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Extending the DeLone and McLean Information Systems Success Model for e-commerce website success

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EXTENDING THE DELONE AND MCLEAN INFORMATION SYSTEMS SUCCESS MODEL FOR E-COMMERCE WEBSITE SUCCESS

By

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ABSTRACT

Extending the DeLone and McLean Information Systems Success Model for E-Commerce Website Success

By

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Website evaluation can continuously improve the performance of websites and increase sales. However, the lack of a comprehensive framework as guidance hampered this task. The main purpose of this research is to provide a comprehensive framework for e-commerce websites evaluation by extending the DeLone and McLean Information System Success Model. A new dimension—"Relationship quality" is proposed to the model. The study also tries to identify characteristics of e-commerce websites that impact the user's satisfaction.

A survey questionnaire was distributed to web users, and a total of 295 responses were obtained. The data was processed through Statistical Package for the Social Science (SPSS).

The data analysis result indicates that there are four important factors that impact user satisfaction, and among them, Relationship quality can be clearly defined. This indicates that there's a need to extend the model. The study also yields a list of important characteristics that impact user's satisfaction.

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CHAPTER 1

INTRODUCTION

E-commerce website has become an interface of the entire e-business rather than simply a part of traditional marketing operations. It effectively increases the competitive advantage and can enhance the performance and reduce the marketing, operating, and administrative costs of organizations. However, businesses have perceived that not all websites bring in as much benefits as anticipated. It is witnessed that improper planning and the ignorance of the critical factors on the successful websites have led to the failure of e-commerce systems. Organizations need to pursue a well-functioned and more effective websites. They need to know what factors make a website more attractive to users and eventually make them commit to the site.

Academic researchers have studied about website success factors for e-commerce systems for a while. Usability issues such as ease of navigation, attractive use of multimedia, content relevance, etc. are well known characteristics of websites (Molla & Licker 2001). Zhang and Dran classified successful website characteristics into two factors: satisfiers and dissatisfiers (Zhang and Dran 2000). Satisfiers are motivating factors that add values to the website by contributing to user satisfaction, and dissatisfiers are those whose presence makes a website functional and serviceable, and whose absence causes user dissatisfaction. Olsina et al. also identified successful website characteristics in four requirement categories: usability, functionality, site reliability, and efficiency

(Olsina et al. 2001). Liu and Arnett identified four factors that are critical to website success; information and service quality, system use, playfulness, system design quality (Liu and Arnett 2000). However, these studies have addressed only some aspects of the important issues and it is generally agreed that there is a scarcity of comprehensive models in e-commerce systems evaluation area (Molla & Licker 2001, Cheung & Lee 2005, DeLone & McLean 2004).

While there's a shortage of comprehensive frameworks for e-commerce systems evaluation, a framework in the area of Information Systems success has been well-established, which is the DeLone and McLean Information Systems Success Model ("D&M model" henceforth) (DeLone and McLean 2003). According to D&M model, *system quality* and *information quality* of an information system singularly or jointly affect both *user* and *user satisfaction*, and the amount of use can affect the degree of user satisfaction, and vice versa. User and user satisfaction make *individual impact*, and this impact on individual performance will have *organizational impact* eventually. Recently DeLone and McLean revised the original model by adding a new factor, *service quality*, and collapsing two previous constructs individual impact and organization impact into *net benefit*, which they thought to be more parsimonious (DeLone and McLean 2003).

When we apply the model to websites, the original context of the model fits nicely into the e-commerce environment. The context is not changed because a Website is an Internet-based information system as a subsystem of an e-commerce system. Traditional information systems serve on the satisfaction of "End Users", which in turn leads to organizational and individual benefits. Users of traditional information systems are mostly employees inside the organization. The scope of users in the e-commerce

environment is shifted to online customers and business partners. As in the D&M model, website success is based on user satisfaction. Factors that impact user satisfaction of information systems such as system quality, information quality, and service quality also apply to e-commerce systems and their websites. However, some important issues such as "trust", "safety" and "privacy" are not included in the D&M model, which questions the comprehensiveness of the D&M model for e-commerce success. Also, since there is not much research done to test the D&M model in e-commerce context, the applicability of the D&M model remains yet to be further studied.

The objective of this study, therefore, is to examine the applicability and comprehensiveness of the D&M model in the e-commerce context, and to propose and validate a new dimension, Relationship quality, to the D&M model.

This study is expected to contribute to both practitioners and academia. Practitioners can use the extended D&M model as a guide to deepen their understanding of building successful websites. The extended D&M model will help them to find the primary needs of Web users, to concentrate on improving most valuable features of their websites, and to avoid unnecessary resource allocation. Academically, this study provides a comprehensive framework for the study of successful website characteristics, in order to build more inspiring and customer-appealing websites.

The remaining of the study is organized as follows: Chapter 2 is the literature review. It starts with the development of D&M Model and introduces some previous studies of e-commerce success factors and their websites. In chapter 3, the new dimension is proposed to the D&M model, and data collection procedure is described to test the framework. Chapter 4 analyzes the test result.

The fifth chapter is the conclusion chapter; it summarizes the thesis and draws the conclusion. It also discusses the research limitation of the study and implication of the future research.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the D&M model is introduced and three quality factors in the D&M model are presented. Then, prior literatures are reviewed to identify quality features for successful website.

2.1 DeLone & McLean Information Systems Success Model

In 1992, DeLone and McLean presented a "taxonomy" and "interactive" model, which was to "conceptualize" and "operationalize" information system success (Figure 1). This model synthesized and incorporated previous IS research findings, and its primary goal is to provide a comprehensive framework and guidance for future IS success research.

In the original model, "System quality" measures technical success; "Information quality" measures semantic success; "Use", "User satisfaction", "Individual impact", and "Organizational impact" measure effectiveness success. These six dimensions are interrelated rather than independent. This model suggests that when an IS system was first created, its features can be observed as some degree of system quality and information quality, then users use the system and are either satisfied or not satisfied with the system, and the use of the system will impact the individual's work performance, and

consequently impact the organization (either positively or negatively) (DeLone & McLean, 1992).

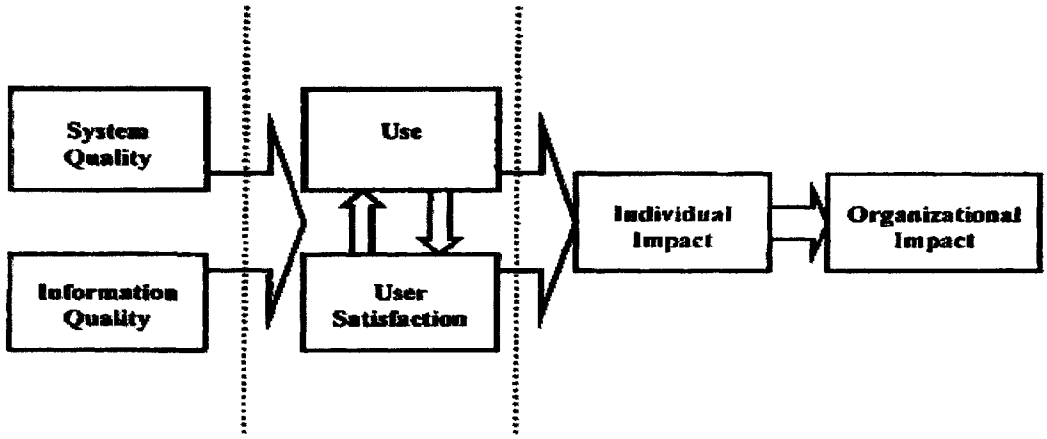

Figure 1: DeLone and McLean Information System Success Model (1992)

In the following ten years, the original D&M model was studied in hundreds of research articles. Many researches had validated the dimensions and confirmed the interrelationships between the dimensions of the model (such as Goodhue & Thompson 1995, Guimaraes & Igbaria 1997, Rai et al 2002, etc); some researches suggested modifications (such as Seddon 1997, Molla & Licker 2001); but overall, it's been proven to be a valuable and effective analytical tool in evaluating IS success (DeLone & McLean, 2003). These articles provided a strong theoretical and empirical foundation for the further development of the D&M model.

