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Validity of DeLone and McLean's Model of Information Systems success at the web site level of analysis

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VALIDITY OF DELONE AND MCLEAN'S MODEL OF INFORMATION SYSTEMS SUCCESS AT THE WEB SITE LEVEL OF ANALYSIS

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DEDICATION

To Thomas and Ana, I love you both.

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ABSTRACT

The DeLone and McLean Model of Information Systems (IS) Success is one of the most cited and commonly-used models in the IS literature. Generally, the model has been used mainly to explain IS success at the individual level of analysis. However, in rare occasions it has been utilized on its entirety to measure success at the organizational level of analysis. In this study, the DeLone and McLean Model of IS Success is applied at the organizational level of analysis in the E-commerce environment. To do so, we gather website features from 448 top retailer, categorize them following DeLone and McLean's taxonomy, and introduce them as the independent variables in our model. The results of our study provide support for utilizing the model to explain the dimensions and relationships of Information Systems Success at the organizational level of analysis. At this higher level, website features that map to quality perceptions of system quality, information quality, and service quality do exist. In terms of relationships between these dimensions; the analysis suggests that both system quality and service quality positively affect system use; and system use strongly affects net benefits as measured by organizational sales. Furthermore, as an extension of the DeLone and McLean model, we add direct paths from all three qualities to net benefits (sales). Results from this extension of the model suggest that information quality and system quality directly affect net benefits. Furthermore, results from this study have strong implications for the IS field and especially for the e-commerce environment. First, it provides support for utilizing real world objective data as outcomes of the analysis. Second, it provides support for utilizing the DeLone and McLean model at the organizational level of analysis as a tool to help researchers and practitioners understand the different dimensions of IS Success and how they affect each other. Third it provides practitioners, web development

instructors, and web developers with real objective website feature groups that directly affect organizational sales.

CHAPTER 1: INTRODUCTION

"The Chinese use two brush strokes to write the word 'crisis.' One brush stroke stands for danger; the other for opportunity. In a crisis, be aware of the danger—but recognize the opportunity." –John F. Kennedy

In these times of crisis, companies are trying to reduce budgets and cut costs to avoid layoffs and sometimes bankruptcy. Because of costs, investing in a new information system or just updating the current one is a difficult decision for any organization. Still, Gartner predicts that 3.3 trillion dollars will be invested in tech spending during 2010 (Gartner 2010). It is clear, then, that companies continue to recognize the opportunity provided by technology investment even in times of crisis. Technology investment, like any investment, results from careful consideration based on analysis and evaluation, and as such, companies want to know if their technology investments will pay off as an element of their future success. Because of this focus on success, Information Systems (IS) success has been an important issue in the field of IS. Many studies have attempted to explain how success occurs in an organization, but for us what is more important is to understand how an information system affects organizational success (Bailey and Pearson 1983; DeLone and McLean 1992; Rai et al. 2002; Seddon 1997). Specifically, we want to understand how IS affects the success in one of the most technology-driven areas of the current economy, E-commerce. Researchers define E-commerce "as the use of the Internet to facilitate, execute, and process business transactions. Business transactions involve a buyer and a seller and the exchange of gods or services for money" (DeLone and McLean 2004). According to the *Internet Retailer* published by Vertical Web Media (2007), in 2007 the top 500 retail websites completed $101.7 billion in sales. For web retailers, the IS utilized is the backbone of the purchasing experience. Without the IS, there would be no Internet sales. For this reason, it is logical that web retailers invest largely

in IS, and it would be cost-beneficial to know what particular elements of an IS drive the success of a website, why one website is more or less successful than another, the purchasing experience through that site, and ultimately, the profits of Internet-based retailers.

The question of how we measure success is central to such a study. To be able to understand and measure IS success, in 1992, William H. DeLone and Ephraim R. McLean introduced their first IS Success model. Based on a taxonomy that includes all the different measures that have been utilized to evaluate IS success in the IS literature, their model attempts to describe how each one of the proposed dimensions of IS success is related to one other. We believe that the E-commerce environment is a unique setting to study the DeLone and McLean's model of IS Success because the system itself is essential to the business, without it, there would not be any business-customer interaction. Also, the system is not internal to the organization; in its primary use, it faces the customer, not organizational employees. Finally, the features in the website are fairly standard, easy to interpret and match with the different dimensions of the DLML model. Their model provides a starting point from which all further research can be fitted and developed. Researchers have shown strong interest in this model, as it has been cited in more than 300 publications that aim to explain IS success (Petter et al. 2008). However, the majority of those studies are done at the individual level of analysis, neglecting the organizational level of analysis and creating an obvious gap in the literature. According to DeLone and McLean, by using the model at the organizational level, researchers would be able to explain how the different dimensions of IS success affect each other, and ultimately, how they affect the organization as a whole. In the E-commerce environment, we believe that utilizing the 2004 updated DeLone and McLean model of IS Success to analyze data at the organizational level of analysis will help us to understand how

website features that map to the different perceived qualities of the website affect visits, satisfaction, and ultimately sales.

1.1 Motivation

According to Heo and Han (2003) and Myers (1997), the DeLone and McLean Model of IS Success is one of the most widely-cited in the IS literature. According to Myers, the basic contributions of the model are extremely important to the IS researchers because (1) it provides a classification for all the evaluation measures that have been reported in the IS literature; (2) the model commences to identify potential stakeholders groups subject to be evaluated in the model, and (3) it suggests how the constructs may interact with each other. This is not meant to suggest that the model is perfect, as has been pointed out by Seddon et al. (Seddon and Kiew 1994b; Seddon and Kiew 1996; Seddon et al. 1999; Seddon 1997), Rai et al. (Rai et al. 2002), and others. DeLone and McLean clearly state that providing a model does not create a study, or develop measures, or interpret the results. A model depicts a theory, and it helps the researcher put the data in a framework to make it easier to understand and explain. DeLone and McLean offer many words of caution for the researchers that attempt to utilize the model. First, they observe that to be able to compare studies that utilize the IS Success model those studies have at least to utilize the same (or extremely similar) measures for each one of the dimensions specified in the model. Second, they caution about the connections between the dimensions of the IS Success model. Since all the dimensions are interrelated, studying the model partially does not produce the same results as studying the model as a whole. Third, it is important to make sure that the model is studied at the appropriate level of analysis. If the study wants to explore individual measures of success, then all measures involved in the model should be at the individual level. Fourth, it is

important to test the model at all levels of analysis to make sure it is a comprehensive model of IS Success and can be used to explain data at all levels.

More than 25 years have passed since DeLone and McLean published their cautionary words about their IS Success model, and we are still not close to filling some of those gaps. After reviewing the IS success literature that utilizes the DeLone and McLean model from 1992 to 2007, Petter (2008) observes that there are still many issues to be solved. Studies tend to focus on a single dimension of success, and studies also tend to utilize self-reported measures of success even though those have not been consistent with objective measures of success (Heo and Han 2003). What is more important, this use of self-reported measures keeps the researchers focused on the individual level of analysis instead of trying to understand how the model works at the organizational level of analysis. While enough studies have been conducted that validate almost every relationship in the model at the individual level of analysis, there are not enough studies to validate even one fourth of the relationships presented in the model at the organizational level of analysis (Petter et al. 2008). This void in the research calls to attention many items of concern for researchers. Researchers are certainly trying to understand how individuals feel, react, and use an IS, and so they have conducted countless surveys in which the user explores his or her intentions and feelings and attempts to become more familiar with the system, use the system, and evaluate the system. However, how do those translate to the organizational level of analysis? In the E-commerce environment for example, how do we know if the websites are successful or not? And what is more important, why are some websites more successful than others, and what can we do to change that? We have studies that rate a single website by many individuals, a group of websites by different individuals, or many different websites by a single individual. In these

cases, the variability of the sample may come from the actual website features, but it can also occur due to the individual differences of the raters. We need to shift the focus of those measures to a higher level so that the variability comes from the differences in the systems not the differences of the raters. Moreover, analyzing the model at the organizational level of analysis will have great implications for practitioners and even web development teachers. It seems that at the individual level of analysis, it is the individual preference of the rater that explains variability in the outcome, while at the organizational level, it is the identifiable features of the website that are responsible for the variability in the outcome. If we can identify which features are most strongly related to success and which features are unrelated to success then practitioners can develop those websites following our indications. Furthermore, teachers would be able to teach about those features of the websites that actually bring success to the company instead of focusing only on those features that arise at the individual level of analysis. Not doing so would be a disservice to the research community, the practitioners, the teachers, and even our students. If we are going to accept the model at the level that it has been accepted in the IS literature, we need to make sure that it is clear where it works and where it does not.

1.2 Purpose of the Study

This study attempts to fill the gap in the IS literature that has been there since DeLone and McLean proposed their model. When the model first appeared in 1992, DeLone and McLean clearly stated that it should be validated at all levels of analysis. In 2002, at the 10-year mark, after plenty of studies had already used the model, DeLone and McLean observed that there was still a big gap in the literature since the IS success model had not been studied at the organizational level. Finally, 15 years later, Petter, DeLone, and McLean reiterated this

observation that the research had not advanced at the organizational level. More than 25 years later, the DeLone and McLean model has still not been sufficiently validated at the organizational level of analysis. The purpose of this study, then, is to try to fill that void. This study analyzes the DeLone and McLean Model of IS Success at the organizational level of analysis in the E-commerce environment.

1.3 Research Questions

Fundamentally, this study attempts to achieve three important tasks: (1) test the DeLone and McLean Model of IS Success at the organizational level of analysis in the E-commerce environment; (2) test the relationships between the different IS success dimensions in the model and extend the model by testing direct effects of IS features on outcomes; and (3) provide support for the use of objective measures for the organizational-level variables included in the model.

The research questions of this project are as follows:

- RQ1: Is the DeLone and McLean Model of IS Success a valid model at the organizational level of analysis?
- RQ2: Do the dimensions and relationships stated in the model of IS success proposed by DeLone and McLean exist at the organizational level of analysis?

1.4 Organization of the Dissertation

This dissertation consists of five chapters. Chapter One presents an overview of the study including key components. Chapter Two provides a survey of relevant literature on the DeLone and McLean model in Information Systems. Chapter Three presents the research methodology selected for the study—measures and operationalizations—as well as the methods for data collection and analysis. Chapter Four describes the results of the analysis.

Finally, Chapter Five presents concluding remarks including implications and limitations of the study and recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

The IS literature has always been on the lookout for a comprehensive and valid way to measure IS success. In the following sections, we will describe the work of Robert Zmud (1979), Blake Ives and Margrethe Olson (1984), and DeLone and McLean (1992). The three studies referenced provide taxonomies that attempt to categorize determinants of IS success and based on thorough analyses of previous literature and theoretical applications. The three studies also provide theoretical models to help researchers understand and explain the relationships between the categories identified in the taxonomies.

2.1 Zmud 1979: Individual Differences as Predictors of Success

In 1979, Zmud published a review of Management Information Systems (MIS) success literature that includes a synthesis of the research that focuses on the individual differences that affect MIS success. Zmud acknowledges that there are many other factors apart from individual differences that could affect MIS success; however, in this publication, Zmud focuses on the individual differences that affect MIS success. Zmud divides individual differences into three different classes: cognitive style, personality, and demographic / situational variables. According to Zmud, cognitive styles indicate "characteristic modes of functioning shown by individuals in their perceptual and thinking behavior"(Zmud and Cox 1979). Personality represents "the cognitive and affective structures maintained by individuals to facilitate their adjustments to events, people, and situations encountered in life" (Zmud and Cox 1979). And finally, the demographic/situational variables vary according to the context (967). These individual differences affect the cognitive behavior of the user as well as the attitude of the user. The cognitive behavior as it affects MIS success refers to the human limitations in cognition. These limitations are directly related to how an MIS is designed and

how it will ultimately succeed or fail. Attitude of the user towards the MIS system before and after the use also affects the ultimate success or failure. Zmud utilizes user satisfaction, use, and user performance as proxies for MIS success. See Figure 1 for a graphical description of the model.

