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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.

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 marketspace 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, e^3-*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 mange conflicts. We adopted the work of [15,16] to develop a goal-driven methodology that aimed at

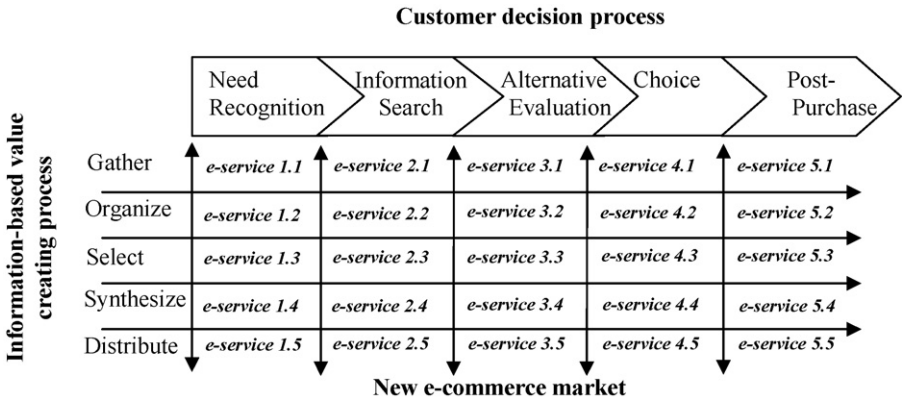


Fig. 1. The e-commerce value matrix.

providing managers with a framework to model EC strategies and offer designers tools to elicit and specify system requirements. Fig. 2 shows the goal-driven methodology. To exemplify the methodology, an online bookstore YLib.com was used to explain the activities in each phase.

3.1. The case example: YLib.com

Yuan-Liou Publishing Company has been publishing Chinese books in Taiwan since 1975. It has established an online bookstore YLib.com since 2000. In addition to the usual functions of a B2C system, the website offers its members services that include book recommendations, a search engine, customized advertising, an auction, and a chat room. Recently, the company attempted to improve the service quality of the website to compete more effectively in the changing environment.

YLib.com wished to become an online library provider promoting new knowledge by providing internal book information and external knowledge resources for online readers. This would be accomplished by creating a varied reading environment composed of four well-designed and differentiated e-services to satisfy customer needs: an *Internet Bookfair*, *Intelligent Bookshelf*, *Interactive Bookclub*, and *Information Bank*. These specific e-services had been designed to achieve YLib.com's four marketing objectives of providing complete information content, reducing search time and cost for customers, improving external communications and member relationships, and achieving excellence in the integration of external databases.

3.2. Phase I: E-Commerce strategy formulation

A top priority in the development of B2C applications is to formulate the EC strategies [18]. An e-business must obviously consider how the application is to be aligned with these strategies [3]. Initially, managers need to carefully consider the implications of Internet applications for all value-adding activities. Thus, the first phase attempts to identify the type of customers: what they need, which of the activities in the CDP must be supported, and which e-services can be employed. Competitive analysis and the ECVM model can be used to shape the strategy, and the results can then be employed to determine the core e-services needed.

Step 1: Identify core e-services

An e-business's competitive advantage may be embedded in its unique products or services [2]. Successful e-businesses must implement new combinations of activities that were not previously possible and develop core services, which should be specific and innovative, and play a key role in realizing the strategy. Managers should consider the services provided by competitors, differentiate their e-services from them, and identify new opportunities. To be more specific, we divided the process of identifying core e-services into two sub-steps.

Sub-step 1.1: Determine customer segments

B2C application requirements often vary considerably with target market segment. The success of an e-business may be determined by its ability to devise customized e-services for different market segments to attract customers [30].

The YLib.com case: YLib.com classified its customers into two segments, *members* and *guests*, according to its internal marketing policy. Customized e-service requirements should be elicited from these two customer segments.

Sub-step 1.2: Identify critical value-added activities

To select the right core e-services, an e-business must carefully evaluate and prioritize its e-service activities and determine the critical value-added activities in the CDP based on the requirements of the customer segments and the analysis of the competition. The ECVM can be used during this process. By considering the identified activities, the system designers can then decide how the IT facilities support the core e-services that support the EC strategy and link it with customer requirements. For instance, an online bookstore website can provide an intelligent agent that collects product information and makes price comparisons for customers. Once the core e-services have been identified, they can be built into the B2C application.

