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The corporate portal as information infrastructure: towards a framework for portal design

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Abstract

Corporate portals offer organizational users the ability to access a wide variety of information sources directly from the desktop. By functioning as an underlying Web infrastructure for information management, portals can provide firms with a shared information work space that facilitates access to information content, organizational communications, and group collaboration. To foster the development of portals in this way requires a design approach that goes beyond traditional technological and content concerns. Utilizing ideas borrowed from both Taylor's value-added model of systems development and Davenport's concept of the information ecology of organizations, a framework for corporate portal design is presented. The framework stresses the need for developers to incorporate value-added processes that match the information needs and uses of organizational participants and improve the organization's informational context. Doing so, can help promote corporate portal designs that function as infrastructure for information access and use.

Keywords: Corporate portal; Information infrastructure; Information ecology; Information behaviours

1. Introduction

Corporate portals are single-point Web browser interfaces used within organizations to promote the gathering, sharing, and dissemination of information throughout the enterprise. As such, these tools offer corporations a means by which to manage and access information from disparate sources across the firm. However, traditional data-driven approaches to portal and intranet design often ignore the information needs and practices of users. As a result, corporate portals can suffer from usability problems such as poor navigation and inappropriate display of information that

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prevent or inhibit use of these systems, circumventing their promise as an information management tool.

To address this issue, this paper explores the potential of portals as an underlying infrastructure for organizational information access and use, and posits the need for a new direction in portal design that calls for an awareness of the contexts in which people are situated, the problems they typically face, and the way organizational actors utilize information to help resolve their problems.

First, background is given on the promise of corporate portals and their potential as a shared information work space. Next, a Behavioural/Ecological design framework is presented. The framework concentrates on user information needs and behaviours, the information ecology of the organization, and the value-added processes offered within a portal design that can enhance the potential usefulness of information to users. It is argued that by focusing on user information practice and the contexts in which information is utilized, system developers can provide richer and more robust corporate portals that function as infrastructures for the creation, sharing, and re-use of information throughout the firm.

2. The potential of corporate portals

By functioning as a home page to departmental intranet sites and external internet resources, portals have generated an increased interest among information managers due to the technology's ability to improve the flow and exchange of information across the enterprise (Newell, Scarbrough, Swan & Aislop, 1999). Like intranets, corporate portals are private, internal Web-based networks usually restricted to organizational participants only. Firewalls prevent access from external internet users and allow information to be securely managed inside an organization. Abraham (1998) defines an intranet as a set of applications built on an internet-enabled infrastructure meant for internal use only by employees of a single organization (Bernard, 1996). However, corporate portals differ from intranets in that a portal's primary function is to provide a transparent directory of information already available elsewhere, not act as a separate source of information itself (Plumtree, 1999). In this way, corporate portals provide access not only to the underlying network but also to the information content, services, and applications built on top of that network infrastructure and located across a company's vast array of information resources.

Recently, industry trend-watchers have forecasted the rise of portal development in corporations. For instance, Gartner Group predicts with 80% probability that more than half of all major companies by the end of the year 2001 will implement corporate portals as the primary method for organizing and discovering corporate resources (Verity, 1999). Likewise, the Delphi Group found that 55% of Fortune 500 companies currently have corporate portal projects in progress; further, Merrill Lynch estimates that the market for portal tools and services will be worth upwards of $14.8 billion (US) by the year 2002 (Roberts-Witt, 1999).

The excitement over portals is due in large part to the success Yahoo! had with its 1996 launch of a personalized portal service called MyYahoo!, which allowed users to customize their own Web interfaces to filter and provide information that was relevant and meaningful to them (Plumtree, 1999). Organizations were quick to notice the success of this product in terms of its adoption and use by the general public and started to investigate ways to develop a similar view of corporate information. Overall, corporate portals are following a similar trajectory as consumer portals,

though over much shorter time frames. First version portals containing referential links to information plus a search engine are quickly evolving into more complex, interactive gateways that embed applications to enhance personal and work group productivity, all within time periods as short as 12 months (Eckerson, 1999).

Common elements contained with corporate portal designs include an enterprise taxonomy or classification of information categories that help organize information for easy retrieval; a search engine to facilitate more specific and exact information requests; and links to both internal and external Web sites and information sources. As such, corporate portals offer a means of pulling together all the various computer technologies that dot the corporate landscape into a single system that enables employees to find information regardless of its physical location (Plumtree, 1999; Verity, 1999; Ouellette, 1999). More advanced portal features include access to work group productivity tools such as e-mail, calendars, workflow and project management software, expense reporting and travel reservation applications, as well as more specialized functions for transaction-based information processing where users can read, write, and update corporate data directly through the portal interface (Eckerson, 1999).