In 2003, DeLone and McLean concluded the research findings of over 100 D&M model studies, and presented the updated D&M model (Figure 2). The major revision is the addition of a new dimension— "Service quality". According to the authors, as

information technology evolved and the environment changed, new challenges emerged; thus the original model had to be adjusted in order to perform more accurate measurement tasks. They also indicated that previous information system effectiveness measures usually emphasize the product quality but tend to ignore the importance of service quality; this may lead to the improper measurement, and result in inaccurate conclusions. The two dimensions "Individual impacts" and "Organizational impacts" in the original model were collapsed into one new dimension — "Net benefits". This new dimension was an attempt to incorporate the "ever growing number of entities" that will be impacted by "Use" and "User satisfaction". The authors defined this dimension in order to keep the model parsimonious; in the practical use, this dimension can be defined differently subject to the goal of the study (DeLone & McLean, 2003). This new model measures IS success in terms of more up-to-date dimensions, and becomes more robust for information system success evaluation.

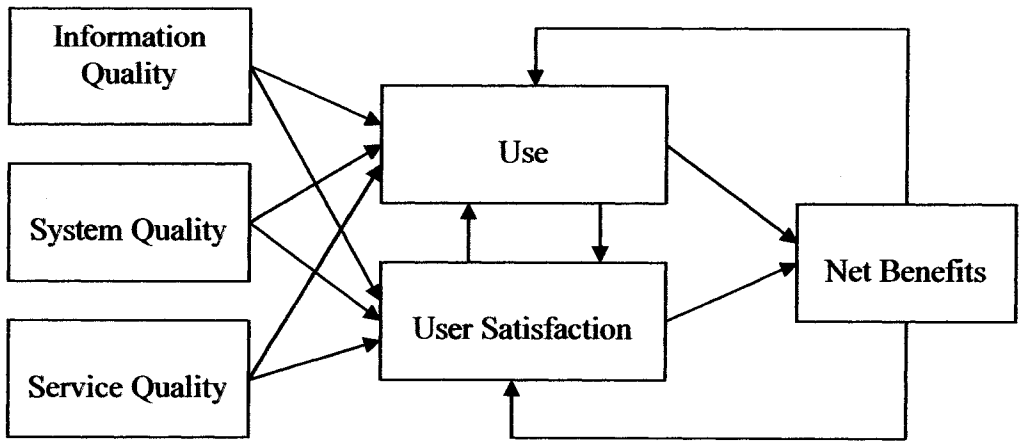

Figure 2: Updated DeLone and McLean Information System Success Model

DeLone and McLean suggested that the updated D&M Model can be adapted into measuring E-Commerce success. In their opinion, although new forms of business are emerging, Information Technology still serves the same fundamental purpose as before. And they believe Information System success and its "underlying dimensionalities" have not changed. Thus, applying measures for information system success to e-commerce success is viable (DeLone & McLean, 2004).

2.2 E-commerce website success research in the past

In this section, the literature on features of e-commerce website success is reviewed. Although they used different terminologies and addressed various aspects of e-commerce website success, many of the features can be grouped into three categories— information quality, system quality, and service quality according to DeLone and McLean's definitions (2004) as follows:

> 'Information quality' captures the e-commerce content issue. Web content should be personalized, complete, relevant, easy to understand, and secure if we expect prospective buyers or suppliers to initiate transactions via the Internet and return to our site on a regular basis. 'System quality', in the Internet environment, measures the desired characteristics of an e-commerce system. Usability, availability, reliability, adaptability, and response time (e.g., download time) are examples of qualities that are valued by users of an e-commerce system. 'Service quality', the overall support delivered by the service provider, applies regardless of whether this support is delivered by the IS department, a new organizational unit,

or outsourced to an Internet service provider (ISP). Its importance is most likely greater than previously since the users are now our customers and poor user support will translate into lost customers and lost sales.

However, some features can not be grouped into any of the three quality factors in the D&M model, such as the features that impact the long term relationship between the customers and the company (Reichheld and Schefter 2000). This may indicate that although the D&M model is well developed in traditional information system context, it needs further extension in order to be applied into e-commerce environment.

2.2.1 Information quality studies

Information quality has always been considered as one of the major factors that impact user satisfaction. In an empirical study, Park et al. (2006) defined two determinants of online customers' site commitment: Information Satisfaction and Relational Benefit. They identified four factors that positively related to Information Satisfaction, and they are: User Interface Quality, Product Information Quality, Service Information Quality and Security Perception. They indicated that when users are satisfied with the information and they perceived the benefit from using the Website, they are likely to come back (Site Commitment). Chiou and Shen (2006) also identified a factor—"Attributive Service Satisfaction" that leads to online customers' overall satisfaction. They defined "Attributive Service" as the interface and performance of the website. In another empirical study, Hsu (2006) discovered that Information quality exhibits a stronger relationship to customer satisfaction than Web system quality does.

There had been other terminologies that describe the similar construct as Information quality, such as "Content quality" (Molla & Licker, 2001) and "Business content"

(Gehrke & Turban, 1999). A summary of the website features related to Information quality is shown in Table 1.

Category	Website Features that impact User Satisfaction	Study
Information quality	Accessibility, information availability	Abbott et al. 2000
	Interactivity, interface design	Auger 2005
	Attributive Service (interface design)	Chiou & Shen 2006
	Product information, site design	Cho & Park 2001
	Self-interested information, current information	D'Ambra & Rice 2001
	Business content	Gehrke & Turban 1999
	Website appearance	Iwaarden et al. 2002
	Access to information, product information, product comparison	Keeney 1999
	Width, depth and update of information, Web design	Kim & Lim 2001
	Content quality	Molla & Licker 2001
	Variety and completeness of information	Palmer 2002
	Tangibles	Parasuraman et al 1990
	User interface, product information, service	Park et al. 2006
	Information Quality	Parsons et al. 1998
	Dynamic content	Peppers & Rogers 1997
	Relevance	Torkzadeh & Dhillon 2002
	Internet ecology, product choice	Teo & Choo 2001
	Competitive intelligence	Zhang & Dran 2001
	Completeness/comprehensiveness of information, currency/timeliness/update, accuracy, readability/comprehension/clarity Completeness	Zwass 1996

Table 1: Information quality related website features

2.2.2 System quality studies

System quality reflects the interactions between websites and the users. Auger (2005) found that there is a positive association between the level of interactivity of a website

and overall performance, but not with the number of visitors. The research also indicated that "response time" is a critical construct for the success of commercial websites. In another empirical study, Gehrke and Turban (1999) defined that page loading speed, navigation efficiency are two of the customers' most concerned issues. And they predicted that website design will continue to pursue "speed, navigation efficiency, simplicity, and elegance with an emphasis on customer focus and security". Zhang and Dran (2001) studied on user expectations and quality factors in different website domains. They identified that navigation, site technical features positively associate with user satisfaction. Table 2 summaries the website features related to System quality.

Category	Website Features that impact User Satisfaction	Study
System quality	Speed	Abbott et al. 2000
	Usefulness	Achrol & Kotler 1999
	Interactivity	Auger 2005
	Web performance	Chiou & Shen 2006
	Ease of use, purchase process	Cho & Park 2001
	Page loading speed, navigation efficiency	Gehrke & Turban 1999
	Navigation, search options, structure	Iwaarden et al. 2002
	Accuracy of transaction, ease of use	Keeney 1999
	Speed of transmission, convenience of use	Torkzadeh & Dhillon 2002
	Download time	Zhang & Dran 2001
	E-Commerce System Quality	Kim & Lim 2001
	Tangibles	Liu & Arnett 2000
	User interface quality	Molla & licker 2001
	Dynamic content	Parasuraman et al 1990
	Versionability	Park et al. 2006
	Download time	Parsons et al. 1998
	System responsiveness, response time	Reisenwitz & Cutler 1998
	Internet ecology, Internet product choice online payment	Spiller & Lohse 1998
	Navigation, site technical features	Tiwana 1998

Table 2: System quality related website features

2.2.3 Service quality studies

Service quality, as a key factor that impacts the successfulness of organizations, had been the core issue in many studies. Rapert and Wren (1998) discovered that "firms with a deeply ingrained service quality orientation often develop both intrinsic culture and an extrinsic reputation which tend to be very enduring and difficult to copy". Pursuing service quality as a strategic orientation positively impacts the organizational performance, and increases the firm's competitive advantage.

