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A Typology for Understanding the Role of Information as a Source of Value Creation in the Emerging Information Economy

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Introduction

Today's economy is increasingly driven by the integration of information in many aspects of business. Greater information intensity in industries such as hospital supply and express package delivery is causing a fundamental transformation in the way firms conduct business, the menu of competitive choices that they are faced with, and the need to continuously keep ahead of competitors. Information driven businesses appear to adopt several competitive or operating innovations. These include: mass customization or the creation of customized products which offer virtually individualized products to customers in mass markets (Pine, 1993); disintermediation or the creation of direct links between producers and consumers such that traditional intermediaries such as wholesalers and retailers are removed from the value-added chain in an industry (Office of Technology Assessment, 1994; Benjamin and Wigand, 1995); self-design of products by customers as firms allow them to design products in-house and then transmit production specifications directly to suppliers; faster response times as direct communication links between customers and suppliers enable reduced order entry and processing cycles and on-demand production (Keen, 1993); and lower transaction costs arising from expanded use of single-source electronic sales channels (Picot and Kirchner, 1987).

This research seeks to forward understanding of sources of value creation in an environment that is increasingly information rich. It therefore focuses on the nature of information itself as a resource, the effective management of which, might be a source of competitive advantage. Implicit in this assertion is the belief that the mere possession of information technology is not a source of competitive advantage. Hence, we focus not on the management of information technology, but on the ways that information itself may be used to reduce production costs, enhance coordination both within and outside the boundaries of the firm, and enhance new product development. The convergence of information, physical products, and services is becoming a particularly powerful driver of value creation in the form of fusion products which embody all three elements (Goldman et al, 1995). Toward this end we propose two fundamental research questions. How can information pertaining to value creation activities be classified? Do firms go through distinct evolutionary stages in information management as they use more sophisticated types of information?

To answer the foregoing, we need to be able to categorize different types of information based on their features, usage, and impact on competitive advantage. The reader should note that in creating this classification scheme we consider only information that is used in the firm's value chain and in the value chain of its customers.

Literature Review

Machlup (1980) suggested that information can be classified into five types: practical, intellectual, pastime, spiritual, and unwanted. Although interesting, this is of very little practical use in depicting the information content of value chain activities. Holsapple and Whinston (1996) proposed two main classification of knowledge: primary and secondary knowledge. The three primary types of knowledge are descriptive, procedural, and reasoning knowledge. The three secondary types of knowledge are linguistic, assimilative, and presentation knowledge. The classification scheme proposed by Holsappe and Whinston (1996) is targeted at Decision Support Systems. Though useful and applicable, it is not ideal for our research questions. Another alternative classification, intended for the health care professionals, distinguishes between professional knowledge and improvement knowledge (Batalden and Stolz 1993). In psychology, Anderson (1983) distinguished between the declarative and procedural knowledge. While important for the study of human cognition, this classification is too general for our purposes.

The question of an appropriate classification scheme may be solved by adopting one already in existence or building on existing schemes to design a classification suitable for understanding the role of information as a source of competitive advantage. In this paper we pursue the latter alternative.

Theoretical Foundation

To effectively and efficiently utilize information for competitive advantage, an organization needs to traverse a learning curve. Nolan (1979) argued that this evolution involves growth in technology and application development, changes in planning and control strategies, and changes in user involvement. He proposed a six-stage growth model: (i) initiation, (ii) contagion, (iii) control, (iv) integration, (v) data administration, and (vi) maturity. No stage of the learning curve, he stressed, can be circumvented. In other words, organizations need to experience growth associated with each evolutionary stage and no stage can be skipped because associated learning processes would be lost.

Similarly, Schein proposed a framework depicting the evolution of new information technology within organizations that provides a holistic view of the organizational change process. Schein's phases include: (i) investment or project initiation, (ii) technology learning and adaptation, (iii) management control, and (iv) widespread technology transfer.

As such, the classification scheme developed for this research needs to represent this pattern of growth and evolution. The information needs to progress from simple to complex and parallel organization learning.

Classification Scheme

This section develops definitions of four types of information that the firm may use in activities recognized as sources of competitive advantage: creating value for customers, reducing production costs, and improving innovation activities with network partners. The four types of information are state information, procedural information, functional information, and behavioral/value information.

State Information

Historical in nature, it provides a chronology of the way a product or service makes its way through the firm's value chain on its way to the customer's value chain. For example, General Motor's information system can provide information concerning the number and types of automobiles that are being shipped to a particular dealership. It may also provide information regarding the shipping date, expected time of delivery, and the vehicle's current location in the distribution system.

State information can be used by a firm to more efficiently and effectively operate its inventory system or to shorten delivery time to customers. Federal Express has used customer access to its state information concerning the location of packages in its delivery pipeline as a source of competitive advantage.

Procedural Information

Procedural information refers to the steps or protocols that are required to execute a process or perform a service. Procedural information for a service, such as issuing a home mortgage, may be represented as the steps associated with performing a credit check, conducting a title search, and issuing a payment. The readers should note that this information may also describe the organization's technologies that may be used in product creation, delivery, and service.

Functional Information

Functional information describes how components and/or subsystems of a tangible product interact and how these interactions give rise to the performance features that characterize the product. Functional information arises from what is commonly known as engineering knowledge. It is grounded in an understanding of the technologies that constitute the product and how variations in these technologies can affect overall system performance. Drawing on a computer analogy, functional information regarding microprocessor speed, access time of the hard drive, and the amount of RAM in a computer permits engineers to design systems with differing performance characteristics.

Functional information may be used to create competitive advantage in the form of reduced product development times by allowing the firm to delegate responsibility for development of subsystems or components to specialized internal departments or to external specialists. Functional information may also be useful in reducing the cost associated with product development since knowledge of subsystems and the interface details of each can be used to simulate product performance characteristics when different subsystems or components are substituted into the design. Similarly, pharmaceutical companies are employing detailed knowledge functional information concerning the interaction of organic and inorganic chemicals to identify combinations of chemicals which have useful pharmaceutical effects.

Behavioral /Value Information

This refers to the way in which systems including humans interact under different environmental conditions and in conjunction with different stimuli. This information is probably the most abstract and may be used to predict the future actions of systems and/or customer segments. For example, capturing information about individual customers and buying preferences might allow the firm to create a model of consumer preference for particular product offerings and thus enable it to fine tune its marketing and sales initiatives.

Conclusion

The preceding information typology spans the spectrum from very simple, static information (state information) to high level, abstract information about drivers of behaviors of complex systems (behavioral/value information). We observe that many exemplars of competitive uses of information technology such as FedEx and Baxter International using state information to create a competitive edge over rivals. We also observe firms such as Toyota and Chrysler using procedural information regarding manufacturing protocols and functional information concerning vehicle system design to quickly and economically perform key activities by linking their value chains with those of suppliers and venture partners. Firms in financial services and insurance use behavioral information. This typology is different from preceding classificatory schemes in that it focuses on the value creation aspect of information. By so doing, it forwards our understanding of sources of competitive advantage in today's

information intensive environment by offering a framework for researchers to possibly link business types and industry characteristics with specific types of information.

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