The YLib.com case: To identify the critical activities, we examined YLib.com's business needs (*Internet Bookfair*, *Intelligent Bookshelf*, *Interactive Bookclub*, and *Information Bank*), marketing objectives, and the underlying customer requirements derived from member feedback and online questionnaires. Thus, we identified the need recognition (NR), information search (IS), and post-purchase (PP) stages as the most critical value-added CDP activities for YLib.com's customers. The corresponding core e-services in each of these stages were *NR_Gather*, *NR_Organization*, *IS_Select*, *IS_Distribute*, *PP_Gather*, and *PP_Synthesize*. Each of the six e-services dealt with the business strategies, customer needs, and informational requirements of the website. In practice, these core services represented the major functionalities of YLib.com's website. These website functions had to be built into the application design. For instance, the *IS_Select* e-service could be implemented through different types of online search services, such as a general search engine, intelligent search agent, or merchant brokering agent. Table 1 summarizes the logical links between business needs, and core e-services.

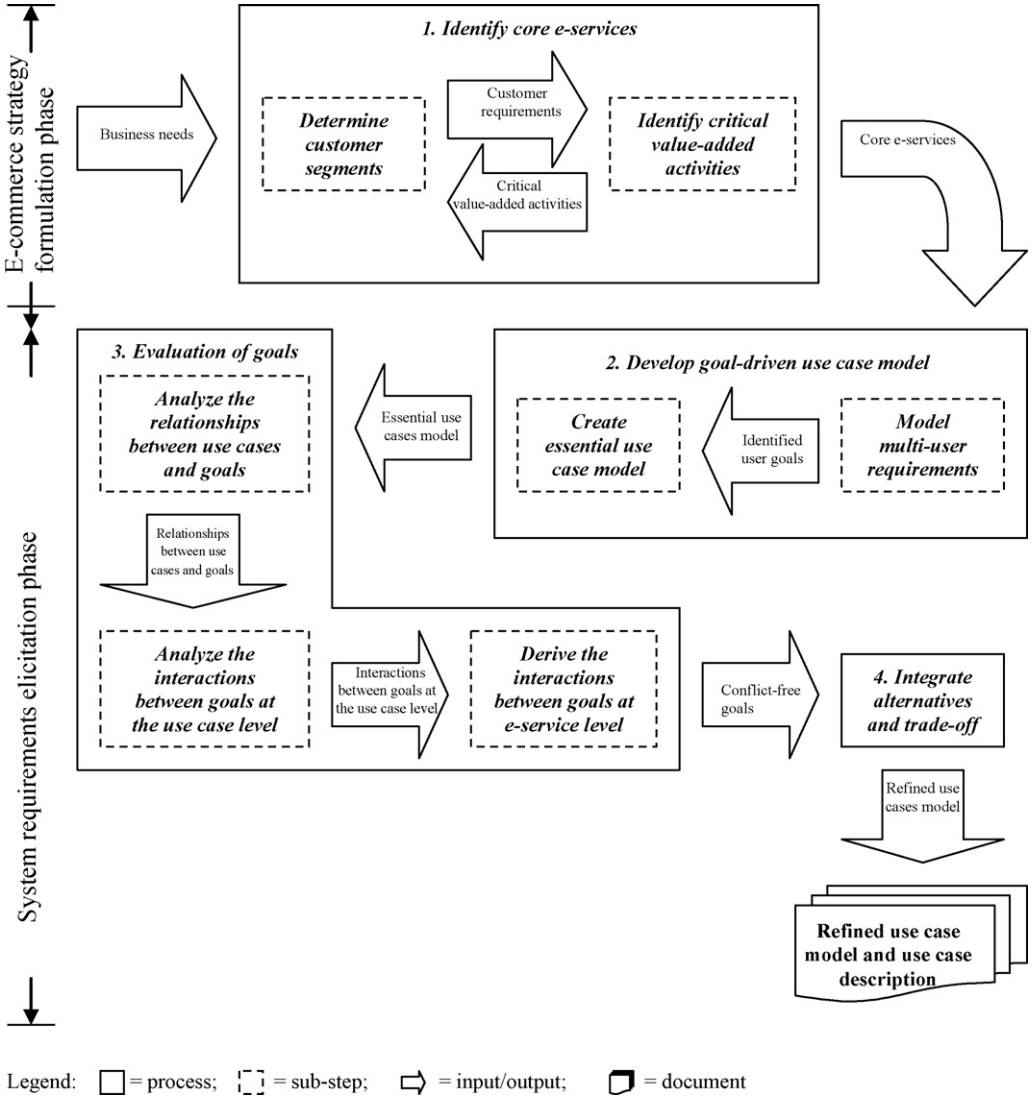


Fig. 2. The goal-driven methodology for eliciting B2C application requirements.

