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AN E-COMMERCE SYSTEM MODEL

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Abstract

This paper presents a model of e-commerce systems that can be used as a framework for analyzing system characteristics. The paper demonstrates the use of the model in a case study that analyzes the e-commerce system of Lands' End. The paper concludes that the model is a potentially useful tool for e-commerce system analysis.

Introduction

E-commerce is a relatively new phenomenon. During its short history, many of the systems that provide the functionality of e-commerce have been developed in ad hoc ways. The result is e-commerce systems that in many cases do not provide the desired functionality for the customer or the business. We have reached a point, however, when we can look more carefully at what functions an e-commerce system should provide and how those functions should be organized. The purpose of this paper is to present a model of e-commerce systems that can be used as a framework for analyzing system characteristics.

Many definitions of *e-commerce* have been presented in the literature. Some focus only on the completion of business transactions (buying, selling, or exchanging of products) while others, such as Turban et al. (2002), take a broad view of e-commerce and include all business activities related to a (potential) business transaction conducted through communications networks. We follow this broad definition and include activities such as product search and comparison, product information presentation and promotion, purchase transaction management, product delivery, and post-purchase customer support in our view of e-commerce (Tarasewich, Nickerson, and Warkentin, 2002).

E-commerce capabilities are provided by information technology-based information systems. By an *e-commerce system* we mean an information system that processes data and provides information to support the operations and management of an organization's electronic commerce activities. Operations include advertising, selling, order entry, order fulfillment, billing, customer support, and related activities. Management involves decision-making tasks and may include customer targeting, product promotion management, sales analysis, and credit management.

It is important to emphasize that the view of this paper is from the information system model perspective and not, say, from the business model perspective. While there are several ways of viewing e-commerce, we focus in this paper exclusively on e-commerce *information systems* and models of such systems.

This paper proposes a *functional model*, by which we mean a model of the functions or tasks that an e-commerce system performs and how those functions relate to each other and to the system users (customers, managers). We distinguish a functional model from a system architecture, which focuses on the technical infrastructure necessary to support the system functions.

E-Commerce Models

Little has been published on functional models of e-commerce systems. Many articles and books describe the business activities typically conducted through e-commerce, such as advertising, order entry, and transaction processing. Few sources, however, fit these activities into a unified whole.

Many authors describe the functions found in common e-commerce applications but do not provide an overall model. For example, Turban et al. (2002, pp. 478-481) lists the functionality of four e-commerce systems: storefronts, e-procurement, auctions, and enterprise portals. His list for a storefront e-commerce system concludes that such a system must contain subsystems supporting an on-line catalog, order transaction processing, and a payment gateway. His lists provide some guidance for a functional model, but they do not present a complete picture.

A search of the ACM Portal to Computing Literature found only one reference (Jhingran, 2000) with "e-commerce system(s)" in the titles of 360,977 articles. Jhingran describes the e-commerce functions supported by IBM's Websphere Commerce Edition at the time of the article's publication. These functions are user management, content management, merchandising, negotiations, order fulfillment, payment processing, and service and support. (Another search for "e-commerce system(s)" in the abstracts found only three references: Jhingran and two others that were not relevant.)

Some authors describe e-commerce system architectures that revolve around technical infrastructure details. As noted earlier, this paper is not concerned with the infrastructure support for e-commerce, but rather with the functions provided by the e-commerce system. One source (Treese and Stewart, 1998) not only reviews four architectures for e-commerce systems but also describes the functional characteristics of systems conforming to each architecture:

- Merchant server architecture. This simple architecture includes functions for product presentation, using product information from an electronic catalog, and order entry.
- SET architecture. This architecture adds an electronic payment function using SET to the merchant server model.
- Open Market commerce architecture: This architecture, developed by Open Market (now part of divine, inc.), includes functions for product presentation, using product information from an electronic catalog, order entry, electronic payment, order fulfillment, and customer service.
- Open Buying on the Internet (OBI) architecture: This architecture is a standard for B2B e-commerce proposed by the OBI Consortium. It includes functions for the buying organization to select a supplier, browse the supplier's catalog, and place an order. It also includes functions for order confirmation by the buying organization, electronic payment with authorization by an external payment authority, and order fulfillment. (See also OBI Consortium, 1997.)

