

**Stakeholder Involvement and Cultural Preference in E-commerce
System Development Life Cycle**

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Abstract

Commercial and technical innovations together push the e-commerce ongoing over the past decades. E-commerce applications differ from conventional software applications because stakeholders' activities and backgrounds vary in the Internet environment. Requirements for e-commerce cannot ignore the business and Web-based nature.

We start the study by illustrating the infrastructure of e-commerce application, and exploring the characteristics of e-commerce applications comparing with conventional software applications.

Results show that stakeholder involvement and their roles vary along the e-commerce application life cycle. Meanwhile, the culture background of each stakeholder group affects the application development and evolvement activities.

Taking into account the characteristics of e-commerce system, this thesis develops an e-commerce application development strategy, focusing on the perspective of stakeholder involvement and cultural preference. The strategy is presented as a multi-layered model, Archery model. The model shows that requirements for e-commerce applications are developed gradually iteratively and incrementally. It depicts the stakeholders' involvement at different stages of an e-commerce application life cycle, and illustrates how culture preferences influence application development.

Keywords and terms

E-commerce, requirements engineering, cultural preference, stakeholders, Archery model

Table of Contents

1. Introduction-----	1
1.1 <i>Research Questions</i> -----	2
1.2 <i>Research Methods</i> -----	2
1.3 <i>Thesis Structure</i> -----	3
2. E-commerce System in a Nutshell -----	4
2.1 <i>Infrastructure of E-Commerce Application</i> -----	4
2.2 <i>Stakeholder Identification</i> -----	6
2.3 <i>Characteristics of E-commerce System</i> -----	8
2.3.1 <i>Software Distribution</i> -----	9
2.3.2 <i>System Maintenance</i> -----	10
2.3.3 <i>User Involvement</i> -----	11
2.3.4 <i>Business Coverage</i> -----	11
2.3.5 <i>Culture Concern</i> -----	12
2.3.6 <i>Risks Management</i> -----	13
3. Requirements Engineering and its Role in Software Development-----	15
3.1 <i>Requirements Engineering Process Models</i> -----	16
3.2 <i>Stakeholders in Requirements Engineering Process</i> -----	18
3.3 <i>Process Improvement--- Hints from ISO 9000 Standards</i> -----	19
3.4 <i>Summaries and Evaluation of Current Requirements Engineering Process Models</i> -----	21
4. Requirements Engineering for E-commerce System Development-----	22
4.1 <i>Fitting the E-commerce Needs</i> -----	22
4.2 <i>Managing the Cultural Preference</i> -----	24
4.3 <i>Practical Model</i> -----	28
4.3.1 <i>E-commerce Development Life Cycle</i> -----	28
4.3.2 <i>Stakeholders Involvement across E-commerce Life Cycle</i> -----	29
4.3.3 <i>Culture Diffusion in the Layers</i> -----	32
4.3.4 <i>Archery Model</i> -----	33
4.3.5 <i>Evaluation of the Archery Model</i> -----	35

5. Case Study	38
<i>5.1 The Case and Background: ALIBABA.COM</i>	38
<i>5.2 Alibaba Development</i>	38
<i>5.3 Development of RE Techniques</i>	42
<i>5.4 Evaluation</i>	43
6. Conclusion	45
Acknowledgement	47
References	48
Appendix	

1. Introduction

Requirements engineering (RE) research appears to software development as an important phase. Kruchten [1995] proposes the iterative approach in software development, and later more studies [Kotonya and Somerville, 1998; Leffingwell and Widrig, 2003; Royce, 1998] are carried out on the approach. Kotonya and Somerville [1998] further develop a linear model equipped with iterative feature, which is widely applied in modern RE.

However, previous studies [Glass, 1994; Bubenko, 1995; Fenton et al., 1994] claim that studies in the field of software engineering focus at academic level on topics like “interesting and researchable” RE problems, and less research on knowledge of relevant issues and problems in practical life. Most RE research does not focus on business aspects of the system, but the architectural, usability, and design concern [Bleistein et al., 2006]. Other research [Zlatev et al., 2004] only emphasises on finding the needs of customers.

Electronic commerce, also known as e-commerce, evolves quickly in the recent decades. Its fast evolvement brings practical benefits to people’s life. From Yahoo.com to Google.com, from Amazon.com to eBay.com, people are now more and more familiar to the virtual business, which we may feel in daily life. Although the e-commerce systems and applications diffuses into people’s daily life, there are few research related to the practice of RE in e-commerce development. Lowe [2003] claims there are not many studies on RE for Web-based system. Lee and Shirani [2004] say that the existing methods for the RE are weak in the Web focus, and often fail to capture and specify the business dynamics.

Lowe [2003] conducts an overview research on RE for Web-based application. However, Lowe focuses in Web-based application rather than e-commerce. Despite the similarity of Web-based application comparing to e-commerce application, we intend to find a proper RE strategy for e-commerce application development by exploring more specific characteristics from its business domain.

The similar concepts are defined with significant diversity even within the same theme of Web-based application [Lowe, 2003]. In order to perform our research without misunderstanding, we clarify some of the distinct terminologies below:

- | User: Individual among general mass that uses software system, not necessarily related to a specific system.
- | Customer: A user who consumes the goods or services provided by specific software system.
- | Stakeholders: Some people, groups or organisations that involved in the development process, directly or indirectly, influence on or affected by the system requirements [Dix, 1993; Pouloudi, 1997; Kotonya and Sommerville, 1998].

1.1 Research Questions

Since this study focuses on the RE for e-commerce system development rather than conventional software system, a comparison on the diversity of the two systems helps us to understand the characteristics of the e-commerce system. Having realised the characteristics, we can narrow down the scope and carry out a more tailored effort. The following question needs to be investigated.

Question 1: What are the key characteristics of e-commerce applications comparing with conventional software applications?

The question involves two objects, e-commerce application and conventional software application. We divide the computer software applications into Web-based and non-Web-based applications. E-commerce applications fall into the Web-based software applications, with business implementation as their goal. In contrast, the conventional software applications fall into non-Web-based software applications.

RE is to meet customers' needs [Lewis, 1998]. Based on the understanding of the characteristics of e-commerce applications, this thesis further discusses the diversity and volatility of users' needs, and tries to find out the solutions dealing with the needs in the RE process. The discussion forms answers to the second research question:

l *Question 2: How to cope the e-commerce characteristics with stakeholders' needs in the RE for e-commerce application development?*

Different from the conventional software applications, e-commerce applications interact with stakeholders, who are physically located worldwide. The interaction activities are handled through the Internet. Due to its business and technical nature, the marginal question is somehow difficult for either a computer engineer or a business analyst to solve. This study focuses more on the business domain, studies the business dynamics, and suggests a proper way of developing requirements in e-commerce application development.

1.2 Research Methods

This thesis reviews the existing RE models in software development. On the basis of the literature review, a RE model for e-commerce application development is built.

Literature review grounds the studies of the research questions. Firstly, the thesis discusses the e-commerce systems, and their characteristics. Secondly, basic concepts of RE, its process models, and its implementation in e-commerce systems are introduced. The resource includes books, journals, conference articles, and Internet retrieves.

Model building is the way of applying the theories reviewed. We take the influencing factors, such as culture background and stakeholder involvement, into account to build an Archery model. This model depicts how heterogeneous groups of stakeholders are involved in an e-commerce development life cycle.

The evaluation is conducted in a case study. We propose three assumptions to evaluate whether the Archery model is suitable for e-commerce application development. The case study towards Alibaba.com is based on the resources achieving by observing the evolvement of the website, analysing the surveys review, and white papers available at Alibaba website. In addition, as a frequent user of Alibaba since 2001, I witness in this study on how the system was evolved and maintained. A summary of the information retrieved together verifies the model we proposed.

1.3 Thesis Structure

This thesis is organised as follows:

In Chapter 2, we first illustrate the infrastructure of the e-commerce application, and explain the relationship among stakeholders. A comparison between the e-commerce application and conventional software application is hereafter carried out, which provides a basis for the follow-up studies on the RE for e-commerce system.

In Chapter 3, the fundamentals of RE are reviewed. The RE models and their roles in software development are presented. The discussion forms the theoretic background to build the RE model for e-commerce application.

Chapter 4 forms the main body of this study. It discusses how stakeholders interact with the e-commerce application. A summary of e-commerce characteristics and RE knowledge discussed in prior chapters together draw the outline of a RE model for e-commerce application. Stakeholders' classification and culture preferences are discussed across the life cycle of e-commerce development.

In this chapter, Archery model presents how to elicit requirements in a dynamic business environment. The model emphasises a phase-by-phase participation of stakeholders and explains how the requirements satisfy the changing environment. In the final part of Chapter 4, we evaluate the Archery model with three assumptions.

A case study to verify the Archery model is done in Chapter 5, where Alibaba.com is adopted for the study. By analysing and examining the characteristics on Alibaba.com, we verify the feasibility of the Archery model.

We discuss the time limitation and the difficulty in tracing all the previous system releases of the Alibaba.com in Chapter 6. The verification is conducted within a limited period based on current situation and witnessed by historic review. Finally, we conclude the study.

2. E-commerce System in a Nutshell

The history of e-commerce traces back to 1968 when the electronic data interchange (EDI) emerged and provides the possibility for electronic transaction [Weisman, 2000], while in 1984 the standardised EDI through ASC X12 makes the interaction became reliable for transaction online implies that serious e-commerce starts [NU, 2008]. In 1992 Compuserve's online retail business provides the first shopping chance for individuals [NU, 2008], which is the milestone for changing people's shopping behaviour. In 1992 the Mosaic browser, a creation of Marc Andreessen, enables a point-and-click access to the Web appears [Weisman, 2000], while the adapted Netscape browser in 1994 further provides convenience to mass Internet users without cost [Weisman, 2000; NU, 2008]. Two e-commerce giants appears from 1995 with the launch of Amazon.com and eBay.com [NU, 2008], which promotes a mass online shopping acceptance. The birth of Red Hat Linux in 1999 provides Internet users a new optional platform for their e-commerce application, which is another major step in e-commerce growth [Weisman, 2000].

These facts show that technical and commercial innovations together push the evolvement of e-commerce onward. Nowadays we may feel from our daily life that e-commerce forms a huge virtual market on the Internet that covers many fields of society, for example, online shopping or payment, business promotion, and so on.

Despite decades of development, definitions of e-commerce differ in its research focus. A general definition describes it as "buying and selling of products or services over electronic systems such as the Internet and other computer networks" [Wikipedia, 2008]. Another related definition is that e-commerce is the "sale of goods or services over the Internet, at any stage in the supply chain", whether between businesses (B2B), between businesses and consumers (B2C), or between the public and private sectors [Boeegh-Nielsen, 2001] from a transactional point of view.

Because of the lack of a common definition, we understand e-commerce based on its development as: an implementation of business on the Internet marketplace with the assistance of electronic technologies, which practically refers to the computer software and the Internet technology.

2.1 Infrastructure of E-Commerce Application

In the e-commerce environment, the interaction between customer and salesperson differs from that of traditional business. Traditional businesses have some key aspects of shopping experience like interaction between customer and salesperson, and being physically in a store [Mahfouz, 2000]. In contrast, physical presence is not required in e-commerce. The Interaction is implemented online.

We illustrate the generic infrastructure of an e-commerce system in Figure 2-1. Basic elements in the e-commerce application include business firm, e-commerce

system, and stakeholders. Business firm is the owner of an e-commerce system, e-commerce system represents the software for implementing business on the Internet, and the stakeholders are people or organisations involved in the system.

Certain relationships link the three elements together as one entity, in both online and offline ways. Online relationships refer to the activities conducted via the e-commerce system on the Internet, including hosting, using, feedback, and online service and satisfying. In addition to the online relationships, offline interaction acts as a supplementary to the e-commerce application. For example, the feedback from users can be conducted offline as well.

The background of stakeholders determines their attribution and relationships between each other, such as, employment relationship, cultural preferences. For example, a stakeholder who is an employee of the business firm has an offline relationship of recruit, while a stakeholder who is a buyer that purchases online might probably be related to the seller (also as a type of stakeholder) by offline goods delivery. Differences in cultural background and cultural preferences may cause conflicts among stakeholders. Any conflict may damage the system. In this case, the e-commerce system should compromise the varied cultural preferences to satisfy each party.