Table 1
Links between business needs and core e-services for YLib.com

Business needs	Marketing objectives	CDP activities	Customer requirements	Core e-services
Internet bookfair	Providing complete information content	Need recognition (NR)	1 Complete book database	1 NR_Gather
			2 Hierarchical product organization	2 NR_Organization
			3 Well-designed book directories and classifiers	
			4 Billboard of books	
			5 Auction mechanism	
Intelligent bookshelf	Reducing search time and cost for customers	Information search (IS)	1 Effective search engine and information retrieval	1 IS_Select
			2 Customized information recommendations	2 IS_Distribute
			3 Pushing technology	
Interactive bookclub	Improving external communications and member relationships	Post-purchase (PP)	1 Online FAQ	1 PP_Gather
			2 Organizing member clubs (YLib club)	2 PP_Synthesize
			3 Author website hyperlinks	
			4 Electronic papers	
Information bank	Excellence in the integration of external databases	Need recognition (NR) Information search (IS)	1 Chat rooms	1 NR_Gather
			2 Cross-site hyperlinks	2 NR_Organizatio
			3 Effective search engine and information retrieval	3 n IS_Select

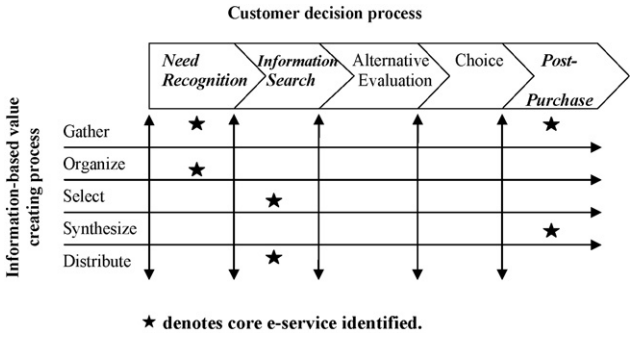


Fig. 3. Ylib.com's e-commerce value matrix.

The formulation of YLib.com's EC strategy and core e-services are depicted in an ECVM (see Fig. 3), where the identified core e-services are marked by "stars" in the cells. The matrix shows that all five types of value chain activities were executed, and thus the system was taking advantage of the information-based value-creating process. This EVCM model shows the underlying interconnectivity of YLib.com's business needs, marketing objectives, and customer requirements, which coalesce to form the company's EC strategy and the architecture of its B2C application design.

3.3. Phase II: Eliciting system requirements

Developing B2C applications frequently involves many stakeholders, including people internal and external to the organization. Because of their diversity, the user requirements may be ambiguous and conflicting.

Step 2: Develop a goal-driven use case model

The use case diagram in UML is a graphic tool that helps in defining the actors' needs and thus capturing the system requirements. However, B2C application requirements are multi-user driven, and some are likely to be ill-defined and non-functional; e.g., good security, convenience, efficiency, and privacy. These are usually informally stated, conflicting, and difficult to resolve and implement. For example, a *member user* may want a secure mechanism but a *guest user* may desire convenience and rapid response. Thus, although the realization of customer requirements is important in B2C application development, little guidance is provided by the conventional structured or object-oriented requirement analysis techniques.

A goal-oriented approach deals with eliciting, analyzing, and specifying requirements by considering the goals at different levels of abstraction. We adopted a goal-driven use case model that extended the original use case model by including a way of capturing and modeling imprecise requirements that satisfy user goals [6]. This approach bridges the gap between the domain descriptions and the system requirements, integrates both functional and non-functional requirements, and identifies conflicting requirements from different stakeholders.