By offering such features, corporate portals have the potential of providing organizations with a rich and complex *shared information work space* for the creation, exchange, retention, and reuse of knowledge. To elaborate this position, an information-based model of the corporate portal is presented in Fig. 1. The diagram illustrates three major components of a portal's shared information work space: a *content space* to facilitate information access and retrieval; a *communication space* to negotiate collective interpretations and shared meanings; and a *coordination space* to support cooperative work action. The provision of a shared information work space may offer great benefit to organizations in that it can help organizational participants acquire, distribute, interpret, store, and retrieve information in their daily work practice.

As an information content space, corporate portals can help organizations with improved information storage and retrieval. Due to their platform independent nature, portals can provide

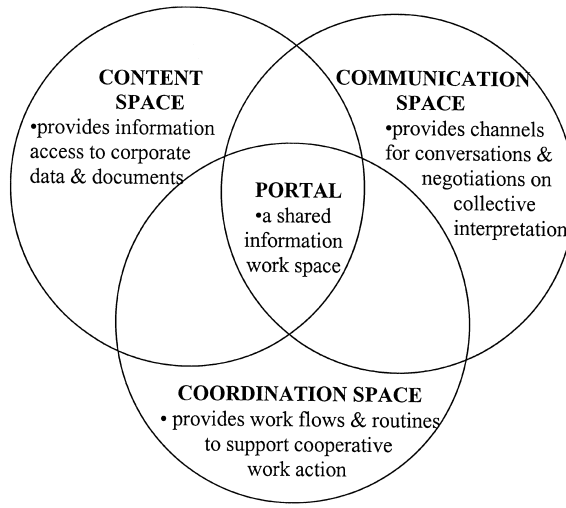

Fig. 1. The corporate portal as shared information work space.

organizations with increased access to a wide variety of information sources, such as databases, legacy systems, and web file servers, that reside both within and outside the company (Orenstein, 1999; Jones, 1999; Stackpole, 1999). The information obtained from these sources can vary considerably, ranging from hard, quantitative structured data typically found in most database application systems to more soft, unstructured information located in a multitude of organizational documents and procedure guides. Further, access to this diverse set of information sources is in a convenient form as portals allow users to search and browse for information directly from individual desktops. This convenience can promote the acquisition and use of information throughout the entire organization as individuals tend to use information characterized by high accessibility (Allen, 1977).

In terms of a *communication space*, corporate portals can help organizational users make better sense of the information they receive. Portals can do this providing rich information channels that help users engage in conversations and negotiations with others in the firm so that shared interpretations can be made. In this way, new perspectives and innovation can result and be stored back into the portal's knowledge base for later re-use. Doing so can help facilitate the processes of information distribution and information interpretation, which are important elements in supporting how organizations learn (Huber, 1996). Information distribution is the process by which information from different sources is shared and used to gain new understanding or insights across the enterprise; such activity can lead to more broadly based organizational learning. Information interpretation is the process by which common understandings are obtained through the sharing and discussion of information from various sources; it is argued that more learning occurs when more varied interpretations have been developed and when more organizational units understand the nature of the various interpretations held by others.

As a *coordination space*, corporate portals can also give organizational participants the ability to manage the flow of information necessary for cooperative action between various organizational units. To do this, organizational participants need functionality in their portal designs which help automate information work flows and/or coordinate work routines. Further, features are required which support the awareness of others in the organization and their availability for cooperative action. As such, portals can provide the necessary context for articulation work, tasks beyond those described by formal procedures which are required to coordinate "real" work activities and keep them running, such as scheduling, organizing, negotiating, making ad hoc decisions, recovering from errors, and assembling resources (Robinson, 1991; Kuutti, 1996; Gerson & Star, 1986). Others have noted the benefits in utilizing electronic technology for collaborative work. For example, Finholt & Sproull remark on the ability of electronic groups in the workplace to cut across organizational boundaries of geography and work unit, to tap and pool expertise of individual employees regardless of their physical location, and to provide a means by which employees can discover others with similar interests (Finholt and Sproull, 1990). Likewise, Malone et al. (1989) extol the benefits of electronic systems in organizations in their description of their experience with their own e-mail based system called the Information Lens which facilitates the exchange of semi-structured messages across an organization (Malone et al., 1989). In their discussion, the authors describe the system's ability to help people filter, sort, and prioritize messages that are already addressed to them, and find useful messages they would not otherwise have received. Here, the tool's facility to help aid the filtering and distribution of messages increased information sharing and coordination across the enterprise.