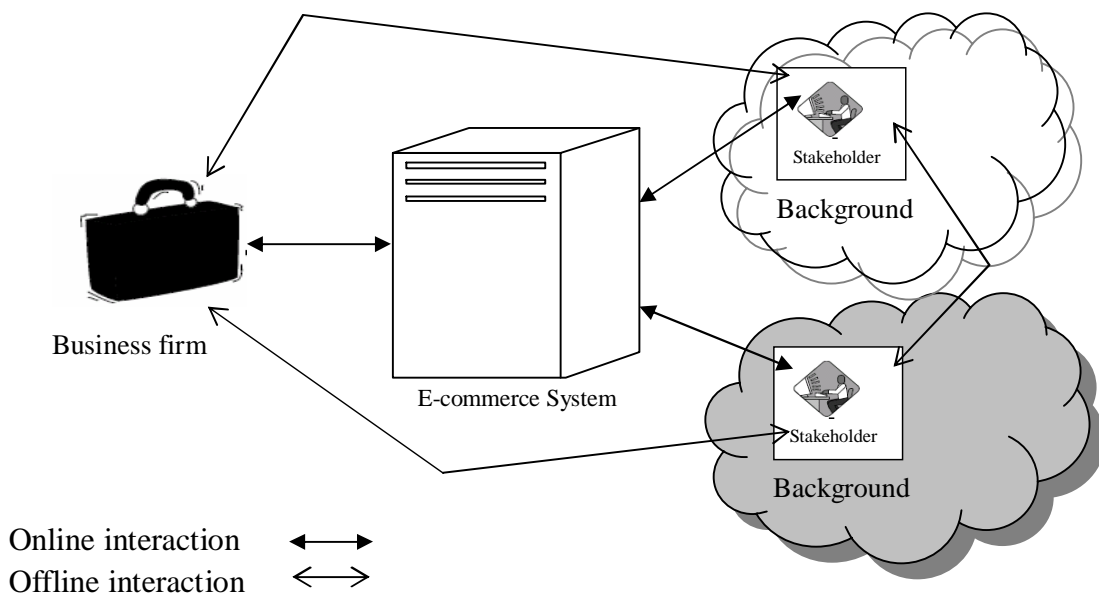


Figure 2-1. Infrastructure of E-commerce Application, adopted from [Yue, 2004]

Business firms are the host of the e-commerce systems. An e-commerce system appears to the users through the interface that stored on the website. The interface is displayed in form of web page. Business firms build their websites, which are the information publisher. The business firms or the sellers can use the websites to publish the information of goods or services to be offered to the markets. Meanwhile, buyers can also make advertisement on the website to seek for their desired items.

All the parties can visit the web pages of the business firms to seek for information instead physically going to the shopping places by themselves. They may decide to purchase the goods or services upon understanding the information shown on the websites. What is shown to the customers is actually the information that available in a virtual way.

The e-commerce system should satisfy the needs of stakeholders (including the background stakeholders) and the business firms in order to keep the system working. The feedback is a channel for helping the business firm to create such satisfaction during its application.

2.2 Stakeholder Identification

Stakeholders have different backgrounds, which determine their roles. This trends to confuse our study. We first identify the stakeholders involved in the e-commerce application by clarifying their interests and backgrounds, which are concerned in our research (see Table 2-1). Interest stands for the stakeholders' needs, and their expectation from the system, while the backgrounds show the fields of strength that might possibly influence the system.

The profile covers all the stakeholders involved in e-commerce systems. However, we do not identify them by position. For example, in an e-commerce development the following professionals required: system analyst, requirements engineer, program developer, coder, computer technician, and so on. We identify them together as employee.

Previous e-commerce research is likely to focus primarily on specific stakeholders and ignore some others, such as suppliers, or investors [Chua et al., 2005]. It is probably because that in each case the research interest differs. However, if talking about a full-function e-commerce system, it is not sufficient to focus on only some specific stakeholders and ignore the others because all the stakeholders may exert their influences on the system, which may damage or promote the system.

To avoid ignoring some stakeholders, we then group them according to the identification. Based on the grouping, we further analyse them systematically.

Lewis [1998] distinguishes customers in three categories: internal, intermediate, and external. Internal customers are those who use the firm's products or services and are from inside the firm. Intermediate customers are those who do not belong to the firm, moreover, they are not end-users of the products or services that the system provides. External customers are the end-users of the products or services outside the firm.

Group	Stakeholder	Description	Interests	Background	
External	Competitor	Other e-commerce business firms	Similar competing systems, which competes. They may study the success experience or technology employed.	Within the same application domain and industry.	
	Seller	Free user	Individual/firm/representative uses the Web for their sales activities on a free use basis.	Functions or services	May from different countries/ regions
		Paying	Formal member who pay for the services for sales purpose.	Functions or service, easy to use, cost, etc.	May from different countries/ regions
	Buyer	Free user	Individual/firm/representative uses the system for their purchasing activities, on a free use basis.	Functions or services	May from different countries/ regions
		Paying	Formal member who pay for the services for purchasing purpose.	Functions or service, easy to use, cost, etc.	May from different countries/ regions
	Intermediate	Supplier/partner	Firms which provide services tied with own benefit or interest	Reliability, functionality and easy to use, cost of system maintenance and evolvement.	Technical or economical strength
Internal	Employee	Persons who are hired to work for the website.	Development technology	Technical strength. A part of firm.	
	Shareholder	Persons or firms who own shares.	Application quality in general	Management strength. A part of firm.	
	Expert group	Expert(s) who provide field knowledge.	Application maintenance and evolvement.	Knowledge strength. A part of firm.	

Table 2-1: E-commerce System Stakeholder Profile

Stakeholder involved in the e-commerce system is not limited to customers, but also anyone who may influence the systems. With such a wider range, we follow the three categories and group the e-commerce stakeholders as internal stakeholder, intermediate stakeholder, and external stakeholder. The stakeholder in the context does not necessarily consume the products or services that the system provides. Rather, they influence the system internally, intermediately, or externally.

Table 2-1 summaries the stakeholders involved in e-commerce system. They are grouped in three categories, of which each group of the stakeholders has their unique demands for products or services. It is the role of the software developing team to discover the variety of interests and needs of all the stakeholders.

l Internal stakeholders include shareholders, employees and the expert group.

Shareholders are the owners of the e-commerce system. They hire employees and experts to develop the system. These stakeholders may firm development team according to the firm's strategy. They push the development internally.

l Intermediate stakeholders mainly refer to partners and suppliers.

Any firm may not able to perform all the tasks along. They need assistance from other parties such like partners and suppliers, who provide services from out side the firm. However, because they aim to build the system together with the firm, they are not purely outsiders. They act as intermediate stakeholders.

l External stakeholders refer to seller and buyer, which can be either free users or paying member, and competitor.

Sellers and buyers use the e-commerce application and bring economic benefit to the business firm. They exert influence on the system externally because they do not participate in the system development directly. Rather, they are one source for the development team to capture the needs, which can be analysed from market report, survey and so on.

We have previously employed the term of customer in the context. From the summary in Table 2-1, we clarify in our research that it mainly refers to the seller and buyer.

We group the competitors into the external customers as well because firstly they are not directly involved in the system, and secondly as a market becomes more competitive, competitors are better able to mimic each other and copy innovations [Chua et al, 2005]. Within the same industry, the successful experience or technology employed by competitors could be a shortcut reference for the system's improvement. The system thus benefits from the competitor indirectly for its own development.

2.3 Characteristics of E-commerce System

As a subject of software application, there are, however, quite many common characteristics between e-commerce and other conventional software application. Still,

e-commerce development projects were initially treated differently from other conventional software development projects such as user involvement [Stevens and Fowell, 2002], despite the common characteristics. It therefore requires the software engineers to regard the e-commerce application as a segment of the software applications, and to employ a more tailored solution for its development. The e-commerce application is not against other Web-based applications. Rather, we regard them as equivalent except for the specific business nature of e-commerce

We analyse the characteristics of e-commerce systems by comparing it with conventional software applications in six aspects: the software distribution, the system maintenance [Lowe, 2003], the user involvement [Stevens and Fowell, 2002], business coverage, culture concern, and the risk management [Stevens and Fowell 2002]. These characteristics may be heightened for Web-based application [Burdman, 1999], not necessarily absolutely unique from conventional software. The assembly of such characteristics together makes significant characteristics for e-commerce application comparing with conventional software. Our focus is on the application of the software systems, rather than the system analysis. The characteristics explored from the e-commerce application helps the system developers to understand how to satisfy the application needs.

2.3.1 Software Distribution

Conventional software application can be regarded as a product for sale on the market [Leffingwell and Widrig, 2003]. Users buy the products for their needs. It is distributed to the users and installed in their own computers. The developer may own the copyright, however, the users somehow own the application such as the ownership of usage. The software possesses features that satisfy the users' needs at least at the moment that users buy it. Otherwise there is no market for it. In general, it does not necessarily require the Internet to work as a precondition if it is completely self-contained.

In contrast, the Internet platform is a must for Web-based systems [Lowe, 2003]. E-commerce applications heavily rely on the Internet technology. From the software distribution point of view, the core of e-commerce system is not installed in the computers of users (except some aiding components such as online security payment plug-in requires a terminal installation), but onto the Internet server.

As shown in Figure 2-1, the business firm is the host of the e-commerce system. It offers the service to the market. Users (as a type of stakeholder) can use browser software to visit the web page that is provided by the e-commerce system. They browse the e-commerce contents on the server by accessing from terminal computers that are located somewhere with Internet connection.

In this case, users can use the e-commerce application even if they do not have the ownership of the product. Rather, they use the services that the application provides.

The business firm can hence run the e-commerce system even if it is not perfect. Thus, the time frame for initial delivery of e-commerce system is shorter than other conventional software system [Lowe, 2003]. That is, the e-commerce systems can be launched even if many features are still missing. The perfecting job can be carried out in later stages by further effort.

2.3.2 System Maintenance

The development of conventional software systems follows the maintenance/release cycle [Lowe, 2003]. When the software system is distributed, it has to be fully designed. Little error is allowed and can be handled by system updating in the maintenance stage. In case there is any defect, the developer should correct it and distribute the correction patches to its users. The after-sale service is obliged before the warranty period expires. After that the users have to buy new software version if they need. The maintenance for the conventional software application is only an after-sale behaviour, which does not bring profits to the business firm directly.

As mentioned above, e-commerce system is not delivered to users, but to be hosted and published onto the website and available to the users. The application of e-commerce system in reality represents a type of business, which follows that market rules. The maintenance cycle of e-commerce is rather an “ongoing process” of improvement [Lowe, 2003] because of its business needs.

Once the contents of e-commerce system are stored on the server, the release can be available to the users. This applies also to later releases of the e-commerce system. It means that the e-commerce host may correct its mistake simply by revising and releasing it to the server. It provides the possibility to make faster and constant modification on the system. From the requirements engineer’s point of view, there is a chance to improve the system although the previous release is not perfect.

Such improvement covers a wide range including both technical and commercial aspects, such as content updating, editorial changes, and interface tuning. Engineers have to improve the e-commerce system with rapid reaction to any change to meet the users’ needs. Otherwise the users may simply switch from one website to another with minimal effort [Lowe, 2003]. Therefore, the life cycle of e-commerce system does not come to an end at each release to the users. In contrast, the launching date of new release to the application is the very start of the interaction with the stakeholders involved.

It is remarkable that the ongoing maintenance process is a motivation for the e-commerce application development, because each new release can attract users if it meets their needs. Once the users are satisfied, they may consume the e-commerce services and may thus directly bring economical benefits to the business firm. The maintenance process means also a development process for e-commerce applications.

2.3.3 User Involvement

The user involvement varies between the application of e-commerce and conventional software. Conventional software application faces much individual interaction while e-commerce application faces mass interaction. Moreover, the mass is not composed of the same users, which further drives the interaction varying with different time measure.

Conventional software licences usually limit the users to install the application in one computer or certain computers, to which the users are more fixed (other authorised users may possibly use the same computer). The interaction in such an application is conducted from point to point. Because of the personal choice, each user may be satisfied with different releases. For example, Microsoft operating system users may prefer either Windows 2000, or Windows Vista. It is the customers' decision to choose the release that fits their needs.

Unlike conventional software application, the information transferred from the e-commerce application is a one-to-many process. E-commerce system, similar to other Web-based systems, is developed for usage by a public mass on the Internet. In the Internet environment, the e-commerce application remains the same within a certain period. It provides a platform to serve the users at the same time. As explained in the previous section, the system follows an ongoing development process. A later release replaces the earlier one. It is always the later release that is available for all the users. Users can push the system onwards instead of drawing back to an earlier stage. The main characteristic of a value Web is a multi-actor business setting for satisfying specific customer needs [Zarvić et al., 2007]. Therefore, the e-commerce application has to satisfy the mass interaction need.

Meanwhile, users are uncertain to the system. As Lowe [2003] explained, users may simply change to other websites. Castro et al [2004] recognise that it is a challenge to specify Web-based application because the users and customers do not remain the same or stable, which makes the customers' needs seems uncertain to the software engineers. The users are not fixed and permanent even though they use the same computers because there are plenty of other choices of e-commerce systems.

