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Product Complexity, Richness of Web-based Electronic Commerce Systems and System Success: A Proposed Research Framework

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Abstract

Despite the popularity of the Internet/World Wide Web (Web) and the millions of web-site visits, serious conduct of electronic commerce (EC) on the web by individual consumers does not appear to have taken root. Notwithstanding security and privacy concerns, it appears that the current EC systems do not address varying levels of user needs. They fail to arouse user interest and motivation to carry out "real transactions." This research proposes a model to argue that a "fit" between product complexity and richness of the EC environment can trigger favorable consumer behavior.

Introduction

Recent literature suggests that the Internet and Web as a business transaction tool provides both firms and consumers with various benefits including but not restricted to lower transaction cost, lower search cost, and greater selection of goods [Bakos 1998]. These advantages may motivate them to participate in conducting electronic commerce over the Web. Yet, despite large investments and proliferation of electronic commerce applications and the growing number of the Internet users, the actual conduct of business on the Internet seems to be still low [Jarvenpaa & Todd 1997]. Notwithstanding information security and privacy concerns [Kiely 1997], it appears that the current EC systems do not satisfy varying levels of user needs and requirements. Many of the current systems appear to share certain common characteristics such as lack of sufficient product descriptions, lack of interactive communication function, lack of reliable on-line functions, and ill-designed search and help functions [Martin 1996, Liu 1997]. This suggests that the design of the EC system is not user-oriented in terms of providing appropriate information and supporting user decision making.

We argue that most existing EC systems fail to provide the rich commerce environment that users have in a physical world and that this deficiency might fail to arouse motivation or interest in carrying out "real transactions". We assert that EC environments should be rich enough to compensate for this deficiency to be successful. Also, we posit that product characteristics would be an important factor that can have significant influences on the level of richness of EC systems. In this study, we identify fundamental dimensions of rich virtual environment for business-to-consumer EC. A set of product characteristics that needs to be considered in the design of EC systems is described. Based on this we propose an EC technology/product fit model.

EC technology and environment

Electronic commerce has been defined as: "the sharing of business information, maintaining business relationships, and conducting business transactions by means of telecommunication networks" [Zwass 1996]; the use of network communication technology to engage in a wide range of activities throughout the value chain [Applegate et al 1996]; and the use of computer networks to address the needs of organizations, merchants and customer, and to search and retrieve information in support of human and organizational decision making [Kalakota & Winston 1996].

EC systems have been classified into customer-to-business, business-to-business, and intra-organizational systems according to business relationship [Applegate et al 1996]. The network used has been classified as: Internet, Intranet, Extranet, and Supranet according to location of application users and type of relationship affected [Riggins & Rhee 1998]. Riggins [1998] describes and categorizes EC systems in terms of five dimensions of commerce (interaction, time, distance, product, and relationships) and three types of values created by EC (efficiency, effectiveness, and strategic).

Some researchers have attempted to characterize and investigate EC systems in terms of a few salient attributes. Ariely [1998] approaches EC systems from the point of interactivity (user control over information provided) and investigates its advantages and disadvantages on consumers' decision quality, memory, knowledge, and confidence. Liu [1997] characterizes EC systems in terms of four attributes, which includes information and service quality, system use, playfulness, and system design quality. Klein [1999] addresses interactivity (user control over information) and media richness (defined as sensory breadth and depth) as key characteristics of EC systems and argues that interactivity and media richness enhance consumer learning and persuasion. She also mentions telepresence as a key feature that can be achieved when both interactivity and media richness are at high levels. Salam [1998] characterizes and evaluates EC systems in

terms of three channel characteristics: communication, transaction, and distribution.

While EC systems can be characterized from many different perspectives, three common themes can be derived: a *communication* dimension between buyers and sellers, or among buyers; an *information* dimension representing interaction with products or services to get product information; and a *transaction* dimension for conducting business transaction. We would argue that in order for the virtual environment to be rich, communication between buyers and sellers or among buyers should be rich; products or services should be richly represented; and functional transaction process should be rich and seamless. The overall level of richness of EC environment would be a product of these three dimensions.