3. Towards a new framework for portal design

To help realize the potential of portals as shared information work spaces, a new orientation may be required in corporate portal and intranet design. Typically organizations launch portal and intranet development initiatives as a means to reduce internal information publishing costs and enhance corporate information distribution (Rice, 1996; Thyfault, 1996). Portal design can be more ambitious than this by providing functionality which helps small and large groups of people cooperate and work together more efficiently (Small, 1999).

To further the development of portals in this way, a new view to portal design may be required, one that tempers the predominant focus on information content and technology concerns with an awareness of the information needs and uses of organizational participants. To do so, this paper suggests that priority in design be placed on people.

By emphasizing the importance of people, corporate portals can be better understood as information seeking systems rather than as systems that merely support the retrieval of information. As voiced by Marchionini in his discussion of information seeking in electronic environments,

> information seeking is preferred to information retrieval because it is more human oriented and open ended. Retrieval implies that the object must have been "known" at some point; most often, those people who "knew" it organized it for later "knowing" by themselves or someone else. Seeking connotes the process of acquiring knowledge; it is more problem oriented as the solution may or may not be found (Marchionini, 1995).

Viewing portals in this way helps underline the necessity for designers to understand the problems and contexts that draw people to use portals and the way in which information must be displayed and presented to make it meaningful to them. Doing so can enhance portal design and improve information access. Designers can no longer assume that employees use a portal knowing what information they want and that they can search for it directly. Developers must realize that people more often use a portal not to find a specific answer, but rather to help them make sense of their environment, learn new ideas, or resolve their problems.

Though not specifically geared to portals, a framework which supports this orientation is offered by Taylor in his *value-added model* for information systems development (Taylor, 1986). Taylor suggests that current design approaches could be improved by an approach which concentrates on the user and attempts to understand the criteria by which information will be judged to be valuable. He states that users and their environments are critical and necessary ingredients to the understanding and improvement of systems, and that developers need to be able to describe user environments and translate those descriptions into useful parameters for systems design. That is, to look

> ...at the user and the uses of information, and the contexts within which those users make choices about what information is useful to them at particular times. These choices are based, not only on subject matter, but on other elements of the context within which a user lives and works (Taylor, 1986, p. 218).

According to Taylor, the major input to the design of information systems must come from an analysis of the information use environment (IUE). Taylor emphasizes the need to describe the

environments from which problems arise and which require information for resolution. He suggests that if present system design approaches were tempered by criteria from users and their environments, then systems could be developed that were more responsive to a wider variety of user needs and problems. Taylor identifies four components of the information use environment: (1) typical settings which include not only physical characteristics of the environment but attitudes toward information and the causal effect of this attitude on employee information behaviour, (2) sets of people who are situated in these settings, (3) problems they typically face, and (4) problem resolutions or ways that these people prefer and use information to help resolve their problems (Taylor, 1991).

In his value-added model, Taylor presents several steps for the design and operation of an information system based on an analysis of the IUE. The first step is to perform an analysis of the IUE and translate its description into "information terms". This translation must inform systems designers not only of the magnitude of the information requirements but also of the types, structure and display of information required to help users perform current and anticipated tasks, and resolve their problems in particular environments. The second step uses the analysis of the IUE to create value-added processes for the information system. Once operational, the products and services of the system produce outputs. They are what the users "see". Moreover, they are what the users work with to solve problems and answer questions. The last step involves judging the merit of the value-added processes by determining how well the outputs of the system help users solve their problems. This is done through an analysis of the negotiating space where attempts are made to match the outputs of the system with the problems users face in their information use environments.

Recent work by Davenport also underlines the need to understand information environments and the way people use information in their work settings (Davenport, 1997). Here, Davenport critiques traditional information management efforts, such as those which overemphasize the use of technology or suggest information be managed like other valuable corporate resource in organizations like capital and labour (Horton, 1979). In his work, Davenport states that traditional approaches to information management no longer fit our information-rich world (Davenport, 1997). In response, he suggests a new, holistic approach, called *information ecology*, which places emphasis on how people create, distribute, understand, and use information.