Among the service quality studies, an instrument called SERVQUAL had been very widely concerned. SERVQUAL was developed by Parasuraman et al (1990), it measures Service Quality from five aspects: tangible (up-to-date hardware and software), reliability (IS is dependable), responsiveness (IS employees give prompt service to users), assurance (IS employees have the knowledge to do their job well), and empathy (IS has user's best interest at heart). The instrument yields the "gap" between expectations and the service delivered in these five dimensions. SERVQUAL had been challenged by a number of researchers (such as Van Dyke et al., 1997), but was also validated by some researchers (such as Kettinger and Lee, 1997).

In the following years, SERVQUAL was studied and improved continuously. Pitt et al. (1998) applied the instrument in their study of two companies in three consecutive years about their service quality, and had yielded effective results that helped the company improve their service quality. Jiang et al. (2002) examined the instrument from a different standpoint—IS professional, and the result was also quite supportive to the usability of SERVQUAL instrument.

Researchers also tried to apply SERVQUAL to E-Commerce success measurement. Iwaarden et al. (2002) empirically tested SERVQUAL in order to identify quality factors that affect the use of websites. The result shows that SERVQUAL is applicable in websites; it can be used to measure E-business performance.

Category	Website Features that impact User Satisfaction	Study
Service quality	Customization, service convenience, assortment	Abbott et al. 2000
	Interactivity	Auger 2005
	Asset specificity (commitments)	Chiou & Shen 2006
	Consumer service, delivery, purchase process, payment methods	Cho & Park 2001
	Attitude	Erogle et al 2003
	Marketing/customer focus	Gehrke & Turban 1999
	Tangibles and responsiveness	Iwaarden et al. 2002
	Service quality	Keating et al. 2003
	Reliable delivery, product variety, product availability, limited personal travel, offer personal interaction, product quality, cost, time of delivery, convenience, time spent, environmental impact	Keeney 1999
	Promptness of retrieval, customer service	Kim & Lim 2001
	Support and service	Molla & Licker 2001
	Tangibles and responsiveness	Parasuraman et al 1990
	Service information quality	Park et al. 2006
	Service quality	Rapert & Wren 1998
	Internet product choice, shopping travel, Internet shipping errors, Internet shopping convenience	Torkzadeh & Dhillon 2002
	Product and service concerns	Zhang & Dran 2001

Table 3: Service quality related website features

However, DeLone and McLean believe that SERVQUAL alone is not sufficient to measure e-commerce success; it can be adopted to measure the Service quality in the

updated D&M model (DeLone & McLean, 2003). A summary of Service quality related website features is shown in Table 3.

2.2.4 Other studies

Literature review shows that the D&M model covers a large proportion of e-commerce success factors, but there are additional research findings that are not explained in the e-commerce environment. Reichheld and Schefter (2000) stated that long term relationship with the customer is the key factor that leads to the company's success, and "trust" is the first thing to gain from customers before any transaction can happen. The same issue had been addressed in Lee's study (2000), which indicated that obtaining new customers to a web site is much more costly than retaining them, thus, to gain the customer's loyalty is very important to E-Commerce success. Fairweather, K. F. (2004) also found positive correlation between online order entry, online inventory management, online billing, payment and problem resolution, and both trust and commitment. The author stated that by utilizing these E-Commerce activity components, companies could implement or expand trust and commitment in their buyer-seller relationships. Chiou and Shen (2006) built and tested a model to identify the antecedents of Web user's loyalty intention. The study showed that "trustworthiness" is the central issue when building long term relationship with customers. In their model, Perceived Opportunism (the behavior that web portal sites sell the Web users' information in exchange for profit) negatively associated with Web users' Overall Satisfaction and Loyalty Intention; and Asset Specificity (Web user's commitments to the website such as e-mail account, schedule, personal setting, etc) and the Overall Satisfaction associated positively with Web user's

Loyalty Intention. A summary of the website features that are not included in the D&M model is shown in Table 4.

Category	Website Features that impact User Satisfaction	Study
Others	Security	Abbott et al. 2000
	Perceived opportunism, asset specificity, trustworthiness	Chiou & Shen 2006
	Relationship quality	Crosby et al 1990
	Perceived benefits from other people, self knowledge increase and positive impact on ability to perform tasks	D'Ambra & Rice 2000
	Pleasure	Erogle et al 2003
	Trust and commitment	Fairweather 2004
	Security, marketing/customer focus	Gehrke & Turban 1999
	Relationship quality	Gummesson 1987
	Assurance, empathy	Iwaarden et al. 2002
	Separation of service and relationship qualities	Keating et al. 2003
	Fraud, security, privacy, safety	Keeney 1999
	Security of user information, entertainment, free stuff	Kim & Lim 2001
	Customer retain	Lee 2000
	Trust, support and service	Molla & Licker 2001
	Trust, value, effort, communication, cooperation, liking and understanding	Page & Sharp 2001
	Assurance and empathy	Parasuraman et al 1990
	Relational benefits	Park et al. 2006
	Trust, customer relationship management	Reichheld & Schefter 2000
	Internet vendor trust, online payment, internet customer relation	Torkzadeh & Dhillon 2002
	Security, privacy	Zhang & Dran 2001

Table 4: Other website features

The literature review provided a theoretical background for the further test and development of the D&M model. The fourth category of the successful e-commerce website features suggests the potential need of the extension of the D&M model, and since these features regard the long term relationship with the online customers, we name this category "Relationship quality".

CHAPTER 3

RESEARCH METHODOLOGY

3.1 The extended D&M model

To reflect additional features, which are found in the prior studies, we extended D&M model by adding Relationship Quality as an additional quality dimension. Customer relationship management has become a very important management issue for companies in the recent years. Well-managed customer relationship increases customer satisfaction, induces repeat purchases, and drives loyalty (Feinberg & Kadam 2002). Companies that develop serious customer relationship strategies and maintain the effective management of it will survive the fierce competition eventually (Cheung & Lee 2005). The most profitable online business has proven that their long-term relationship with loyal customers brought them considerable rewards. E-companies like Amazon and eBay are good examples. Loyal customers make repeat purchases, and as an added bonus, they bring in other customers. The referred customers usually commit purchases faster than those who were attracted by advertisements. And the loyal customers also serve as technical support since those who they referred would prefer consulting them to calling the Website technical support, which means that the online company saves money on technical support expense.

Many web sites provide features that aim at building a long-term relationship with customers. For example, Amazon.com provides reviews of the books, movies, and other

media products from many different sources. They may be the key information that book and media buyers want, and make customers keep coming to the site again and again and build trust to the site. Procter & Gamble launched the Stain Detective on their Tide.com site, which provides information about how to remove various kinds of stains. P&G believes that the fact that consumers are coming to know about the Tide Stain Detective adds to the brand's equity. P&G also invites people to "get closer" online by emailing an animated mint fresh kiss to someone special, for its Scope brand. Campbell Soup is on connecting directly with consumers by serving as a sort of invisible lifestyle coach, helping busy Americans decide everything from what to have for dinner to what to name their pets, rather than pushing their products. Nabisco opened a couple of online amusement parks where customers play games and are exposed to a brand at the same time. Coca-Cola rigged its Cherrycoke.com site as an entertainment gateway, filled with links to interesting sites around the Internet. These companies believe that through these approaches on the Web they will eventually get customer loyalty to their brands.

Several case studies show some important features that bring and keep customers on web sites. Some studies identified *trust* as one of the most important aspects to bring and keep customer loyalty in e-commerce (such as: Chiou and Shen 2006). Trust is not built simply on good system, information, and service in a short period. E-commerce vendors must put a conscious, strategic, and long-term effort to stack up trust. If your website wins customer's confidence that you keep customer's privacy, it may provide more satisfaction to customers. Unintended, unexpected *benefits (promotion)*, which are not related to product, may keep customers coming back to a certain website and increase their satisfaction. Internet brought customers to most information and opened more two-

way communication between the companies and customers than ever. Not only direct product information, but also any related information is easily available to customers through the information *community*. And finally *enjoyment* is also an important aspect of websites that retain customers.

Considering the above, our extended D&M model for successful website features contains four quality factors: System quality, Information quality, Service quality and Relationship quality. Figure 3 shows the extended D&M model; the current study concentrates on the four quality factors and the User Satisfaction. The study investigates the constructs and relationships depicted by solid lines. The dotted parts of Figure 3 are beyond the scope of the study.