Stakeholder involvement also emerged as an area where differences between e-commerce development projects and other software development projects were identified [Stevens and Fowell, 2002]. We realise that all the stakeholders actually locate inside the e-commerce environment, rather than outsiders (see figure 2-1). The involvement difference is not only limited to users, but applies to all the stakeholders.

2.3.4 Business Coverage

The e-commerce application grants a characteristic to the system from its business nature in contrast to traditional business. The e-commerce application provides such a

convenience to the business world: the business firms and customers can stay locally and act globally. There is a possibility for customers to cross borders by simply clicking the mouse through the Internet connection. On the other hand, the business firms can promote their products worldwide by loading information onto any local Internet server. The internationalisation process in the Internet marketplace is thus performed automatically.

Internationalisation is a process in which the firms gradually increase their international involvement [Buckley and Ghauri, 1993]. In traditional business expedition, many firms start their international operations when they are still comparatively small and gradually develop their operations abroad [Buckley, 1993]. It is normal for firms to implement the internationalisation process downstream via ethnic links or reactive response through its foreign partnership and the first stage is to start exports with countries, which are psychologically close to them [Johanson and Widenshiem-Paul 1975] because of culture closeness [Johanson and Vahlne, 1977].

Despite no physical presentation requirement for the internationalisation process of e-commerce, the marketing rules, however, are still applicable in its application. Of course it is possible to design new e-commerce systems to local markets. In this case, the internationalisation process for the business firm can be reached by many local websites, which are tailored for each separately. However, such approach is not our focus because it is no more one single e-commerce system that fits the users' needs from worldwide (later refer as one-Web-fit-all), but a collection of many systems.

The one-Web-fit-all e-commerce application has to follow the marketing rules to respect all the customers. In this case, the software developers have to take each concerned market into account because we recognise from our experience that market environments vary in each place, for instance, culture in the market. As described in Figure 2-1 and section 2.1, the background of stakeholders decides their attributes. Market environment is such a kind of background.

2.3.5 Culture Concern

The Internet enables users to cross borders easily. E-commerce automatically carries out an internationalisation process. It implies that there is more than one culture to be taken into account in an e-commerce system.

Culture is "that complex whole which includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as a member of society" [Tylor, 1871]. It is a combination of a set of factors, which influence people's thought and behaviour. People are individuals who physically live in different places in the world, and due to the differences, cultures vary from place to place. Hofstede [1991] defines culture as a collective programming of the mind that distinguishes the members of one group or category of people from another. We recognise that variations of culture

drive people toward acting differently. El-Said [2006] further realises that culture determines the customers' behaviour, and it extends to the e-commerce.

As a direct reflection to cultural differences on the Internet, we introduce the study of Kang and Corbitt [2001] on Graphical User Interface (GUI) applications to the web page design. They suggest that GUI applications need to be considered in localised interface design with globalise information on the web page.

Table 2-2 shows although that both Australia and Singapore are English-speaking countries, there is, however, a big difference between (at least) the two countries in design of web page even though the Internet is being used world-wide. The Singaporeans tend to use more pictures and other graphical components than the Australians do. The background reason for the variation is cultural difference.

Characteristic	Web developers' attitudes	
	Singapore (Singaporean)	Australia (Australian)
Use of display colours	Use particular colour scheme (depends on companies preference)	No colour preference from companies
Image represented	Company logo is important	Company prestige is more important than image
Use of symbols	No particular scheme	No particular scheme
Use of animations	Important part	Less important
Use of pictures	Heavily used	Mainly used text
Functionality of the web site	Customers are not main consideration (Display only)	Customer reactions are major influence on design

Table 2-2. Some of the Key Difference among Web Developers in Australia and Singapore [Kang and Corbitt, 2001]

They conclude that cultural differences need to be considered in localised design with globalised information on the web page of e-commerce system [Kang and Corbit, 2001]. Since customers in different regions may prefer different culture than others, we regard the cultural preference as a characteristic of the e-commerce application.

2.3.6 Risks Management

Risk control is a consideration in the RE process. Stevens and Fowell [2002] recognise three types of risks related to e-commerce projects, which are:

- | Project Management Risks,
- | Branding and Reputation Risks, and
- | Integration Risks.

Firstly, the management of e-commerce project has to face the same project management risks like any other projects. Time and cost would be two major considerations, which should be controlled properly.

Secondly, because e-commerce is directly launched for commercial use, the branding and reputation would be risky. The acceptance upon the e-commerce system by the market determines whether it is a successful system. In order to reduce such a risk, the project development team must figure out a good image for build suitable brand for earning the reputation from the market. This type of risk has to be controlled according to customers' valuation. When having successfully managed the customers' preferences, there is a possibility to build satisfied branding and reputation.

Thirdly, the integration of the system is risky. Lowe [2003] recognises that the software companies develop Web-based systems by adapting software engineering with less attempts to integrate the elements concerned. Differing from traditional business, e-commerce system relies on the Web, which is a type of Internet involved business. Such firms have to use Web-based application on the Internet for their business processes supporting, to create competitive advantage, global collaboration and integration with external partners [Lee and Shirani, 2004]. Customers may require the system to obtain variations of functionalities to satisfy their needs, which can be reached by different components. The integration of such components decides how well the system works.

As a summary, the success management of customers' needs help the business firm to brand well and earn a good reputation. However, the integration of the system components generated from such demands has to be reasonably arranged for the integration purpose. If these risks can be successfully managed within acceptable time and cost limitation, it is possible to lead to a successful project. The precondition of the risks control relies on the understanding of how the e-commerce application differs from conventional software application.

3. Requirements Engineering and its Role in Software Development

Requirements are specifications of the functions and services that the system should provide, the constraints on the system and the background information that is necessary to developing the system [Zave, 1997]. Requirements tell the development team what the customer is expecting the team to build [Jacobs 2004].

In failed projects, insufficient requirements form a major factor [Alford and Lawson, 1979]. Many studies [Appleton, 1997; Scott and Vessey, 2002] summarise that the risk for unsuccessful RE leads to risk that enterprise system implementation projects tend to run late, exceed budget, and even fail completely.

Loucopoulos and Karakostas [1995] define RE as: “A systematic process of developing requirements through an iterative co-operative process of analysing the problem, documenting the resulting observations in a variety of representation formats, and checking the accuracy of the understanding gained.”

Royce [1998] analyses that in a conventional software project across its life cycle, requirements period is the major source of risks. When the requirements are nearly specified, the risk level goes lower. Risk analysis should be managed according to the life cycle of a software project. The earlier the stage, the more risks could be discovered and reduced.

RANK	ELEMENTS
1	User Involvement
2	Executive Support
3	Experienced Project Manager
4	Clear Business Objectives
5	Minimised Scope
6	Agile Requirements Process
7	Standard Infrastructure
8	Formal Methodology
9	Reliable Estimates
10	Skilled Staff

Table 3-1. Top 10 Most Important Elements for Successful Projects, adopted from [Standish, 2003]

Table 3-1 lists the top ten most important elements for successful projects. We notice that many elements are related with the performance of stakeholders, for example, the user involvement, executive support, experienced project manager, and skilled staff. Meanwhile, the clear business objectives element ranks the fourth after three elements concerning stakeholders, and before the technical related elements (agile requirements

process, standard infrastructure, and formal methodology). It implies that despite the importance of technical related elements such as standard infrastructure, other non-technical elements still plays vital role in software projects.

Firesmith [2003] argues that traditional RE process assumes that the requirements specification remains unchanged during the software developing procedure. However, requirements gathered in the early process of software projects are often incomplete because they are just unknown, not omitted [Tomayko, 2005]. The requirements are not ordered, but elicited from customers or users' demands [Williams, 2004]. The role of RE is to work out such requirements for developing a successful system that satisfies the stakeholders' needs.

3.1 Requirements Engineering Process Models

This section reviews three RE process models, which are Linear RE Process Model [Macaulay, 1996], the Iterative Process model [Royce, 1998], and a linear model with iterative feature, although namely the Linear RE Process model [Kotonya et al., 1998]. They are typical process models used in traditional RE.

Activities in a pure Liner Model such as Liner Requirements Engineer Process model [Macaulay, 1996] are performed in sequence. The concept, problem analysis, feasibility and choice of options, analysis and modelling, and the requirements documentation, are sequenced in order. A previous step forms the precondition to a later one. When one task is ready, the next task starts. The life cycle of whole the RE in a Liner model starts from the conception phase, and ends at the requirements documentation phase.

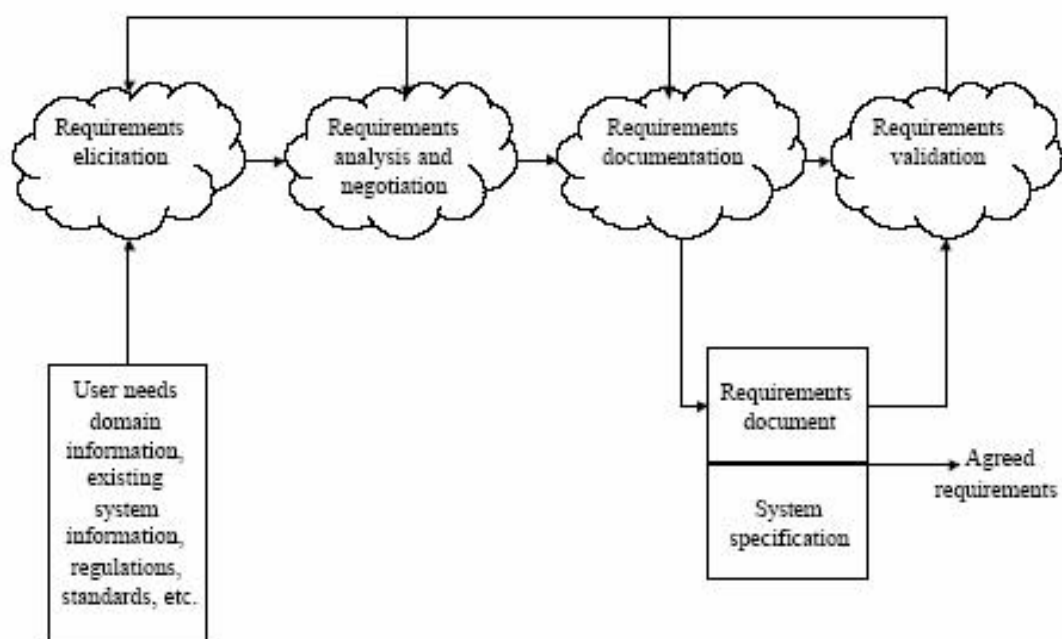


Figure 3-1. Linear RE Process Model [Kotonya and Somerville, 1998]

The iterative model is a modern software management process [Royce, 1998], which develops the software project by means of a repeated cycle of operations. The iterative development model delivers a full system at the very beginning and then changes the functionality of each subsystem with each new release [Pfleeger, 2001]. Major advantages of the iterative model summarised by Leffingwell and Widrig [2003] are that it provides firstly a better adaptability to requirements change, and secondly a better scope management.

Despite the representation in a linear way, the RE cannot be done linearly because incremental and iterative is the feature of the process [Kotonya and Somerville, 1998]. They propose the Linear RE Process model, which indicates iterations between activities, is a linear model combined with iterative features. Figure 3-1 illustrates the process in linear and tangled with iterative activities. Having defined the user needs domain, the other activities, including requirements elicitation, requirements analysis and negotiation, requirements documentation, requirements validation, are to be processed step by step. Before the requirements document is finally agreed, there is always a possibility to trace back to previous activity from a later one. It is to prove that the requirements are correctly capture, elicited, and documented.

As described by Kotonya and Somevelle [1998], there is a typical five-stage RE process for single product development, including: requirements capturing, requirements analysis, requirements specification, requirements verification and requirements management. The fist step in RE process, capturing, is often used as elicitation of requirements to avoid the suggestion that requirements are out there to be collected simply by asking the right questions [Goguen and Jirotko, 1994].

Similar to the model of Kotonya and Somerville [1998], Zhang [2007a] also suggests that requirements development is an iterative and incremental process, which contains four activities: elicitation, analysis, specification, and validation. REPEAT is an RE process that manages requirements throughout a whole release cycle, which covers typical RE activities [Sommerville and Sawyer, 1997].