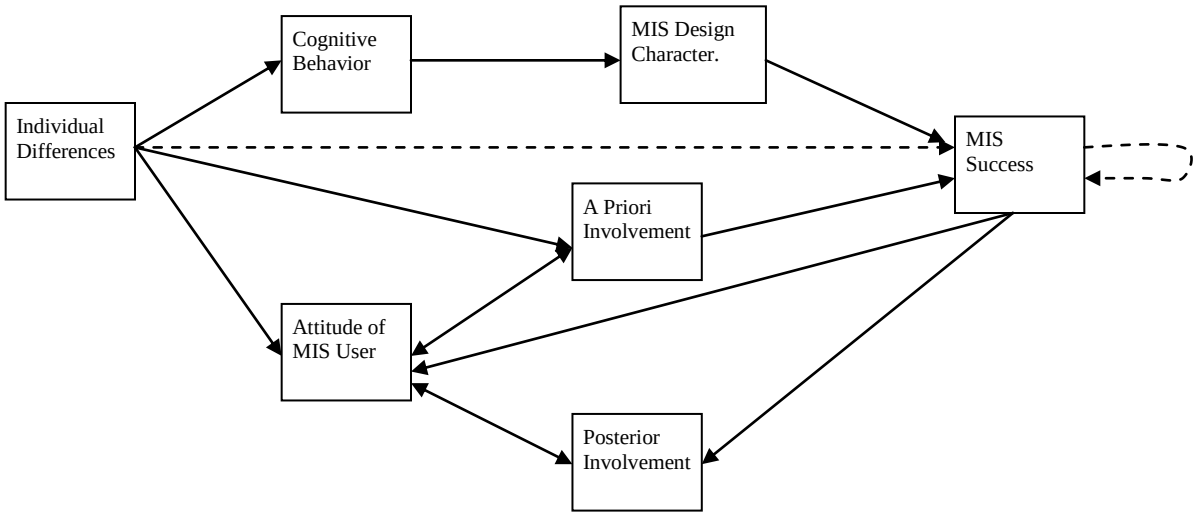

Figure 1 - Zmud 1979: Impact of Individual Differences upon MIS Success

According to the author, cognitive behaviors are strongly influenced by contextual factors (i.e. task type) as well as individual differences. It is role of MIS research to focus on these differences to attempt to find patterns of differences to better accommodate them. In terms of complex vs. simple individuals, Zmud reports that complex individuals search for and use more information, prefer aggregate over raw data, and use more rules when integrating information. In terms of decision making, complex individuals generate more decision alternatives. In terms of personality traits, Zmud reports that subjects with internal locus of control and high-risk propensity tend to have a greater information search activity. Zmud adds that demographic and situational contexts affect information search behavior of the user: higher general intelligence subjects process information faster and more effectively

as well as make decisions faster. All these differences in cognitive behaviors make the design and creation of successful MIS even more important. See Table 1 for a summary of individual differences affecting cognitive behavior in Zmud's study (1979)

Table 1 - Individual Differences Affecting Cognitive Behavior (Zmud 1979)

Individual Differences → Cognitive Behavior		
Cognitive Style	Complex subjects: search for and use more information, prefer aggregate over raw data, use more rules.	(Bariff and Lusk 1977; Harvey and Schroder 1963; Karlins 1967; Schroder et al. 1967; Seiber and Lonzetta 1965; Tuckman 1964)
	They generate more decision alternatives, greater flexibility, less confidence, more decision time.	(Bruner and Tajfel 1961; Driver and Mock 1975; Harvey and Schroder 1963; Scott 1962; Seiber and Lonzetta 1965)
	Field-Independent subjects: seek more information, prefer detailed, aggregate, quantitative reports and more decision time	(Bariff and Lusk 1977; Benbasat and Dexter 1979; Doktor and Hamilton 1973; Lusk 1973)
Personality	Internal locus of control, low degree of dogmatism, high risk-taking propensity subjects: higher information search activity.	(Lambert and Durand 1977; Lefcourt 1972; Long and Ziller 1965; Prokop and Brooks Jr 1970; Taylor and Dunnette 1974)
Demographic & Situational	Higher general intelligence subjects: process information faster, more effectively, more retention, faster decisions, and better organization	(Hunt and Lansman 1975; Taylor and Dunnette 1974)

Zmud reports that search activity, decision accuracy, and decision confidence all increase as the quantity of relevant information is presented. However, the inclusion of information irrelevant to the decision and/or the inclusion of overly redundant information degrade performance. Hence it is the role of MIS to select and filter the appropriate bits of information for each decision maker (Table 2).

Zmud divides MIS design attributes into three different areas: information, decision aids, and delivery systems. In terms of information, users are more satisfied if the information

presented is exactly matched with the information needs and also if the information presented is dynamic (reports could be modified).

Table 2 - Cognitive Behavior Affecting MIS Design Characteristics (Zmud 1979)

Cognitive Behavior → MIS Design Characteristics		
Information	Search activity, decision accuracy, and decision confidence increase as the quantity of relevant information is increased.	(Adams and Swanson 1976; Dorris et al. 1977; Levine et al. 1975; Slovic and Lichtenstein 1971)
	Subjects prefer more information than justified but use less information than expected.	(Driver and Mock 1975; Vasarhelyi 1977)
	Inclusion of irrelevant information decreases performance.	(Coffey 1961; Ebert 1972) (Dorris et al. 1977; Hsia 1977; Mitroff et al. 1974; Sarbin et al. 1960; Slovic and Lichtenstein 1971)
	Redundancy helps the user in recognizing, evaluating, and remembering critical information. Over-redundancy hinders information processing.	(Hsia 1977)
Decision Aids	Humans are slow in initiating action, take too long to make decisions, and are unwilling to change prior decisions.	(Hammer and Ringel 1965; Schrenk 1969; Vaughan Jr and Mavor 1972)
	Humans develop and use few alternatives, are reluctant to work with probabilistic data, violate the rules of decision making, and find it difficult to evaluate new evidence.	(Beach 1975; Brightman and Urban 1974; Conrath 1973; Moskowitz 1973; Schultz 1961; Slovic et al. 1977)

Decision aids such as quantitative models improve decision performance but lengthen the decision time and decrease confidence. Graphical and color-coded reports also improve decision making. In terms of the delivery system, easy to use interfaces are positively related to user satisfaction. On-line usage provides faster and more consistent performance but seems

to be mediated strongly by accessibility and reliability of the system. In the same line, delays in the flow of communication lower user satisfaction (Table 3).

Table 3 - MIS Design Characteristics Affecting MIS Success (Zmud 1979)

MIS Design Characteristics → MIS Success		
Information	User satisfaction: positively related to the degree information needs are met and the degree of alterability of the information.	(Barrett et al. 1968; Schewe et al. 1974)
	Negatively related to the amount of information received.	(Lucas Jr 1975)
Decision Aids	Availability of quantitative models improves decision performance, lengthens decision time, and decreases confidence	(Benbasat and Schroeder 1977; Chervany and Dickson 1974; Smith and Crabtree 1975)
	Graphical reports provide better performance than tabular reports. Color-coded reports, single multi-line graphs, and format improvements increase MIS usage.	(Benbasat and Schroeder 1977; Ferguson and Jones 1969; Schultz 1961; Zmud 1978)
Delivery System	Poor MIS-user interface designs decreases satisfaction.	(Carlson et al. 1977; Eason 1976)
	Ease of use increases satisfaction.	(Barrett et al. 1968; Lucas Jr 1976)
	Online usage provides faster and more consistent performance and higher degree of satisfaction.	(Dickson et al. 1977; Prokop and Brooks Jr 1970; Sackman 1972)
	Response time delays decrease user satisfaction.	(Miller 1968; Nickerson 1969; Sackman 1972; Schewe et al. 1974)
	Vocabulary enhancements are positively related to usage and satisfaction.	(Ferguson and Jones 1969)
	User compatibility with the MIS staff and training increase user satisfaction.	(Barrett et al. 1968; Schewe et al. 1974)

In terms of user attitudes towards the MIS system, Zmud reports that extroverted, perceptive individuals possess a positive attitude towards MIS. On the contrary, males, older individuals, and individuals with fewer years of education exhibit less positive attitudes. Concerning the a priori involvement, users that are involved in the MIS design show a

positive association with satisfaction. User attitudes are also extremely related to MIS success in terms of use. Subjects tend to use the system more if they are told of its potential and if the system has strong top management support. Furthermore, the relationship between individual differences and MIS success is also important since studies have found that individuals with more education, greater organizational success, and a longer tenure in the organization seem to use the MIS systems less and be less satisfied with it than those subjects with more task knowledge and professional status. Finally, there are constant reports of a positive relationship between usage and MIS success (Table 4).

Table 4 – MIS Success Determinants (Zmud 1979)

Individual Differences → User Attitudes	
Extroverted, perceptive individuals have more positive attitudes towards MIS.	(Wynne 1975)
Males, older individuals, and less educated subjects have less positive attitudes.	(Lucas Jr 1976; Lucas Jr 1978a; Mann and Williams 1960; Mumford and Banks 1967)
Individual Differences → A Priori Involvement	
Cognitive differences between MIS user and MIS designer decrease a priori user involvement.	(Edstrom 1977; Zmud and Cox 1979)
MIS User Attitude → A Priori Involvement	
Positive association between MIS attitude and a priori involvement.	(Lucas Jr 1975)
A Priori Involvement → MIS Success	
Positive association between a priori involvement and user satisfaction.	(Dickson and Powers 1973; Edstrom 1977; Igersheim 1976; Lucas Jr 1975; Maish 1979; Swanson 1974)
MIS User Attitude → MIS Success	
Usage positively associated with MIS potential, urgency of an MIS, top management support, and quality of MIS staff.	(King and Rodriguez 1978; Lucas Jr 1973; Lucas Jr 1976; Lucas Jr 1978a; Robey 1978; Robey and Zeller 1978)
Satisfaction positively related to attitudes towards top management support.	(Lucas Jr 1976; Lucas Jr 1978a)
Posterior Involvement → MIS Success	
Negative association between posterior involvement and MIS satisfaction.	(Lucas Jr 1975)
Individual Differences → MIS Success	
Usage is negatively related to individuals characterized with more education, longer tenure in an organization, and greater organizational success.	(Lucas Jr 1973; Lucas Jr 1975; Lucas Jr 1976; Werner 1974)
Satisfaction is negatively related to more education and longer tenure.	(Lucas Jr 1975; Lucas Jr 1976; Maish 1979)
Performance was positively related to general intelligence level and quantitative ability.	(Chervany and Dickson 1974; Taylor and Dunnette 1974)
MIS Usage → MIS Success	
Positive association between usage and satisfaction.	(Barrett et al. 1968; Lucas Jr 1975; Lucas Jr 1976; Lucas Jr 1978b; Maish 1979; Schewe 1976; Swanson 1974; Vasarhelyi 1977)

Zmud proposes that several areas of research still need to be explored. For example, he observes that many of the studies had been conducted in a laboratory setting. He suggests that the studies need to be brought to real MIS situations in order to validate the results. Moreover, he notes that there is a need to link user attitudes towards MIS and MIS design characteristics "particularly with regard to delivery system components" (p.975). Zmud concludes that much is left unknown in the field of individual differences as they relate to contextual factors. More research is needed in these fields if the organizations are willing to commit more resources to MIS efforts.

2.2 Ives and Olson 1984: User Involvement and IS Success

Whereas Zmud focuses on how individual differences affect MIS success, Ives and Olson's review of the MIS success literature, published five years later, focuses on the level of user involvement in the development of computer-based information systems. In their article, Ives and Olson first describe the user involvement construct as "participation in the system development process by representatives of the target user group (Ives and Olson 1984)" (p. 587). The authors observe that user-involvement studies normally use theories and research from the field of organizational behavior where two areas of research are relevant to the topic: participative decision making and planned organizational change. According participative decision making, increased job satisfaction and increased productivity can be directly related to increasing the inputs that subordinates provide management about their own jobs. In terms of MIS, participative decision making occurs when users and system developers work together to increase the quality or acceptance of the system. The authors report on several studies that measure the level of user involvement and its relationship on system quality improvement. Ives and Olson report that user involvement provides an

accurate assessment of requirements and expertise about the organization that improves user understanding and helps avoid unwanted features.

Table 5 - User Involvement Affecting System Quality (Ives and Olson 1984)

User Involvement → System Quality	
Provides a more accurate and complete assessment of user information requirements.	(Norton and McFarland 1975; Robey and Farrow 1982)
Provides expertise about the organization.	(Lucas Jr 1974a; Lucas Jr 1974b)
Avoids unacceptable or unimportant features.	(Robey and Farrow 1982)
Improves user understanding.	(Lucas Jr 1974a; Lucas Jr 1974b; Robey and Farrow 1982)

In terms of how user participation may be related to the user acceptance of the system, Ives and Olson report that user involvement develops realistic expectations of the system, provides grounds for conflict resolution between the development team and the users, decreases user resistance, and increases system ownership by the users, which, in turn, commits users to the system.