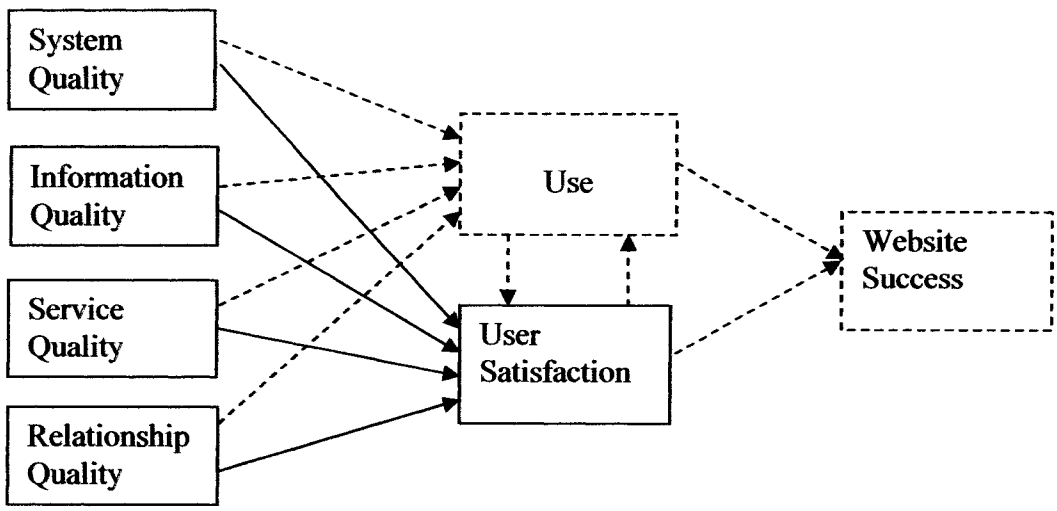

Figure 3: Extended D&M model

Relationship quality is clearly separated from service quality. Service quality is measured for specific information system products or services that are provided to customers. In the context of e-commerce, it encloses all the characteristics of websites that are related to business transactions on the website. Relationship quality, on the other

hand, is the company's efforts to build a long-term relationship with its customers through its Website regardless of its business transaction.

Relationship quality, as a dimension, enriches the D&M model and covers important issues that are not covered by the existing D&M model. The extended D&M model would perform the e-commerce website evaluation task more accurately and more thoroughly.

3.2 Validating the extended D&M model

This research is concerned about two questions:

(1) Is the D&M model sufficient to measure e-commerce website success?

(2) What are the features of e-commerce websites that impact the user's satisfaction?

The research questions lead to the testing of the applicability and comprehensiveness of the D&M model to the e-commerce environment, and the identification of features that impact the user's satisfaction.

Our proposition to the first question is that (1) the D&M model must be extended to be applied in the e-commerce context (in other words, three quality factors are not enough to explain the e-commerce environment and additional factors exist), and (2) at least Relationship Quality is one of the representative quality factors that compose features of successful e-commerce websites.

3.2.1 Instrument design

This section discusses the design of the research instrument. A list of characteristics was selected to measure each quality factor. The selection of the characteristics is based on the lists of measures that summarized in DeLone and McLean's literature (2004),

supplemented by the literatures reviewed in chapter 2. Each characteristic is described briefly, and followed by the reference of supporting literature. The questions and their features along with the sources are listed at the end of each subsection; the questions were generated by adopting the style from Torkzadeh and Dhillon's instruments (2002), using the above mentioned characteristics as keywords, none of the questions were adopted directly from other instruments.

3.2.1.1 System Quality

System Quality measures technical success, it focuses on the quality of interaction outcomes between Websites and the users. System Quality had been used in Information System research for the last few decades. Some measures such as system accuracy, reliability, response time, ease of use, no errors and so on, are applicable to e-commerce research (DeLone & McLean, 2004).

In order to measure this dimension, eight questions are used to get the participant's opinion of certain characteristics of website systems. These characteristics are: system accuracy, system reliability, system errors, response time, ease of use, and usefulness.

Accuracy refers to the ability for systems to perform functions correctly. Websites are supposed to respond accurately to every user input, whether a click on a navigation button, a selection from the user menu, or a request from a search engine. (Gehrke and Turban 1999, Keeny 1999, Molla & Licker 2001)

Reliability provides the foundation for the business operation. Users expect dependable, 24/7 available websites, which provide convenient alternative solutions to customers. (D'Ambra & Rice 2001, Gehrke and Turban 1999, Liu & Arnett 2000, Molla & Licker 2001, Zhang and Dran 2001)

Errors, such as missing links and bugs, will cause disruption of Web usage, and cause dissatisfaction of online customers. (Gehrke and Turban 1999)

Questions	Characteristic measured	Source
I am concerned about the accuracy of transaction.	System accuracy	Torkzadeh & Dhillon 2002
I like to visit a web site that is dependable.	System reliability—dependability	Molla & Licker 2001
I like to visit a web site that has little or no downtime.	System reliability—no downtime	Molla & Licker 2001
I like to visit a web site that has little or no missing links.	System error—missing links	Molla & Licker 2001
I am concerned about the bugs in the system of the web site.	System error—bugs	Gehrke and Turban 1999
I am concerned about the response time (e.g. download time) of the web site.	System response time	Auger 2005
I am concerned about the ease of navigation/use of the web site.	Ease of use/navigation	Keeny 1999
I am concerned about the usefulness of the web site features and functions.	Usefulness	Reisenwitz & Cutler 1998

Table5: Questions measuring System Quality

Response time had been reported as the customer's mostly complained issue. Online customers always want the website to be fast. Bhatti et al. (2000) discovered in an experimental research that the web user's average tolerance of page loading speed was 8.57 seconds, with a standard deviation of 5.85 seconds depending on the subjects of the usage. (Auger 2005, D'Ambra & Rice 2001, Gehrke and Turban 1999, Kim and Lim 2001, Molla & Licker 2001, Tiwana 1998, Torkzadeh and Dhillon 2002, Zhang and Dran 2001)

Ease of use or navigation concerns about the sequence of Web page arrangements, and content structure. Ease of use will enable customers to get familiar with the Website

easier and faster, and make them feel more comfortable and would like to re-visit the Website. (Chiou and Shen 2006, Cho and Park 2001, D'Ambra & Rice 2001, Gehrke and Turban 1999, Keeny 1999, Kim and Lim 2001, Molla & Licker 2001, Spiller & Lohse 1998, Torkzadeh and Dhillon 2002)

Usefulness of Website features and functions is also a means to measure system quality. Websites are supposed to provide useful features and functions to enhance the effectiveness of website interactivities. (Reisenwitz & Cutler 1998)

The questions we used to measure the above features are shown in Table 5.

3.2.1.2 Information Quality

Information Quality is used to measure semantic success. It had long been considered as a determinant of online customer satisfaction.

We used 15 questions to measure Information Quality, in terms of accuracy, impartiality, uniqueness, reliability, up-to-date, timeliness, sufficiency/completeness, precision, conciseness, understandability, format, usefulness, and relevancy.

Accurate information helps customer lower risks, make better judgments and decisions. It includes the accuracy of both literal and the information it conveyed. (Molla & Licker 2001, Torkzadeh and Doll 1998, Zhang and Dran 2001)

Impartiality means that websites provide objective and unbiased information to Web users. It is important in areas such as news casting. Impartial information also ensures the credibility of the website, and enhances the image of the business. (Zhang and Dran 2001)

Uniqueness of information sometimes exists in Websites like government Websites, real estate Websites. It is the attribute usually sought by specific groups of people. (Zhang and Dran 2001)

Reliability also associates with credibility. Providing reliable information is an important means to ensure customer satisfaction. (Kim and Lim 2001, Molla & Licker 2001)

Up-to-date information is mostly expected in finance, government, medicine, and entertainment area (Zhang and Dran 2001), such websites should update information regularly; information of some finance or entertainment business change very quickly, such websites have to keep up to enable the normal operation. (Chiou and Shen 2006, Kim and Lim 2001, Gehrke and Turban 1999, Molla & Licker 2001, Park et al. 2006, Reichheld and Schefter 2000)

Timeliness is an attribute that is vital in certain business such as stock trading; it keeps web users informed, and increases user satisfaction. (Chiou and Shen 2006, D'Ambra & Rice 2001, Molla & Licker 2001, Torkzadeh and Doll 1998)

Sufficiency or completeness of information ensures that customers get as much information regarding the matter as possible, and they don't have to spend time searching around or call the customer service to get more information, which will improve customers' experience with the website. (D'Ambra & Rice 2001, keeney 1999, Molla & Licker 2001, Palmer 2002, Park et al. 2006, Torkzadeh and Dhillon 2002, Zhang and Dran 2001)