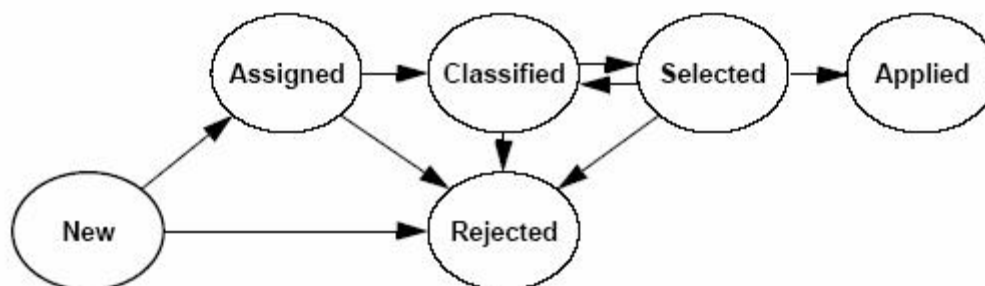


Figure 3-2. The states of a requirement in the REPEAT process [Regnell et al., 1998]

The REPEAT process shown in Figure 3-2 contains a set of states: new, assigned, classified, selected, rejected, and applied. The stages imply that a new requirements is assigned to expert for classification. In the classification stage, there is an estimate for cost and impact, and a statement of the implementation ideas. If the requirement combines with acceptable result, it may be verified and selected with a certain priority attached. Before the requirements applied, it can be rejected at any phase if it does not cope with the strategy.

3.2 Stakeholders in Requirements Engineering Process

Gerald Weinberg [1971] regards the computer programming as a human activity. The active human factors, stakeholders, have direct effect on the application. Stakeholders form the requirements source and they include a wider range more than human beings, but also others such as the (physical) environments [Zhang, 2007a].

Leffingwell and Widrig [2003] argue that the system should fulfil one or more stakeholder needs that addressed by different features. We recognise that a system that only fulfils the need of one shareholder can survive, but only within a certain period. In a long run, the system has to fulfil all the stakeholders' needs. It is a guarantee for successful project to investigate all the stakeholders involved in the system. Otherwise the system cannot survive because other unsatisfied stakeholders may exert their influence on a firm [Phillips et al., 2003; Smith, 2003]. Organisations should collect the requirements from all the stakeholders involved. However, the implementation can be done step by step. The satisfaction of other not involved (in current stage) stakeholders can be postponed.

It is difficult to gather requirements from a variety of stakeholders [Williams, 2004]. We argue that the requirements engineers have to clearly distinguish the application field, reasonable group and layer the stakeholders. When the complexity is narrowed down, it is possible to perform the requirements elicitation process smoothly. For example, in a business related software project, the RE should start from a clear business strategy [Goguen and Jirotko, 1994]. Project managers or customer representatives are the good resource for capturing the business needs because they have clear sense of desired products. There are plenty of techniques available for the knowledge acquisition, for example, conversational techniques [Zhang, 2007a], development sessions, groupware [Williams, 2004], and so on.

Despite the techniques of how to capture the requirements, Williams [2004] recommends some processes for dealing with the inevitably changing requirements, such as short iteration, change control board, using a structured process, frequent communication between the stakeholders and the developers, making explicit tradeoffs in functionality, and by developing the process as quickly as possible.

Zhang [2007b] recognises that the stakeholder analysis consists three steps in sequence: identification, profiling, and prioritisation. The process is illustrated in Figure 3-3. Stakeholder identification is to class the stakeholders involve in the system development to obtain initial information on the stakeholders. It requires the understanding of firm's needs and the problem domain as a basis to reach such a goal. The goal further forms the basis for the next step, stakeholder profiling. The profile records stakeholders' concern of the system, including stakeholders' characteristics, goals, and interests, and so on.

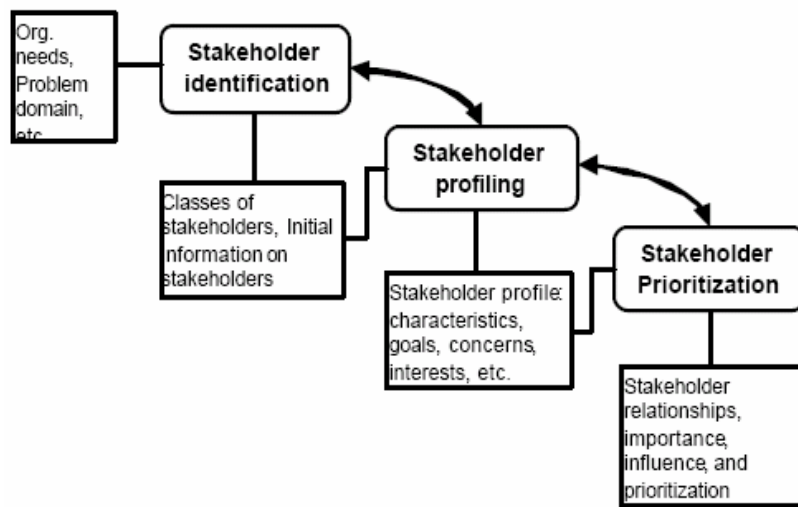


Figure 3-3. Stakeholder Analysis Process Model [Zhang, 2007b]

The final step identifies the relationships between stakeholders and figures out the priority. Stakeholder prioritisation enables the system developers aware the importance and influence of each stakeholder. Jawahar and Mclaughlin [2001] claim that during the initial stages of the typical software development life cycle, a firm does not have sufficient resources to satisfy all stakeholder needs. The firm has to prioritise its stakeholders and identify those that most impact its chances for short-term survival. Once the organisation has satisfied those stakeholders and accumulated more resources, it can turn to satisfying other constituents. With the prioritisation, business firms may allocate their resources to minimise damage and maximise benefit [Phillips et al. 2003].

3.3 Process Improvement--- Hints from ISO 9000 Standards

ISO 9000:2000 is an international standards applicable for software engineering, which is the 2000 version published by the committee of TC176/SC2 in International Organisation for Standardisation [ISO, 2000]. The standards concerning software are available in the released publication of ISO9000-3: 2000.

Since software is developed in projects, it is important to introduce ISO 9000 standards, which is applied in the software companies. ISO 9000 standards deal with quality management. Quality is certainly an essential consideration of software. The quality is controlled in each production. However, we do not focus on quality management benefit from the ISO 9000 in this context, but to learn some hints from the way, in which how a successful tool performs.

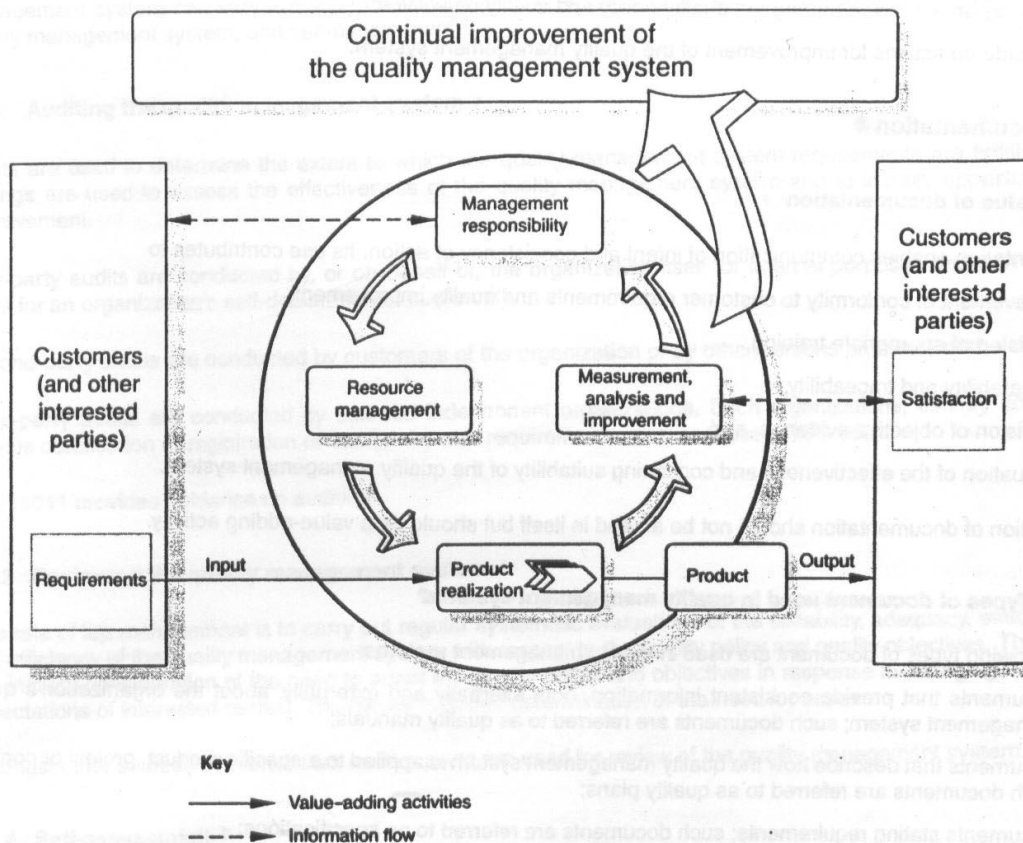


Figure 3-4. Model of a process-based Quality Management System [ISO, 2000]

Figure 3-4 illustrates the quality management system by a process-based model. On the left part of the figure, there is an input of requirements by customers and other interested parties. The output locates on the right part, which is the satisfaction of customers and other interested parties. The body part, which locates in the middle, describes how the relations among the four factors of management responsibility, resource management, product realisation and the measurement, analysis and improvement. The relation is a circled process connected with value-adding activities and information flow, which means a continual improvement. The continual improvement leads the firm to produce a product that meets customers' needs.

One of ISO's emphases is to focus on the customers. Every effort is processed according customers' requirements. This implies the key role of customers in software development. Meanwhile, the ISO 9000 system requires the firms to cope with

customer complaints. Compliant implies that the customer is not satisfied with the system. Therefore, each complaint has to be properly recorded and handled. The complaint handling process is the method for interacting with the customers' needs. The successful solving of the customer complaint is the fundamental for further improvement.

3.4 Summaries and Evaluation of Current Requirements Engineering Process Models

Linear development model [Macaulay, 1996] is the basis theory for RE. However, it is argued that such model exist only in theory, rather than in practice [Kotonya and Somerville, 1998]. In practices, the iterative development model [Royce, 1998] and linear model with iterative feature [Kotonya and Somerville, 1998] are more suitable for requirements development and management. The REPEAT process manages requirements throughout a whole release cycle [Somerville and Sawyer, 1997]. The application of ISO 9000 international standards [ISO, 2000] also proves such a trend by emphasising on a continual process of improvement according to customers' needs. Any compliant implies that the system does not perfectly meet customers' needs. The improvement process is carried out by handling the customers' complaints upon received. Once the compliant is properly handled, the customers' needs are satisfied.

Software may differ from each other because the factors involved can grant unique characteristics accordingly. These factors widely include for example stakeholders and their background, which should be taken into account. There is no universal principle applicable to all cases. None of them could be best or worst. A tailed development method is recommended for each type of software.

Since business firms may not able to satisfy the stakeholders at one time [Jawahar and McLaughlin, 2001], they should maximise their benefits with limited resource [Phillips et al. 2003] gradually. The stakeholder analysis process model [Zhang, 2007b] provides such possibility to priority the stakeholders' needs on the basis of identification and profiling. We conclude that the RE is actually a continual satisfaction of stakeholders according to their influence priority to a system.

4. Requirements Engineering for E-commerce System Development

In the previous two chapters we reviewed the characteristics of e-commerce application and the role of RE in software development. Comparing with conventional software applications, we distinguish the characteristics of e-commerce applications from six categories based on the Web-based nature and business domain. Meanwhile, previous RE researches does not focus on the Web-based application [Bleistein et al., 2006]. We conduct the research with these two aspects together to examine how the RE is processed in e-commerce systems.

4.1 Fitting the E-commerce Needs

Based on the summarised e-commerce characteristics (see section 2.3) and the basis of RE (reviewed in Chapter 3), we further cope in the process to exam a strategy fitting into the e-commerce application development. This section compares each characteristic with its focused stage. We study the suitable methods or approaches to eliciting appropriate requirements for e-commerce application development and evolvment. Moreover, we recommend the possible strategy for each aspect of characteristics. Details are listed in the Table 4-1.

Table 4-1 shows that the initial stage, continuous improvement, stakeholder, business domain, culture, and general software project management are concerned in the development and maintenance of e-commerce application. Suitable approaches and methods for such aspects are iterative (or similar ones), process improvement, requirements analysis, and general project management.

For example, software distribution characteristic of e-commerce application is discussed in section 2.3.1. E-commerce application is not delivered to the users, but released to the Internet server. Lowe [2003] suggests that the time framework for initial delivery of the Web-based application can be shorter than conventional software application. Thus, we recognise that this characteristic links to the initial stage of e-commerce application.

We further recognise that iterative feature suits this characteristic, because the system is not perfectly developed within a short timeframe work. There are many tasks left for future effort. With such acknowledgement, we recommend the strategy for the developer.

With similar effort, we link the characteristics to suitable RE process knowledge, and then recommend the development strategy for each characteristic. The recommendation integrates together, and forms the strategy for the development of e-commerce applications. The strategy to the RE that we recommend is:

- l Firstly, launching an initial release even if it is not perfect yet, which forms the basis for further development.