A Proposed E-Commerce System Model

The literature provides some guidance for a functional model of e-commerce systems. E-commerce functions or features that are commonly listed in the literature include product presentation, electronic catalogs, order entry, order confirmation, electronic payment, order fulfillment, and customer service. Some of these functions and features, however, are necessary for or subsumed by other functions. For example, an electronic catalog is needed for a product presentation function to provide information about products to customers. As another example, an order confirmation feature is part of the order entry function.

The commonly listed functions and features revolve mainly around the transaction processing capabilities of an e-commerce system. As noted earlier, however, e-commerce systems, like most information systems, provide information to support the management of the organization. Much of this information results from the analysis of data gathered during the customer's visit to the e-commerce site. We need to include the necessary functionality in an e-commerce system model to gather and analyze this data to provide information to management.

The literature also provides little guidance as to how the functions of an e-commerce system are organized, that is, how they interact with one another and with the system users. For example, does the electronic payment function interact directly with the product presentation function? Do customers have access to the order fulfillment function? An e-commerce system functional model needs to include not only the functional capabilities of the system, but also the interactions among the functions.

Based on our review of the literature and our examination of the questions not addressed in the literature, we propose an e-commerce system model that consists of eight interrelated functions: product presentation, order entry, electronic payment, order fulfillment, customer service, product support, data acquisition, and data analysis. How these functions interact with each other and with the system users is shown in Figure 1. This model does not include functions, such as inventory control, that are necessary for the full operation of the enterprise because these functions are present whether or not the organization has an e-commerce system, and thus we consider them to be outside the system. Nevertheless, an e-commerce system interacts with many of these functions.