Precision differs from "accuracy" in the way that it represents a higher level of correct interpretation of subjects. It is not widely tested and we included this attribute in the instrument to examine how people think the importance of it. (Molla & Licker 2001)

Concise information is always welcome. Time is money, and people need to know the facts in a simple way if possible. Complicated information sometimes confuses people and is misleading, thus shall be avoided. (Gehrke and Turban 1999)

Understandability and Clarity are basic qualities that customers require from websites. Information on any e-commerce websites should be clear, easy to read, and easy to understand. (D'Ambra & Rice 2000, Gehrke and Turban 1999, Molla & Licker 2001, Park et al. 2006)

Format of information also affects the Web user's experience with the site. Information should be presented in a simple and easy to read structure, frequently changed patterns or unusual ways of arranging messages will discourage the customers to read on. (Gehrke and Turban 1999, Jiang et al. 2002, Molla & Licker 2001, Torkzadeh & Doll 1998)

Usefulness of information is the reason web users come to the website. It concerns about the target audience. Websites should focus on the customers that they are trying to attract, and provide corresponding information to the target groups. (Gehrke and Turban 1999)

Relevance is among the first things coming to designer's mind when building a Web site (www.Microsoft.com). Microsoft web design experts suggest that relevant, high-quality content should always be the number one priority. Everything else including look and feel, ease of use, uniqueness to the medium, and promotion should be considered later. They also suggest using market research to determine the target group and tell the potential customers how the Website is relevant to them. (Park et al. 2006, Peppers & Rogers 1997, Molla & Licker 2001, Zhang and Dran 2001)

The questions we used to measure the above features are as follows:

Questions	Characteristic measured	Source
I am concerned about the biased information.	Impartiality	Zhang and Dran 2001
I am concerned about the accuracy of the information.	Accuracy	Molla & Licker 2001
I like unique information.	Uniqueness	Zhang and Dran 2001
I like up-to-date information.	Up-to-date	Zhang and Dran 2001
I like timely information.	Timeliness	Chiou and Shen 2006
I like sufficient information.	Sufficient	D'Ambra & Rice 2001
I like complete information.	Completeness	D'Ambra & Rice 2001
I like precise information.	Precision	Molla & Licker 2001
I like reliable information.	Reliability	Molla & Licker 2001
I like concise information.	Conciseness	Gehrke and Turban 1999
I am concerned about the understandability of information.	understandability	D'Ambra & Rice 2000
I am concerned about the readability of information.	Format	Gehrke and Turban 1999
I am concerned about the usefulness of information.	Usefulness	Gehrke and Turban 1999
I am concerned about the clarity of information.	Clarity	Molla & Licker 2001
It is important that the web site provides relevant information.	Relevancy	Molla & Licker 2001

Table 6: Questions measuring Information Quality

3.2.1.3 Service Quality

Service Quality was adopted into the D&M Model in 2003. Service quality had long been a very important part of a company's success, whether traditional business or online.

It plays an important role in determining customer satisfaction. Compared to System and Information Qualities, service quality is quite "behind the scene", it's not as visible as the former two. Service quality should include pre, during and after-sale service. Customers expect quick response, attention, interaction, etc. Although old business pattern had been replaced by information based business pattern, the old rules still apply: satisfy your customer by delivering consistently superior experience to them.

This study selectively applied the principles of the "website-adapted SERVQUAL" (Iwaarden et al. 2002). The standards we applied are as follows:

(1) tangibles: the appearance of the Web site, use of multimedia (and colors), structure, professional look, state-of-art technology.

(2) reliability: reliable processing (no transaction error), transaction security, contacts.

(3) responsiveness: the willingness to help customers and provide prompt service.

(4) assurance: Help, tech support, supporting tools.

(5) empathy: the provision of caring, individualized attention to customers, including user recognition and customization, specific offers and free stuff.

Followed the lead, we designed our questions according to the above standards. 13 questions were asked about: up-to-date technology, visual appeal, neat site structure, professional look, timely service, no error in transactions, prompt service, willing to help, always respond, close attention, customer interests, and confidence instillation.

Up-to-date technology impresses Web users in many ways. It responds fast to requests and provides more function for the customers to use. It also shows the company's efforts to improve service quality and customer experiences. (Molla & Licker 2001)

Visual appeal, neat site structure and professional look are all "tangible" features that contribute to service quality. Such attributes increase attractiveness and encourage customers to explore; the longer they use the website, the familiar and comfortable they are with it, thus will lead to better customer experience and customer satisfaction. (Gehrke and Turban 1999, Kim and Lim 2001, Molla & Licker 2001, Zhang and Dran 2001)

Timely service involves performing the service in a timely manner, and within the promised time. At the same time, customers like to be informed-- online order tracking, or e-mail informing will improve the shopping experience. Timely service increase customer satisfaction and encourage repeat patronage. (Abbott et al. 2000, Cho and Park 2001, Keeny 1999, Torkzadeh and Dhillon 2002)

Errors in transactions sometimes occur, but it should be reduced to as little as possible. Customers expect the service to be performed as they requested, especially in online order, which involves trip to the postal office and mailing expense, if any error occurs, customers will have to bear the loss of more mailing expense and travel time, not to mention the frustration. (Keeny 1999, Parasuraman et al 1990, Pitt et al. 1998, Torkzadeh and Dhillon 2002)

Prompt service sometimes works wonders. Some well operated websites like Amazon, always deliver prompt service to customers, this behavior shows customers of the company's effort to please their customers and the effort to maintain a good relationship. (Jiang et al. 2002, Torkzadeh and Dhillon 2002)

Willing to help, close attention and always respond to customers assure customers of the company's intention to provide quality services. While lack of these qualities,

customers feel ignored and dissatisfied, and sometimes result in a one-time only purchase, and result in unfavorable word-of-mouth reputation, thus will damage the company's image and profitability. (Jiang et al. 2002, Gehrke and Turban 1999, Keeney 1999, Parasuraman et al 1990, Pitt et al. 1998, Torkzadeh and Dhillon 2002)

Question	Characteristic measured	Source
It is important that the web site uses up-to-date technology for the service.	Up-to-date technology	Molla & Licker 2001
It is important that the web site is visually appealing.	Visual appealing	Gehrke and Turban 1999
It is important that the web site is well structured and neat in appearance.	Structure	Gehrke and Turban 1999
It is important that the web site has professional look.	Professional look	Gehrke and Turban 1999
It is important that the web site provides the service by the promised time.	Timely service	Keeny 1999
It is important that the web site performs the service right.	No error	Keeny 1999
It is important that the web site gives the prompt service to the users.	Prompt service	Jiang et al. 2002
It is important that the web site is always willing to help users.	Willing to help	Parasuraman et al 1990
It is important that the web site is never too busy to respond to users' request.	Always respond	Parasuraman et al 1990
It is important that the web site instills confidence in users.	Confidence instillation	Jiang et al. 2002
It is important that the web site has the knowledge to answer users' questions.	Knowledgeable	Parasuraman et al 1990
It is important that the web site provides users a feeling that they are given close attention.	Close attention	Parasuraman et al 1990
It is important that the web site has the users' best interests at heart.	Users' interests	Parasuraman et al 1990

Table 7: Questions measuring Service Quality

Companies should always keep customers best interests at heart. This practice ensures a win-win situation, and it gives customer impression that they are ensured good experiences with the company. Companies will also gain more trust from their customers once the customer perceived benefits from their relationship. (Gehrke and Turban 1999, Parasuraman et al 1990, Reichheld and Schefter 2000)

Confidence instillation can be the consequence of good services. By continuously pursuing good customer experience, and delivering quality service, companies will instill confidence to their customers and as the exchange, gain their loyalty. (Jiang et al. 2002, Pitt et al. 1998, Torkzadeh and Dhillon 2002)

The questions we used to measure the above features are shown in Table 7.

3.2.1.4 Relationship Quality

Relationship quality is proposed as the fourth quality factor that impacts user satisfaction in D&M model. The characteristics selected to measure Relationship quality came from the literature in the areas of customer loyalty, customer relationship management and alike.

Twenty-one questions are used to measure Relationship Quality. The aspects we measured are: trustworthiness, security and safety, privacy, familiarity, well communication, personalization/customization, community, technical support, contact information, help support, specific offer, free stuff, enjoyment.