Davenport's work is relevant to this paper's call to understand how users operate in their information environments and the need for a focus on people and information behaviour. He suggests that information providers not concern themselves just with the production and distribution of information but also with what recipients do upon receiving this information. Only by knowing how individuals workers seek, share, structure, and make sense of information can information providers facilitate its effective use.

To help organizations better acquire and utilize information, Davenport proposes an ecological model for information management. In this model, the information environment is at the core of an ecological management approach and encompasses the six most critical components of information ecology: strategy, politics, behaviour/culture, staff, processes, and architecture.

The ideas behind both Taylor's and Davenport's work add support for the need for a new approach to portal design if these systems are to facilitate and enhance organizational information access and use. Together, Taylor and Davenport stress the need to place less emphasis on information technology and content concerns and more awareness on how people behave with

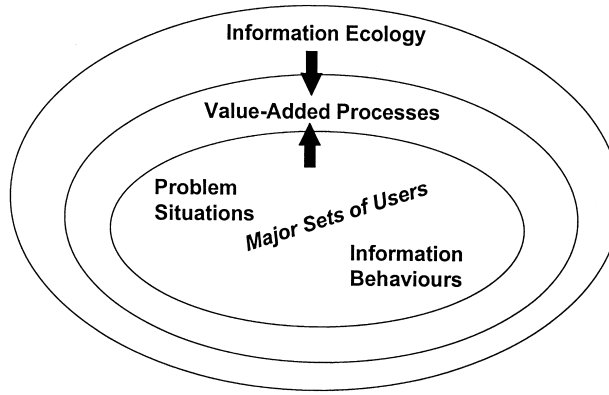

Fig. 2. A behavioural-ecological approach to corporate portal design.

information in their typical work practice and settings. As such, Taylor's and Davenport's ideas can be used as a theoretical basis for the development of a new *Behavioural-Ecological framework* for the design and evaluation of corporate portals. Fig. 2 illustrates the workings of the Behavioural/Ecological model which consists of three nested layers: the information ecology of the organization, the information behaviours of users, and the value-added processes within a portal.

The *information ecology* refers to the internal information environment of an organization. As described by Davenport, the internal information environment comprises many interdependent social and cultural subsystems that can influence the creation, flow, and use of information. Adopting ideas from Taylor's description of the IUE and Davenport's ecological approach, the following eight elements may need be examined when analyzing an organization's information ecology: organizational mission; corporate portal goals; information management plans; information culture; information politics; physical setting; information staff; and information handling.

An organizational mission is described by the overarching goals and activities of an organization that define its identity and purpose. Corporate portal goals refer to the ways in which portals help organizations accomplish their missions. Information management plans are the formal policies and standards an organization establishes to structure and control the management of its information resources and services. Information culture incorporates the attitudes and norms organizational participants hold regarding issues such as the ownership and sharing of information, and the amount and intensity of information gathering and analysis appropriate or expected in an organization. Information politics refer to the political barriers in an organization which obstruct the movement of information across departmental boundaries and lead to the unproductive hiding and hoarding of information. An organization's physical setting refers to the physical context which imposes particular constraints and requirements on user information behaviour. For example, an organization that is dispersed over multiple locations, or whose employees spend most of their time in the field, would need to address issues such as information access, remote communications, and data currency. Information staff are the people in an organization needed to provide and interpret information to others in the company. Last, information handling are the rules and routines utilized by an organization for the management of its records and archives, and the maintenance of its institutional memory.

The *information behaviour* of users refer to the practices of individuals and groups as they go about obtaining and using information to resolve their work-related problem situations. Basically, three steps are required to understand user information behaviour. The first is to develop a clear understanding of who the major sets of users are in terms of their information needs and information seeking preferences. This involves gaining insights on not only the types of information content accessed and utilized in typical work practice but also how users share and communicate this information with others in the organization. The second is to gain insight on the structure of work-related problem situations that users typically face. MacMullin and Taylor identify eleven problem dimensions that define the information attributes of most work problem situations (MacMullin & Taylor, 1984). These dimensions include such categories as "design/discovery", "well/ill-structured", "specific/amorphous goals". The third is to understand how users seek and prefer information. MacMullin and Taylor propose a generalized list of information traits by which information is recognized and evaluated (MacMullin & Taylor, 1984). These traits go beyond subject relevance (what is this message about?) to situational relevance (how can this message help me in my work situation?). Taylor further suggests eight generic information uses (Taylor, 1986).

The v*alue-added processes* offered by a corporate portal are functions or features within a portal design that signal, amplify, and extend the value of information to the organization and its users. This can be accomplished on three different levels.