Table 6 - User Involvement Affecting User Acceptance (Ives and Olson 1984)

User Involvement → User Acceptance	
Develops realistic expectations.	(Gibson 1977)
Provides conflict resolution grounds.	(Keen 1981)
Increases system ownership by users.	(Robey and Farrow 1982)
Decreases user resistance.	(Lucas Jr 1974a; Lucas Jr 1974b)
Commits users to the system.	(Lucas Jr 1974a; Lucas Jr 1974b), (Markus 1983)

Based on previous literature and the Organizational Behavior literature, Ives and Olson propose a descriptive model of user involvement, in which the dependent variables are system quality and system acceptance.

In their model (Figure 2), involvement roles describe who should be involved in the development of the system. According to their research, there are three different levels

advocated: primary users of the system, secondary users that provide input to the system, and top management. Development characteristics refer to the type of system being developed and where in the development process the involvement of the user should take place. According to Ives and Olson, there are systems that cannot be developed without the input of the user (i.e. decision support systems require user input and acceptance) and others where the input of the user would not be necessary at all (i.e. technical systems where the product is the only visible item for the user). At the same time, according to the authors, user participation is critical during the definition stage and becomes less important in the installation stage.

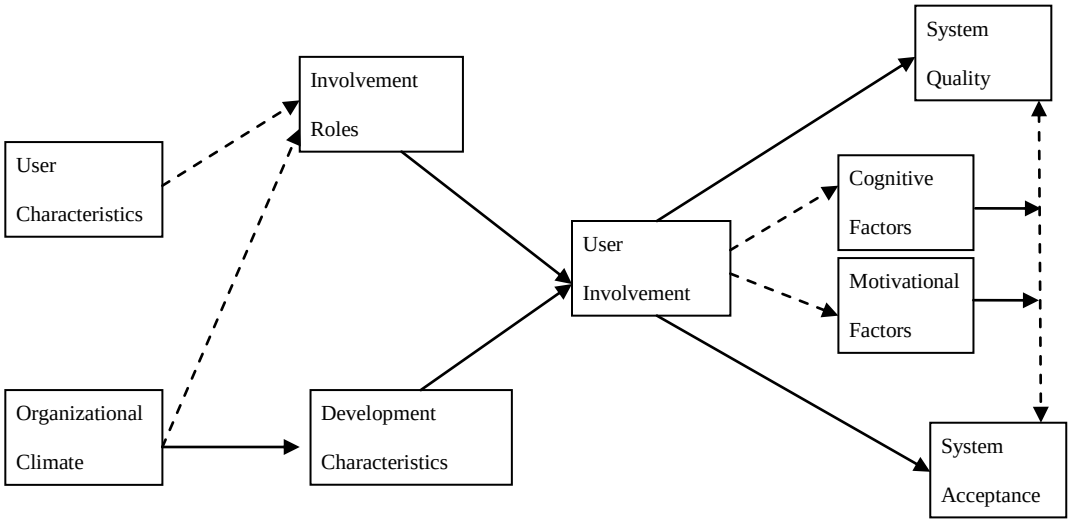

Figure 2 - A Descriptive Model of User Involvement (Ives and Olson 1984)

Ives and Olson propose several facets for the user involvement construct. First, they describe the level of involvement from least to most direct: consultative, representative, and consensus. Consultative involvement happens when the users provide the needs of the system but the decisions are made by the development group. Representative happens when users at all levels are represented in the development group, and finally, consensus occurs when all users are consulted through the development process. Second, they discuss the degree of involvement of the users, which runs from no involvement to complete control. In between,

the involvement can occur by advice, by weak-control (sign off responsibilities), and by doing (user is a team member).

The outcomes of the model represent system quality and system acceptance. Those two variables are mediated by cognitive factors and motivational factors. Cognitive factors refer to improved understanding of the system, system needs, and improved evaluation of system features. The motivational factors that lead to system acceptance are increased ownership, decreased resistance to change, and increased commitment.

In their review of relevant studies, Ives and Olson find that even though there were multiple studies that operationalized user involvement, there is a lack of consensus on these operationalizations. Several studies utilize Likert-type scales for user self-report of their own involvement; others use perceptual measures focusing on specific activities; and still others rate user influence instead of participation. The system success variables (system quality and system acceptance) are equally controversial. The authors define system quality as a set of measures "utilized to determine some aspect of the benefits of a system" (p.591). System acceptance is defined as system use, changes in behavior and attitude, and user satisfaction.

In terms of research strategies, Ives and Olson report that the majority of studies utilize surveys, and those are either multiple or single systems and organizations based. Only two of the included studies are controlled experiments.

The results of their literature review indicate that there is not a common and shared view of user involvement and MIS success. Ives and Olson report that the majority of the studies reviewed have several problems: first, there exists a lack of theory utilized in the literature which leads to weak development of measurement models; second, the methodology used in the literature is singular so that there is no validation of results by different

methodologies; and third, there exists an inconsistency of outcome variables used in the literature. The studies included in the literature review utilized system usage and information satisfaction as outcome measures; however, these measures may not be the most appropriate outcome measures if, for example, the use of the system is non-volitional. All these issues make for a highly varied and non-consensual set of results and measures. For example, only 12 of the 22 included studies used satisfaction as an outcome measure, and of those 12, only 5 found positive significant results between user involvement and satisfaction. The relationship between user involvement and attitudes/behaviors was supported in only 1 of the 7 studies that included the variable. Due to these issues and results, Ives and Olson conclude that there is not strong support for the relationship between user involvement and MIS success. More research that carefully attends to the above issues is needed to further clarify the relationship between user involvement and MIS success.

2.3 DeLone and McLean: The Quest for the Dependent Variable-First Model 1992

In 1992, DeLone and McLean introduced an alternate taxonomy to understand the different dimensions of IS success. According to the authors, the article aims to make IS success research more coherent and to provide a well-defined outcome measure that can be used to evaluate IS practice, policies, and procedures.

DeLone and McLean use the taxonomy developed by Richard Mason (1978), which grew out of Shannon and Weaver's Information Theory (1949). In Shannon and Weaver's Information Theory, the outcome or goal is the successful transmission of information, which can be affected by three possible complications that can be described on three different levels of error: Level A or how accurately can the symbols be transmitted (Technical Level), Level B or how precisely are the symbols depicting the message being transmitted (Semantic

Level), and finally Level C or how effective is the message to attain the desired behavior in the receiver (Effectiveness Level), (Shannon and Weaver 1949). Working out of these three levels of information complications in 1978, Mason presents a framework for measuring the output of an IS. Mason's framework translates two of the levels of Shannon and Weaver's Information Theory to the measurement of the information as an output: Level A, Technical Level, becomes "Production"; Level B, Semantic Level, becomes "Product." The third level, Level C, the "Effectiveness" level, is further divided into three smaller parts: first, how the receiver accepts the message being sent (Receipt); second, how the message affects the individual (Influence on Recipient); and third, how the message influences the system (Influence on System). According to Mason, the technical level output can be measured in terms of bits, characters, physical words, lines, or even data banks. The semantic level can be measured in terms of natural linguistic forms (such as logical words, sentence expression, written messages, texts, and documents) and forms with truth value (such as statements, data records, data files, reports, and queries). Finally, the influence level can be measured in terms of acceptance (i.e. number of items read by the recipient as well as number of items considered relevant, useful, or acceptable), retain-ability, integration (i.e. compare and contrast questions), evaluation, and application of the information obtained. Furthermore, the application of the information received may or may not incite a change in the recipient behavior that may or may not finally affect the system.

Even though Mason's work is largely based on Shannon and Weaver's Information Theory, Mason's framework focuses on the actual output of information instead of in the whole process. Shannon and Weaver's levels of possible communication problems become Mason's specific areas of analysis when looking at an information output. Mason's adapts

Shannon and Weaver's Information Theory and sets the basis for the fundamental terminology for what would be the DeLone and McLean Model of IS Success. In 1992, DeLone and McLean used that framework as a foundation to build up their analysis of the MIS success literature and their own model of IS success.

2.3.1 DLML: MIS Success Taxonomy

Based on Mason's taxonomy, DeLone and McLean propose six different categories or dimensions of IS success: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. With this taxonomy on hand, the authors attempt to identify, categorize, and analyze the success measures, labels used, and the success measure definitions that have been published in seven journals in the IS Field (*Management Science*, *MIS Quarterly*, *Communications of the ACM*, *Decision Sciences*, *Information and Management*, *Journal of MIS*, and the *ICIS Proceedings*) between 1981 and 1988. Their search yields around 180 articles that cover MIS success measures. DeLone and McLean categorize each study and the measures into one of the six categories developed for the taxonomy. The authors do not report results; instead, they provide the type of study performed, a short description, and the type of measurements used in each of the selected studies.

2.3.1.1 System Quality

According to DeLone and McLean, one of the most studied dimensions of IS success is system quality. It refers to measures of the information processing system itself, basically how well the hardware and the software work together. System quality has been operationalized in many different ways in the IS literature, but some of the most relevant are convenience of access, flexibility of system, integration of system, response time (Bailey and

Pearson 1983); reliability, response time, ease of use, ease of learning (Belardo et al. 1982); and perceived usefulness of IS (Franz and Robey 1986). See Table 7 for the complete list reported by DeLone & McLean.

Table 7 - System Quality Measures (DeLone & McLean 1992)

System Quality Measures	
Convenience of access, flexibility of the system, integration of systems, response time	(Bailey and Pearson 1983)
Realization of user expectations	(Barki and Huff 1985)
Reliability, response time, ease of use, ease of learning	(Belardo et al. 1982)
Response time	(Conklin Malcolm and James 1982)
Perceived usefulness of IS	(Franz and Robey 1986)
Usefulness of DSS features	(Goslar 1986)
Usefulness of specific functions	(Hiltz and Turoff 1981)
Resource utilization, investment utilization	(Kriebel and Raviv 1980)
IS sophistication (use of new technology)	(Lehman 1986)
Flexibility of system	(Mahmood 1987)
Stored record error rate	(Morey 1982)
Response time, system reliability, system accessibility	(Srinivasan 1985)

2.3.1.2 Information Quality

According to DeLone and McLean, information quality refers to the quality of the information the system produces. This construct has been operationalized in many different ways. For example, Bailey and Pearson (1983) operationalize information quality by asking if the output of the system is accurate, precise, current, timely, reliable, complete, concise, relevant, and in a preferred format. See Table 8 for a complete list of measures:

2.3.1.3 System Use

DeLone and McLean state that system use has been proposed as a success measure in many IS conceptual models and empirical studies. The construct has been measured as actual (as opposed to reported) use (King and Rodriguez 1978; Lucas Jr 1973; Lucas Jr 1978a;

Swanson 1974), and reported use (Fuerst and Cheney 1982; Maish 1979; Raymond 1985). Another measured facet of use is who is actually using the system: executives (DeLone 1988) or company controllers (Raymond 1985). DeLone and McLean report that use has also been studied at different levels of adoption, for example, Vanlommel and DeBrabander (1975) discuss four levels of use: getting instructions, recording data, control, and planning. See Table 9 for a complete summary of measures.

Table 8 - Information Quality Measures (DeLone & McLean 1992)

Information Quality Measures	
Accuracy, Precision, Currency, Timeliness, Reliability, Completeness, Conciseness, Format, Relevance	(Bailey and Pearson 1983)
Perceived usefulness of specific report items	(Blaylock and Rees 1984)
Perceived importance of each information item	(Jones and McLeod 1986)
Currency, Sufficiency, Understandability, Freedom from bias, Timeliness, Reliability, Relevance to decisions, Comparability, Quantitativeness	(King and Epstein 1983)
Report accuracy, Report timeliness	(Mahmood 1987)
Report usefulness	(Mahmood and Medewitz 1985)
Completeness of information, Accuracy of information, Relevance of reports, Timeliness of reports	(Miller and Doyle 1987)
Usefulness of information	(Rivard and Huff 1984)
Report accuracy, Report relevance, Understandability, Report timeliness.	(Srinivasan 1985)

2.3.1.4 User Satisfaction

According to DeLone and McLean, user satisfaction is one of the most important dependent variables used in measuring the success of the system due to the non-volitional status of the majority of the systems. If the system has to be used as mandated by the company implementing it, use by itself becomes an empty dependent variable. In these cases, user satisfaction becomes the preferred measure of IS success.

