



The e-commerce value matrix and use case model: A goal-driven methodology for eliciting B2C application requirements

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ABSTRACT

We developed a goal-driven methodology for eliciting and modeling the requirements of a business-to-consumer application. It has two phases: e-commerce strategy formulation and eliciting system requirements. In the first phase, an EC value matrix is used to develop a strategy and value-adding services for a business and then necessary customized requirements are identified. In the second phase, a goal-driven approach is used to specify the system requirements based on the strategy. This methodology enables business managers and system developers to develop high-level strategies that improve value activities and obtain competitive advantage, and thereby determine the specifications of the core e-services. To illustrate the methodology, we use a B2C application of an online bookstore. Finally, implications and conclusions are discussed.

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1. Introduction

With the rapid growth of e-commerce (EC), many transactional activities are now being conducted through the Internet. It has changed the traditional marketplace into one in which the business model is highly complex and requires rapid changes to business strategies, products and services, marketing methods, etc. The complexity has rendered the traditional approach to defining application requirements obsolete.

EC websites must be multi-functional, with a strong link to business strategy and incorporate marketing skills [14]. This means that a B2C application must create value, making aligning application development projects with business strategies critical.

Several authors [1,21] have noted that traditional methodologies, such as structured development and prototyping are inappropriate for EC application development [13,26]. According to a survey by Taylor et al. [27], EC application development lacks the specialized and formal methodologies that exist for traditional IS applications.

Although several EC application development methods, such as the *e-Commerce Development Method* [9], *Web IS Development Methodology* [28], and *Internet Commerce Development Methodology* [26], have been proposed, very few support all the characteristics of EC applications. These typically involve a conceptual framework that begins with the engineering of the business strategy and ends with the production of a set of graphic tools for modeling and specifying the requirements of an application. However, although such frameworks are useful for understanding the key activities (such as strategy formulation, analysis, work design, and application implementation), they offer insufficient guidelines for eliciting and modeling requirements, and provide little help in integrating the various activities. To address these issues, we developed a goal-driven methodology for the eliciting and modeling of B2C application requirements.

2. Related work

2.1. The virtual value chain

EC has provided a marketplace where participating companies create value in both the physical and virtual worlds; Porter [22] proposed a model to describe this but treated information merely as a supporting element rather than as a source of value itself. The activities that exploit information in the virtual world are unique to it and the process is fundamentally different from that of the

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physical world. To explain the differences, Rayport and Sviokla [23] proposed a virtual value chain (VCC) model that mirrors the physical chain. Each stage involves a sequence of five value-creating activities: (1) gather information; (2) organize it; (3) select what is valuable; (4) synthesize it; and (5) distribute it. Here, each activity adds value to the information. The VCC is nonlinear; it is a matrix of potential inputs and outputs that can be accessed and distributed through a variety of channels.

2.2. E-Commerce application development methodologies

Conallen [5], Wang [29], and Saleh [24] have used UML to specify and document EC websites. However, this approach leads to the overemphasis of the design of computer-based artifacts with little attention paid to the business and market aspects of application development. To address this shortcoming, Finger proposed an *E-Commerce Development Method (ECDM)*, which included business strategy engineering, business process engineering, and component-based software development; it advocated an end-to-end and strategy-to-code method of developing EC applications. Vidgen proposed a *Web IS Development Methodology (WISDM)* based on a Multiview framework; it states that a successful EC application project is consisted of five phases: organizational analysis, information analysis, work design, technical design, and human-computer interaction (HCI) design. During the initial phase, an EC strategy is built and a market survey conducted. The information analysis involves the specification of requirements, the work design phase aims to include stakeholder interests, and the technical design involves the engineering of physical designs. Finally, the HCI design phase deals with the aesthetics of the user interface.

In a different approach, Gordijn et al. [11] included three design viewpoints: business model development, business process design, and software architecture requirements. They proposed an approach, *e³-VALUE*, to express, create, and integrate the requirements of different stakeholders in an iterative process. By using scenarios expressed by use case maps, the different requirements are presented as an integrated and traceable set of requirements. Standing proposed an *Internet Commerce Development Methodology (ICDM)* with a framework for developing B2C applications. It provided management strategies and development strategies driven by business needs and covered Web management structure, user involvement, meta-development strategy, website and component development, requirements analysis techniques, functional requirements framework, and a physical architecture framework. Its development process involves five phases: strategy and business analysis development, analysis, design, implementation, and evolution. The user requirement analysis in the ICDM uses two group communication techniques: brainstorming and group requirement sessions.

All of these methodologies pointed out the importance of linking EC strategy to system specifications in EC application development, but none provided an integrated suite of tools or methods to help developers establish such a link.

2.3. The customer decision process

A significant feature of the B2C market is its emphasis on “customer-driven commerce” [7,12]. To meet customers’ requirements, it is important to understand how they make purchase decisions [20] and the value-adding activities critical in their procurement process. To identify such activities, we adapted the decision-making process detailed by Simon [25] and in marketing research literature [8] to define a *customer decision process (CDP)* model, which explains and predicts consumer behavior. By

analyzing CDP activities, managers could determine how the Internet can facilitate EC activities to create a competitive advantage and ultimately values for their customers [17].

The five main customer activities and the sellers’ responses in CDP are:

- *Need recognition*: Customers must determine factors that trigger them in deciding on their needs for a particular product or service. Sellers must recognize these needs and plan to satisfy them.
- *Information search*: Customers must search for more information about their needs, depending on the importance, volume, value, and satisfaction obtained from the search. Sellers must carefully assess their customers’ sources of information and importance, to prepare for effective communication with the target markets.
- *Evaluation of alternatives*: Customers then use the information to choose among the alternatives, ranking them to form purchasing intentions. The way in which customers evaluate the alternatives depends on their characteristics and specific buying needs. Sellers therefore need to know how their customers evaluate alternatives.
- *Choice*: Customers then form a purchase decision and order their preferred products or services, depending on the value that they expect from them. Sellers can therefore improve a customer’s value expectations and trigger a buying decision.
- *Post-purchase*: Finally, many actions must be performed including: payment, delivery, return, logistics, and other post-purchase services. Here, sellers must provide secure, convenient, and flexible payment mechanisms and deliver quality services to build good will and encourage customer loyalty.

2.4. The e-commerce value matrix

Online CDP has become information intensive and seldom requires interaction with products, salespeople, or service technicians [4]. Executives must thus pay attention to the ways their companies can create value. To create value with information, it is imperative to answer the question: “What value-added steps might be shifted to a virtual value chain?” To answer this, we adopted the value matrix concept and created a matrix of value-creating opportunities that places a generic information-based value-creating process in one dimension and a customer decision process in another, as shown in Fig. 1; we term this an “*e-commerce value matrix*” (ECVM). Each cell is labeled an *e-service*, which identifies the underlying interconnectivity of the B2C activities and IT functions.

Each e-service extracted from the ECVM is an opportunity to add value for customers. A business can thus create competitive advantage by utilizing differentiated e-services to support EC strategies. For example, Amazon.com focused on providing intelligent search and new-product recommendation e-services to its customers; it successfully created competitive advantage from these e-services. Similarly, Microsoft’s Internet application software provided “self-service” support functions that allowed customers to troubleshoot their own technical problems, thus differentiating Microsoft [10] from its competitors.

3. The goal-driven methodology

Developing a B2C application requires participation of stakeholders both inside and outside the business. However, there may be conflicts between their requirements, and a systematic and communicable methodology was needed to allow stakeholders to include their needs and manage conflicts. We adopted the work of [15,16] to develop a goal-driven methodology that aimed at

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