Trustworthiness is the most important attribute that a company tries to gain before any purchase will occur. When customers trust an online business, they are willing to provide their sensitive private information such as their credit card number, bank account number or social security number. These information of customers enable companies to

establish their customer database, and by tracking the customers behavior on the Website and researching on the customers personal information of their interest, companies are able to build a closer relationship to their customers by providing customers with products and services that fit the customer specifically and thus earn more trust from the customers. (Chiou and Shen 2006, Keating et al. 2003, Gehrke and Turban 1999, Jiang et al. 2002, Molla & Licker 2001, Page & Sharp 2001, Park et al. 2006, Reichheld and Schefter 2000, Torkzadeh and Dhillon 2002)

Security, safety and privacy are all sensitive issues, customers care about them and consider them as priority when doing transactions with online businesses. Their concern should be attended by providing proof of security such as "Verisign" icon, privacy policy, generating confirmation page, providing contact information, etc. Such practice will improve the customer's confidence, and they will feel more comfortable doing business with the Website. (Abbott et al. 2000, Gehrke and Turban 1999, Jiang et al. 2002, Keating et al. 2003, Keeney 1999, Kim and Lim 2001, Molla & Licker 2001, Torkzadeh and Dhillon 2002, Zhang and Dran 2001)

Familiar with a website is also an asset to the site. Once a customer had spent time and effort learning how to use the functions on the Website, they would like to continue using it. (Chiou & Shen 2006)

Feeling comfortable of a website usually makes the web users stay on the Website longer, which also contribute to the long term relationship with the web users. (Chiou & Shen 2006)

Well communication ensures that customers' requests are always heard and responded. It will improve customers' feelings and encourage continuing relationship. (Auger 2005, Page & Sharp 2001, Reichheld & Schefter 2000)

Personalization of Web pages enables Web user a better control of the web usage. Web users can rearrange the web page according to their own preferences, thus become more comfortable with it. This feature has been adopted by more and more Websites. (Abbott et al. 2000, Barua et al. 2001, Jiang et al. 2002, Molla & Licker 2001)

Customization of products or services attracted a lot of online customers in the recent years; online customers are given certain degree of products customization choices, such as print their names or photos on the products. Product or service customization can help form some bonds between customers and companies, and encourage the long term relationship (Ives and Piccoli 2003, Molla & Licker 2001).

Community is also a means to build a certain connection between Website and its users, the more the users come to conduct activities in the community, the more intimate they feel with the website, thus create a good relationship. (Auger 2005)

Technical support and help support such as FAQ/help desk are all functions that help online customers get more comfortable with the Website, and get more confident of the company's service. Maintaining a good quality of technical support will satisfy customers better, and encourage long term relationship. (Auger 2005, Gehrke and Turban 1999, Molla & Licker 2001, Reichheld and Schefter 2000Torkzadeh and Dhillon 2002)

Specific offer such as language support and free stuff are out of customer's expectation; their existence can be an incentive for more visit of the Website. (Gehrke and Turban 1999, Molla & Licker 2001)

Question	Characteristic measured	Source
I am concerned about the honesty of the web site.	Trustworthiness—honesty	Molla & Licker 2001
It is important that the web site is not opportunistic.	Trustworthiness—sincerity	Molla & Licker 2001
I like the web site that cares about customers.	Care about customers	Molla & Licker 2001
I like to visit the web site with which I am familiar.	Familiarity	Chiou & Shen 2006
I like to visit the web site that I feel safe.	Safety	Gehrke and Turban 1999
I like to visit the web site that I feel comfortable.	Feeling comfortable	Chiou & Shen 2006
I like to visit the web site that I can trust.	Trustworthiness	Gehrke and Turban 1999
I like to visit the web site that I can enjoy.	Enjoyment	Abbott et al. 2000
I like to visit the web site with which I can well communicate.	Well communication	Auger 2005
I like to visit the web site that is secure in transaction.	Security	Gehrke and Turban 1999
I like to visit the web site over which I have control through personalization of web pages.	Personalization	Molla & Licker 2001
I like to visit the web site that supports customization of product/service.	Customization	Molla & Licker 2001
I like visit the web site that understands the specific needs of its users.	Care about customers	Gehrke and Turban 1999
I like to visit the web site that can well protect my privacy.	Privacy	Gehrke and Turban 1999
I like to visit the web site that can provide language support.	Specific offer	Gehrke and Turban 1999
I like to visit the web site that provides community I am interested in.	Community	Auger 2005
I like to visit the web site that provides free stuff.	Free stuff	Gehrke and Turban 1999
I like to visit the web site that provides contact information.	Contact information	Auger 2005
I like to visit the web site that is environment friendly.	Friendliness	Chiou & Shen 2006
I like to visit the web site that provides technical support.	Technical support	Auger 2005
I like to visit the web site that provides help support such as FAQ, help desk, etc.	Help support	

Table 8: Questions measuring Relationship Quality

Enjoyment is one of the important reasons that Web users come to the site. Some suggests providing humor, jokes or multimedia content such as games, movie, music, etc. to the web users, in order to improve their experiences with the site, strengthen the relationship with the Web users, and attract more visits. (Abbott et al. 2000, Eroglu et al. 2003, Keeney 1999, Kim and Lim 2001, Park et al. 2006, Torkzadeh and Dhillon 2002)

The questions used to measure the above features are shown in Table 8.

A total of 57 questions about the features of websites were made, which were measured by a five-point Likert scale ranged from *Not at all (1)* to *A great deal (5)*. The participants mark each score based on how much the item impacts their satisfaction with a website. There are 7 questions that ask the participants about their age, gender, employment, Web experience, weekly Web using hours, and major usage of the Web.

3.2.2 Data collection

A total of 295 usable responses were obtained. The samples for this study were Graduate and Undergraduate students from a major university in the southwestern United States. The participants all had experience in the web usage. The survey questionnaire were distributed in the classrooms before the class began, and the subjects were instructed to complete the questionnaire after the class and bring it back next time to the course instructor. With great support from the MIS Department faculty, the survey was completed with a favorable response rate of 72%. Their descriptive data are shown in Table 9.

According to the data, the gender is well proportioned, with 55% of female participants and 45% male; this ensures that the result would not be affected by severe gender imbalance. 79.3% of the participants were under the age of 25, which is relatively

young. But at the same time, 79.1% of them were employed, and this ensures an acceptable degree of purchasing power. The data also shows that more than 96% of the participants had more than 3 years of web experience, which conforms to our condition of "individual with web experiences". The data also shows that over 76% of the participants used website between 5 hours to over 40 hours per week, and this ensures the participants' familiarity with web usage.

Measure	Items			Percentage
Gender	Female			55
	Male			45
Age	Under 25			79.3
	26-30			11.9
	31-35			3.4
	36-40			1.7
	41and over			3.7
Employment	Employed			79.1
	Unemployed			20.9
Web Experience	<1 year			0.3
	1-3 years			3.0
	3-5 years			16.7
	Over 5 years			79.9
Web Hours / week	<1			0.3
	1-5			22.8
	5-10			22.8
	>10			54
Major Web Usage	Online Banking	Online shopping	Online Business	26.8
			Non Business	23.1
		Non online shopping	Online Business	5.8
			Non Business	12.5
	Non Online Banking	Online shopping	Online Business	2
			Non Business	5
		Non online shopping	Online Business	7.1
			Non Business	17.9

Table 9: Descriptive statistics of the respondent profile

The data also shows that 82% of the participants declared the major use of Websites for E-Commerce related activities, such as online banking, online shopping and online business. This number ensures that our data reflects the Web users' perspective on E-Commerce Websites, which conforms to the purpose of this research. Only 17.9% of the participants did not use Websites for E-Commerce related purposes. Other major usages are information search, communication, entertainment, education, etc.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Factor analysis and Validity

This research first examined the Content Validity, which was assessed by examining the process that was used in generating scale items. This was done during the instrument design; all the features that were used to measure the four quality factors were identified in previous studies. Most of the questions were straight-forward and used the predefined features as keywords.