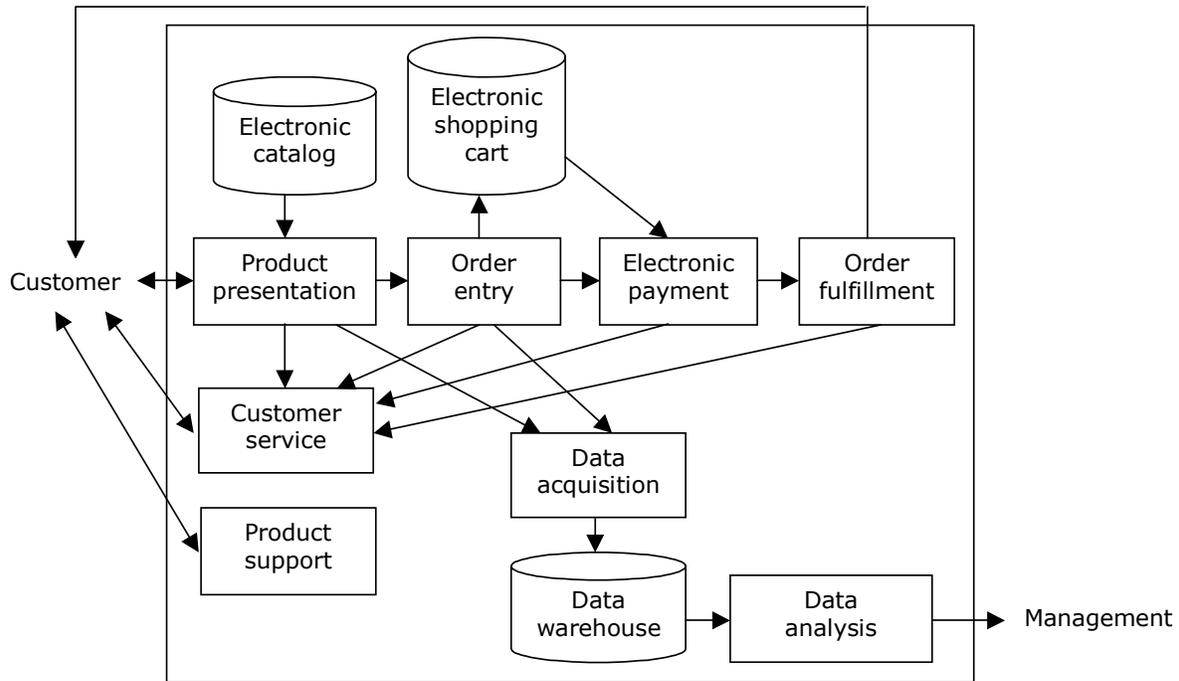


Figure 1. E-Commerce System Model

We next describe each of the functions in Figure 1. Then we demonstrate the use of this model in the analysis of an existing e-commerce system.

Product Presentation

The product presentation function provides the customer with information about the product through the user interface (browser). The information presented can include:

- Product advertisements, including product descriptions and features
- Detailed product specifications
- Product views, including photographs, diagrams, or other two-dimensional images; three-dimensional views; single or multiple views; moving or animated views; rotating views, perhaps under customer control; and figure models (e.g., for apparel)
- Sample product presentations (e.g., music clips, software demos, book chapters)

This function can include additional features such as language selection, product search, and customization for customer preferences. The function is linked to the electronic catalog, which is a database of information about products. It may also be linked to the enterprise's inventory system to ensure integrity between the data in the electronic catalog and the inventory database.

Order Entry

The order entry function allows a customer to place an order for selected products. Information about each product ordered is added to the electronic shopping cart, which is a database of orders in process. One characteristic of this function is the effort (e.g., number of mouse clicks) required by the customer to order an item.

This function is linked to the enterprise's inventory system in order to check product availability. It also requires access to the enterprise's customer database in order to update and use customer data.

Electronic Payment

The electronic payment function provides the capabilities for the customer to pay for the order and thus complete the transaction. Payment options may include credit card, debit card, COD, check (before delivery), and invoice (after delivery). In B2B transactions, electronic funds transfer (EFT) may be a payment option. As with order entry, a characteristic of this function is the effort required by the customer to complete the transaction.

Security is very important in the electronic payment function. The function should provide the necessary security through SSL, SET, or some other protocol, and customers should be apprised of the security provisions.

This function may be linked to an external payment authorization system. It may also be linked to the enterprise's accounts receivable and other financial accounting systems.

Order Fulfillment

The order fulfillment function provides for the delivery of the product to the customer. The delivery can be digital for products such as music, software, and information. Only physical delivery is possible, however, for many products such as apparel, electronics, and manufacturing components.

This function is linked to the enterprise's inventory system so that the inventory database can be updated when the order is fulfilled. For physical delivery, the function is linked to the enterprise's warehouse and shipping systems.

Customer Service

The customer service function provides assistance to customers who have problems or questions related to the purchasing process. This assistance may be needed before, during, or after a purchase, as illustrated in the following examples:

- Before purchase: questions occurring during use of the product presentation function, such as product features or use
- During purchase: assistance with the use of the order entry and electronic payment functions
- After purchase: questions about order fulfillment such as order tracking; questions about exchange or return

Options for providing customer service include FAQs, toll-free telephone number, e-mail, and chat.

Product Support

The product support function provides assistance to the customer related to the product after it has been received. This support may include initial set-up and installation, regular operation, troubleshooting, on-going maintenance, and warranty or non-warranty repair or replacement.

The options for providing product support are the same as those for providing customer service. The function is separate, however, because the information about the product provided by the product support function is more specific than that provided by the customer support function. This function may be linked to a product information database.

