A Content-Incentive-Usability Framework for Corporate Portal Design

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INTRODUCTION

The knowledge based theory of the firm argues that firms obtain competitive advantage by creating, storing and applying knowledge (Jayatilaka, Schwarz, & Hirschheim, 2003). According to Grant and Baden-Fuller (1995), a firm's ability to leverage knowledge held by members in the organization is dependent on first, the ability of the firm to create an infrastructure to access this knowledge, transfer it and make it available to others. A second determinant is the extent to which the knowledge that is captured matches with the product domain of the firm.

Enterprise Information Portals have emerged as gateways to streamline information access in firms (Kim, Chaudhury, & Rao, 2002). The first service they provide is access to transactions with the various information sources scattered across the enterprise, such as structured databases, e-mail servers and document repositories. A second service is access to data and knowledge from both internal and external information sources, such as the World Wide Web (WWW). Finally, these portals allow users to interact with other users to perform activities that require team collaborations.

The discussion above indicates that a *knowledge* portal (KP) is a significant component of an enterprise information portal, and can contribute to a firm's competitive advantage. In this work, we present a multidimensional framework we term the content-incentive-usability (CIU) framework for KPs to analyze the challenges in building and utilizing KPs.

THE CIU FRAMEWORK

The Content Dimension for KPs

The content dimension deals with the determination of the content that should be presented on the KP (what should be presented) and the process of creation of the content (what are the challenges facing this content creation?). We subdivide this dimension into the following subdimensions: elicitation and translation of tacit and explicit knowledge, the integration of structured and unstructured data and the creation of a knowledge ontology to enhance availability.

Elicitation and Translation of Tacit and Explicit Knowledge

According to Nonaka and Takeuchi (1995), tacit knowledge embodies beliefs and values, and is actionable. In contrast, explicit knowledge is codifiable into artifacts such as documents, or multimedia formats. Both are essential for organizational effectiveness.

The transmission of knowledge from one individual to another can take the forms shown in Table 1.

Of the possibilities shown in Table 1, the elicitation of tacit knowledge from experts, and the codification into explicit knowledge represents an important task in the creation of a KP. Eraut (2000) found that elicitation task was easier if:

Table 1. Conversion of knowledge (Nonaka & Takeuchi, 1995)

Conversion	Process	Facilitating Technologies
Tacit to Tacit	Socialization	E-meetings, Chat
Tacit to Explicit	Externalization	Chat
Explicit to Tacit	Internalization	Visualization of data
Explicit to Explicit	Combination	Text search, document categorization

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- there was a mediating object that experts were used to, such as a drawing, a picture or a graph
- a precedent of regular mutual consultation existed between novices and experts
- a training or mentoring relationship was part of the cultural and behavioral expectations in the organization
- informal meetings were held, where "riskier" comments could be made
- there was a perceived potential crisis or change

The degree to which a KP allows the translation of knowledge will influence the final quality of content. Table 1 lists some example technologies that can be used to facilitate the conversions. For example, if we need to capture the tacit knowledge of an expert into a KP, we need to make this tacit knowledge explicit, which can be facilitated by conversations with the expert. The explicit knowledge may then need to become tacit within other users in order to transfer the expertise, and this process can be enhanced if the explicit knowledge is presented on the KP in a form that is easy to visualize.

Integration of Structured and Unstructured Data

Every organization has a large amount of data scattered in sources such as structured databases, e-mail, documents, blogs and newsgroups set up for specific user groups. A major challenge in constructing a KP is the integration of this information. The use of semistructured data to integrate heterogeneous data sources has been shown in several works (Fernandez, Florescu, Levy, & Suciu, 2000; Garcia-Molina et al., 1995). We characterize the issues that need to be addressed in this integration at different layers: *the physical layer, the syntax layer* and *the semantic layer*. This is similar to the approach used in Jin, Decker, and Wiederhold (2001) which uses integration, semantic, composition and generational layers.

The physical layer involves the composition of the files that store this data. These files include relational database management system (DBMS) files, word processed documents in various formats and text based or HyperText Markup Language (HTML) files for e-mail, blogs and newsgroups. Part of the challenge is that in most cases, these "islands of information" are not touched, and an automated integration mechanism needs to be created for real-time updating of the KP from these multiple feeds.

The syntax layer deals with the representation of the same information in different formats. For example, information on the same customer may be scattered and/or duplicated across multiple relational DBMSs, documents, blogs newsgroups and e-mails. Duplicated information may have different labels, so that one system may use the *customer_id* as the unique identifier, while another may use the *customer_account_number* for the same purpose. The usage of eXtensible Markup Language (XML) (Glavinic, 2002) has greatly simplified the mechanism of automation. However, firms still face the organizational challenge of creating a common XML schema that can be fed from these multiple streams. Examples of existing XML schemas that may be used include the TSIMMIS approach in Garcia-Molina et al. (1995) for structured data and the resource description framework (RDF) (Jin et al., 2001) for semistructured information.

The semantic layer deals with the inference of meaning from the data. We propose that one way to accomplish this is to link the data to processes performed by the end-user of the KP. A second method to accomplish this is to create metacategories of the data that map to a knowledge ontology. For example, information on customers, purchases, products and promotions may be combined into a "selling assistant" screen that can be part of the KP. In order to create metacategories, the meaning of the data needs to be understood. The semantic layer feeds into the creation of a knowledge ontology, described next.

The Knowledge Ontology in a KP

The question of what defines knowledge needs to be answered if knowledge is to be codified and made available. Examples of knowledge include reports and charts from structured data, summary statistics on unstructured data (such as the number of e-mails sent to a customer), and data mining into templates (which are part of the ontology) from blogs, newsgroups and documents. The aim here is to match the knowledge ontology to the product domain and the organizational structure of the firm, to increase efficacy of the KP (Marwick, 2001). For example, in a process driven organization, the knowledge ontology may stem from process descriptions that are already developed. In a functional organization, in contrast, the knowledge ontology would be better off incorporating the functional areas such as sales, marketing, accounting and operations.

Many ways to develop ontologies have been suggested. Some suggestions include using text classifiers (Woods, Poteet, Kao, & Quach, 2006), allowing individual employees to add to an existing list of terms (Amidon & Macnamara, 2003), and forming expert subgroups of employees to develop key words to be incorporated into the ontology (Markus, 2001). However, using these methods individually to develop ontologies can create problems. In the case of text classifiers, this method only allows for ontologies that use existing documents. It is important to share other forms of knowledge such as lessons learned (Gaines, 2003; Gill, 2001; Hanley & Malafsky, 2003; Holsapple & Jones, 2004). This type of knowledge may not be represented in a

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