The collected data was analyzed using SPSS for Factor analysis (the methods were adopted from Torkzadeh and Doll 1988). The Principal Components analysis technique was used to extract data, and Varimax was used for rotation. The 57 variables (from question 1 to question 57) yielded eleven factors with Eigenvalues greater than one. Many variables had multiple loadings that were greater than 0.3. These variables were taken off one at a time to gradually improve the distinction between factors. The rule of thumb for the order to eliminate variables is to start with the one that makes the "biggest noise"—such as the one that has a larger number of loadings than others. The elimination was repeated until the pattern of factors (with no major cross factor loadings) emerged as shown in Table 10.

	Component					
	1	2	3	4	5	6
VAR00002						0.541
VAR00003						0.831
VAR00004						0.669
VAR00012	0.702					
VAR00013	0.710					
VAR00014	0.734					
VAR00015	0.846					
VAR00016	0.819					
VAR00017	0.789					
VAR00019		0.836				
VAR00020		0.797				
VAR00021		0.753				
VAR00022		0.755				
VAR00025				0.805		
VAR00026				0.803		
VAR00027				0.773		
VAR00028					0.668	
VAR00029					0.751	
VAR00030					0.710	
VAR00031					0.571	
VAR00032					0.548	
VAR00040			0.646			
VAR00041			0.830			
VAR00042			0.803			
VAR00043			0.813			
VAR00044			0.569			
VAR00046			0.561		0.421	
VAR00050			0.638		0.369	

Table 10: Rotated component matrix of six factors

The above process yielded six distinct factors with 28 variables. This result shows good Discriminant Validity—factor loadings for all variables are greater than 0.54, only two variables have secondary loadings. Together, the six observed factors account for 66.5% of the total variance.

The six factors were interpreted tentatively because factor analysis only provides a succinct description of the data. The names could be countered by future research (Torkzadeh 2005). Factor 1 is about the credibility and timeliness of information, and

Factor 2 is about the understandability and usefulness of information. Factor 3 measures Relationship quality as defined in chapter 3. Factor 4 measures the appearance of a website, and Factor 5 measures transaction-related aspect of service quality. Factor 6 measures System quality.

The two variables that have secondary loadings are "Privacy protection" (0.369 in Service quality) and "Security" (0.421 in Service quality) in Relationship quality. These two variables appear to have relationship with both Relationship quality and Service quality, but they are grouped by the primary factor loadings. The value of the primary and secondary factor loadings for variable "Security" are close, to test if the removal of this variable will improve the result, another deduction was made. When the variable "Security" was taken off, the alpha was dropped to 0.927, and the total variance was increased to 66.7%, but since this is not a significant improvement, so the variable "Security" was kept in the factor.

The Convergent Validity was assessed by the Corrected Item-Total Correlation and the Alpha. The lowest value of Corrected Item-Total Correlation is 0.353 ("No down time"). If this variable is deleted, the Alpha will become 0.9279; while the overall Alpha is 0.9279 before the deletion of this item, the deletion of this variable doesn't make any difference, so it was kept in this factor. All the other Corrected Item-Total Correlation values are greater than 0.4 (standard was adopted from Park et al. 2006), significantly different than zero, which indicates acceptable Convergent Validity.

4.2 Internal Consistency Reliability

The Internal Consistency Reliability was also assessed by Alpha. Alpha reflects how well a set of variables measure a single unidimensional construct; higher Alpha value means higher Reliability. The results range from 0.9135 to 0.6878. While acceptable Alpha in most Social Science research situations is greater than 0.7 (http://www.ats.ucla.edu), these values are acceptable. Table 11 summarizes the data analysis results.

It can be seen in the table that Relationship quality explains 14% of the total variance, which is much higher than System quality. Since System quality has long been an independent variable in the D&M model, this result suggests that the model needs to be extended to measure e-commerce success. Service quality is transaction-related; it can be distinguished from Relationship quality. The data analysis results support our proposition that Relationship quality is different from Service quality, and should be treated as a separate construct. Also, Relationship quality impacts user satisfaction, so it should be included in the model as a dimension.

However, the six-factor result does not comply with the four dimension of the proposed framework. In an attempt to test the four-factor theory, we forced the six factors into four. The result is shown in Table 12, the four factors account for 58.04% of the total variance.

Construct	Factor	Variable	Factor Loading	Corrected Item-Total Correlation	Cronbach's Alpha	Variance Explained (%)	Cumulative Percentage (%)
Information credibility and timeliness	1	Complete information	0.846	0.624	0.9135	15.594	15.594
		Precise information	0.819	0.67			
		Reliable information	0.789	0.652			
		Sufficient information	0.734	0.6			
		Timely information	0.71	0.605			
		Up-to-date information	0.702	0.624			
Information understandability and usefulness	2	Understandable information	0.836	0.513	0.8751	10.99	26.584
		Readable information	0.797	0.58			
		Clear information	0.755	0.589			
		Useful information	0.753	0.563			
Relationship quality	3	Feel safe	0.83	0.535	0.8684	14.017	40.601
		Trust	0.813	0.594			
		Feel comfortable	0.803	0.61			
		Familiarity	0.646	0.417			
		Privacy protection	0.638	0.451			
		Site enjoyment	0.569	0.589			
		Security	0.561	0.404			
Website appearance	4	Visual appeal	0.805	0.522	0.8318	8.518	49.119
		Neat site structure	0.803	0.535			
		Professional look	0.773	0.473			
Service quality	5	No error in transactions	0.751	0.573	0.8754	10.945	60.064
		Prompt service	0.71	0.544			
		Timely service	0.668	0.556			
		Willing to help	0.571	0.642			
		Always respond	0.549	0.523			
System quality	6	No downtime	0.831	0.353	0.6878	6.474	66.538
		No missing links	0.669	0.517			
		Dependable site	0.541	0.488			

Table 11: Data analysis result of six factors

	Component			
	1	2	3	4
VAR00002	0.405			
VAR00003	0.308			
VAR00004	0.430		0.392	
VAR00012	0.719			
VAR00013	0.722			
VAR00014	0.742			
VAR00015	0.856			
VAR00016	0.809			
VAR00017	0.794			
VAR00019				0.794
VAR00020				0.752
VAR00021				0.752
VAR00022	0.307			0.715
VAR00025			0.673	0.429
VAR00026			0.730	0.344
VAR00027			0.676	
VAR00028	0.332		0.591	
VAR00029	0.432		0.552	
VAR00030			0.579	
VAR00031	0.381	0.321	0.491	
VAR00032	0.304	0.315	0.439	
VAR00040		0.625		
VAR00041		0.804		
VAR00042		0.774		
VAR00043		0.819		
VAR00044		0.558	0.345	
VAR00046		0.638		
VAR00050		0.694		

Table 12: Result of suppression from 6-factor to 4-factor

There appear to be some "noises", and variables 31, 32, 4 and 3 were taken off in order to improve the discriminate validity. The result is shown in Table 13, the observed four factors account for 62.59% of the total variance.

It can be seen that the value of the primary and secondary factor loadings for variable 29 are close, but taking off this variable will affect other variables and more variables will have to be taken off, so the result will be worse than the current one. Therefore, this variable was kept in this factor.

	Component			
	1	2	3	4
VAR00015	0.861			
VAR00016	0.812			
VAR00017	0.798			
VAR00014	0.744			
VAR00013	0.734			
VAR00012	0.723			
VAR00002	0.385			
VAR00043		0.826		
VAR00041		0.808		
VAR00042		0.778		
VAR00050		0.695		
VAR00046		0.640		
VAR00040		0.630		
VAR00044		0.572		0.338
VAR00019			0.800	
VAR00020			0.758	
VAR00021			0.756	
VAR00022	0.308		0.715	
VAR00026			0.306	0.766
VAR00027				0.737
VAR00025			0.401	0.697
VAR00028	0.356			0.579
VAR00030		0.311		0.534
VAR00029	0.458			0.528

Table 13: Rotated component matrix of four factors

When we apply the same standards we used for analyzing the six factors in the above context, the four factors also exhibit good discriminate validity, convergent validity and internal consistency validity. The number of items for Relationship quality was not reduced during the factor reduction process, and the total variance explained by Relationship quality was increased from 14% to 17.2%, the Alpha remains the same value, 0.868.