Aspect	Software distribution	System maintenance	User involvement	Business coverage	Culture Concern	Risk Management
Characteristics	Not distributed to users, but released to Internet sever. (our understanding) The time frame for initial delivery of Web-based system is shorter than conventional software system [Lowe, 2003]	An “ongoing process” of improvement [Lowe, 2003]. Launching date of new release to the application is the very start of the interaction with the stakeholders involved. (our understanding)	Users and customers do not remain the same or stable, which makes the customers’ needs seems uncertain to the software engineers [Castro et al., 2004]. User involvement differs [Stevens and Fowell, 2002]. Background decides stakeholders’ type, therefore stakeholder involvement differs (our understanding).	Internet makes the business cross-borders. (our understanding). To start with countries, which are psychological close [Johanson and Widershiem-Paul, 1975] because of culture close and [Johanson and Vahlne, 1977].	E-commerce faces more than one culture (our understanding). Culture drives people acting differently [Hofstede, 1991], determines the users behaviour and extends to e-commerce [El-Said, 2006].	Same project risks in cost and time as others; Application for commercial use lead to branding risk [Stevens and Fowell, 2002]; Integration of the system is risky [Lowe 2003].
Focus	Initial stage	Continuous improvement	Stakeholder involvement	Business domain and culture	Culture, stakeholders	Project management
Approach / method	Iterative feature	Iterative feature / improvement	Requirements analysis (stakeholders)	Requirements analysis (domain)	Requirements analysis (culture)	Project management
Strategy	Launching the initial release even if it is not perfect.	Perfecting the system in later releases.	Identifying and grouping stakeholders. Facilitating user participation.	Handling the internationalisation with culture awareness.	Managing cultural preference to avoid conflicts.	Controlling time, cost, branding, and integration.

Table 4-1. E-commerce Characteristics and Recommended Development Strategy

- l Secondly, perfecting the system gradually by adopting process improvement in later releases, which means that the system development can be processed on a multi-layer basis.
- l Thirdly, taking the time, cost, branding, and integration under control in whole the development process.

Before implementing the strategy, requirements engineers should aware that:

- l Stakeholders do not remain the same at each stage. It is necessary to group them properly based on the understanding their roles.

In order to reduce volatile requirements caused by unstable users, we should employ some software components, which help to try to keep as many users as possible. A closer connection between the system developer and the users helps the developer to avoid incomplete requirements that satisfy some users and ignore the others.

Suppose that if the customers can be attracted by the system, that is, customers frequently use the system for their daily work, it is easier for the system developer to observe and analyse on the customers. There will be more opportunities to identify their needs and habits.

- l There is no border in the e-commerce application. The internationalisation process is automatically started and may possibly involve with more than one country. The Requirements engineer thus needs to aware the culture background of the involved users from different countries, and be able to manage such difference.

In practice there are more factors involved in the e-commerce application (see section 2.1). Among these background factors, culture directly affects peoples' behaviour. Furthermore, stakeholders are the source for RE and the stakeholders includes also the environment [Zhang, 2007a], and we regards culture background as a type of environment (see section 2.1). We hence examine the influence of culture background. We research in this thesis on how to manage the culture coping with the RE process. Therefore, we intend not to discover the diversity of each culture in details, but towards a processing method to deal with the arising difference.

4.2 Managing the Cultural Preference

The cultural preference is a reflection of preferred value of people. Culture has its value [Hofstede, 1980; 1991], and cultural value is broad tendencies to prefer certain states or affairs than others. Other definition is that the value is "any object of any interest" [Johnson, 2008]. Cultural value can be reflected in symbols, while new symbols are easily developed and old ones disappear [Hofstede, 1991].

We intend to discover a method to reduce the side effects in e-commerce application development, which are caused by culture conflicts. Our research on culture is not focused on the details because there are plenty of researches on the culture. For example, Hofstede's [1980] four-dimensional cultural framework (power distance, individualism, masculinity, and uncertainty avoidance) describes the differences of national cultures. It measures national cultures from the four aspects: the degree of social inequality among people, the relationship between the individual and group, concepts of masculinity and femininity, and the degree of dealing with uncertainty by using structured or unstructured situations.

Since culture's influence upon customers' behaviour extends to e-commerce [El-Said, 2006] and culture can be represented by symbols [Hostede, 1991], it is possible to express it on the Internet by using some commonly accepted ideas from the cultures. For example, it can be managed either in language description or by graphical arrangement.

Furthermore, Hofstede [2001] suggests that groupings of individuals' values constitute the shared meanings, which helps to discuss cultures and cultural differences. Therefore, we propose three principles, which group the cultural preferences into three categories, in dealing with cultural preference in the study: target oriented, mistake avoidance, and abstraction of common features. Details are described below.

- l Principle 1: Target oriented: Eliciting requirements in a proper way from specific segments.

The first principle can be regarded as the most basic level of culture management. It is target oriented. Requirements engineers can simply focus on the preferred culture in selected target groups to acquire their needs. This principle corresponds to requirements elicitation in RE process.

- l Principle 2: Mistake avoidance: Avoiding offending factors to keep certain groups.

The second principle deals with more complicated issues. It links to the requirements analysis and negotiation in RE process. Principle 1 helps to generate suitable solutions for some specific culture groups. However, when putting all the solutions together, it does not ensure that the combined one meets all stakeholders' needs. In contrast, there might be some factors against other groups. There are no scientific standards for measuring which culture is better than another [Hofstede, 1991]. Therefore, we respect each concerned culture in the e-commerce application. In this case, the conflicting factors have to be modified or compromised to satisfy the related parties.

The cultural difference between Australian and Singapore [Kang and Corbit, 2001] gives such an example (see section 2.3.5). In order to make the web page suitable for both of the two cultures, some certain modification should be carried out. For example, a common front page leads to two sub-pages, which provides two options for the two cultural preferences.

- l Principle 3: Abstracted Common Features: Getting the common features for mass acceptance.

			
Chile	Cuba	Czech Republic	France
			
Iceland	D.P.R.K. Korea	Laos	Luxembourg
			
Myanmar	Netherlands	Panama	Russia
			
Serbia	Thailand	U.K.	U.S.

Figure 4-1. A Gallery of 16 National Flags Represented in Three Colours
(Blue /Red / White)

Principle 3 leads to a requirements validation activity in the RE process. The most difficult thing is to abstract the cultural preferences in a multi-culture environment that principle 3 deals with. As an extension to principle 2, things can be handled more actively to capture some abstracted factors for a mass satisfaction. When dealing with more varied cultures, it is not possible to arrange the preferred style expected by each culture a single e-commerce system. However, it is possible to arrange something in common to reflect the cultural preferences. It is based on sufficient understanding of many culture group preferences. There are some examples regarding the cultural preference, such as the star and moon composition is preferred in the Islamic world, while the red colour often implies happiness in the Chinese culture.

In case not able to represent customers' cultural preference, it can try to avoid the offending factors to get a neuter result. This is also the benefit from principle 3. A harmless neuter abstraction is acceptable in case of zero choice. We explain this method by giving an example below.

Blue, red, and white are the three ordinary colours appearing in people's daily life. Whatever they represent separately, the composition of such three colours makes a big difference in term of culture. There are sixteen national flags collected in Figure 4-1. They represent countries widely located in different continents, including Asia, North America, South America, and Europe. Each flag represents a certain meanings. Despite that these national flags are composed of only the three colours, blue, red and white, there is no direct link among them. However, there could be something common abstracted. What is common is: it is the three colours (blue, red and white) that represent these national flags. The abstraction does not necessarily imply the same meaning. Nevertheless, there is a possibility to pleasure the market by adopting such abstraction close to the preference of the target group on the market.

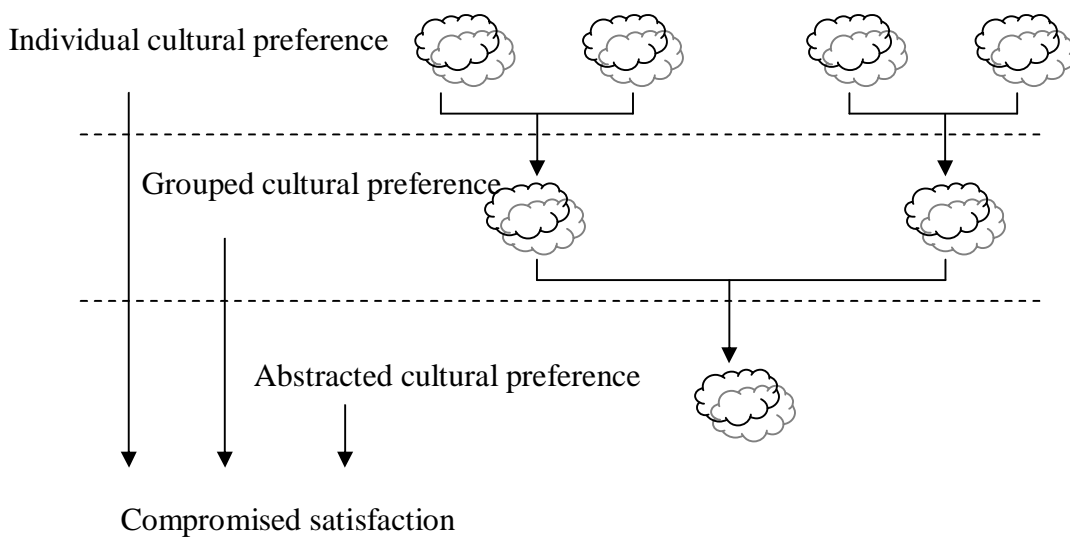


Figure 4-2. The Satisfaction of Three Levels of Cultural Preference

Figure 4-2 shows the satisfaction of three levels of cultural preference. It copes with the three principles that we proposed. We use the following formula to represent the relationship:

Compromised culture satisfaction = f (Individual cultural preference, Grouped cultural preference, abstracted cultural preference),

where,

Individual cultural preference means that the cultural preference in a certain region (for example, Finnish culture, Swedish culture, and so on);

Grouped cultural preference represents the common features representing some certain culture groups (for example, both Finland and Sweden are Nordic countries); and,

Abstracted cultural preference stands for the common things, either meaningful or not, abstracted from different culture groups (for example, European Union covers both Nordic countries and other European countries. Its abbreviation form, EU, may represent a common acceptance).

The above-mentioned three levels of cultural preferences could lead to a result through specific rules depends on the situation. Why we regard the result as a compromised culture satisfaction is because culture is not suitable to be judged as good or not. Each nation or ethnic group may measure the culture differently Hofstede [1980; 1991; 2001]. A little something can make a big difference. When trying to satisfy different cultures simultaneously, we have to compromise to meet all the acceptable aspects, and avoid the conflicting aspects. Thus, it would be a compromised culture satisfaction.

4.3 Practical Model

Lee and Shirani [2004] argue that the existing methods for the RE are weak in Web-based application development. It fails to capture and specify the business dynamics. Other arguments [Arch-int and Batanovv, 2003] include that the Web-based applications should be agile enough to respond to the dynamic business and the ever-changing customer demands.

In order to deal with the dynamic business environment, we suggest a strategy for the development of e-commerce application. Moreover, we propose a method to manage the cultural preference that involved in the e-commerce application. In this section, we develop a model to cope with the stakeholders' involvement. It starts from identify the life cycle of the development of e-commerce application.

4.3.1 E-commerce Development Life Cycle

Similar to conventional software application, any e-commerce system has its life cycle. Different from the conventional applications, e-commerce is put into use even at its starting stage of the whole life cycle. In this section, we describe the e-commerce system life cycle into different stages: initial, survival, progressed, and fined stages.

We summarised in section 4.1 the way of implementing e-commerce application:

Firstly an initial stage of requirements is being elicited. The initial stage of requirements provides a basis for implementing the e-commerce application that is used for testing. During the application period, requirements engineer can further collect and

analyses the feedback upon the testing system, and elicits more accurate requirements as soon as possible. A survival stage of requirements is thus captured.

The work repeats for eliciting progressed stages of requirements, till a fined stage of requirements is finished. It is remarkable that in practices, the fined stage may never be reached, because the system remains in a dynamic business environment. Thus, the fined stage is actually the target for RE effort.

Before reaching the final target, there could be many stages of so-called progressed stages existing. Each progressed stage of requirements can satisfy the customers' needs at that moment and thus at working level.

Requirements are results of RE effort. We aware that there is plenty of effort to do before reach to each stage of requirements. Therefore, we define the process for capturing the requirements as *layer*. Each layer of RE effort leads to a specific stage of requirements.

Different stages of requirements elicited (except the initial stage) in each layer, suit the e-commerce application at working level. The precondition is that in each phase, the requirements should (as much as possible) fully satisfy the needs of the stakeholders involved. Note that the stakeholders involved in such phase do not necessarily mean all the stakeholders in the system. Depends on the stage, it could be part of them, or all of them. Accordingly, the later release tends to be more accurate than a previous one.

