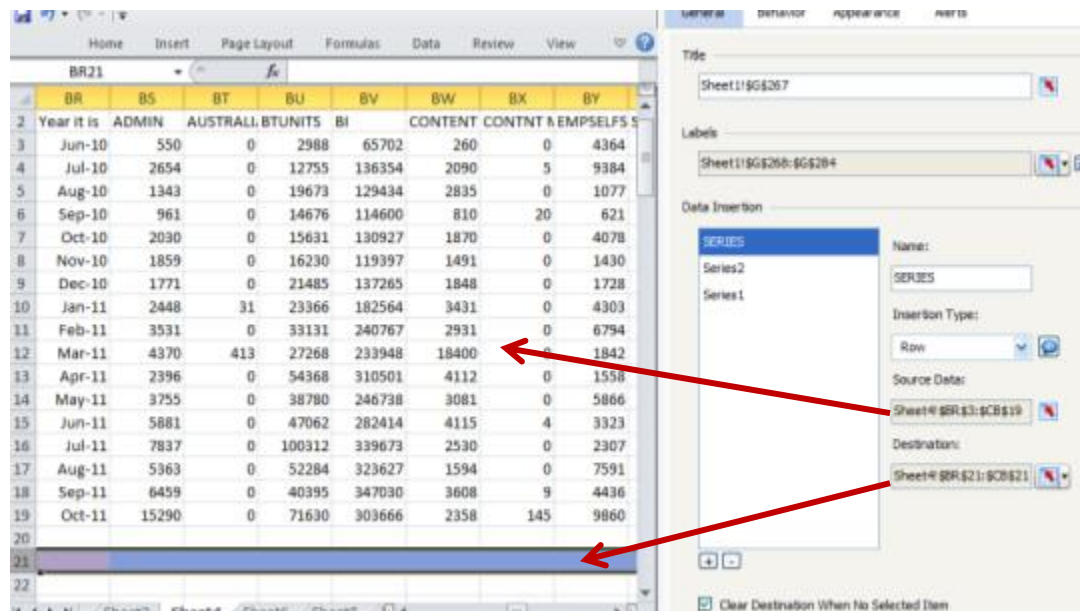


Figure B.19. The configurations of the combo box in the second quadrant of the second tab of the dashboard.

Combination Charts:

The combination charts are used to show the combined analysis of the web pages based on the number of PageViews and the duration of PageViews. The combination charts are each controlled by combo boxes. Here the combo box provides a list of the different sections. Depending on the user selection from the combo box, the combination chart in the third quadrant will display the top (most popular) web-pages of that section, and the combination chart in the fourth quadrant will display the bottom (least popular) web-pages of the section selected.

Third quadrant:

The combination chart in this quadrant addresses the top pages according to the number of PageViews combined with the duration of PageViews as shown in figure B.20.

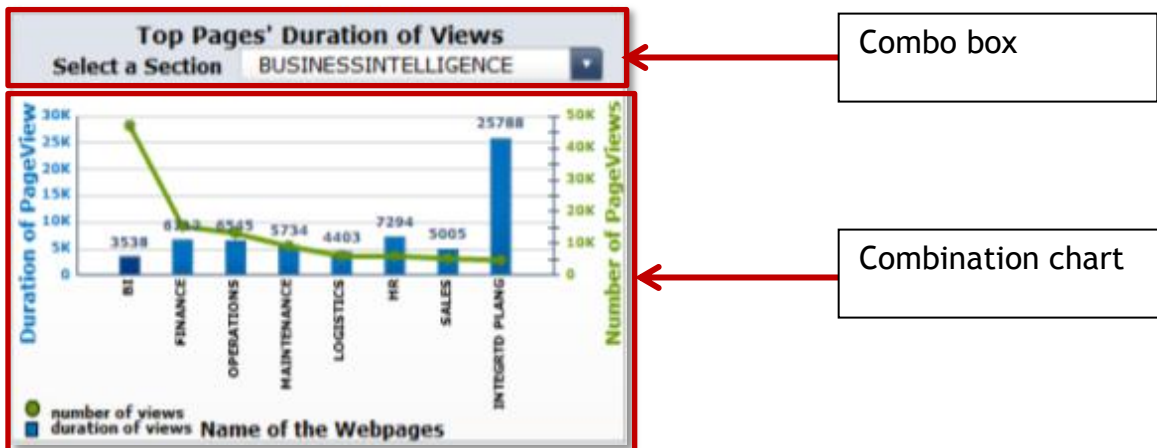


Figure B.20. The third quadrant of the second tab of the dashboard.

The configuration of the combination chart is shown in Figure B.21.