Construct	Factor	Variable	Factor Loading	Corrected Item-Total Correlation	Cronbach's Alpha	Variance Explained (%)	Cumulative Percentage (%)
Intrinsic information quality	1	Complete information	0.861	0.612	0.897	19.546	19.546
		Precise information	0.812	0.671			
		Reliable information	0.798	0.653			
		Sufficient information	0.744	0.589			
		Timely information	0.734	0.599			
		Up-to-date information	0.723	0.613			
		Dependable site	0.385	0.469			
Relationship quality	2	Trust	0.826	0.599	0.868	17.224	36.77
		Feel safe	0.808	0.546			
		Feel comfortable	0.778	0.618			
		Privacy protection	0.695	0.45			
		Security	0.64	0.402			
Extrinsic information quality	3	Familiarity	0.63	0.417			
		Site enjoyment	0.572	0.593			
		Understandable information	0.8	0.527	0.875	13.376	50.146
		Readable information	0.758	0.587			
		Useful information	0.756	0.573			
		Clear information	0.715	0.603			
Service quality	4	Neat site structure	0.766	0.533	0.81	12.447	62.593
		Professional look	0.737	0.479			
		Visual appeal	0.697	0.514			
		Timely service	0.579	0.542			
		Prompt service	0.534	0.524			
		No error in transactions	0.528	0.557			

Table 14: Data analysis result of four factors

Although the final result of factor analysis is not completely satisfactory, because System quality and Information quality do not emerge distinctly as expected, our resulted framework is slightly different from the one we proposed, it could be because that Webusers do not consider the System quality as important or relevant as in traditional Information Systems; and Website Information quality could be more complicated than the traditional Information qualities. But in both case scenarios, Relationship quality can be clearly distinguished from Service quality and other factors, , which supports our propositions that three quality factors are not enough to explain the e-commerce website success and Relationship quality is one of the representative quality factors that compose of features of successful e-commerce websites.

CHAPTER 5

CONCLUSIONS

This study theoretically developed and empirically tested the applicability and comprehensiveness of the D&M model. A new dimension—Relationship quality was proposed for the model, which improves the thoroughness of the model and ensures better evaluation of e-commerce website performance. A list of important characteristics that impact user satisfaction is also identified during the study.

This study makes contributions in three folds. First, it provides a comprehensive framework that practitioners can use as a guidance to evaluate the performance of their websites. Second, through an extensive literature review, this study identified a thorough list of characteristics in four theoretical categories. It can help companies to form evaluation instruments according to their specific needs. And third, it provides a research base for extending the D&M Model toward a better and sufficient framework.

As in any study, there are some limitations. First, our survey population is limited to a small region, and there are other factors such as educational level, culture, language, religion and so on that might affect a user's perspective to websites, so the data might not be sufficiently representative. Second, variables eliminated during factor analysis account for 37.5% of total variance; the characteristics they measured either have relationships with more than one factor or can not be distinguished by web users. The answer can only be found by doing future research in the same manner.

This research forms a foundation and opens a window for a lot of future research opportunities. The soundness of the extended model, the functionalities of the instruments, and the practical application of the research results all need further examinations. We encourage the replication of the study, and expect more researches in this field.

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APPENDIX A: SURVEY QUESTIONNAIRE

QUESTIONNAIRE FOR WEB SITE QUALITY FACTORS

THANK YOU FOR YOUR PARTICIPATION IN THIS SURVEY.

How do you value the following factors that contribute to your satisfaction with a web site?

	Not at all	A little	Moderately	Much	A great deal
I am concerned about the accuracy of transaction.	__ :	__ :	__ :	__ :	__ :
I like to visit a web site that is dependable.	__ :	__ :	__ :	__ :	__ :
I like to visit a web site that has little or no downtime.	__ :	__ :	__ :	__ :	__ :
I like to visit a web site that has little or no missing links.	__ :	__ :	__ :	__ :	__ :
I am concerned about the bugs in the system of the web site.	__ :	__ :	__ :	__ :	__ :
I am concerned about the response time (e.g. download time) of the web site.	__ :	__ :	__ :	__ :	__ :
I am concerned about the ease of navigation/use of the web site.	__ :	__ :	__ :	__ :	__ :
I am concerned about the usefulness of the web site features and functions.	__ :	__ :	__ :	__ :	__ :
I am concerned about the biased information.	__ :	__ :	__ :	__ :	__ :
I am concerned about the accuracy of the information.	__ :	__ :	__ :	__ :	__ :
I like unique information.	__ :	__ :	__ :	__ :	__ :
I like up-to-date information.	__ :	__ :	__ :	__ :	__ :

	Not at all	A little	Moderately	Much	A great deal
I like timely information.	__ :	__ :	__ :	__ :	__ :
I like sufficient information.	__ :	__ :	__ :	__ :	__ :
I like complete information.	__ :	__ :	__ :	__ :	__ :
I like precise information.	__ :	__ :	__ :	__ :	__ :
I like reliable information.	__ :	__ :	__ :	__ :	__ :
I like concise information.	__ :	__ :	__ :	__ :	__ :
I am concerned about the understandability of information.	__ :	__ :	__ :	__ :	__ :
I am concerned about the readability of information.	__ :	__ :	__ :	__ :	__ :
I am concerned about the usefulness of information.	__ :	__ :	__ :	__ :	__ :
I am concerned about the clarity of information.	__ :	__ :	__ :	__ :	__ :
It is important that the web site provides relevant information.	__ :	__ :	__ :	__ :	__ :
It is important that the web site uses up-to-date technology for the service.	__ :	__ :	__ :	__ :	__ :
It is important that the web site is visually appealing.	__ :	__ :	__ :	__ :	__ :
It is important that the web site is well structured and neat in appearance.	__ :	__ :	__ :	__ :	__ :
It is important that the web site has professional look.	__ :	__ :	__ :	__ :	__ :
It is important that the web site provides the service by the promised time.	__ :	__ :	__ :	__ :	__ :
It is important that the web site performs the service right.	__ :	__ :	__ :	__ :	__ :
It is important that the web site gives the prompt service to the users.	__ :	__ :	__ :	__ :	__ :
It is important that the web site is always willing to help users.	__ :	__ :	__ :	__ :	__ :
It is important that the web site is never too busy to respond to users' request.	__ :	__ :	__ :	__ :	__ :
It is important that the web site instills confidence in users.	__ :	__ :	__ :	__ :	__ :

	Not at all	A little	Moderately	Much	A great deal
It is important that the web site has the knowledge to answer users' questions.	__ :	__ :	__ :	__ :	__ :
It is important that the web site provides users a feeling that they are given close attention.	__ :	__ :	__ :	__ :	__ :
It is important that the web site has the users' best interests at heart.	__ :	__ :	__ :	__ :	__ :
I am concerned about the honesty of the web site.	__ :	__ :	__ :	__ :	__ :
It is important that the web site is not opportunistic.	__ :	__ :	__ :	__ :	__ :
I like the web site that cares about customers.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site with which I am familiar.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that I feel safe.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that I feel comfortable.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that I can trust.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that I can enjoy.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site with which I can well communicate.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that is secure in transaction.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site over which I have control through personalization of web pages.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that supports customization of product/service.	__ :	__ :	__ :	__ :	__ :
I like visit the web site that understands the specific needs of its users.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that can well protect my privacy.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that can provide language support.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that provides community I am interested in.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that provides free stuff.	__ :	__ :	__ :	__ :	__ :

	Not at all	A little	Moderately	Much	A great deal
I like to visit the web site that provides contact information.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that is environment friendly.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that provides technical support.	__ :	__ :	__ :	__ :	__ :
I like to visit the web site that provides help support such as FAQ, help desk, etc.	__ :	__ :	__ :	__ :	__ :

Demographic information

All responses to this questionnaire are strictly confidential; only statistical findings will be analyzed. Thank you again for your participation in this survey.

Gender: Male _____ Female _____

Age: Under 25_____ 26-30_____ 31-35_____ 36-40_____ 41 and over_____

Marital Status: Married_____ Unmarried_____

Employment Status: Employed_____ Unemployed_____

Web Experience: < 1 years_____ 1 to 2 years_____ 2 to 3 years_____
3 to 4 years_____ 4 to 5 years_____ 5 to 6 years_____
6 to 7 years_____ 7 to 8 years_____ over 8 years_____

Web Using Hours per Week:
< 1 hour_____ 1 to 5 hours_____ 5 to 10 hours_____ 10 to 15 hours_____
15 to 20 hours_____ 20 to 25 hours_____ 25 to 30 hours_____
30 to 35 hours_____ 35 to 40 hours_____ over 40 hours_____

What is your major use of the Web? (Please select all that apply)
Search for information_____ Online shopping_____ Entertainment_____
Business_____ Banking/Pay bills_____ Other_____

THE END

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