4.3.2 Stakeholders Involvement across E-commerce Life Cycle

The interaction with stakeholders happens across the life cycle of the e-commerce application. During the early stage, it is mainly the internal stakeholders who work on the project, while the intermediate stakeholders may provide advice. Later, more and more external stakeholders get involved. A good e-commerce system can never be built without fully eliciting the requirements from all the stakeholders.

In each stage of the system, people who have "shared purpose, being aware of each other, interacting and communicating with each other" [Bruce, 1965] vary. Because the e-commerce system is developed gradually (see section 4.1), the earlier layer concerns the interest of fewer stakeholders while more stakeholders may participate in the system in later layers.

According to the stakeholders' interest (see section 2.2), we distinguish how the stakeholders participate in the e-commerce application life cycle. It is a prioritisation of stakeholders, as Zhang [2007b] recommends. Table 4-2 states the role of each type of stakeholders played in each layer of RE. The priority is marked with grey background.

I Roles of internal stakeholders

Shareholders' main role is the decision-making and support. They provide the strategy-level of requirements according to the firm's business strategy and make judgement upon any change in later development.

Employee provides technical support for the system development. In later stages, they also provide feedback regarding the system development to shareholders.

Expert group provides the knowledge support in fields of either technical or marketing, or general management. Their advices form the foundation for choosing suitable technology or methods for the management and development of the e-commerce system.

| Roles of intermediate stakeholders

Intermediate stakeholders provide technical or commercial suggestions throughout the system development life cycle.

| Role of external stakeholders

Competitor exerts a role of mysterious shopping, which means that the competitor may research on the development of the system anonymously. They may visit the e-commerce site to gain experience, either good or bad. Same to competitor, requirements engineer can also monitor the development of the competitors and learn from their advantage, avoid the disadvantage.

During the first layer, because the e-commerce system is not available on the Internet, the external shareholders like the seller and the buyer, whether free or paying, are not involved in the project and therefore have no contribution. When the initial requirements are elicited and implemented, an initial version of e-commerce system is launched on the Internet. It attracts users to access and use the services that are already available. Consequently, feedbacks of user experience and comments are collected.

| Priority of Stakeholders

Stakeholders' involvement in the system varies, which makes the extent of their influence on the system differs. We therefore prioritise them according to their roles.

In the first layer, internal stakeholders are the major source of requirements because they plan the development strategy and effort to start the system. Meanwhile, intermediate stakeholders provide suggestion, which may contribute to the development. In this layer, because of the lack of customers, competitors' experience can be adopted. These Requirements engineer can focus on these stakeholders to work for an initial stage.

In the second layer, an e-commerce system is launched. The previously absent stakeholders, seller and buyer, start to involve in the system. However, during this stage, the system is not perfect enough to attract the attention for the users to pay for use the system. The users participated are free seller and free buyers. The Requirements engineer needs to capture the needs of all the related parties.

Group	Stake-holder		Role played			
			Layer 1 (Initial stage)	Layer 2. (Survival stage)	Layer 3. (Progressed stage)	Layer N. (Fined stage)
External	Competitor		Mystery shopping	Mystery shopping	Mystery shopping	Mystery shopping
	Seller	Free user	Not involved	Feedback, and Web Traffic count	Feedback, and traffic count	Feedback, and traffic count
		Paying	Not involved	Not involved	Feedback, and traffic count	Feedback, and traffic count
	Buyer	Free user	Not involved	Feedback, and Web Traffic count	Feedback, and traffic count	Feedback, and traffic count
		Paying	Not involved	Not involved	Feedback, and traffic count	Feedback, and traffic count
	Intermediate	Supplier/ partner		Technical or commercial suggestion	Technical or commercial suggestion	Technical or commercial suggestion
Internal	Employee		Technical support	Technical support	Feedback, and technical support	Maintenance
	Shareholder		Strategy Panning	Decision on modification	Decision support	Decision support
	Expert group		Technical, Marketing, Management.	Technical, Marketing, Management.	Change management	Change management

Table 4-2. Priority of Stakeholders' involvement in Requirements Layers

In the third and later layers, the system is expected to capture enough requirements, which may lead to a progressed system at working level. All the stakeholders start to appear on the scene at the same time. Sellers and buyers are not limited to free users, who might be willing to pay for the system that with good functionalities. From this stage on, more stakeholders such as paying customers start to involve in the system development. It requires the Requirements engineer to analyse the new stakeholders as

well as the old stakeholders. The previous requirements elicited from the earlier layers can be used as a basis, to which more new features can be added.

Despite of all the stakeholders' involvement, we suggest the requirements engineer to put the priority on the external stakeholders. The reason is that since the system is implemented for practical use, customers' needs should be fully respected. Although the competitors are not the customers, their successful experience is always worthy for the system development.

In each stage, since the external environment may change along with the time, the earlier-elicited requirements may not valid as it used to be. They have to be modified according to the stakeholders' needs in the dynamic environment. That is, the engineering of layered requirements is a process of continuous improvement with iterative feature. Later requirements are increased and improved compared to that of pervious versions.

4.3.3 Culture Diffusion in the Layers

Figure 4-3 illustrates the cultural preference tangled with the each RE layer. It shows how the varied cultural preference groups fit in the development of e-commerce application. We can find that the most abstracted cultural preference applies to the fined stage of RE, and less abstracted cultural preference trends to fit an earlier stage well if the system will not be later modified for specific market area.

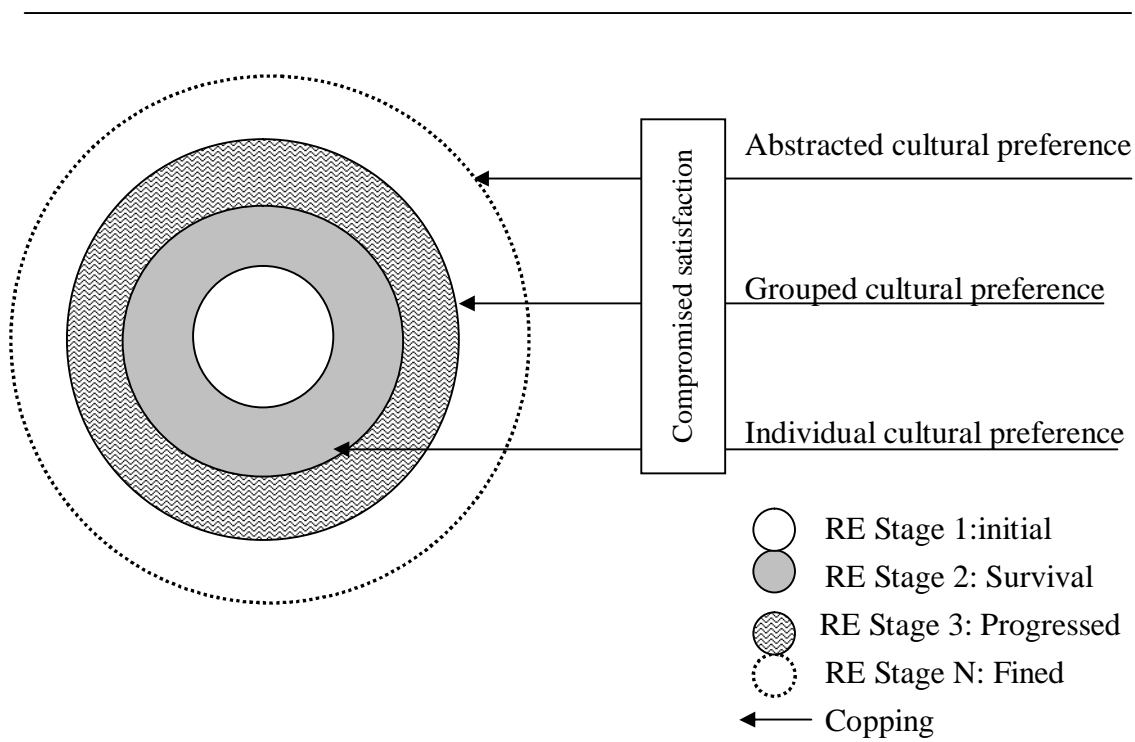


Figure 4-3. Satisfaction of Cultural Preference to Requirements Layers

However, it is not necessary always to change less abstracted cultural preference with grouped or abstracted cultural preference. The grouped or abstracted cultural preference is only a choice, not strictly obliged. It depends on which market the focus of the e-commerce is. As mentioned in section 4.2, the grouped or abstracted cultural preference leads to a compromised satisfaction. In a certain circumstance, if the e-commerce is implemented towards more specific markets, individual cultural preference or less abstracted cultural preference is more suitable. For example, an e-commerce application originally aims towards global markets. However, result shows that the majority of customers come from certain countries. In this case, if these customers are more important to the firm, the less abstracted cultural preference applies better.

Cultural preference is the choice of stakeholders. Even for the same stakeholders, the value does not remain the same over time change [Sinden and Worrell, 1979] because value has its time limitation [Sinden and Worrell, 1979], and so does the cultural value. Old symbols previously used may not able to represents the cultural value in a changed situation. Thus previously elicited fully satisfied requirements become uncertain once the condition changed. Kauppinen et al [2002] notice the effect of cultural change regarding the RE, and suggest that software engineers should change their ways to fit those of users', to think and work according to users' point of view, in which the engineers will benefit systematic requirements. Hence, the software development engineers need a massive effort to effect a change of culture and behaviour [Jacobs, 1999]. Our recommendation is that the requirements engineer should review previous culture related requirements in each new layer. This warrants the symbol or abstracted cultural requirements not to expire for future application.

4.3.4 Archery Model

The right involving stakeholders and the right concerning culture in each stage compose together the source for accurate requirements. We integrate such consideration and express them in the Archery model that we developed.

Figure 4-4 illustrates three groups of stakeholders' contribution to different requirements stages along with the users' cultural satisfaction. Each stage of requirements meets the cultural preference at a certain location, which represents a unique situation. Any other requirements does not cope with the measure does not fully satisfy the needs to this layer.

The internal stakeholders are listed on the left, while the external stakeholders are put on the right. The market force is always *right*. We have to respect the external factors' requirements more carefully.

An IT perspective makes analysts confused to decide the right technology because of the rapid evolving of technology [Baghdadi, 2005]. The assistance of the partner or

supplier could be either correct or incorrect, which means that their product maybe good while it does not necessarily proper for each system. It is just an optional choice available on the market.

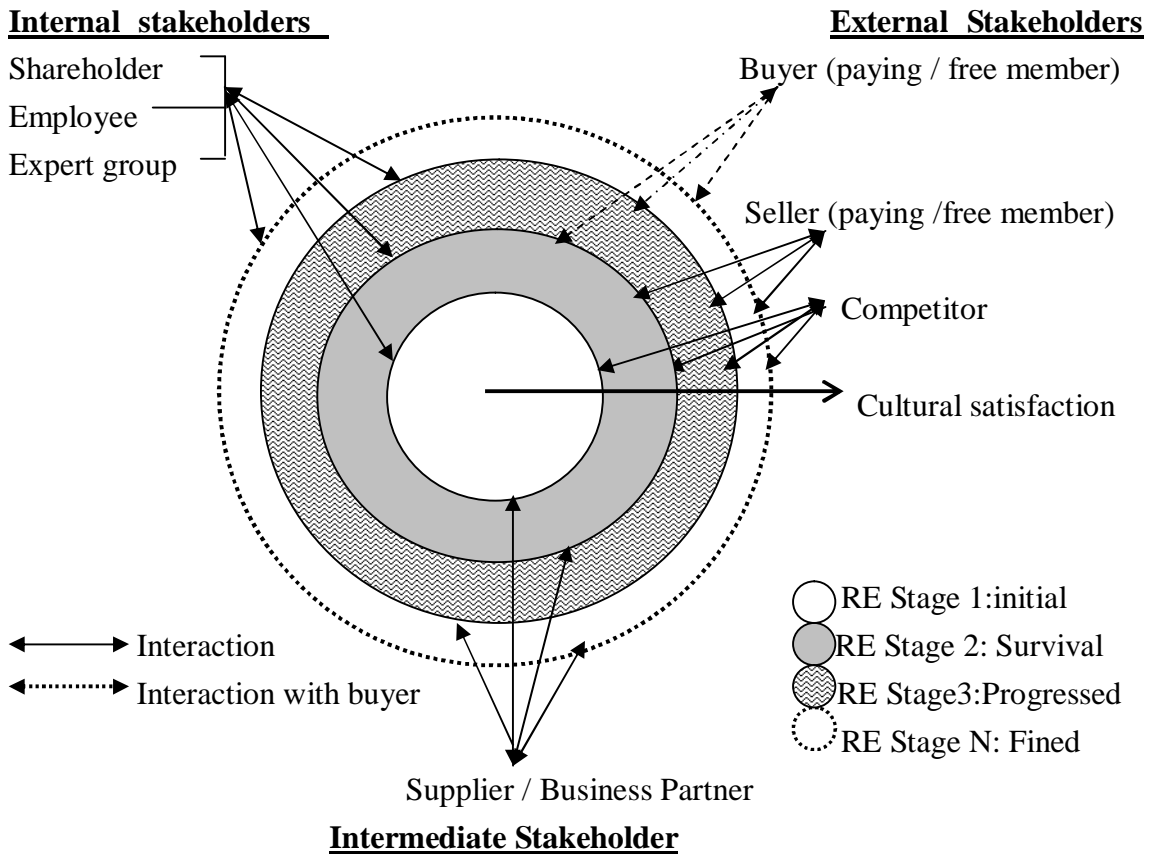


Figure 4-4. Archery Model of Multi-Layers of RE Processes for E-commerce System

The Archery model takes the contribution of different stakeholders' requirements into account. Such model implies the development process of e-commerce application first starts with a plan with fewer stakeholders. Later, it expands with iterative feature.