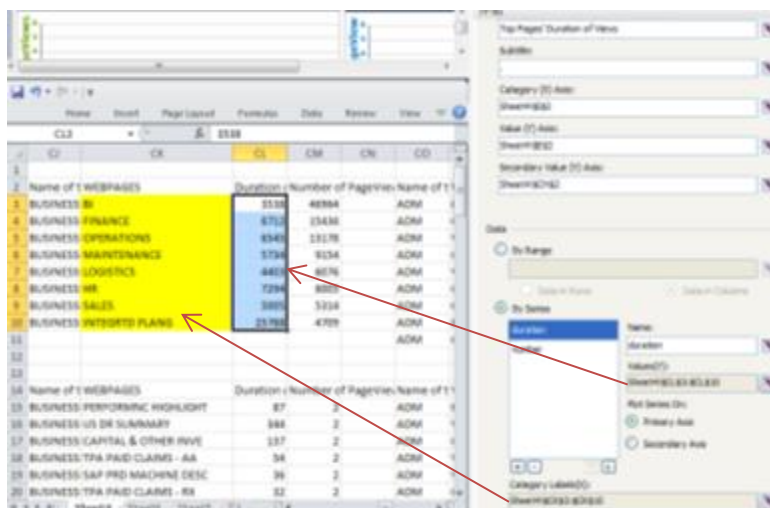


Figure B.21. Configuration of the combination chart of the second tab of the dashboard.

Fourth Quadrant:

The combination chart in this quadrant addresses the bottom pages according to the number of PageViews combined with the duration of PageViews as shown in figure B.22.

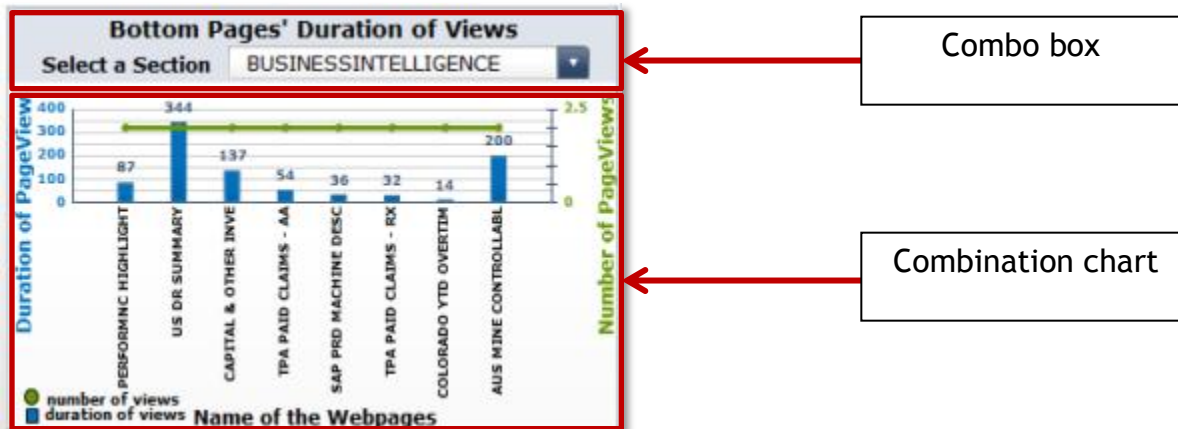


Figure B.22. Combination chart and combo box in the fourth quadrant of the second tab of the dashboard

The configuration of the combination chart is displayed in figure B.23 below.

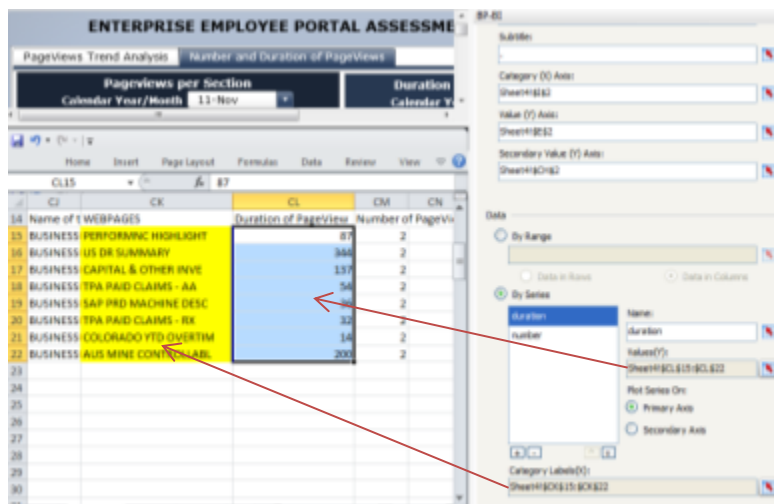


Figure B.23. Configurations of the combination chart in the second tab of the dashboard.

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