Sub-step 2.1: Model multi-user requirements

A *goal* states "what" a user wants. Goals determine the respective user roles and provide a basis for defining the actions that users best perform. Goals may be formulated at different levels of abstraction [6,13] and cover different concerns [19]: e.g., functional ones are associated with the services and non-functional ones with the quality of service [17]. Here, goals are classified into two types: *generic* and *articulated*. Generic goals usually map to actions that must occur, whereas articulated ones map to non-functional requirements. Accordingly, the designer must identify a *generic goal* (G_g) that states the minimum system requirement, after which the different user segments create *articulated goals* (G_a) that expand on generic goals, as illustrated in Fig. 4.

Each goal has three facets or categories <*competence*, *view*, *content*>

- *competence*, whether it is rigid (*R*) or soft (*S*);
- *view*, whether it is actor-specific (*A*) or system-specific (*S*); and
- *content*, whether it is functional (*F*) or non-functional (*N*) based on its content.

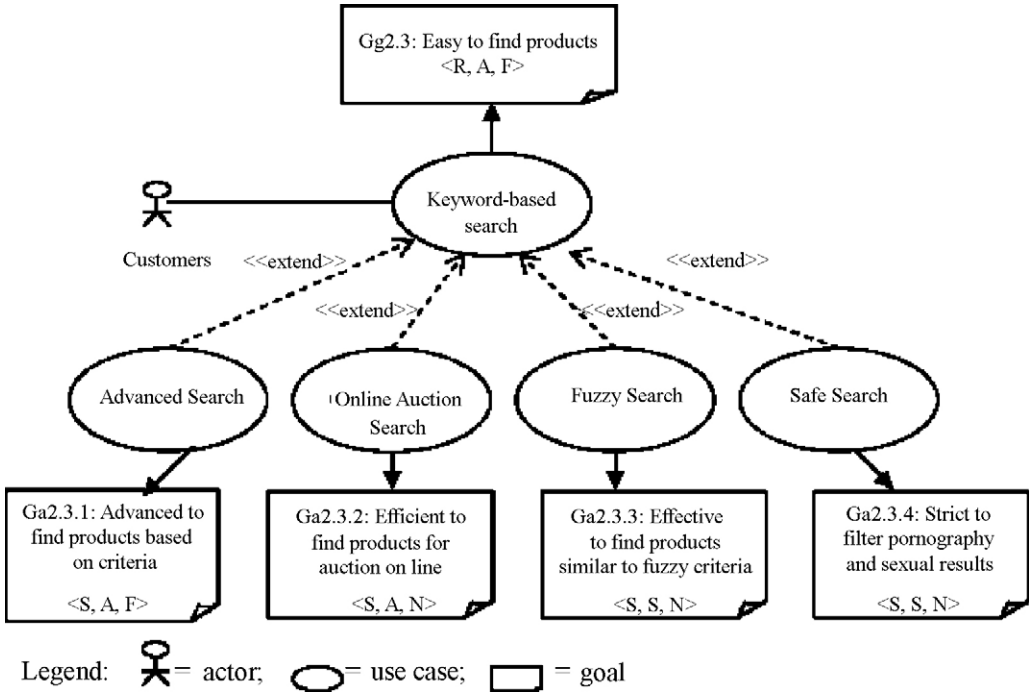


Fig. 4. Essential use case model for the IS_Select e-service.

Table 2
User goals and system requirements for the *IS_Select* e-service

User segment	User generic goals and their articulated goals	System requirements
Member	1. Easy to find products <R.A.F> 1.1 Advanced in finding products based on criteria <S.A.F> 1.2 Efficient in finding products for auction online <S.A.N>	1 Keyword-based search 2 Advanced search (based on the criteria: book title, ISBN, book no.) 3 Online auction search
Guest	1. Easy to find products <R.A.F> 1.3 Effective in finding products similar to fuzzy criteria <S.S.N> 1.4 Strict in filtering pornography and results of a sexual nature <S.S.N>	1 Keyword-based search 2 Fuzzy search (based on homophonous word and tolerance search) 3 Safe search

The YLib.com case. At YLib.com, designing a completely *IS_Select* e-service was accomplished by analyzing user goals from the guest and member segments. For example, Table 2 shows the generic goal *Easy to find products*, which is rigid, actor-specific, and functional, and its four articulated goals of *Advanced in finding products based on criteria*, *Efficient in finding products for auction online*, *Effective in finding products similar to fuzzy criteria*, and *Strict in filtering pornography and results of a sexual nature*.

