TOWARDS A STRUCTURED METHODOLOGY FOR E-BUSINESS APPLICATIONS DEVELOPMENT: APPLYING THE ZACHMAN FRAMEWORK TO E-BUSINESS

Richard V. McCarthy, Quinnipiac University, richard.mccarthy@quinnipiac.edu
Jay E. Aronson, The University of Georgia, jaronson@terry.uga.edu

ABSTRACT

Doing business on the Internet is not by itself a strategy, to provide lasting value to customers through better service or to be the low cost provider is a more effective representation of a company's strategy. Electronic commerce has permeated into virtually every business organization. Companies have scrambled to establish a Web site presence, but have they considered what are the strategic uses of the Internet? The use of the Internet by an organization requires that they pay attention to three key factors: (1) technical infrastructure, (2) data management and (3) applications development. The five forces model developed by Michael Porter defined a framework for competitive advantage within an organization. This framework now extends to the use of the Internet as a channel of distribution. The Internet channel can be used to expand an organizations' reach into the global market. We examine the strategic issues that an organization must assess in order to develop an effective Web site presence. Our framework, based upon that of Zachman, can be used to implement e-commerce strategy. The framework shows how to develop an effective electronic commerce strategy that supports the five forces model of competitive strategy.

Keywords: e-Commerce Strategy, Zachman Framework, Five Forces Model

INTRODUCTION

The Internet has emerged as a cost-effective channel of distribution. Its usage supports the organizational strategies to provide low cost, customer focused products and services. In 1988, Zachman proposed a framework to categorize enterprise architectures that support organizational strategy. Sowa and Zachman extended that framework (1992) to show the interrelationships that people, location and data play in the development of enterprise architecture. This paper extends that framework to incorporate e-commerce development within an organization.

REVIEW OF THE LITERATURE

Zwass (1996) defined electronic commerce as "the sharing of business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks." In addition to the transactions that support the interrelationship of activity between two business entities, it also includes the corporate processes required to support those transactions. The integration of electronic commerce has caused firms to alter the manner in which they are doing business. Firms that look to compete through the use of electronic commerce need to be concerned with three meta-levels:

1. The infrastructure of hardware, software, web servers, databases and telecommunications that is required in order for a firm to maintain an Internet site.

2. Delivery services that enable a business to be found on the Internet and facilitate business negotiations and transactions.
3. The organization of electronic markets and supply chains that provide the mechanism for businesses to complete the commerce transactions electronically. The market structure must support consumer-oriented business, business-to-business, and intra-organizational business.

Organization's e-commerce strategy should identify which strategic position the firm is trying to achieve and how the e-commerce applications are supported within each meta-level.

Management information systems strategic planning has been defined as consisting of systems objectives, constraints, and design principles designed to support the organizational strategy set made up of the organizations mission, objectives, and strategy (King, 1978). Systems objectives define the purpose that information technology provides to an organization. System constraints consist of the internal and external constraints that serve to provide parameters around which the technology base must respond. Examples of external constraints may include legal or industry reporting requirements, or external system interfaces. The resources and personnel within an organization define its internal constraints. System design strategies guide the specific development objectives for the applications that support the organization. King (1978) identified *parsimony* as one of the design strategies, whereby "the system should be designed so that the user is provided with the minimum amount of relevant information which is necessary to achieve his managerial objectives." MIS strategy therefore should provide an intrinsic link between the achievement of organizational goals and the detailed design and implementation of the technology needed to support those goals.

Information Technology Use for Competitive Advantage

Porter's model (1980) consists of five underlying forces. These forces of competition consist of:

1). The intensity of rivalry between existing companies.
2). The barriers to entry for new competitors.
3). The bargaining power of suppliers.
4). The bargaining power of buyers.
5). The threat of substitute products or services.

Blake and Ives (1984) extend the Porter model to point out that information technology, such as the use of the Internet for electronic commerce, is strategic if it changes the way a firm competes in its industry or if it changes the product. Electronic commerce has not only changed the manner in which some organizations compete, but has also extended them well beyond their original scope and focus.