Table 9 - System Use Measures (DeLone & McLean 1992)

Information System Use Measures	
Use or nonuse of computer-based decision aids	(Alavi and Henderson 1981)
Use of IS to support production	(Baroudi et al. 1986)
Percentage of time DSS is used in decision making situations	(Barki and Huff 1985)
Use of numerical vs. non-numerical information	(Bell 1984)
Frequency of requests for specific reports	(Bergeron 1986)
Acceptance of report	(Chandrasekaran and Kirs 1986)
Direct use of IS vs. chauffeured use, number of requests for information	(Culnan 1983a)
Frequency of use	(Culnan 1983b)
Use vs. non-use of datasets	(De Brabander and Thiers 1984)
Motivation to use	(DeSanctis 1982)
Frequency of past use, frequency of intended use	(Ein-Dor and Segev 1978)
Number of DSS features used	(Green and Hughes 1986)
Frequency of general use, frequency of specific use	(Fuerst and Cheney 1982)
Number of minutes, number of sessions, number of functions used	(Ginzberg 1981)
Frequency of voluntary use	(Hogue 1987)
Expenditures/charges for computing use	(Gremillion 1984)
Frequency of use, voluntariness of use	(Kim and Lee 1986)
Number of queries, nature of queries	(King and Rodriguez 1978)
Extent of use	(Mahmood and Medewitz 1985; Nelson and Cheney 1987)
Frequency of use, regularity of use	(Raymond 1985)
Hours per week	(Snitkin and King 1986)
Frequency of use, time per computer session, number of reports generated.	(Srinivasan 1985)
Average frequency with which user discussed report information	(Swanson 1987)
Use in support of cost reduction, management, strategy planning, and competitive thrust	(Zmud et al. 1987)

The variable has been operationalized in multiple different ways and scenarios. The variable has been measured as a single item (Ginzberg 1981; Lucas Jr 1981) or as a multiple item construct (Bailey and Pearson 1983; Ives et al. 1983; Kriebel 1979; Swanson 1974). DeLone and McLean claim that user satisfaction is probably one of the most widely used

measures of IS success because of its face validity and the development of multiple measurement tools that have been thoughtfully validated. See Table 10 for a summary of the measures evaluated by DeLone and McLean.

Table 10 - User Satisfaction Measures (DeLone & McLean 1992)

User Satisfaction Measures	
Overall satisfaction with DSS	(Alavi and Henderson 1981)
User satisfaction (39 item instrument)	(Bailey and Pearson 1983)
User information satisfaction	(Barki and Huff 1985; Baroudi et al. 1986)
User satisfaction	(Bruwer 1984; Mahmood and Becker 1985)
Satisfaction with DSS (multi-item scale)	(Cats-Baril and Huber 1987)
Top management satisfaction, personal management satisfaction	(DeSanctis 1982)
User satisfaction (11 item scale)	(Doll and Ahmed 1985)
User satisfaction (1 question)	(Edmundson and Jeffery 1984; Hogue 1987; King and Epstein 1983; Lángle et al. 1984),
Overall satisfaction	(Ginzberg 1981; Mahmood 1987),
User satisfaction (Bailey & Pearson instrument)	(Ives et al. 1983; Nelson and Cheney 1987; Raymond 1987)
User satisfaction (25 item instrument)	(Jenkins Justus and Milton 1984)
Software and hardware satisfaction	(Lehman 1986)
Enjoyment, satisfaction	(Lucas Jr 1981)
User satisfaction (multi item scale)	(Mahmood and Medewitz 1985)
Satisfaction with the development project (Powers and Dickinson instrument)	(McKeen 1983)
Information satisfaction/dissatisfaction difference between information needed and amount of information received	(Olson and Ives 1981; Olson and Ives 1982)
Controller satisfaction (modified Bailey and Pearson instrument)	(Raymond 1985)
User complaints regarding Information Center Services	(Rivard and Huff 1984)
Overall user satisfaction	(Rushinek and Rushinek 1986; Rushinek Sara 1985)
Overall satisfaction, decision making satisfaction	(Sanders and Courtney 1985; Sanders et al. 1984)
User satisfaction with interface	(Taylor and Wang 1987)

2.3.1.5 Individual Impact

In their review of IS success literature, DeLone and McLean state that user satisfaction is one of the measures more widely used when studying IS success mainly because individual

impact per se is the most ambiguous to define. The authors describe how individual impact becomes a general term used to reflect how the information received affects the user, for example: a behavioral change (Mason 1978), individual learning (Lucas Jr and Nielsen 1980), understanding of a problem and test scores related to the problem (Lucas Jr 1981), information recall (Watson and Driver 1983), decision effectiveness in terms of average time (Benbasat and Dexter 1979; Benbasat and Schroeder 1977), or confidence on the decision made (Chervany and Dickson 1974; Taylor 1975). See Table 11 for a complete list of reported measures of individual impact.

2.3.1.6 Organizational Impact

According to DeLone and McLean, organizational impact does not have a clear and defined measurement variable. The measures can be grouped into three different areas: studies that use profit, studies that use productivity, and studies that use cost/benefit analysis. From these three areas, studies select one or more measures to operationalize organizational impact. For example, Benbasat and Dexter (1985; 1986) have used profit and profit performance to measure organizational impact. Miller (1987) and Rivard (1984) both utilize a cost-benefit analysis to study the success of the IS. Edelman (Edelman 1981) utilizes productivity as his outcome, and an overall organizational effectiveness is the selected outcome for Millman (Millman and Hartwick 1987). Basically, organizational impact variables have been given the task to measure how information affects the overall performance, cut or lower costing, productivity gains, problem resolution, company revenues, sales and return on investment, and cost benefit analysis. See Table 12 for a complete list of individual impact measures as gathered by DeLone and McLean (1992)

Table 11 - Individual Impact Measures (DeLone & McLean 1992)

Individual Impact Measures	
User confidence, quality of decision analysis	(Aldag and Power 1986)
Efficient decisions, time to arrive at a decision	(Belardo et al. 1982)
Time take to complete a task	(Benbasat and Dexter 1985; Benbasat and Dexter 1986)
Time to make pricing decisions	(Benbasat et al. 1981)
Extent to which users analyze charges and investigate budget variances	(Bergeron 1986)
Quality of career plans, number of objectives and alternatives generated	(Cats-Baril and Huber 1987)
Improved personal productivity	(Crawford Jr 1982)
Time efficiency of task accomplishment, user adherence to plan	(De Brabander and Thiers 1984)
Decision Quality, forecast accuracy	(DeSanctis and Jarvenpaa 1985)
Interpretation accuracy, decision quality	(Dickson et al. 1986)
Computer awareness, cost awareness	(Drury 1982)
Change in decision behavior	(Ein-Dor et al. 1981)
Value in assisting decision making	(Fuerst and Cheney 1982)
Number of alternatives considered, time to decision, confidence in decision, ability to identify solutions	(Goslar 1986)
Ability to identify strategic opportunities or problems	(Goul et al. 1986)
Time to decision, number of alternatives considered, amount of data considered	(Green and Hughes 1986)
Precision of decision maker's forecast	(Grudnitski 1981)
Task performance, confidence in performance	(Guental et al. 1984)
Dollar value of information	(Hilton and Swieringa 1982)
Time to reach decision, number of alternatives considered	(Hughes 1987)
Management takes investigative action	(Judd et al. 1981)
Ability to forecast firm performance	(Kasper 1985)
Worth of information system, quality of policy decisions	(King and Rodriguez 1981)
Accuracy of information interpretation, time to solve problem.	(Lee et al. 1986)
User understanding of inventory problem	(Lucas Jr 1981)
Power and influence of IS department	(Lucas Jr and Palley 1987)
Time to solve problem, accuracy of problem solution, and efficiency of effort	(Luzi and Mackenzie 1982)
Effectiveness in supporting decisions, time savings	(Meador et al. 1984)
Personal effectiveness	(Millman and Hartwick 1987)
User productivity	(Rivard and Huff 1984)
Productivity improvement	(Rivard and Huff 1985)
Decision making effectiveness and efficiency	(Sanders and Courtney 1985)
Effectiveness of personal DSS	(Snitkin and King 1986)
Problem identification and generation of alternatives	(Srinivasan 1985)
Change in commitment of time and money	(Vogel et al.)
Immediate/delayed recall of information	(Watson and Driver 1983)
Recognition and use of modern software practices	(Zmud 1983)
Decision accuracy and confidence	(Zmud et al. 1983)

2.3.1.6 Organizational Impact

According to DeLone and McLean, organizational impact does not have a clear and defined measurement variable. The measures can be grouped into three different areas: studies that use profit, studies that use productivity, and studies that use cost/benefit analysis. From these three areas, studies select one or more measures to operationalize organizational impact. For example, Benbasat and Dexter (1985; 1986) have used profit and profit performance to measure organizational impact. Miller (1987) and Rivard (1984) both utilize a cost-benefit analysis to study the success of the IS. Edelman (Edelman 1981) utilizes productivity as his outcome, and an overall organizational effectiveness is the selected outcome for Millman (Millman and Hartwick 1987). Basically, organizational impact variables have been given the task to measure how information affects the overall performance, cut or lower costing, productivity gains, problem resolution, company revenues, sales and return on investment, and cost benefit analysis. See Table 12 for a complete list of reported measures.

According to DeLone and McLean (1992), after reviewing the IS success literature, there are four areas or concern: first, there is a long list of different dependent variables used in the studies. There seems to be a lack of consensus in the IS success literature when measuring the success dependent variable. Second, since the list of variables utilized in the studies is so large and varied, comparisons cannot be made between research results in different studies. Third, the organizational impact of the information systems seems largely understudied. Even though there have been strong efforts to create an organizational measure of success, the research is still in its infancy and more development is needed. Fourth, the IS success taxonomy developed in their review is composed of six dimensions that should be

studied completely, not partially. Many studies have looked at relationships between two or three dimensions of IS success; none of the studies include an empirical investigation of all six dimensions of the IS success construct.

Table 12 - Organizational Impact Measures (DeLone & McLean 1992)

Organizational Impact Measures	
Profit performance	(Benbasat and Dexter 1985; Benbasat and Dexter 1986)
Profit	(Benbasat et al. 1981)
Ratio of total general expense to total premium income	(Bender 1986)
Pretax return on assets, return on net worth, pretax profits, average 5 year sales growth	(Cron Marion and William 1983)
Overall manager productivity (cost of information per employee)	(Edelman 1981)
Profitability	(Ein-Dor et al. 1981)
Number of computer applications	(Lincoln 1986)
Inventory Ordering costs	(Lucas Jr 1981)
Overall cost-effectiveness of IS	(Miller and Doyle 1987)
Organizational effectiveness	(Millman and Hartwick 1987)
IS contribution to meeting goals	(Perry 1983)
Production scheduling costs	(Remus 1984)
Cost reduction, profit contribution	(Rivard and Huff 1984)
Net income relative to total operating expenses	(Turner 1982)
Return on investment of stock portfolio	(Vasarhelyi 1981)
Profits per net assets	(Yap and Walsham 1986)

Focusing on the work of Steers (1979) and Miles (1980) that describe organizational effectiveness as continuous process rather than an outcome (Steers 1979) and where the constructs involved in this effectiveness hold a dependency relationship among each other to complete the effectiveness process (Miles 1980), DeLone and McLean propose a Model of IS Success that "recognizes success as a process construct which must include both temporal and causal influences in determining IS Success" (DeLone and McLean 1992)

2.3.2 The DeLone and McLean Model of IS Success

The IS Success Model created by DeLone and McLean incorporates the six different dimensions of IS success that the authors identified in their extensive review of the literature. The authors implement a model in which the dimensions share a dependent relationship (i.e. the system has to be used in order to be satisfactory) as well as temporal and causal relationships. According to the authors, system quality and information quality both affect use and user satisfaction, both being antecedents of individual impact, and this individual impact should ultimately affect the organizational impact. See Figure 3 for complete model.

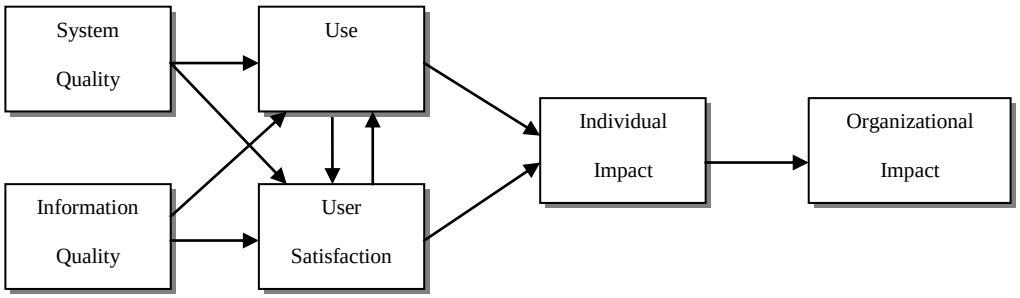

Figure 3 - DeLone and McLean IS Success Model (1992)

In the proposed model, system quality refers to technical level measures such as reliability of the computer system, online response time, ease of use, response time, and system accuracy. Information quality targets the meaning level of the IS output in terms of accuracy, timeliness, relevance, accessibility, and adaptability. Use is measured as reported by the users (i.e. "System Use") or the actual use as reported by the system in terms of queries by time, connect time, or number of computer functions utilized. User satisfaction refers to measures of how the information affects the user. Individual impact deals with how the information system modifies the user's experience with the system. Finally, organizational

impact contains measures about how the system and the information provided influence the organization.