Stakeholders' requirements are elicited in different stage or layer of the RE according to their priority. In early stage, it is hard to elicit enough requirements from the all stakeholder involved. In addition to internal stakeholders' contribution, the Requirements engineer can study from the competitors, and listen the advice from suppliers or partners, then form an initial stage of requirements. In the initial stage, internal stakeholders play much more important roles according to their strategy and capability. Later on, external factors start to play more and more important roles in perfecting the system. It shows in the Archery model that two types of external stakeholder (seller and buyer) do not participate in the initial layer.

It is remarkable that the customers' needs do not appear to the system developer automatically. Instead, it based on the successfully handling customers' disagreement or

complaint. Maintenance service, including both active and passive, is the solution for compliant handling. When the engineers try to research the stakeholders' need when there is no complaint, the active attitude is applicable. In dealing with complaints, it is a means of passive service. Active service helps the engineers to capture the requirements faster, while with passive service, they can capture the requirements when complaint is presented. In practice, both the service attitudes are useful because even if the requirements had been proved to be good and complete, it still cannot satisfy the stakeholders' needs everlasting. Passive service is necessary to rescue in case there is a mistake. This shows in the Figure 4-4 as a two-way interacting between the stakeholders and the development layers.

Because the buyers are likely to spend less effort and switch to other systems [Lowe, 2003], we represent the relationship in a weak form to emphasize the difficulty on capturing the buyers' needs.

The Archery model has a practical function to avoid misusing requirements elicited in earlier layers. The model carries out the project step by step with iterative feature. Previous requirements should be reviewed and modified in later layers according to the measures of changed stakeholders involvement and cultural preference.

4.3.5 Evaluation of the Archery Model

We developed the Archery model for RE of the e-commerce application development. Such model distinguishes the involvement of stakeholders and the culture preference across the life cycle.

In theory, it is possible that requirements have been successfully elicited in the early stage of software development. However, as time goes, the environment possibly changes in one or some of the customers' region. Such change further changes the needs of customers. The requirements elicited previously become inaccurate for later application accordingly.

In this section, we evaluate how the Archery model works with a theoretical evaluation. We propose three assumptions regarding the requirements change in the development process of the e-commerce application comparing with conventional software:

- a). The software project will finish before the requirements change.
- b). The software project will not finish before the requirements change.
- c). The software project takes long time, always in the phase of implementing and improving.

In the first assumption, the software could be delivered for the commercial use because it is ready despite the requirements changed later. However, plenty of problems

will arise in this situation because the software is not modified according to the changed requirements after the delivery.

For a conventional software system, it will be sufficient to satisfy the requirements and finish the project before the change. The ready products are possible to deliver to the market and gain economic benefits. The maintenance of such a system is limited within specific period. After the promised after-sales period, the users have to pay for new system if they want to update it.

In contrast, for an e-commerce system, the system itself does not bring profit but the service provided by the system. It will be a disaster if the system is just launched before the change. The system has to fit users' needs during the application phase. Otherwise, users are not willing to pay for its services. Therefore, assumption A will lead to an unsuccessful e-commerce project because it does not meet users' needs, although it seems being perfectly finished.

In the second situation, requirements changed and project is not completed. The uncompleted project will not be able to serve in practical use. It therefore can be either a failed project, or a postponed one, depends on whether the business firm wishes to spend more budget and invest to re-work on the project. It is definitely a failed system no matter from the viewpoint of project management, either conventional software or an e-commerce project.

Assumption C actually means an ongoing improvement process. This process is too long for a general software system if the engineers always keep working on it. The endless procedure cannot bring profit to the business firm, even that the firm can afford the budget and time consumption. No customers are willing to pay for unfinished products, unless the firm is selling semi-products to other software system at component or service level.

However, for an e-commerce system, it is a normal phenomenon to deal with such a situation. The e-commerce system makes profit during its service process. A modification according to the requirements captured from the changed needs will make the system survive for a certain period, if it satisfies the customers' needs at that moment. After that, the process can be repeat over again. In this case, the ongoing process implies more opportunities rather than failure.

To summarise, the e-commerce application can always be modified according to customers' needs. Each modification of the system can satisfy the customers' needs till it changes again. In practice, there is a gap between two modifications that cannot fully satisfy customers' needs. This is the core of RE for an e-commerce application: when there is a gap appeared, the requirements engineer captures the newly changed requirements. The improved system meets customers' needs. It aims to a better solution across its life cycle.

In the initial stage of the e-commerce, the Archery model desires to fit some certain stakeholders' needs. In later layers, it satisfies more stakeholders gradually. The process

implies that the Archery model is ready for satisfy stakeholders' needs in a changing status. Meanwhile, Archery model copes each layer with the culture background. It takes the stakeholders' needs changed by culture into account. The analysis shows in theory that Archery model is a suitable one for e-commerce application development.

5. Case Study

In addition to the evaluation at theoretical level, we carry out a case study for validating the summarised knowledge and the Archery model. The case is an e-commerce system, Alibaba.com (later referred as Alibaba).

The methods used in the case study are firstly to make a survey on the case, then collect the information on the development of the system by observation, and Internet searching. Finally, we analyse the data in a qualitative way to evaluate how does the development cope with our suggested Archery model from the point of view of a requirements engineer.

5.1 The Case and Background: ALIBABA.COM

Launched in 1999, Alibaba presents B2B services aiming towards global importers and exporters for international trade on the Internet marketplace [Chaffery, 2008] and first started from China [Bmpc, 2006]. Now it is a leading B2B e-commerce [Alibaba, 2008], regarded as one of the world's best e-commerce website along with Yahoo, Amzon, eBay and AOL [FinancialTimes, 2008]. We notice some milestone events and features of Alibaba to summarise its successful experience for the development of other e-commerce systems. We first study its development life cycle: initial, the past, present, and future expectation. After a general view of the development, we summarise the significant features as an evaluation.

Our survey is limited to Alibaba.com only, not refer to other Web-based application of the corporation.

5.2 Alibaba Development

The business idea of providing a business platform for linking Chinese companies to the world comes from the personal experience of use Yahoo.com searching on the Internet of the founder, Jack Ma. However, the plan was not successful because no support from its first business partner, according to Ma claims [Fannin, 2008]. In March 1999, the Alibaba was built with other shareholders [Alibaba, 2008].

Alibaba plans a long-term “stickiness” strategy in its initial stage, which intends to build a big database for future service and to earn transaction commission [Zeng, 2001]. The reason for choose a global name, Alibaba, is because it is easy to spell, and the company believes that people everywhere associate it with ‘Open, Sesame’, the command that *Ali Baba* used to open doors to hidden treasures in the story of *One Thousand and One Nights* [Fannin, 2008].

Alibaba does not complain about the problems asked by customers, but tries to build solutons for them because they realise that the e-commerce enviroment is not good enough [Bmpc, 2006]. What's more, they regard Alibaba as ‘1,001 mistakes’

[Fannin, 2008]. Despite other potential mistakes claimed, we noticed that Alibaba audits the contents that the users wish to publish on the web page. In case the desired contents do not bring harmful influence, it will be published within twenty-four hours. What is shown on the web page is only accepted information meeting with stakeholders' needs. It is a solution for reducing potential conflicts among the stakeholders. Some political issues are taken into account. For example, Taiwan is regarded as one un-controlled province of China. Its insisted 'national flag' does not appear to the Alibaba web page as the other national flags, instead, replaced by a "TW" mark. China is one of the major markets for Alibaba, therefore the compromised culture acceptance likely inclines to a China's accepted abstraction.

The company requires itself to remain a 'start-up' status no matter how long it has been in existence [FinancialTimes, 2008]. The values mentioned in the business vision (see Appendix II) requires customer focus, employees should be ready for change. We understand this implies that Alibaba keeps aware of customers' needs and aiming to solve it at any time. The embrace of change according to customers' needs determines a continuous improvement of the system.

We summary some observed components/service in a checklist in the table 5-1 below. The source of references varies from Internet retrieves, our own experience and our current observation. We use them for evaluate the current functionalities of the website.

Components/ Services	Description/ Purpose	Contribution to system	Concerns	Launch time	Reference
Built-in Email	A system for business communication.	Sticking users inside the website	Seller and buyer	Before 2001	Our experience
Keyword service	A search engine in the website.	Efficiency of locating information.	All users	2002	[Alibaba, 2008]
TradeManager software	An instant messaging tool, acting also as an integrated operating centre.	Sticking users near to website Integration of system related components.	Seller, buyer, employee	2003	Software instruction, our experience

Talbe 5-1. Checklist I: Alibaba Functionalities Development

The components listed in Table 5-1 have different functions, which are adopted to enhance the functionality of the Alibaba system. It is an improvement to the system as

one entity. The launching time of each component implies that the development of the Alibaba e-commerce system follows a continuous progressing way. No matter how many components are developed later on, they are just added to the Alibaba system and act as supplementary. For example, before the end of 2003, there are at least three components/services (including email system, keyword search and so on) are added related to the Alibaba system. Over years of development and updating, the system attain stronger functionalities, appears in an iterative development orbit.

In the early stage of e-commerce, communication between seller and buyers is often taken via Email information published on the web page. The launch of TradeManager instant massaging software in 2003 provides a shortcut for real-time communication between buyers and sellers of the Alibaba system. This tool is similar to MSN messenger both in appearance and functionality (see Figure 5-1).

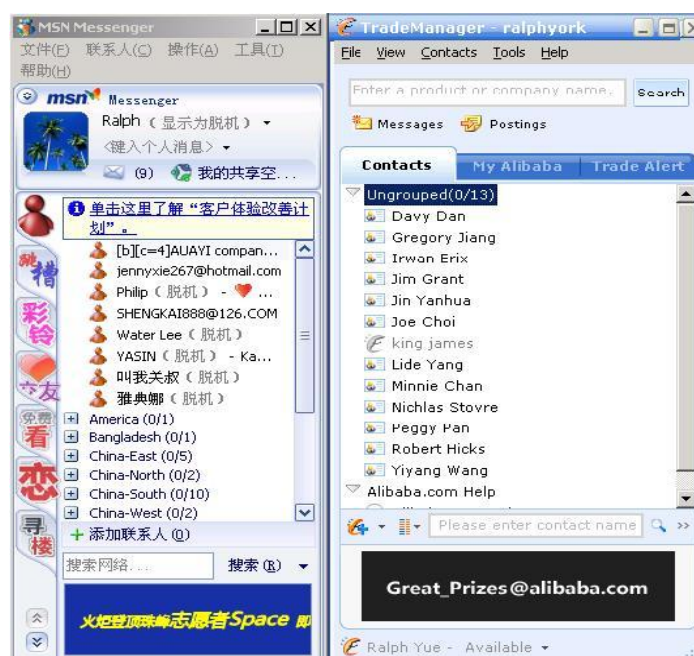


Figure 5-1. Screenshot of MSN and TradeManager

Similar basic functionalities of the two instant messaging software includes: file, view, contacts, tools, and help. The main bodies are contact information, which enable instant communication online between the users.

A significant difference is that MSN trends to provide more personalised features for the users' communication needs. In contrast, *TradeManager* trends to provide more functions related to the service on the website that Alibaba provides. The communication function is only one technique for linking the users to the website. For example, there is a searching function available, which helps the users to locate information that available on the Alibaba website. From the point of view of system developers, they are able to capture our needs through the keyword that users searched.

There is a screenshot available in Figure 5-2, which shows how the *TradeManager* users are linked to the Alibaba website. When users login the *TradeManager* tool, they can simply click on the hyperlink available on the interface. For example, in the Figure 5-2, when we click on the *Trade Alert* hyperlink, the Web browser directly opened, and lead us to the *Trade Alert* on Alibaba website. This part provides the convenience to the users to review the trade opportunities that Alibaba recommends. Such recommendation is based on the personal interest that recorded in the Alibaba database, not by assumption.