Porter and Millar (1985) point out the strategic significance that information can provide to a firm and how if managed appropriately, information can be used as a competitive weapon. They define three ways in which the information revolution effects competition:

1. By changing the industry structure.
2. By creating competitive advantage, thereby giving companies a way to outperform their competition.
3. By creating new businesses or supporting infrastructures.

One of the significant contributions to the Porter and Millar (1985) value chain is the recognition of the importance that information technology adds to an organization in order for it to achieve its mission.

McFarlan (1984) identified five questions that can be used to support the ultimate impact of information technology on an organization:

1. Can information systems technology create barriers to entry? The more difficult it is to copy a technology or service provided by the technology, then the higher the barrier to competition.
2. Can information system technology build in switching costs? Switching to a competitor will be viewed as unattractive if the customer has become increasingly dependent upon the technology and perceives specific value from it that cannot be obtained elsewhere.
3. Can the technology change the basis for competition? If the technology can be used to support one of the three competitive strategies (low cost provider, product differentiation, or specialization) that were defined by Porter (1979), then the information systems technology plan should seamlessly integrate into the business plan.
4. Can information systems be used to change the balance of power in supplier relationships? Inter-organizational technology can be used to establish competitive advantage by more effectively linking suppliers to an organization. Inter-organizational systems are driven by business needs that continue to evolve in rapidly changing markets and are driven by the need to facilitate and control the cost of communication between organizations. Electronic commerce facilitates this interaction (Senn, 1996).
5. Can information systems technology result in new product development? Information technology may be used to speed delivery or improve product quality; or it may result in the creation of new technology products.

The explosive growth of the Internet has created opportunities for successes and failures in all three categories. As organizations struggle to increase their presence on the Web, they must also deal with the issue of how to use the Internet as a *strategic tool of commerce*. We present a model that addresses the integration of strategic and technological issues involved during the development of an e-commerce architecture. We provide a framework that connects the people, data and technology issues required to support an e-commerce environment. Exploitation of the Internet can help a firm achieve a competitive advantage through improved operational effectiveness (Porter, 2001). For example, customer service response via the Internet requires fewer human resources, and effectively transfers much of the service function from the organization to the customer. Additionally, the Internet can be used to automate other outbound logistics such as the handling of service complaints, warranty registrations and claims, and providing a streamlined process for the ordering of replacement parts. After sales services can be enhanced through the use of on-line chat, automated email response and intelligent service request management through knowledge bases.

Porter (1996) points out that competitive strategy is distinguishing yourself from your competition. In order to utilize electronic commerce to build a lasting competitive strategy, organizations need a Web site that will provide a service that sets it apart from their competition. This is difficult to achieve, since it is so easy to copy Web site functions. One way in which an organization can use its Web site to distinguish itself from its competitors is to offer links to complimentary products and services to streamline the purchase process.

Meador (1990) defined the first level of data architecture as the business scope definition. In order to build a data framework that will support and be understood by the organization, it is critical to establish the strategic importance of information by management. The second step in the data architecture process is to build a business information model consisting of the business objects and their interrelationships. The business information model provides the framework for electronic commerce applications development.

E-Commerce Strategy

Fruhling and Siau (2000) defined an Innovation Strategy Model that consists of ten dimensions that support internal management responsibilities and external organizational interfaces. The dimensions look at the core competencies of an organization. Their model posits that e-commerce success is maximized when the *core competencies of the organization are aligned with the critical success factors of an e-commerce project*. The interrelationship of the ten dimensions (collaborative process, performance measures, education, distributed learning network, intelligence market positioning, knowledge of products and services, market penetration, technology, leadership and market image) will influence the success of the organization.

Porter (2001) contends that companies that use the Internet to compliment their traditional methods for competing will be more successful than those companies that seek to utilize the Internet in the false hopes that it will provide them a distinctive competitive advantage. Internet technologies provide companies an opportunity to utilize technology as a core competency in order to provide strategic positioning. The Internet's economic value will be realized by the linkages that it is capable of supporting between suppliers and customers. Companies that take advantage of the ease in which these linkages can be established will help to overcome the increased competition that is created by the easing of the barriers to entry that emerge in the digital world.