The authors emphasize that the model should be studied as a whole: "a measurement instrument of overall success, based on items arbitrarily selected from the six IS categories, is likely to be problematic" (DeLone and McLean 1992). DeLone and McLean do not offer a study to validate the model; instead, they strongly appeal to IS researchers to utilize and test it in their studies to validate and further develop the model. Their request has been accepted and appropriated. According to DeLone and McLean, after the publication of the DLML IS Success Model, and until the publication of the 10-year update, more than 280 articles in journals and proceedings cited or referenced the model.

2.4 DeLone and McLean: The 10 year Update - DLML 2003

After the publication of the DLML model and following the authors' request for validation and extension of the model, IS researchers utilized the model in a myriad of IS environments, such as knowledge management, decision support systems, and accounting IS. According to the authors, the model was used both in its entirety and, against the authors' wishes, only partially where only some of the relationships between the IS success dimensions were studied. The authors identify only two studies, both at the individual level, that attempt to validate the model as a whole: Seddon and Kiev (1994) and Rai et al. (2002). The first validation test (Seddon and Kiew 1994a) finds that system quality and information quality both have significant relationships with user satisfaction and individual impact. At the same time, user satisfaction also has a significant relationship with individual impact. Rai et al. (2002), in their attempt to validate the DeLone and McLean Model, perform a complete model test. Their findings are two-fold. They find that while some of the goodness-of-fit

measures were not at the required limits, all the relationships between IS Success dimensions were significant.

In terms of individual relationships between dimensions of the IS Success Model, DeLone and McLean report that 7 different studies find a positive relationship between system use and individual impact (Goodhue and Thompson 1995; Guimaraes and Igbaria 1997; Igbaria and Tan 1997; Teng and Calhoun 1996; Torkzadeh and Doll 1999; Weill and Vitale 1999; Yuthas and Young 1998). The relationship between system quality and individual impact is also supported as a result of 5 of the studies reviewed by DeLone and McLean (Etezadi-Amoli and Farhoomand 1996; Goodhue and Thompson 1995; Seddon and Kiew 1994a; Teo and Wong 1998; Wixom and Watson 2001). The relationship between information quality and individual impacts is studied in four of the articles reviewed by DeLone and McLean (Etezadi-Amoli and Farhoomand 1996; Seddon and Kiew 1994a; Teo and Wong 1998; Wixom and Watson 2001). All four articles support the significance of the relationship. Overall, 36 out of the 38 articles included in DeLone and McLean's review provide support for the model and the internal relationships between the 6 dimensions of the IS Success Model.

However, not all researchers agree with the model completely, and this work offers criticism of the model. Seddon (1997) argues that the model contains both process and variance variables which make the possible results confusing to describe, evaluate, and understand. Pitt et al. (1995) suggest that due to the increasing importance of the relationship of the user with the IT departments (as opposed to the IT applications) a service quality construct needs to be added to the model. Another criticism of the model is the fact that only individual benefits and organizational benefits are included in it (Myers et al. 1997) so that

benefits related to other levels of analysis, such as industry or even society, do not have a place in the model (Peter et al. 1999).

After ten years of validation attempts and criticism, the 1992 DLML Model of IS Success received an update. The 2003 DLMC IS Success Model includes two important modifications and a clarification: first, the updated model includes the service quality dimension to the model acknowledging the critique of Pitt et al. (1995), and second, accepting Seddon's (1997) suggestion, the authors group both impact measures (individual impact and organizational impact) into a single measure called net benefits. Making this modification increases the scope of the model such as other impacts (such as the market, industry, or society) can be measured with the model if necessary. Finally, the authors clarify that, in a process sense, use should happen before user satisfaction, but in a causal sense, a positive experience with the use of the system will increase the satisfaction of the user. Furthermore, an increased user satisfaction will increase the intention to use which ultimately will increase use (DeLone and McLean 2003).

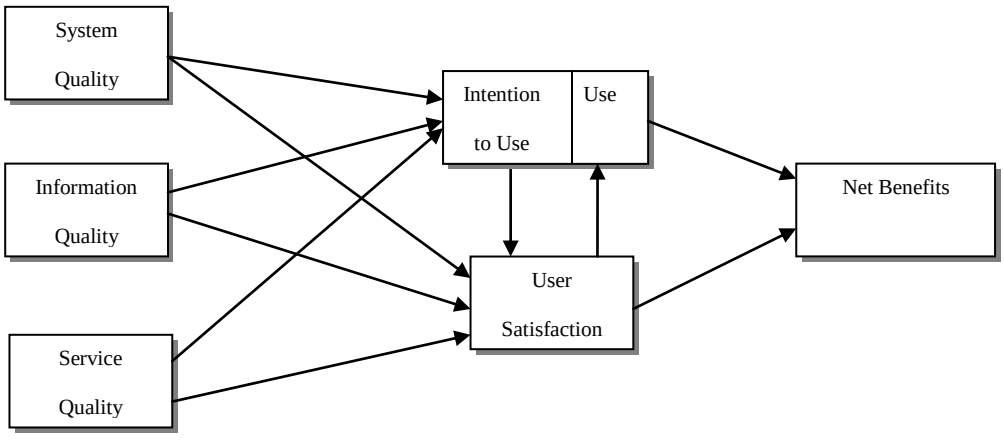

Figure 4 - Updated DeLone and McLean Model 2003

In the "10 Year Update," using previous research and willing to provide a deeper insight in each of the dimensions of the model, DeLone and McLean provide a more detailed description of each one of the shades or dimension of IS success included in the model. According to the authors, system quality refers to those characteristics that are needed or desired in an IS. Some of the measurement examples that the authors provide are ease of use, system flexibility, system reliability, ease of learning, intuitiveness, sophistication, and response times. The second dimension of IS Success is information quality. Information quality represents the output of the system in terms of how relevant, understandable, accurate, concise, complete, timely, and useable is the output produced. The third dimension of IS success—the new one added to the model—is service quality. According to DeLone and McLean, and in the general context of Information Systems, this new dimension refers to the support that the users of the system receive from their IT area personnel (i.e. responsiveness and knowledge). In the center of the model, we find two more dimensions system use and satisfaction. To avoid the process/casual and volitional/mandatory conflict brought up by Seddon (1997), the authors propose to measure this dimension utilizing intent to use, as an attitude, instead of simply use, as a behavior. However, they caution researchers that matching attitude and behavior as would be necessary for the model to work as presented could be a difficult task so they still recommend utilizing use as their selected measure. System use, then, is defined as the quantity and manner of utilization of the system. In terms of operationalization, system use is measured as the amount, frequency, nature, extent, and purpose of the use. User satisfaction captures how the user feels about the whole experience with the system starting from the system itself, moving to the output as an outcome of the system, and finally including the support services that are provided by the system. Finally, net

benefits covers how much the IS adds to the success of the individual, group, organization, industry, or even nations (Petter et al. 2008).

With this update, the authors propose that the model leads itself to be used not only in already existing IS but also in new and developing systems. Especially, the authors open the dialog to utilize the model as a success measure for E-commerce systems. The authors observe that the "old" DLML IS Success Model has already been used to measure success in the E-commerce area. Studies such as Molla and Licker (2001), D'Ambra and Rice (2001), Palmer (2002a), and Teo & Choo (2001) have attempted to measure IS success by operationalizing its six dimensions in the E-commerce field.

The authors provide definitions for each one of the stated dimensions of the IS success model. According to the authors, system quality in the E-commerce world "measures the desired characteristics of an e-commerce system: usability, availability, reliability, adaptability, and response time" (DeLone and McLean 2002) . Information quality refers to the content offered in the E-commerce environment. The content offered should be "personalized, complete, relevant, easy to understand, and secure" (DeLone and McLean 2002). Service quality should cover the support that the service provider offers to the customer regardless of what business unit provides it before, during, and after the E-commerce exchange. Usage refers to any type of interaction that customers, visitors, or browsers have with the E-commerce site. User satisfaction measures the customers' opinions of the E-commerce system during the complete service cycle. Finally, net benefits attempts to measure the impact of the system on "customers, suppliers, employees, organizations, markets, industries, economics, and even our societies (DeLone and McLean 2002)."

2.3 Measuring e-Commerce Success: Case Studies

Just a year later, in 2004, DeLone and McLean publish a second article as a follow up to their updated model. This article picks up and builds upon their attempt to apply the 2003 updated model to the area of E-commerce. The article further explores each one of the dimensions of IS success, how it has been studied in the previous literature, and how they would apply their model to two specific case examples. (DeLone and McLean 2004)

The authors claim that an E-commerce system is different from other types of systems implemented in an organization because its use is volitional instead of mandatory. The most possible user of an E-commerce system is also the customer; hence, slow systems, difficult systems, and systems that take a long time to get used to are problematic and can discourage usage. Of course, without usage, net benefits would not occur. For this reason, system quality becomes an important and expected dimension of IS success. New measures utilized in the E-commerce environment are customization, ease of navigation, privacy, and security (Molla and Licker 2001; Palmer 2002a). From these new measures, it is especially important to notice the security measure. Since the interaction between customer and organization is done through the Internet, being able to secure transactional data and customer information becomes one of the most important features of the E-commerce system.

In terms of information quality, the E-commerce system has to be able to reduce the level of uncertainty of the customer. Since the interaction between customer and organization is done through the Internet, in the majority of cases, there are not physical links between the two entities. The customer has to believe what the E-commerce system is presenting. To reduce the customer's uncertainty, historical measures of information quality speak of accuracy of the information, relevance, understandability, completeness, and currency (Molla

and Licker 2001). New measures based on the E-commerce environment bring up the possibility of information personalization and dynamic content (Parsons et al. 1998), (Barua et al. 2000).

Service quality in the E-commerce environment reflects the organizational support given to the customer (the E-commerce system user) before, during, and after the exchange cycle. Measures of responsiveness, assurance, and empathy with the customer have been used to operationalized service quality (Liu and Arnett 2000). Service quality refers to any contact directly or non-directly related to a service or purchase that the organization offers the customers to help make their experience better. Service can include answering questions, solving problems, offering information about business processes—such as delivery or refunds—or E-commerce policies such as ethics, privacy, and security issues.

In the E-commerce environment, system use refers to any interaction between the user and the organization's system. It is not necessary to have a complete transaction to measure the use of the system. In the E-commerce environment, browsing the system, visiting the system, or even not completing a purchase is important; these behaviors give the organization data points to analyze the popularity of their products, the demographics of their visitors, or even their usage time preferences. Again, any interaction with the system is an important metric that can be captured for the organization's benefit. Measures that have been previously used in the E-commerce literature are of two types: nature of the interaction and amount of the interaction. The nature of the interaction measures refer to a variety of elements, for example: customer information search, receiving customer orders, accepting customer payments, service requests, purchase orders, and payments to vendors (Young and Benamati

2000). In terms of the amount of use, researchers have used number of visits, length of stay, and the number of purchases completed (D'Ambra and Rice 2001; Molla and Licker 2001).

According to DeLone and McLean, viewing the model as a process model first and recognizing that e-commerce use is mainly volitional, system use may lead to user satisfaction. As such, user satisfaction refers to the impact, feeling, or reaction that the user gets when he or she is interacting or has interacted with an E-commerce system. The process here is clear. If a customer does not utilize the system, he or she cannot be satisfied or dissatisfied. There has to be an interaction with the system to actually form a "feeling" towards the system. This is clearly at the individual level and speaking of the customer as the user of the system. User satisfaction in the E-commerce environment seems to be a measure that refers more to an individual level than an organizational level. Moreover, since customer satisfaction is such an individual level measurement and it depends so much on customer attitudes and individual differences, Reichheld and Schefter propose E-loyalty as a surrogate measure of customer satisfaction (Reichheld and Schefter 2000).

Finally, net benefits in the E-commerce environment can be positioned depending on the level of study. We can study net benefits at the individual level, where the customer can benefit from the system in terms of increased information, lower prices, ease of purchase, etc. We can study net benefits at the organizational level, where basic organizational measures such as growth in customer base, sales, profit, market share, or productivity (Barua et al. 2001; Griffith and Krampf 1998; Peppers and Rogers 1997; Teo and Too 2000) can be paired with E-commerce organizational measures such as global reach, stickiness, brand awareness, customer acquisition, and click to buy ratio (Demers and Lev 2001; Gonsalves et al. 1999; Parthasarathy and Bhattacherjee 1998).