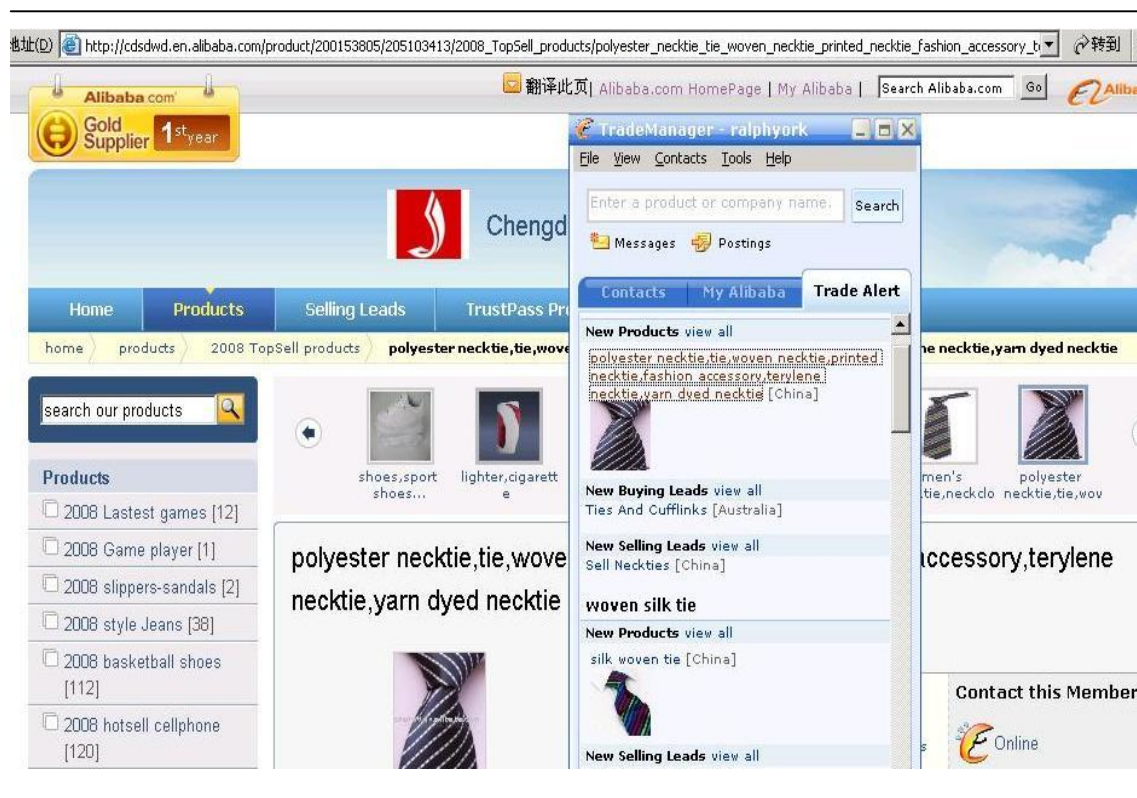


Figure 5-2. Screenshot of Entry to Trade Alert via TradeManager

We previously published an advertisement for seeking for silk ties. It was stored in the *My Alibaba*. Therefore, the system thus regards silk ties is the interest of us, and recommends opportunities to us. From our point of view, such service is convenient to our business performance because the system knows what we need. We do not need to spend more time to seek for such items that we needs, if we satisfy with the items that the system recommends. Meanwhile, we even do not need to visit the Alibaba website. The business opportunities are available to us immediately when we login the *TradeManager* tool. As we discussed previously, such a tool is an instant messaging tool for communication. However, it links us to the website by capturing our needs. As a buyer, the system fits our needs.

5.3 Development of RE Techniques

We explored some RE techniques of Alibaba listed in Table 5-2. From the launching time, we found that it is also gradually enhanced. The requirements could be captured from both traditional meeting (such as customer practicing in company and Forum in Guangzhou) and online monitoring (for example TradeManager and Online Forum).

Alibaba builds a ‘stickiness’ relationship between stakeholders [Zeng, 2001]. It pays attention to customers experience in practicing by regularly inviting customers to the company [Yeji hao, 2004]. Meanwhile, Alibaba starts an E-business Forum in Guangzhou city, which is aiming to discuss with the stakeholders.

Tool	Description/ Purpose	Contribution to system	Concerns	Launch time	Reference
Trade- Manager software	An instant messaging tool, acting also as an integrated operating centre.	Sticking users near to website Integration of system related components.	Seller, buyer, employee	2003	Software instruction, our experience
Customer practicing in company	Demonstration to customers	System promotion, requirements capturing	Employee, experts, seller, buyer	Before 2004	[Yeji hao, 2004]
E-business Forum in Guangzhou city	Discussion	Acquiring requirements	All stakeholders	2005	[FinancialTimes, 2008]
Online community Forum	A discussion platform for users.	Try to make the users express their opinion and needs	All stakeholders	Not traceable	Our observation

Table 5-2 Checklist II: Some RE techniques of Alibaba

We explored that in addition to its instant massaging function, *TradeManger* software also enables a shortcut entry to other functions on the website (see Figure 5-2). In this case, it acts as an operating centre to integrate the functionalities available on the website. With such a tool, the users are automatically linked to the website. Even though the *TradeManager* users may apply it as a non-business communication tool, it still provides the possibility for link the users closer to the Requirements engineers for managing the requirements uncertainty caused by unstable customers (see section 2.3).

Other online tool such as the online Community Forum motives all the stakeholders to express their needs and demands actively from different aspects. The RE techniques are in a developing process towards different stakeholders.

5.4 Evaluation

The case study reviews the development of Alibaba application. We summarise the observations into the table 5-3.

Layer	Initial	Survival	Progressed	Fined
Basic feature	1). Carefully selection of partners. 2). Long-term stickiness strategy. 3). Culture awareness	1). Recognising its own defect, as a system with '1,001' mistakes. 2). No complaint to customers' feedback.	Continuous development of 1). Functionality 2). RE technique	1). Remaining a start-up status. 2). Respecting customers' needs
Stakeholder involvement	Internal, Competitor (Yahoo).	All types	All types. More focus on users	All types. More focus on users
Culture preference	Ali Baba background story throughout the development			
		Abstraction of TW mark	Abstraction of TW mark	

Table 5-3. Comparison of Alibaba Development in the Four Layers

It shows that Alibaba starts from a business idea. Technical support provides the way of how to implement. Internal stakeholders (including, shareholders, employees, and expert group) collaborative and study from certain external stakeholder (competitors) such as Yahoo.com, and launch a system. However, this system may not be successful because it does not fully satisfy the needs of all the stakeholders involved.

Therefore, after launching the system in initial layer, more attention is put on the other ignored stakeholders such as buyer and seller. However, the needs of seller and buyer are not easy to capture because they do not involve in the application simultaneously. The uncertainty requires the requirements engineers to develop more suitable techniques to discover it. A system that not fully captured customers' requirements does not bring enough profit to satisfy the shareholders. This is also a motivation for continuous development.

The continuous developed components and services show that Alibaba grows with an effort to meet the stakeholders' needs. We prove it by the checklist tables 5-1 and 5-2 (see also Appendix I). The discovering and perfecting processes form a multi-layer structure in Alibaba's RE practice.

Meanwhile, the cultural preference is managed throughout Alibaba's development. The branding strategy shows that Alibaiba starts by employing an international background story. It has a metaphor of fortune to business companies [Fannin, 2008]. The implementation of the system has observed handled with culture issue in term of branding and conflicts avoidance during the internationalisation process, for example the background story and the abstraction of Taiwan.

To conclude, the Alibaba system development match the four layers suggested in Archery model. We therefore evaluate such a model as a suitable model for e-commerce system development.

6. Conclusion

The study is carried out by examining two questions: *What are the key characteristics of e-commerce applications comparing with conventional software applications*, and on basis of which, the second is, *How to cope the e-commerce characteristics with stakeholders' needs in the RE for e-commerce application development?*

For the first research question, we conduct a comparison of between e-commerce application and conventional software from six categories: software distribution, system maintenance, user involvement, business coverage, culture concern, and risks management. The comparison shows that e-commerce system, as a segment to software systems, has its own features or some highlighted characteristics. The analysis result is:

E-commerce application is not delivered to users. It follows an ongoing process rather than a maintenance/release cycle [Lowe, 2003]. Stakeholders do not remain stable [Castro et al., 2004]. E-commerce application automates the internationalisation process towards more markets. The system thus deals with more than one culture, which determine the stakeholders behaviours [Hofstede, 1991; El-Said, 2006] and extends to e-commerce. Despite time and cost, there are more aspects should be managed to avoid risk in the e-commerce project, such as branding and integration [Stevens and Fowell, 2002].

To answer the second research question, we first conduct a literature review to discover how the traditional RE process. Then we combine the knowledge reviewed with the explored e-commerce characteristics.

The conjunction outlines such a solution: the RE for e-commerce application development starts from an imperfect initial requirements [Lowe, 2003], and is perfected gradually [Jawahar and McLaughlin, 2001] with iterative feature [Kotonya and Somerville, 1998; ISO, 2000]. During the process, stakeholders contribute to the system development with different priority [Zhang, 2007b]. Meanwhile, culture decides the attribution of stakeholders.

With the awareness of culture influence, we further study how to manage culture preference in RE process. In this case, our culture study does not go in depth for identifying each culture and its feature. Rather, we effort to find a solution for managing the cultural preference by means of grouping and abstracting [Hofstede, 1991; 2001]. This solution aims to a compromised culture satisfaction.

We contribute in this thesis by proposing an Archery model. This model layers the RE development into several stages. The participation of stakeholders is distinguished across the life cycle of e-commerce application development. Moreover, cultural preference limits varies stages of requirements to cope with the development situation.

We evaluate the two research questions in two methods. First to evaluate it with assumed conditions at theory level, then by a case study.

The assumptions are:

- a). The software project will finish before the requirements change.
- b). The software project will not finish before the requirements change.
- c). The software project takes long time, always in the phase of implementing and improving.

In the case study of Alibaba, we trace the development history of the Alibaba, and collect information on the functional components of the e-commerce system. Furthermore, we reviewed others' case study result on alibaba.com and adopt the related opinion to support our research.

We suggest that the RE process for an e-commerce application development, particularly for a single one-Web-fit-all e-commerce, should act well if adopting the Archery model. The limitation for validation such model is time consuming, which might take tens of years. It is not possible for monitoring one case completely as a part of the thesis work for such a long period.

As we explored the maintenance of an e-commerce system is an ongoing process [Lowe, 2003] (see section 2.3.2), what shown to the users is always only at progressed stage. Previous releases of systems are not traceable because they are replaced immediately upon modification. Therefore, the validation for the case study focuses on the current situation and witnessed by historic review.

It is beyond our ability to forecast the future direction of Alibaba. It is the retrieved company vision (see appendix II) that supports our Archery model is towards a fined stage. Overall, the evaluation result shows that the Archery model suits the development of e-commerce application.

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Appendix I: Key Development Milestones for Alibaba [Alibaba, 2008]

September 1999	Established Alibaba Group.
October 2000	Launched Gold Supplier membership to serve China exporters.
August 2001	Launched International TrustPass membership to serve exporters outside of China.
March 2002	Launched China TrustPass membership to serve SMEs engaging in domestic China trade.
July 2002	Launched keyword services on our international marketplace.
November 2003	Launched TradeManager instant messaging software launched to enable users to communicate in real time on our marketplaces.
March 2005	Launched Keyword bidding on our China marketplace.
March 2007	Launched branded advertisements on our China marketplace.
September 2007	Started distributing Alisoft Export Edition in three major regions and launched premium placement display on our China marketplace.
October 2007	Launched SME loans in collaboration with China Construction Bank and Industrial and Commercial Bank of China.
November 2007	Successfully listed on the Hong Kong Stock Exchange.
December 2007	Re-launched our upgraded Alibaba Japan marketplace.
March 2008	Became a constituent stock of Hang Seng Composite Index Series and Hang Seng Freefloat Index Series.

Appendix II: Alibaba Vision, Mission, and Values [FinancialTimes, 2008]

1. Vision

To last 102 years

To be one of the world's top 10 internet sites

To be an essential partner for all business people

2. Mission

To make doing business easy

3. Values

Customer comes first	Customers are everything
Teamwork and Cooperation	Team interests are always ahead of individual interests
Embrace changes	Go beyond yourself and welcome changes
Integrity	Honest and upright, honoring commitments
Passion	Never give up and stay optimistic
Honoring your job	Perform the extraordinary with a professional attitude and an ordinary mind