The adoption of electronic commerce by a firm makes it necessary to ensure that high levels of coordination are in place to manage the communication infrastructure required to support a Web site. A firm that masters this coordination can use it as a competitive advantage over firms that ignore the infrastructure management issues. The infrastructure can be used to provide access to information and services both internally and externally. Applegate and Gogan point out "the connectivity, flexibility and power of the tools available on the Internet provide an excellent platform for delivering interactive real-time information both inside and outside the firm. But taken alone, they are insufficient. The Internet's power must be integrated with the internal databases, networks and transaction processing systems within each firm that unites to deliver value chain activities" (Barau, Chellappa, & Whinston, 1996).

STRUCTURED E-DEVELOPMENT MODEL

To successfully integrate an electronic commerce strategy into an existing information technology infrastructure; an organization must ensure that the people, data and technology issues are coordinated into a cohesive and comprehensive architecture. The methodological framework for e-business development utilizes this basic construct first developed by the Zachman (1988) framework for enterprise architecture. The framework interrelates the people, data, and technology components required to successfully build and maintain e-business applications that support organization objectives (Figure 1). The first component in the framework is the *definition of business objectives*. This step drives all subsequent steps in the process as it establishes the boundaries for e-business development within an organization. It should also drive the development of e-business objectives and determine the organizational dependence on e-commerce to determine the technological objectives required for support (McCarthy and Aronson, 2001). It is imperative that organizations integrate their technology objectives with their business objectives if they intend to utilize technology as a core competence.

An organization's Web site can no longer be viewed as a means to establish strategic position. Organizational Web sites have become a commodity item that is expected by consumers regardless of firm size. For a Web site to add value then it must help to establish a sustainable presence in the eyes of the consumer that supplements the other activities of the firm. It needs to provide long-term value so that customers will want to return to it. The definition of e-commerce objectives should address three areas:

1. Data format
2. Data transport
3. Method invocation.

Data format defines the standard that the company will use to exchange information with other trading partners such as suppliers. In order to be able to extend the value chain to include other trading partners, an organization must adopt a recognizable, cost effective standard that can be used as the common exchange mechanism. The *data transport* mechanism defines the standard that will be used by the network to move information from one location to another. HTTP and FTP are examples of transport mechanisms that are supported by the Internet. The transport mechanism used will determine security and network performance requirements. An organization must establish transport criteria in order to determine which mechanism most effectively meets their needs. *Method invocation* is the ability for one company to run a component on another companies system. The techniques for executing this type of transaction requires careful planning and usually requires that security precautions are addressed immediately. For example, one technique is SOAP (Simple Object Oriented Protocol). SOAP is an independent specification that defines how to exchange structured information in a peer-to-peer environment using XML. The protocol consists of three parts:

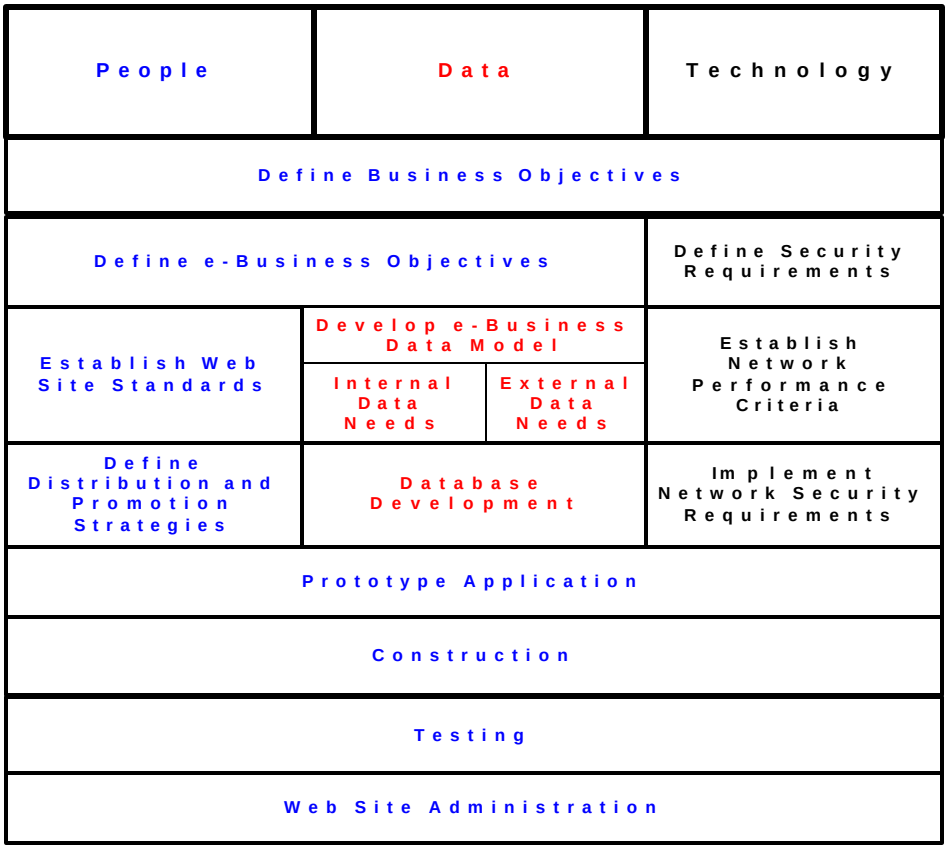
1). An envelope that serves as a header to describe what the message is and how to process it.
2). A set of pre-defined rules for data types.
3). A means to all remote procedure calls and responses.

An effective e-commerce strategy defines which standard is to be used consistently throughout the organization. Technology standards therefore must address security requirements needed to ensure that the transport mechanism satisfies the business objectives. Network performance criteria should be established to evaluate the initial implementation and to serve as a basis for supporting the ongoing Web site administration.

Web site standards also need to be established to satisfy the need to provide a consistent appearance and navigation scheme to customers, along with consistency of business purpose. Web site standards should address issues such as organizational standards for privacy of information, use of cookies and third party access to Web site information.

An e-commerce data model that is consistent with the overall information model of the organization should be defined to establish the data needs that will be required to support both the end user information needs and the internal processing needs of the organization. Internal and external consistency of information needs to be integrated into e-commerce applications. Information that is required from or displayed to customers should present a seamless view of the organization and should be relate to the specific business objectives that the Web site addresses.

Figure 1- Methodological Framework for e-Business Development



DISCUSSION

The e-commerce development model differentiates between the people, data management and technical components that must all be present in order to develop an effective Web site. Web site standards should be developed that so that there is a consistent look, consistent navigation, a means to communicate with the organization, standards for changing the Web site, and a clear definition of the organizational objectives that the Web site supports. Distribution and promotion strategies should define how an organization intends to make its presence known. For example, it could advertise on commercial search engines such as Yahoo, Inc. or America Online.

Barau, Chellappa, and Whinston (1996) identified three common infrastructure characteristics that are needed for defining collaboratory system architecture. These include:

1. Information access – which allows the user to seamlessly access needed information.
2. Interaction richness – which provides value-enhancing interactions with the users.
3. User scalability – which allows the system to grow as the number and needs of the users increase.

Organizations that rely on information technology as a core competence to establish and maintain a competitive position need to define an e-commerce strategy if they are going to compete in cyberspace. An e-commerce presence no longer serves to differentiate an organization, as it has become an *accepted* and *expected* business practice. If an organization is to achieve lasting value from their Web site, their Web site design needs to be linked to the strategy that the firm is seeking to obtain. Organizations that seek to successfully integrate their Web presence internally, as well as extending to reach their customers and suppliers, need to integrate the technical components (such as databases and security standards) into a seamless design that supports the business strategy that the Web site seeks to achieve. The development of an e-commerce strategy should utilize a framework that integrates technological objectives with the organizations' business strategy.

FUTURE WORK

The methodological framework for e-commerce development will be evaluated through a series of four case studies. The case studies will evaluate the methodology utilized to develop the organization's Web site and will evaluate the effectiveness of the results. The study will include a quantitative and qualitative measure of the development methodology.

REFERENCES

Available upon request