As they did after the creation of the first model, DeLone and McLean call for researchers to utilize the new model in their studies. They provide two examples for how the model could be easily adapted to measure two different retailers in the E-commerce environment: a bookseller and an electronics store. The examples are adaptations of the model to the specific environments without any data collection or analysis, just the specifications. With these two examples, the authors want to demonstrate how the Updated DLML Model can be successfully transferred to an E-commerce environment. The dimensions offered are comprehensive enough and parsimonious enough to study success in the E-commerce environment with the existing success item measurements.

2.4 Validations and Meta-analyses.

Since its inception in 1992, the model has received criticism, validation, an update, and many new applications. It has also been used as the foundation for comprehensive literature reviews. Many researchers have compiled articles that use the DeLone and McLean Model of IS Success as the basis for their analysis, in order to be able to provide a snapshot of the status of the model. Unfortunately, compiling and matching measures and relationship results is not an easy task. Many of the studies that use the DeLone and McLean model focus on parts of the model instead of the complete model. For example, Seddon and Kiew tested the model partially, and their results provide support for the relationships between information quality, system quality, and user satisfaction (Seddon and Kiew 1996). Another study also found support for these relationships but did not find support for information quality, system quality and use (Roldán and Millán 2000) . The relationship between user satisfaction and use is studied by Baroudi, Olson, and Ives in 1996. They find that user satisfaction influences use. This relationship is also supported in Igbaria and Tan (1997) and Fraser and Salter (1995).

However, they do not find enough support for the reverse relationship (use influences user satisfaction) (Baroudi et al. 1986). See Table 13 for a summary of positive significant relationships found in McGill's study (1995)

Table 13 - Positive Relationships and References (McGill 1995)

Positive Relationship	Reference
System Quality → User Satisfaction	(Rivard et al. 1997; Roldán and Millán 2000; Seddon and Kiew 1996)
Information Quality → User Satisfaction	(Roldán and Millán 2000; Seddon and Kiew 1996)
User Satisfaction → Use	(Baroudi et al. 1986; Fraser and Salter 1995; Igbaria and Tan 1997)
Use → Individual Impact	(Igbaria and Tan 1997; Snitkin and King 1986)
User Satisfaction → Individual Impact	(Etezadi-Amoli and Farhoomand 1996; Gatian 1994; Gelderman 1998; Igbaria and Tan 1997; Roldán and Millán 2000)
Individual Impact → Organizational Impact	(Kasper 1985; Millman and Hartwick 1987; Roldán and Millán 2000)

Apart from the difficulty of achieving some consensus about the model when only partial relationships are being studied, another difficulty arises: the studies seldom utilize the same measures to operationalize the different dimensions of IS success. For this reason, some studies attempt to validate the complete model by comparing it with an alternate model. Out of those studies that have tried to validate the complete model, it is important to mention Rai's (2002), McGill's (2003), and Sedera's (2004) studies. Rai's study attempts to "empirically and theoretically assess DeLone and McLean's (1992) and Seddon's (1997) models of information systems" (2002). The study utilizes data gathered in the form of a survey about a single information system in quasi-voluntary use. The main difference between Seddon's model and DeLone and McLean's model is the placement of IS use. In Seddon's model, use precedes impacts and benefits, but it does not cause them. There is a temporal relationship but

not a causal relationship between those constructs (Seddon 1997). Results in Rai's study are twofold. First, they present substantial evidence to prove that all paths studied are significant in both models, and second, both models receive mixed results in the goodness-of-fit of the structural model tests. When comparing the mixed results, the DeLone and McLean model provides better results than the model proposed by Seddon

McGill's study (2003) applies the DeLone and McLean model to the study of User Developed Applications. Unfortunately, and contrary to Rai's study, in McGill's study, only four of the relationships between the different dimensions of IS success are found significant: Information Quality → User Satisfaction, System Quality → User Satisfaction, User Satisfaction → Intended Use, and User Satisfaction → Individual impact. The rest of the relationships were found non-significant. This paradox is repeated throughout other studies that attempted to validate the model; some studies found significance where others did not (Au et al. 2002; Grover et al. 1996; Zviran and Elrich 2003).

Sedera and Gable import the DLML model of IS success into the enterprise systems environment. In their study, the six dimensions of IS success are systematically analyzed in 5 different models, ranging from a first order model with all indicators loading on a single construct to a full model with the six dimensions stated in the model. To support their results, the authors conduct a specification survey and a confirmatory survey. The data is then analyzed as in a split-sample where the results are validated if the data from the confirmatory survey replicates the results received from the data from the first specification survey. As expected, after benchmarking the full DLML model against different specifications of success models, the authors state that the full DLML model provides the best fit for analyzing enterprise systems success (Sedera et al. 2004).

Several meta-analyses have been conducted to test the IS Success Model completely or partially. Bokhari (2005) attempts to "better understand and explain the nature and strength of the relationship between system usage and user satisfaction…and to validate this relationship empirically as defined in DeLone and McLean's IS success model." Sabherwal (2006) utilizes a modified version of Seddon's model, which is based on the DeLone and McLean Model of IS Success, to test the relationships between the IS success factors, four user-related constructs (user experience, user training, user attitude, and user participation in development), and two constructs representing the context (top-management support and facilitating conditions). In the study, the authors collect data from 121 different studies that report suitable results for any of the relationships between the selected IS success dimensions (user satisfaction, system use, perceived usefulness, and system quality) and user and context constructs. Sabherwal tests find significant paths between all dimensions of the IS Success Model, with strong support for the user factors and the context factors.

More recently, two meta-analyses attempt to cover all published literature that utilizes the DLMC model to provide an overall picture of the state of the model. These two meta-analyses, one qualitative (Petter et al. 2008) and the other quantitative (Petter and McLean 2009), are the most up-to-date attempts to evaluate the state of the DLML model. The quantitative meta-analysis studies the strengths of the relationships that make up the IS Success Model. The authors propose fourteen hypotheses that closely follow the Updated DLML Model of IS Success. To gather the pertinent literature, the authors perform multiple full-text database searches for papers published from 1992 to mid-2007. Studies that are not included in the meta-analysis are those in which (a) the paper is purely theoretical or just a literature review, (b) does not have quantitative data to report, (c) does not cover any of the

authors' proposed hypotheses, or (d) does not provide sufficient data to perform the meta-analysis (Petter and McLean 2009). It is very important to notice that the study does not include any measures of IS success at the organizational level. The authors concentrate on the individual level of analysis after realizing that most studies included in the literature examined the hypothesis at the individual level of analysis. Results of the meta-analysis show support for the majority of the hypotheses implied in the Updated DLML model. Interestingly enough, only the service quality construct was found to be unsupported or not measurable among the relationships. The relationship between service quality and intention to use was not measured due to insufficient data. Not enough studies have been conducted that include measures of service quality and intention to use; hence, the meta-analysis could not come out with an appropriate measure for the aggregated studies. The other two service quality relationships included in the meta-analysis (Service Quality → Use and Service Quality → Satisfaction) are not supported.

The qualitative review of literature conducted by Petter et al. (2008) covers empirical research, both qualitative and quantitative, published from 1992 to mid-2007 in IS-discipline-related journals. This review of literature builds on and improves the previous one at two different levels. First, it includes qualitative studies, and second, it considers the DLML model at two different levels of analysis: individual and organizational. As such, it divides the literature review and the results of the analysis into these two levels. In this analysis, the authors conduct a qualitative literature review following the steps stated by Olivier (1987). By using this methodology, the researchers are able to analyze both qualitative and quantitative findings to form an accurate picture of the current state of the field in terms of IS success and the DeLone and McLean model. To gather the pertinent studies, as in the previous study, the

researchers first conduct multiple database searches covering well known journals of the IS field. Second, references are triangulated with reference lists of papers and websites that cover the history of IS success models (DeLone and McLean 2003; Grover et al. 2003). The results of the analysis are summarized in the following two figures: Figure 5 depicts the DLML model with the different levels of support found for the relationships at the individual level of analysis. Figure 6 depicts the same model at the organizational level of analysis.

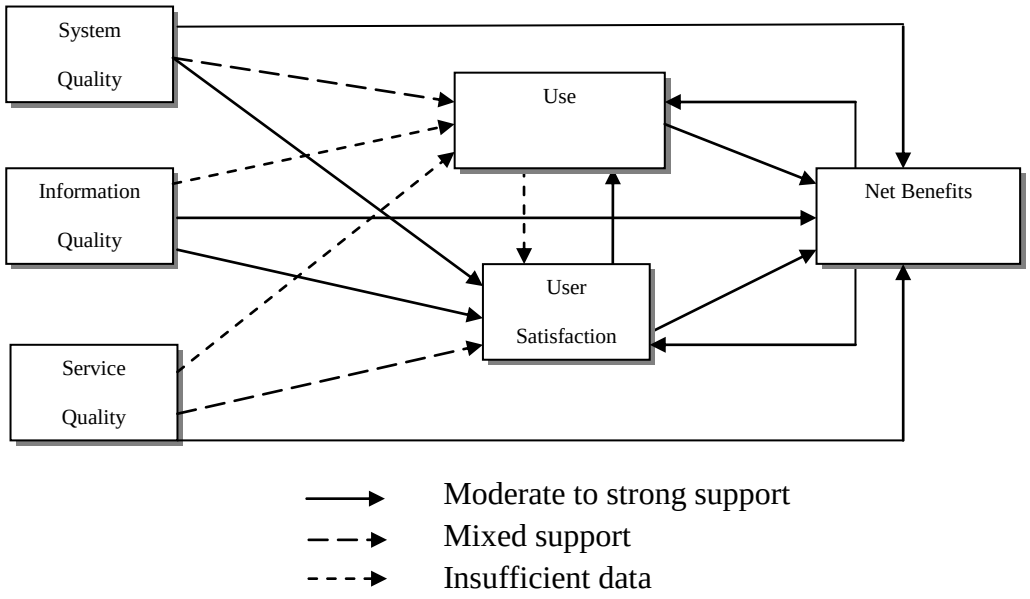

Figure 5 – Relationship support at the Individual level of analysis (Petter et al. 2008)

At the individual level of analysis, the study finds significant results for all the relationships in the model except for System Quality →Use and Service Quality → User satisfaction, which includes many studies with different and non-comprehensive results. The authors give these types of results a "mixed support" label. Unfortunately, at this level, there is still insufficient data to accurately study the Information Quality → Use relationship and the Service Quality → Use relationship. At the individual level of analysis, these two

relationships have not been studied enough in the reviewed literature to be included in the critical analysis of the literature.

The results of the critical review of the literature are very much different when the data is categorized at the organizational level of analysis. According to the authors, at the organizational level of analysis, the study finds only one relationship with interesting results. See Table 14 for a summary of empirical studies at the organizational level of analysis.

Only the relationships between use and net benefits and system quality and net benefits appear to have moderate support. The relationship between system quality and net benefits is the only one that has moderate to strong support in the critical review of literature. One other relationship in the model has mixed support, which according to the authors, means that in some studies the relationship is supported whereas in other studies the relationship is not supported. The relationship with mixed support is System Quality → Use. The rest of the relationships that are included in the DeLone and McLean Model of IS Support cannot be analyzed at the organizational level of analysis due to insufficient data. There are simply not enough studies that cover all the relationships at the organizational level of analysis.

The results of the meta-analysis and critical review of the literature seem to corroborate the results of previous studies. Comparing the results of this meta-analysis to Sabherwal's (2006), both confirm the relationships between system quality and use, user satisfaction, and net benefits. However, the results differ in terms of the relationship between user satisfaction and use. While this meta-analysis finds support for the relationship, Sabherwal's study does not. In any case, one of the most important insights from this study is not the analysis of the specific relationships; instead, it is important to notice what is not there. There are just not enough studies that analyze the data at the organizational level of

analysis. Hence, there cannot be a consensus in terms of measures, relationships, or overall fit of the model at the organizational level of analysis.