Each dimension is described further. Communication support can be defined as the capability of EC technology to provide and support communication between buyers and sellers, or among buyers. It includes such elements as interaction mode (e.g., synchronous/asynchronous), and interaction media (e.g., text, audio, and video). Basically the communication between any two parties should be two-way and interactive to be effective. Examples could range from a simple e-mail system through on-line chatting, audio conferencing and video conferencing. Communication feature is an essential part of any business commerce environment. Thus, communication among parties involved should be open and rich enough to support their transaction environment.

Information support means the extent to which EC technology provides product/service representation and enables consumer interaction with product/service. It includes such elements as representation vividness and interactivity. All necessary product/ service aspects need to be fully represented. The representation should be multi-faceted; multimedia interactive technology could be a richer format to represent product/service [Palmer & Griffith 1998]. In a rich representation environment, a buyer may psychologically perceive the products/services to be physically present when interacting with them [Schloerb 1995, Klein 1999]. Klein [1999] argues that this psychological state can be enabled by the interplay between interactivity and media richness.

Process support relates to structuring the transaction process. It can be defined as the capability of EC technology to support an efficient and effective transaction process. It includes such elements as transaction path display, user-friendly order process, and decision aids. A number of existing EC applications appear to be poorly organized with the result, consumers find it difficult to place an order [Jarvenpaa & Todd 1997]. Various functions are needed to ensure a seamless walkthrough of the transaction process from visiting through to leaving the virtual shop. Examples could be search engines, on-line help, shopping carts, easy payment system, etc.

Product Characteristics

There is no one best EC application system for all products [Palmer & Griffith 1998, Klein 1998]. Product characteristics have been discussed as an important factor in the EC literature [Malone et al. 1987, Benjamin & Wigand 1995, Bakos 1991, 1998, Strader & Shaw 1997]. Product characteristics are expected to influence the design of EC system. Appropriate selection of EC system characteristics based on product characteristics will have an effect on user behavior. For example, simple and cheap products like toothpaste will need different EC environment characteristics than high-priced, durable products like a car or a computer. We need to consider fundamental dimensions of product characteristics in order to investigate the overall effect of EC environment on user behavior.

In the EC literature, different product characterization schemes have been discussed, including digitizability [Strader & Shaw 1997, Chellappa 1997], differentiation [Bakos 1991, 1998], asset specificity and description complexity [Malone et al. 1987, Benjamin and Wigand 1995], and information intensity [Palmer & Griffith 1998]. Several goods classification schemes have been described in marketing literature. These include search/experiential/ credence goods [Nelson 1970, Darby & Karni 1973], low/ high involvement goods [Krugman 1965], convenience/ shopping /specialty goods [Copeland 1923], and so on.

In this study, we focus on product/service complexity, one critical dimension that has been discussed frequently in the EC literature. Product complexity is considered to be an appropriate product characterization scheme in business-to-consumer EC environment. Many researchers have addressed product complexity either directly or indirectly in relating product characteristics to electronic commerce. Malone et al. [1987] note that the complexity of product description is an important variable to classify a product in electronic market and to affect electronic market structure. They define complexity of product description as “the amount of information needed to specify the attributes of a product in enough detail to allow potential buyers to make a selection”. Palmer and Griffith [1998] suggest use information intensity as a key product characteristic for designing EC web.

Drawing from task complexity characterization [Campbell 1988], we define product complexity along three dimensions: multiplicity, variation, and inter-dependence of product/service attributes. We posit that the degree of product complexity is a function of these three dimensions. The more the number of attributes of a product, the higher the level of variation of each attribute, the greater the degree of interdependence among product attributes, the greater the product complexity. These dimensions are expected to impact EC systems design and user decision task.