Sub-step 2.2: Create an essential use case model

For each core e-service, designers must examine the use cases to guarantee that the e-service will at least satisfy the minimum user requirements. Each use case is associated with at least one actor and it must satisfy all those actor's goals. To take into account the different types of goals and multi-user perspectives, an extended use case model must be created; this will be termed the "*essential use case model*."

The YLib.com case: To satisfy the user goals and system requirements for the *IS_Select* e-service, the original use case *Keyword-based search* was designed to satisfy the generic goal of *easy to find products* (G_g2.3); it was made up of the extended use cases *Advanced search*, *Online auction search*, *Fuzzy search*, and *Safe search*. Fig. 4 shows the various user cases, goals, and e-services for Gg2.3: *Easy to find products*.

Step 3: Evaluation of goals

Once the essential use case model has been developed, the designer must solve any goal conflict or contradictions due to different user segments.

Sub-step 3.1. Analyze the relationships between use cases and goals

A use case can be viewed as a process that is associated with a goal achieved, optimized, maintained, ceased, or impaired by the use case. The relationships between goals and use cases can be analyzed by investigating the effects of the use cases on the goals. According to Lee et al. [16], five predicates can be defined to characterize the relationships between use cases and goals: *satisfied*, *satisfiable*, *denied*, *deniable*, and *independent*. A goal will be *satisfied* or *denied*, depending on whether it can be achieved or have to be abandoned. The predicates *satisfiable* and *deniable* will be used to describe a goal that can be satisfied or denied to some degree. The predicate *independent* is used to describe a goal that will not be affected by any designated use case. The relationships between the goals and use cases in our *IS_Select* e-service example are shown in Table 3.

Sub-step 3.2. Analyze the interactions between goals at the use case level

The interactions between goals must be considered at both the use case and system levels. At the use case level, the relationship between two goals can be either *conflicting*, *positively cooperative*, *negatively cooperative*, or *irrelevant*. The goals are conflicting if the satisfaction of one goal increases when the other decreases after completion of the use case. In contrast, two goals cooperate with each other if the satisfaction degree of both goals either increase (positively cooperative) or decrease (negatively cooperative) at the same time. Finally, if the satisfaction degrees of both goals remain unchanged, then the goals are said to be irrelevant to the use case.

The interactions between two goals for a use case can be derived from the interactions between the use case and each goal. For example, if the interactions between a use case (e.g., U_k) and goals, say, G_i and G_j, are satisfiable and deniable, respectively, then the satisfaction degree of G_i increases and that of G_j decreases after U_k is performed. The interactions between G_i and G_j with respect to U_k can thus be said to be conflicting. Table 4 summarizes the interactions between goals at the use case level.

The YLib.com case: For YLib.com, Table 5 (derived from Tables 3 and 4) shows the interactions between the goals for the *IS_Select* e-

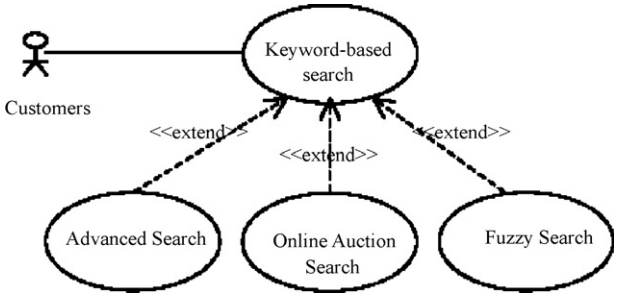


Fig. 5. Refined use case model for the *IS_Select* e-service.

Table 3
Relationships between use cases and goals for the *IS_Select* e-service

User goals use cases	Easy to find products (*Gg2.3*)	Advanced in finding products based on criteria (*Ga2.3.1*)	Efficient in finding products for auction online (*Ga2.3.2*)	Effective in finding products similar to fuzzy criteria (*Ga2.3.3*)	Strict in filtering pornography and results of a sexual nature (*Ga2.3.4*)
Keyword-based search	Satisfied	Satisfiable	Satisfiable	Satisfiable	Deniable
Advanced search	Satisfied	Satisfied	Satisfiable	Independent	Deniable
Online auction search	Satisfied	Satisfiable	Satisfied	Independent	Independent
Fuzzy search	Satisfied	Satisfiable	Satisfiable	Satisfied	Deniable
Safe search	Independent	Independent	Independent	Independent	Satisfiable