Data Acquisition

The data acquisition function captures data during the customer interaction with the system. Some of the acquired data, such as customer identification and credit data, is stored in the enterprise's customer database. Much of the acquired data, however, is stored in a separate data warehouse. This data includes customer preferences and purchasing decisions. Customer preferences data could be acquired from the product presentation function. A customer could explicitly indicate his/her preferences by entering them into the system, or the system could track the customer's product searches to identify preferences. Customer purchasing decisions would be acquired from the order entry function when a customer places an order for specific products. The data acquired by this function would typically be used for marketing research purposes.

Customer privacy should be guaranteed when data is acquired. The customer should be informed of this guarantee, which can be handled by an explicit privacy statement.

Data Analysis

The data analysis function analyzes the data in the data warehouse. Data mining techniques are typically used for this purpose in an effort to identify trends, relationships, and other useful information. The results of the analysis can be used by management for decision making in many areas, especially marketing.

Analysis of an E-Commerce System Using the Model

As a preliminary evaluation of the effectiveness of the e-commerce system model, an existing e-commerce system was analyzed using the framework of the model. The system chosen was that of Lands' End, Inc., an established (founded 1963) U.S.-based mail order company that sells "traditionally styled clothing for the family, soft luggage, and products for the home" (Lands' End, 2002). Lands' End sells its products through catalog sales – 269 million catalogs were mailed in fiscal 2001 (Lands' End, 2002) – and through its Web site.

The Lands' End Web site (www.landsend.com) is well regarded and has received a number of accolades (for example, Rosencrance, 2000). Country-specific Web sites are also available for Japan (landsend.co.jp), the UK (landsend.co.uk), Germany (landsend.de), France (fr.landsend.com), Ireland (landsend.ie), and Italy (landsend.it). Lands' End began selling online in 1998 with a limited selection of its products. Currently its entire product line is available online. In fiscal 2001, its online sales were US\$218 million or 16.1% of its total sales (Lands' End, 2001). Using the Choi et al. (1997) categorization, Lands' End's e-commerce is a digital process with a physical product and physical delivery. Its e-commerce is mainly B2C, although a small amount of it is B2B for corporate sales.

The remainder of this section describes the functions of the Lands' End e-commerce system using the e-commerce system model discussed previously. The information provided was acquired from a detailed inspection of the Lands' End Web site and from literature provided by the company. The details of some functions are incomplete because it was not possible to find information about them from the available sources. (Screen images of the Lands' End Web site are not included in the following discussion because of paper length limitations.)

Product Presentation

Lands' End advertises its products on its Web site by providing inviting descriptions and giving details such as the type of fabric used and the product construction. Some details, such as laundry or cleaning requirements, are included in a separate section that the customer accesses by clicking on a "More info" button. Each product is shown in a photograph. For apparel, the product is often pictured on a live model. Color options are also shown in images, and sizes are listed.

One of the most interesting features of the product presentation function is My Virtual Model™. The customer provides personal body dimensions and other characteristics, such as facial shape and hair color, and this feature creates a three-dimensional image of the customer. The customer can try different clothing items on the image to see how they might appear on him or her. The customer can rotate the image through 360 degrees to view the clothing on the model from different sides.

The Lands' End system allows the customer to select a language (Japanese, German, French, Italian) by clicking on a country-specific site from among those available. The system includes a search tool for locating products. The system also includes a customization feature, called My Personal Shopper, that allows the customer to specify preferences. Using these preferences, the system recommends products to the customer.

Order Entry

Two clicks are required to order an item: one to select the item and one to add it to the customer's electronic shopping cart. Inventory availability information is provided by the list of available sizes and colors on the order page. The customer knows before selecting an item if it is available in his or her size and desired color.

Electronic Payment

Payment options available are credit cards and gift certificates. Security is provided through SSL, and an explanation of the security is available from most pages. Four clicks are required to complete the transaction: one to start the check out process, one

after completing the name and address page, one after selecting the shipping method, and one after providing the payment information.