EC technology/product fit

A key theme that has been studied extensively in information technology research is the notion of the relation between technology and task [Huber 1983, Daft & Lengel 1986, Zigurs & Buckland 1998]. The prevalent view is that technology should be designed to meet task requirements. Problem or task complexity confronting the user is one of the most widely investigated task characteristics [Zigurs & Buckland 1998].

Consumers confront a choice type of decision task. We would argue that the main determinant of task complexity of consumers would be product complexity. The multiplicity, variation, and conflicting inter-dependence of product attributes interact with each other to determine the overall complexity of their problem, that is product choice. More complex problems require richer information systems that can help to reduce complexity. More complex products require richer product information and representation to support users' information acquisition and processing activities [Palmer & Griffith 1998]. EC system users may feel more decision uncertainty in case of a complex product due to lack of information and thus have a greater need for product information and support for searching and evaluating relevant information in an efficient way. Products with high complexity require greater communicational interaction between buyers and sellers or among buyers [Palmer & Griffith 1998]. In addition, buyers might want to have various functional or decision aids such as finder, on-line help, or adviser to guide and support their transaction process for more complex products. Thus, the degree of sophistication of each dimension of EC application system needs to vary depending on the product complexity. As product complexity increases, richer communication support, product information support, and better transaction process structuring should be provided.

As shown in Figure 1, we propose that there must be congruence between EC systems and product characteristics to have a successful EC environment. In other words, we suggest that the EC systems need to have a higher level of richness for consumers dealing with a more complex product choice context. On the other hand, if the system is too rich for a simple product, it can distract the user and the user might be less satisfied with it. Also, over-rich systems may cause under-utilization of various features and not be a good design strategy from an economic perspective.

We envision three types of fit in this situation; under-fit, optimal fit, over-fit. Under-fit is when the systems are too low in richness relative to the product complexity, whereas over-fit is when the systems are too high in richness relative to the product complexity. Thus, we propose that optimal fit leads to EC system success and that under-fit or over-fit will not lead to a successful system. Given the arguments provided above, for a simple product such as toothpaste, textual information with a static picture, e-mail communication and a table of feature comparison might be appropriate. On the other hand, for complex products such as a car or house, 3-D visualization, live audio and/or video communication with domain experts, and transaction process guide might be needed. Therefore, the proposition of this study is:

PROPOSITION. The congruence between product complexity and system richness leads to system success.

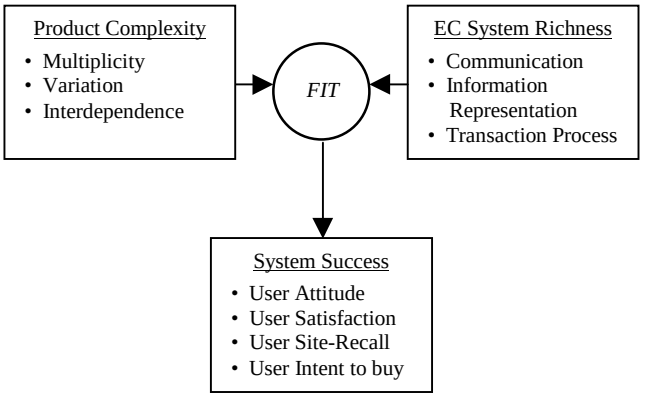

FIGURE 1 EC technology/product fit model

EC environment's success can be considered in terms of its impact on user attitude, satisfaction [DeLone and McLean 1992], site recall and recognition [Liu 1997], and intent to buy [Salisbury et al. 1998]. Given inherent advantages of EC such as, convenience [Jarvenpaa & Todd 1997] or lower search cost [Bakos 1998], we propose that an appropriate level of richness of EC system relative to product complexity would result in improvement in above-noted user outcome variables.

Conclusion

The expected contribution of this study is in providing researchers with a theoretical foundation for the alignment of EC technologies with product characteristics, and in offering practitioners an opportunity to evaluate and (re)design their EC systems to realize enhanced effectiveness (e.g., increase sales).

References are available upon request from authors.