At the user task level, portals may be designed so that they directly support the information behaviours of users as they resolve their work-related problem situations. To do this, system designers should understand the typical problem situations that users face and the information required to help users resolve these problems. This necessitates portal developers learning which information sources are desired by participants, how they prefer to see this information displayed, and the ways in which they typically use this information. Doing so can help developers create portal designs that address the information needs and uses of organizational participants.

At the organizational level, corporate portals may be designed to fit or improve the organization's information ecology. To do this, developers must be aware of the situational contexts in which portals are used. This includes not only understanding the physical characteristics that impede information access and use, but also the political factors that impede the free flow of information between groups and the culture of the organization that deters the extent to which information is shared and valued in the company. Designers need to understand these factors and try to develop portals that overcome these barriers and promote "good" information behaviours such as the sharing and re-use of organizational knowledge. In this way, portals can promote organizational communication between departments and encourage collaboration between groups dispersed throughout the firm.

At the interface level, corporate portals may be designed to incorporate functions and features which enhance the potential usefulness of information to users. To do this, developers must be aware of the importance of presenting information in engaging ways to facilitate the use of the portal. Emphasis is required on the organization and presentation of information content as a means of facilitating use of such systems.

Incorporating value-added processes in the design of intranets at these three levels can help facilitate the use of corporate portals as a unified shared information work space in which users can move seamlessly between accessing content, engaging in communications, and collaborating with others. For example, by addressing the information behaviours of employees, portals can function

Table 1
Common design scenarios of the behavioural/ecological framework

Behavioural/ecological component	Common design scenario
Information ecology:	
Physical setting	If users are physically removed from the information sources they need to do their jobs: provide portal access to these sources
Information culture	If users do not readily value or appreciate information: present information in engaging ways; profile links to departmental intranet sites that are exemplars at sharing and promoting information that is of relevance to others
Information politics	If information hoarding is rampant: incorporate features within the portal that facilitate discussion and communication such as on-line discussion groups or anonymised chat sessions; remove corporate propaganda from the portal design that promotes distrust of the system by employees
Information staff	If information overload and disorganization of information is a problem: recruit information content professionals, such as those found within corporate libraries, to filter, summarize, organize, and index information that resides on the portal
Information behaviours:	
Problem dimensions	If users' information problems are well-structured, simple, familiar, and have specific goals then provide links to steps or procedures that walk users through their information requests; if problems are ill-structured, complex, and have amorphous goals provide links within the portal to multiple perspectives and summaries of information that can help users interpret and make sense of the information they need to resolve their problems; if problems are discovery-related then provide search tools within the portal to help users find the information they need
Information traits	Find out how users prefer their information displayed to help them resolve their problems and present the information in this manner on the portal (e.g. if users prefer quantitative/qualitative, historical/forecasting, factual/diffuse, applied/theoretical information then present the information in that way on the portal)
Information uses	If users need information for enlightenment or problem understanding purposes: provide links to sufficient background information and related stories and summaries on the portal for them; if users need information for instrumental purposes: provide references to specific instructions on what or how to do something; if user need information for factual purposes: then provide links to precise, relevant data

as information content spaces that provide relevant information in ways that organizational participants prefer and find useful. By facilitating the creation, flow, and use of information within a firm's information ecology, portals can function as coordination and communication spaces which support the exchange of ideas and know-how, the discovery of other experts in the company, and the creation of products and services by groups of people throughout the organization. By

incorporating functions and features which enhance the potential usefulness of information, portals can promote better user engagement of these systems.

Table 1 outlines possible design scenarios of how components of the information ecology and information behaviours of major sets of users can be utilized to devise value-added processes in corporate portal designs that facilitate a shared information work space. These examples are based on two years of experience with the Behavioural/Ecological framework by project teams of graduate students who utilized the approach to develop intranet and portal designs for local organizations. The table describes the more common scenarios experienced by the project teams in their application of the framework.

As such, the Behavioural/Ecological framework can help facilitate the design of corporate portals as a mobilizing information technology infrastructure upon which to cultivate and promote information access and use. By focusing attention to the information ecology and information behaviours of organizational participants, designers can be better positioned to develop portal designs that help organizational participants obtain access to desired information content, break free from many of the communication barriers commonly found in traditional organizational hierarchies, and coordinate work flow and cooperative action. Doing so can help promote the use of corporate portals as an organizational information infrastructure.

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