Table 4
Interactions between goals at the use case level

Relationship between goals (*Gi*, *Gj*)	Conflicting (*Cf*)	Cooperative (Cp)		Irrelevant (*I*)
		Positive cooperative (*C*)	Negative cooperative (*C*−)	
(Satisfied, satisfied)		✓		
(Satisfied, satisfiable)		✓		
(Satisfiable, satisfiable)		✓		
(Denied, denied)			✓	
(Denied, deniable)			✓	
(Deniable, deniable)			✓	
(Satisfied, denied)	✓			
(Satisfied, deniable)	✓			
(Satisfiable denied)	✓			
(Satisfiable deniable)	✓			
Independent				✓

(✓) Denotes the presence of interaction.

Table 5
Interactions between the goals in the *IS_Select* e-service at the use case level

Goals pair Use cases	*Gg2.3* *Ga2.3.1*	*Gg2.3* *Ga2.3.2*	*Gg2.3* *Ga2.3.3*	*Gg2.3* *Ga2.3.4*	*Ga2.3.1* *Ga2.3.2*	*Ga2.3.1* *Ga2.3.3*	*Ga2.3.1* *Ga2.3.4*	*Ga2.3.2* *Ga2.3.3*	*Ga2.3.2* *Ga2.3.4*	*Ga2.3.3* *Ga2.3.4*
Keyword-based search	*Cp*	*Cp*	*Cp*	*Cf*	*Cp*	*Cp*	*Cf*	*Cp*	*Cf*	*Cf*
Advanced search	*Cp*	*Cp*	*I*	*Cf*	*Cp*	*I*	*Cf*	*I*	*Cf*	*I*
Online auction search	*Cp*	*Cp*	*I*	*I*	*Cp*	*I*	*I*	*I*	*I*	*I*
Fuzzy search	*Cp*	*Cp*	*Cp*	*Cf*	*Cp*	*Cp*	*Cf*	*Cp*	*Cf*	*Cf*
Safe search	*I*	*I*	*I*	*I*	*I*	*I*	*I*	*I*	*I*	*I*

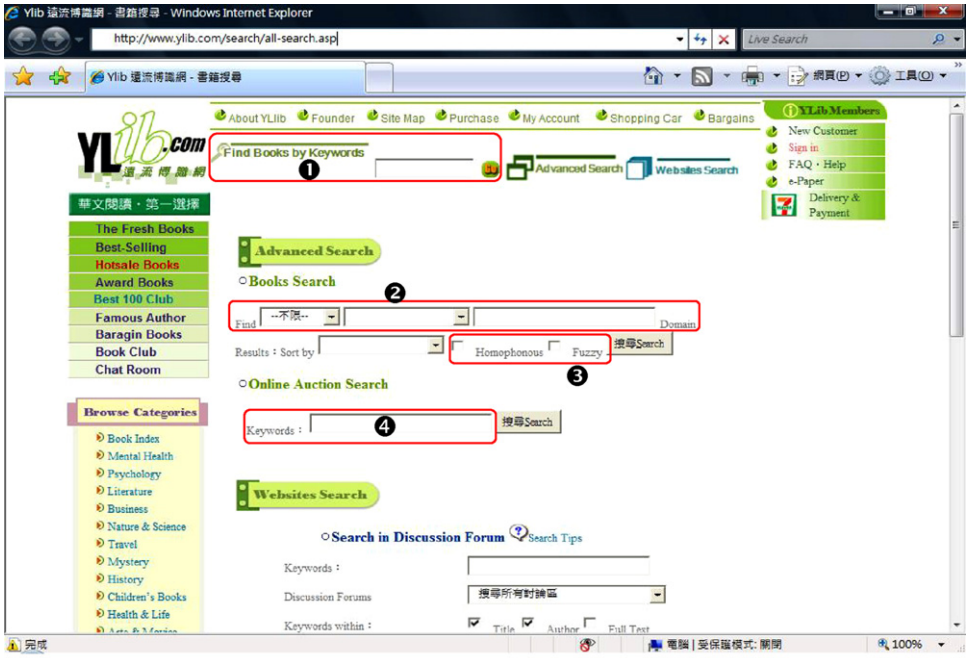
Where *Cf*: conflicting; *Cp*: cooperative; *I*: irrelevant.

service at the use case level. For instance, the first row of the table shows that the interactions of ($G_g2.3$, $G_a2.3.4$), ($G_a2.3.1$, $G_a2.3.4$), ($G_a2.3.2$, $G_a2.3.4$), and ($G_a2.3.3$, $G_a2.3.4$) on the *Keyword-based search* use case are in conflict.