Table 14 - Empirical Studies at the Organizational Level of Analysis (Petter et al 2008)

Relationship	Empirical Studies	Study Result	Conclusion
System Quality → Use	(Fitzgerald and Russo 2005) (Caldeira and Ward 2002) (Weill and Vitale 1999) (Premkumar et al. 1994) (Gefen 2000) (Gill 1995)	+ + - Mixed Not Supported Not Supported	Mixed support
System Quality → User Satisfaction	(Scheepers et al. 2006) (Benard and Satir 1993) (Premkumar et al. 1994)	+ + Not Supported	Insufficient data
System Quality → Net Benefits	(Wixom and Watson 2001) (Gefen 2000) (Weill and Vitale 1999) (Farhoomand and Drury 1996) (Bradley et al. 2006)	+ + + + Mixed Support	Moderate Support
Information Quality → Use	(Fitzgerald and Russo 2005)	+	Insufficient data
Information Quality →User Satisfaction	(Scheepers et al. 2006) (Coombs et al. 2001) (Teo and Wong 1998)	+ + +	Insufficient data
Information Quality → Net Benefits	(Wixom and Watson 2001) (Teo and Wong 1998) (Farhoomand and Drury 1996) (Bradley et al. 2006)	+ + + Mixed Support	Insufficient data
Service Quality → Use	(Fitzgerald and Russo 2005) (Caldeira and Ward 2002) (Gill 1995)	+ + +	Insufficient data
Service Quality → User Satisfaction	(Coombs et al. 2001) (Thong et al. 1994) (Thong et al. 1996) (Benard and Satir 1993)	+ + + Not Supported	Insufficient data
Service Quality → Net Benefits	(Gefen 2000) (Thong et al. 1994) (Thong et al. 1996)]	+ + +	Insufficient data
Use → User Satisfaction	(Gelderman 1998)	Mixed	Insufficient data
Use → Net Benefits	(Leclercq 2007) (Zhu and Kraemer 2005) (Devaraj and Kohli 2003) (Teng and Calhoun 1996) (Belcher and Watson 1993) (Gelderman 1998)	+ + + + + Not Supported	Moderate Support
User Satisfaction → Use	No studies		Insufficient data
User Satisfaction → Net Benefits	(Gelderman 1998) (Law and Ngai 2007)	+ +	Insufficient data
Net Benefits → Use	(Gefen 2000) (Gill 1995) (Belcher and Watson 1993) (Premkumar et al. 1994)	+ + + Mixed	Insufficient data
Net Benefits → User Satisfaction	(Jones and Beatty 2001) (Teo and Wong 1998) (Premkumar et al. 1994)	Mixed Mixed Mixed	Insufficient data

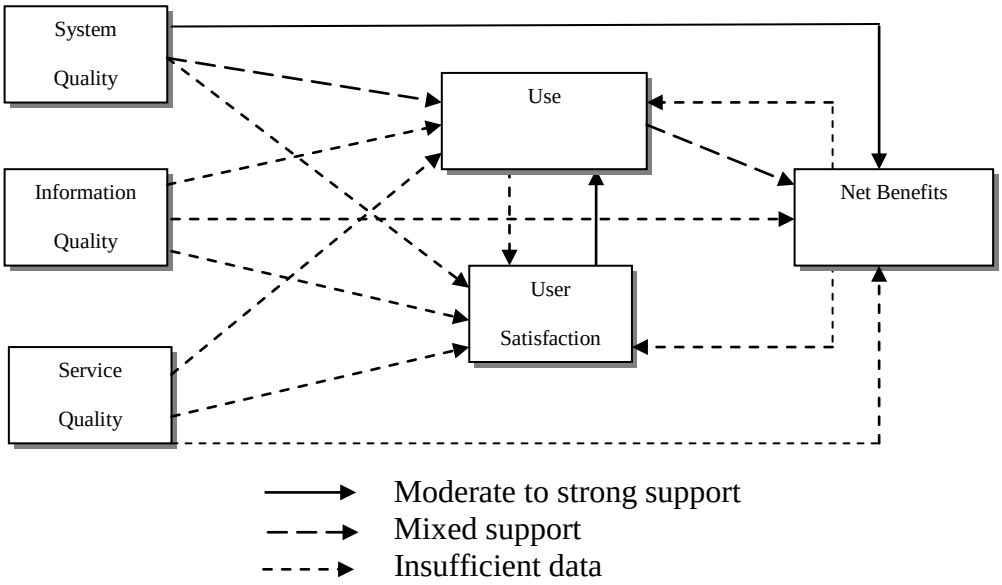

Figure 6 - Relationship support at the organizational level of analysis (Petter et al. 2008)

It is important to note that out of all these studies only one included in the analysis corresponds to an E-commerce environment (Zhu and Kraemer 2005). Unfortunately, his study aggregated all the quality measures of the system into two different constructs Technology Competence and Front End Functionality. Zhu's model also includes variables at the environmental and organizational levels (such as competitive pressure, international scope, and regulatory support) that affect the use construct. In Zhu's model, use is defined as "the extent to which e-business is being used to conduct the value chain activities" (Zhu and Kraemer 2005). It is interesting to notice that the results of the study support that technology competence appears to be the strongest factor affecting use.

As we see in the results of the previous meta-analyses, the DeLone and McLean Model of Information Success has been extensively studied at the individual level. There are plenty of studies that analyze the relationships stated in the model with individual measures normally provided by single user's perceptions of the IS. However, the model seems to have

stalled there. There is a lack of research that analyzes the relationships stated in the model at a higher level: how do all these relationships affect the success of the system at the organizational level of analysis? Another problem is that many of the studies have focused only on one or two relationships inside the model. According to DeLone and McLean, the model depicts the dimensions of IS success so that studying the model partially only reflects a portion of the possible relationships. Since all the dimensions are part of the same construct, they all affect each other; hence, studying the model partially may give biased results because we are missing part of the variability of the construct. Results may have been different if the model had been studied in its entirety because this interrelatedness among the six dimensions of IS success.

The reasons behind this gap in the IS success literature, specifically in relation to the E-commerce area, are numerous. First, the model was developed before E-commerce even existed. Before E-commerce, the IS had only a supportive role in the organization. With the advent of E-commerce, the IS becomes an integral part of the business process. Second, since the system is an integral part of the business process, we can argue that the objective features of the system (in this case: system quality, service quality, and information quality) are good measures of concrete system-level variables as opposed to the individual perceptions upon which the individual level of analysis relies. The individual level of analysis has found that visitors are attracted to websites with high levels of quality. Therefore, composite measures of quality at the website level of analysis along with measures of use and satisfaction will reflect the appropriate levels of IS success outcomes. It is important to notice that at the individual level of analysis, the variability arises from the individual perception of a website. Hence, it is the perception of the user, not the website, itself that changes. If the study is based on a single

website, it is the individual differences of each user with respect to the website that create the variability in the results of the measures (e.g., previous knowledge of the company, previous use, knowledge of the product, knowledge of the system itself). Instead, using a large sample of websites and gathering the measures from aggregated website features, the variability of the sample makes the features of the system the actual area of study. It is the features of the website that makes them different from each other. By opening this variability to a study, we can actually see what features contribute more to the overall success of the system. If the research at this level is successful, we can actually state what features contribute to the most to E-commerce success so that web sites could change their designs, programming approach, information sources, and the like in order to attract and retain more customers. If this line of research were successful, we could finally link financial outcomes such as sales, growth, or net benefits to actual investments in website features. Moreover, we could link external measures of customer satisfaction and loyalty to the features of the website that drive those outcomes. This line of research would shine a light on how websites compare to one another in terms of competitors or allies, and as such, it would make it easier to come out with benchmarks for different types of websites.

Overall, it is troubling that such a gap in the literature still exists. Closing the gap is not only an important issue for research and practitioners but also for teachers. We are using the results of website studies at the individual level to teach about website design, interactive feature development, and even color choices, but these results may be the result of individual user differences rather than directly related to the ultimate success of the system. We have to bear in mind that in E-commerce the IS is the lifeline of the company, the backbone. Without

the IS, the company's face to the customer is gone, and without the IS, no matter how good their service or their product is, the E-commerce company is nothing.

The conclusions from these meta-analyses are clear. Whereas there are plenty of studies that utilized the DLML model to study IS success at the individual level of analysis, there is a lack of research that utilizes the same model at the organizational level of analysis. As we have seen in the literature review, there is a recognized gap in the IS success literature. There have been plenty of studies that look at information systems and their impact at the individual level of analysis. Plenty of researchers have developed surveys that ask the individuals about their perceptions of the quality of information, quality of the system, and quality of service in an IS. Even more studies have looked at the individual user satisfaction when dealing with an information system. However, only a few studies have looked at the impact of the DLML constructs at the organizational level of analysis. The purpose of the present study, then, is to analyze the Updated DeLone and McLean Model of IS Success at the organizational level of analysis. To do so, the complete DeLone and McLean IS Success Model is tested at the organizational level of analysis and an extension of the model is proposed and tested. We propose that the model needs some re-specification in terms of the user satisfaction construct. We believe that at the organizational level of analysis the user satisfaction dimension of the model is not significant. We also believe that user satisfaction is an individual measure of success and, thus, it is liable to offer little or no explanatory power at the organizational level of analysis. This supposition is in line with Sedera's finding (Sedera et al. 2004) that the user satisfaction dimension should be deleted from the IS success model due to a lack of explanatory power.

2.5 Hypotheses

In this study, we test the basic DeLone and McLean Model of IS Success (Figure 7) as presented in the 2004 update and as it has been measured by many studies at the individual level of analysis.

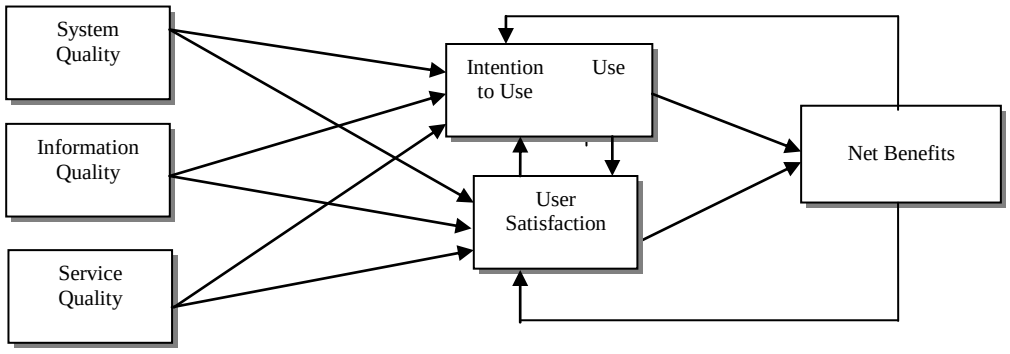

Figure 7 – Updated DLML Model of IS Success (DeLone and McLean 2004)

We believe that a website that offers features that reflect a high level of system quality—such as a low response time, product customization engines, different types of payment accepted, different types of purchasing provided, and consistency—will positively affect the number of visits that the website receives. A website that does not offer or offers only a few of those features will not have as many visits. Thus, we propose that:

H1: There will be a positive relationship between system quality and use.

Information quality refers to the content that the organization provides to the public in order to increase their knowledge of the product and influence them into the purchase. In the E-commerce environment, this dimension of IS success measures the accuracy, understandability, relevance, and completeness of the information provided as seen from the individual perspective of the user. In terms of organizational level of analysis, the measures are not individual perceptions of the information provided; instead, the measures refer to how the relationships change if the features are provided or not. Basically, we measure if it makes

a difference to actually provide information in all these different manners. We believe that it does. We believe that offering more features related to information quality positively affects the use of the system.

H2: There will be a positive relationship between information quality and use.

The service quality dimension has been studied in E-commerce at the individual level of analysis in many different ways. Overall, in the E-commerce literature, service quality refers to the "gaps between the perceptions of customers, the level of service provided and the potential improvement" (Molla and Licker 2001). We believe that at the organizational level of analysis, website features that map directly with service quality perceptions will have a positive effect on system use.

H3: There will be a positive relationship between service quality and use.

We believe that at the organizational level, there has to be use prior to have any type of satisfaction with the website. We measure satisfaction as E-loyalty or return visits to the website. We believe that higher levels of use will be positively related to higher levels of E-loyalty or return visits to the website.

H4: There will be a positive relationship between use and user satisfaction (E-loyalty).

It is important to remember that in the E-commerce environment, it is use that drives sales. If the organization exists only in the E-commerce environment, without visits to the website, the organization cannot have any sales. Therefore, we believe that as the usage of the website increases so will the net benefits of the organization measured as sales.

H5: There will be a positive relationship between use and net benefits.

We believe that user satisfaction measured by E-loyalty is positively related to net benefits. If customers return to the website, they are more likely to be satisfied with a

previous experience. In this case, sales are more likely to occur than if the visitor is a new visitor to the website.

H6: There will be a positive relationship between user satisfaction and net benefits.