Order Fulfillment

Because of the nature of its products, only physical delivery is possible. Different shipping options are available with varying times and costs for shipment, and worldwide shipping is provided. The shipping charge is added to the purchase total based on the customer-selected shipping option. The system defaults to the least expensive option (except in the case of shipment to Japan, where only faster and more expensive shipping is available).

Customer Service

Customer's can contact Lands' End before, during, or after an order is placed in a number of ways including by e-mail, by a toll-free telephone number, and through a feedback form. One interesting feature is the ability to fill out a brief form with name and phone number, and a Lands' End representative will telephone the customer soon afterward. Another feature allows the customer to ask questions of a representative through online chat. An online order tracking capability is provided with which the customer can check the status of his or her order at any time.

Product Support

Because of the nature of the product, little after-sales product support is needed. One common support question, how to launder or clean an item, is included with the other product description information. If necessary, a customer can contact Lands' End for product support through any of the options available for customer service.

Data Acquisition

Certain data is collected from a customer who places an order, including name, address, telephone number, e-mail address, credit card information, and product-ordered details (item, color, size). If a customer uses the My Virtual Model feature, then body dimensions and other personal features are also acquired. If a customer uses the My Personal Shopper feature, personal preference information is explicitly gathered. Whether other customer preference information is captured as the customer browses the system is not known. Site traffic information is gathered, however. A privacy statement explaining the use Lands' End makes of the data it acquires is available from most pages.

Data Analysis

The only data analysis explicitly stated is analysis of site traffic patterns; no information on other forms of data analysis is available. We can speculate, however, that other data analysis is done, including analysis of customer demographic data (age, sex, location, etc.) and customer product preference data (item, size, color, etc.) with appropriate correlation analysis.

Discussion

The Lands' End case demonstrates that the e-commerce system model presented in this paper can be used as a framework for the analysis of an e-commerce system. All the functions in the model were found in the Lands' End e-commerce system, and no additional functions not in the model were identified during the analysis. In another study (Turberg, 2002), the model was used to analyze 43 e-commerce systems in France, Switzerland, and Germany and to derive descriptive statistics that found distinguishing characteristics in e-commerce systems among these countries.

The Lands' End case analyzed a mostly B2C e-commerce system, but the model applies equally well to B2B systems. The same e-commerce system functions are necessary for B2B e-commerce, although some of the details (such as the forms of electronic payment available) may be different.

Lands' End follows the merchant e-commerce business model (Rappa, 2001). The e-commerce system model may apply to other e-commerce business models, although this hypothesis needs to be tested.

The e-commerce system model, with some modification, also applies to many service businesses such as banks, travel companies, and security brokers. An e-commerce system for a service business should have the following functions:

- Service presentation/description: provides information to customer about available services
- Service order: allows customer to place order for service
- Electronic payment: provides capabilities for customer to pay for service
- Service fulfillment: provides service to customer; can be done electronically for some types of services
- Customer service: provides assistance to customers who have problems or questions related to the service purchasing process
- Service support: provides assistance for customer after service has been provided
- Data acquisition: gathers data related to customers and desired services
- Data analysis: analyzes acquired data

Conclusion

This paper presents an e-commerce system model and shows how the model can be used to analyze an e-commerce system in a case study of the Lands' End system. As demonstrated by this case study, the model is a useful tool for identifying and analyzing the functions of an e-commerce system.

One case study does not prove the effectiveness of a model, however, and so analysis of multiple e-commerce systems using the model is necessary to gain additional insight into its effectiveness. Furthermore, the model should be tested with a variety of types of businesses including service businesses and with different types of e-commerce (e.g., B2C, B2B) and e-commerce business models. If additional testing demonstrates the effectiveness of the model, then it can serve as a framework for the analysis of other e-commerce systems.

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