Sub-step 3.2. Derive the interactions between goals at the e-service level

The interactions between goals at the e-service level can be derived from the use case description. The relationships between any two goals at the e-service level are analyzed with respect to a specific use case in a use case model in which related use cases are amalgamated. The interaction between goals G_i and G_j at the e-service level is denoted by $R(G_i, G_j)$, or as a pair of predicates $\{Cp(G_i, G_j), Cf(G_i, G_j)\}$, where $Cp(G_i, G_j)$ is true if G_i cooperates with G_j, and $Cf(G_i, G_j)$ is true if G_i conflicts with G_j at the e-service level. There are four possible interactions between goals at the e-service level.

- $R(G_i, G_j) = <True, True>$: G_i and G_j are *counterbalanced* (*B*) at the e-service level. This occurs when G_i and G_j are cooperative in one use case but conflict in another.



Legend: ❶= keyword-based search ❷= advanced search; ❸=fuzzy search ❹= online auction search

Fig. 6. Screen shot of the search engine page on the YLibCom website.

Table 6
Relationships between the goals in the *IS_Select* e-service

Goals pair e-service	*Gg2.3* *Ga2.3.1*	*Gg2.3* *Ga 2.3.2*	*Gg2.3* *Ga2.3.3*	*Gg2.3* *Ga2.3.4*	*Ga2.3.1* *Ga2.3.2*	*Ga2.3.1* *Ga2.3.3*	*Ga2.3.1* *Ga2.3.4*	*Ga2.3.2* *Ga2.3.3*	*Ga2.3.2* *Ga2.3.4*	*Ga2.3.3* *Ga2.3.4*
IS_Select core e-service	*Cp*	*Cp*	*Cp*	*Cf*	*Cp*	*Cp*	*Cf*	*Cp*	*Cf*	*Cf*

Cf: conflicting; *Cp*: cooperative; *B*: counterbalanced; *I*: irrelevant.

- $R\ (G_i, G_j) = <True, False>$: G_i and G_j are *cooperative* (*Cp*) at the e-service level.
- $R\ (G_i, G_j) = <False, True>$: G_i and G_j are *conflicting* (*Cf*) at the e-service level.
- $R\ (G_i, G_j) = <False, False>$: G_i and G_j are *irrelevant* (*I*) at the e-service level.

The YLib.com case: The interactions between the goals at the *IS_Select* e-service level in the YLib.com example are shown in Table 6. The interactions of *Easy to find products* ($G_g2.3$) with *Advanced in finding products based on criteria* ($G_a2.3.1$), *Efficient in finding products for auction online* ($G_a2.3.2$), and *Effective in finding products similar to fuzzy criteria* ($G_a2.3.3$) are cooperative, while the interactions between *Strict in filtering pornography and results of a sexual nature* ($G_a2.3.4$) and the other G_a's are conflicting, and the other pairs of goals are cooperative because there is no conflicting interaction at the use case level.

Step 4: Integrate alternatives

To resolve the conflicts that arise from multiple goals and multiple user requirements, a designer must explore alternative solutions for an e-service by analyzing the interactions between goals at the e-service level. Designers must organize the goals into several alternatives so that each contains a set of goals that do not conflict with one another. The organization of goals into alternatives must satisfy the following constraints.

- For any two goals G_i and G_j in an alternative, the interaction between the goals is either *cooperative* or *irrelevant*.
- For any two alternatives A_i and A_j, there are goals $G_i \in A_i$ and $G_j \in A_j$ such that the interaction between the goals is either *conflicting* or *counterbalanced*.
- For any alternative A_k and goal G_i, where $G_i \notin A_k$, there is a goal $G_k \in A_k$ such that the interaction between the goals is either *conflicting* or *counterbalanced*.

Finally, designers can evaluate the alternatives by selecting a set of goals that collectively either satisfies or at least provides good support for the generic goals. This is based on the EC strategy and a trade-off between the goals and use cases, the result of which will generate a refined use case model that serves as a basis for determining the system requirements.

The YLib.com case: By applying this approach to the *IS-Select* e-service, the set of goals: {$G_g2.3$, $G_a2.3.1$, $G_a2.3.2$, $G_a2.3.3$}, which include all of the goals except $G_a2.3.4$, can be identified. As the objective of the e-service is to maximize the satisfaction of all users (both members and guests) in accordance with YLib.com's needs, EC strategy, or marketing purpose, the combination of $G_g2.3$, $G_a2.3.1$, $G_a2.3.2$, and $G_a2.3.3$ is the most complete alternative solution to the achievement of conflict-free requirements, because the goals enhance each other. Fig. 5 shows the refined use case model for this e-service, which indicates its major functionalities. Table 7 gives a description of the *IS_Select* e-service.

The other core e-services of YLib.com can be identified in the same manner. Once the requirements of each have been specified, the overall requirements of the customized EC application can be identified and the system implemented. Ideally, each e-service is a software component of the EC application.

Table 7
Textual description of the use case model for the *IS_Select* e-service

Use case description	
Name	Information Search_Select (*IS_Select*) e-service
Initiator	Customer (member or guest)
Generic goal	Easy to find products (*Gg2.3*)
Extended goals	*Advanced in finding products based on criteria* (*Ga2.3.1*), *Efficient in finding products for auction online* (*Ga 2.3.2*), *Effective in finding products similar to fuzzy criteria* (*Ga2.3.3*)
Pre-conditions	Criteria items are available and valid
Begin when	Customer initiates a search request
Scenarios	*Main scenarios (MS)* 1: System creates a Search_Request 1.1 Customer selects a search service, such as keyword-based search, advanced search 1.2 Customer inputs Criteria_Items for the search 2: System receives the Criteria_Items 3: System checks the validation of the Criteria_Items 4: System translates the Criteria_Items into a language understood by the book database. 5: System searches the book information that matches the Criteria_Items. 6: System collects the corresponding results and responds to the customer 7: System cancels the Search_Request. *Extension scenarios (ES)* 1: Customer requests advanced search, or online auction search, or fuzzy search 2: The Criteria_Items that the customer inputs for the different Search_Request: 2.1 General query search: keyword 2.2 Advanced search: Book_Title, Author_Name, ISBN, and Date_Range. 2.3 Online auction search: online auction keywords. 2.4 Fuzzy search: tolerance (y/n), homophonous (y/n).
Exceptions	1: Criteria_Items are not valid or available. 1.1 The search request fails. 2: The results are not found. 2.1: Discard the Search_Request. 2.2: Resume the main scenario MS.
Post-conditions	Customer receives results, a rejection of the Search_Request, or a notice that the Serach_Request has been discarded.

Fig. 6 shows a screen shot from an application on the YLib.com website that was implemented based on the use case model for the *IS_Select* e-service. It shows that the search engine service is composed of a set of search functions that consist of a keyword-based, advanced, fuzzy and online auction search, as shown by numbered markers.

4. Conclusion and implications

An effective EC application development methodology must include an integrated and seamless method of strategic planning and software development. To achieve this end, we developed a goal-driven methodology that integrates ECVM and a goal-driven

use case model for B2C applications. The model, which is derived from CDP and the value matrix, provides a guiding framework for planning and formulating EC strategies effectively. The approach also addresses multi-requirement conflict issues and provides a systematic trade-off solution and requirement analysis for application development. The feasibility of the methodology was illustrated using a real-life case example of YLibcom's online bookstore B2C application.

At YLibcom, the methodology provides a template that helped the managers and system developers seamlessly transform a high-level EC strategy into specific system requirements, thus made it easier to create its architecture. It also helped them to address the following critical issues:

- What characteristics and segmentations of customers do we have?
- What value will be created or provided in the customer decision process?
- What core e-services can we provide each customer segment to gain competitive advantage?
- How can these core e-services realize the business's EC strategy and goals?

Our work has two managerial implications. First, the methodology provides a systemic approach that makes the eliciting and modeling of EC system requirements easier. It integrates several concepts and methods (such as CDP, VCC, ECVM, and a goal-driven use case model) into a requirement eliciting process and allows the seamless definition of customized requirements from EC strategies. Second, the methodology takes both strategic and technical aspects into account, and not only provides e-business managers with a framework to help them develop differentiated EC strategies and gain a competitive advantage, but also helps system designers to translate the core e-services into critical system requirements.

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