While the relationships between system quality, information quality, and service quality with use will seem to be able work equally at both levels of analysis, we do not think those relationships will work equally when paired with user satisfaction. Since we believe that the satisfaction measure is more of an individual measure than an organizational measure, we posit that there is not a significant relationship between any of the qualities of the system and user satisfaction. For this reason, we believe that even though there could be a relationship between the website qualities and satisfaction, this relationship is not significant enough at the organizational level of analysis.

Finally, we will extend the 2004 model by adding direct effects from the website quality features to net benefits (Figure 8). These paths have been studied in the past but only in isolation, never as part of the complete model (Bradley et al. 2006; Farhoomand and Drury 1996; Gefen 2000; Teo and Wong 1998; Thong et al. 1994; Thong et al. 1996; Weill and Vitale 1999; Wixom and Watson 2001).

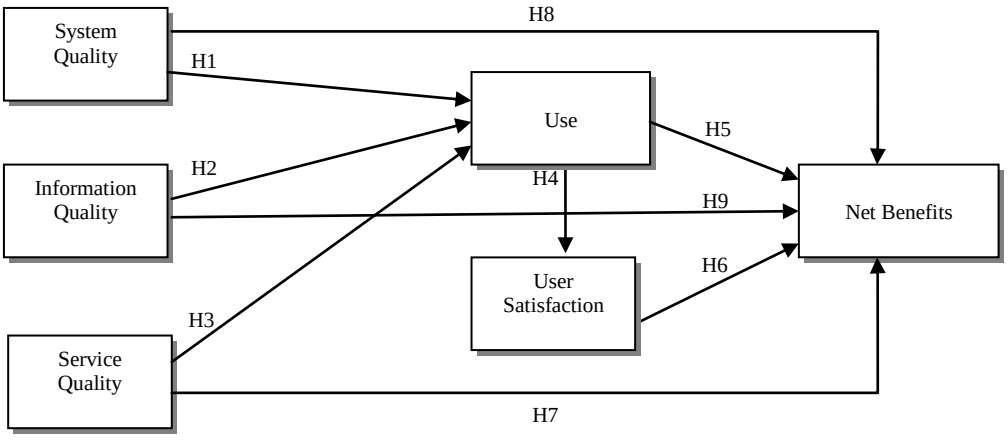

Figure 8 - Extended DLML Model of IS Success

Hence, we believe that there are direct effects from each one of the three website quality features to Net Benefits. We believe that a website that offers quality features directed to improve the perceived system quality, information quality, and service quality will positively affect the number of sales. For this reason, we propose that:

H7: There will be a positive relationship between service quality and net benefits.

H8: There will be a positive relationship between system quality and net benefits

H9: There will be a positive relationship between information quality and net benefits.

CHAPTER 3: RESEARCH METHODOLOGY AND DATA COLLECTION

3.1 Sample

Our sample contains data on 448 different web retailers. The selected websites are considered the top websites in the retail industry based on annual sales on the web (Media 2007). This study utilizes 448 top retailers ranked by volume of net sales. Even though data was available on the top 500 companies, only 448 of the 500 companies are utilized in the analysis. Since it would be difficult to distinguish which sales correspond to which websites in the case of companies with dual or more websites, only those websites that operated a single website are included in the analysis. Hence, it is possible to state that the sales and other objective measures utilized in the study refer to the single website.

3.2 Instrumentation

As we have seen in the literature review, the six dimensions of DeLone and McLean's model have been operationalized in multiple and different ways. Since this study focuses on the organization rather than the individual, the variables that we employ to measure each dimension refer to the website itself, not to the impression an individual may or may not have of the website. However, we have followed closely the definitions provided by the authors for each dimension. In this case, and since the area of study is E-commerce in retail stores, we have focused on the measures that point specifically to website features. The website features selected for this study have previously been used and operationalized in other E-commerce studies. The following sections describe each one of the IS success dimensions, the measures used in previous E-commerce studies, the possible measures included in the data set, and the final measures selected.

3.2.1 System Quality

It is important to note the importance of the system quality measures in an E-commerce environment and how the majority of these measures have been used at the individual level of analysis. Some of the measures that have been used in the E-commerce literature to study the different dimensions of system quality are response time (Molla and Licker 2001), site availability (Liu and Arnett 2000), site personalization (Palmer 2002b), product customization (Palmer 2002b), credit card payment (Parsons et al. 1998), and consistency (Tiwana 1998). See Table 15 for a summary of system quality measures.

Table 15 - E-commerce System Quality Measures (Petter et al. 2008)

Construct	Historical E-Commerce Measures	Possible Measures
System Quality	Usability, Ease of Use, Help Features, Intuitiveness, Attractiveness (Liu and Arnett 2000; Molla and Licker 2001; Spiller and Lohse 1998) Download Time (Palmer 2002b; Spiller and Lohse 1998) System Responsiveness, Response Time (Molla and Licker 2001; Tiwana 1998) Dependability, Reliability, Availability (Liu and Arnett 2000; Molla and Licker 2001; Tiwana 1998; Ünal 2000) Adaptability, Flexibility, Usefulness, Functionality: Versionability (Reisenwitz and Cutler 1998), Transaction Capabilities (Parsons et al. 1998), Environmental Scanning (Achrol and Kotler 1999), Customer Feedback Capability (Palmer 2002b; Peppers and Rogers 1997). Interactivity, Customization (Palmer 2002b) Ease of Navigation (Molla and Licker 2001; Palmer 2002b) Privacy, Security (Molla and Licker 2001)	Response Time Site Availability Site Personalization Product Customization 360 Degree Spin Gadgets Widgets Zoom Consistency Real Time Inventory Check Wish list Registry Catalog Quick Order Account Status Order Status Order confirmation Shipment Tracking Buy/Online Pick up in Store

In the E-commerce environment, studies that have used these measures at the individual level (user's perceptions of a single website) recognize that the use of the system is almost always volitional (users utilize the system when and how they want). In that case, the quality of the system can encourage/discourage the user to first utilize the system and, most importantly, to make a purchase. If the system is slow or difficult to use, the user will be discouraged to visit and make a purchase. The opposite also holds: if the system is fast, responsive, and easy to navigate and use, the system will disappear, and the purchase experience will become much more natural (DeLone and McLean 2004). However, we argue that at the website level of analysis, the measures should be based on the system quality features provided by the website. At the website level of analysis, high measures of system quality mean that the website is able to perform and offer those features that are expected by the user. Basically, does the website itself have all the required system features that are expected by strict comparison with the rest of the other websites? The variability at this level does not appear in the user's perception of the quality of the system but on the features of the system itself and how those features are related to the rest of the constructs in the model.

At the website level, the system quality construct also has three different dimensions. SYQ_01 refers to the interactivity that the system offers to the user with features such as 360 degree spin, gadgets, widgets, and zoom. SYQ_02 refers to those features of the system that allow the user to track his/her activity with the system (account status, order status). Finally, SYQ_03 refers to those features that allow the user to interact with the purchasing and tracking system after a purchase has been made (order confirmation, shipment tracking).

3.2.2 Information Quality

Information is an important asset to any organization. In the E-commerce environment, the quality of the content provided by the organization to the user reaches a higher level of significance. In some E-commerce business models, information is the core of the business (content aggregation or infomediation). Information quality in an E-commerce environment refers to the characteristics of the presented information. These characteristics include measures such as accuracy, relevancy, comprehensiveness, timeliness, and preciseness of the information provided, but it is also important to measure how the information is presented, organized, and how much control of that information the user has (Table 16).

Table 16 - E-commerce Information Quality Measures (Petter et al. 2008)

Construct	Historical E-Commerce Measures	Possible Measures
Information Quality	Accuracy, Understandability, Customer Integration across Multiple Channels (Molla and Licker 2001) Relevance (Molla and Licker 2001; Peppers and Rogers 1997) Completeness (Palmer 2002b; Zwass 1996) Currency (D'Ambra and Rice 2001; Molla and Licker 2001) Competitive Intelligence(Teo and Choo 2001) Dynamic Content (Parsons et al. 1998) Content Personalization (Barua et al. 2000; Molla and Licker 2001) Variety of Information (Palmer 2002b)	Product Comparisons Product Ratings Product Recommendation Advanced Search Number of SKU's Coupons Rebates Pre Orders Customer reviews Social Blogs RSS feeds Top Sellers

In our study, for this first level measurement model, the information quality construct is made of three different dimensions. IQ_01 contains variables that reference features that offer product information in terms of customer reviews and product ratings. IQ_02 contains

the social aspect of the information quality with variables that refer to websites offering of social content, blogs, and RSS feeds. Finally, IQ_03 contains those variables that refer to features in websites that internally compare products and provide extra product and price information.

3.2.3 Service Quality

In the E-commerce environment, service quality has often been measured by the SERVQUAL instrument developed by Zeithaml et al. (1990), which measures "the gaps between the perceptions of customers, the level of service provided and the potential improvement" (Molla and Licker 2001). Liu and Arnett (2000) claim that it is imperative that web designers study how to provide, arrange, and present more customer service opportunities to the users because of the lack of personal interaction on the website. They operationalize service quality by measuring the quick responsiveness, assurance, empathy, and follow-up service of the organization. See Table 17 for a summary of historical e-commerce service quality measures and the service quality features present in our data sample.

Table 17 - E-commerce Service Quality Measures (Petter et al. 2008)

Construct	Historical E-Commerce Measures	Possible Measures
Service Quality	Quick Responsiveness, Assurance, Empathy, Follow-up Service (Liu and Arnett 2000) FAQ, Customized Site Intelligence, Order Tracking, Responsiveness, Technical Competence (Molla and Licker 2001)	FAQ Online Circular What's new Mapping Store Value Cards Frequent Buyer Program Live chat/Email Dynamic Imaging Enlarged Product Shipment Tracking Toll Free Number Coupons/Rebates

The final measurement model for the construct service quality contains 10 individual dichotomous variables that create 3 different dimensions of the service quality construct. The construct SEQ_01 contains the following variables: Store value cards, Frequent buyer program, and Mapping. SEQ_02 contains the following individual features of the website: Dynamic imaging, Enlarged product view, guided navigation and recently viewed searched. Finally, SEQ_03 contains four features of the retail website: Daily seasonal specials, online circular, what's new, and outlet.

3.2.4 System Use

In the E-commerce literature, system use refers to active interaction between a user and the website in terms of browsing, searching, or any other type of interactivity. At the individual level of analysis, this measure has been typically self-reported by the user. At the website level of analysis, this type of information is easily captured through the website access logs (Table 18). In our model, system use is operationalized by the objective measure monthly visits. Since we are studying the website reported numbers during a one year span, the measure reports a monthly average of user visits. Hence, we operationalize system use with the measure of monthly visitors to the website.

Table 18 - E-commerce System Use Measures (Petter et al 2008)

Construct	Historical E-Commerce Measures	Possible Measures
System Use	Information Search, Receiving Customer Orders, Accepting Customer Payments, Customer Service Requests (Young and Benamati 2000) Number of E-commerce Site Visits, Length of Stay, Purchases Completed (D'Ambra and Rice 2001; Molla and Licker 2001)	Monthly Visits Monthly Unique Visitors Conversion Rate

3.2.5 User Satisfaction

At the individual level of analysis, user satisfaction refers to the feeling that the user receives during and after the interaction with the E-commerce website. This has always been a difficult dimension to measure, and it has been studied in many different research articles. This dimension is problematic because satisfaction is such a personal attitude that it can be very much influenced by the individual differences of the users. In the E-commerce environment, this measure has been operationalized as E-loyalty (Reichheld and Schefter 2000), which includes how many visitors are satisfied with their interaction with the website, come back to the website for repeat purchases, or recommend the website to friends (Table 19). DeLone and McLean utilize the measure repeated purchases to measure the user satisfaction (2004).

Table 19 - E-commerce User Satisfaction Measures (Petter et al 2008)

Construct	Historical E-Commerce Measures	Possible Measures
User Satisfaction	E-loyalty (Reichheld and Schefter 2000) Repeat Purchases (DeLone and McLean 2004)	Browser Satisfaction Purchase Intent Score Return Shoppers

Browser satisfaction, purchase intent score (DeLone and McLean 2004), return shoppers, customer reviews, frequent buyer program, and coupons/rebates (Reichheld and Schefter 2000) are some of the possible measures that we can use to operationalize the user satisfaction dimension of IS success. In this model, we utilize return shoppers as a measure of E-loyalty (Reichheld and Schefter 2000).

3.2.6 Net Benefits

Historically, net benefits refer to any and all outcomes that the IS causes to occur for the individual, the organization, or even the market. It has been very difficult to accurately

target a single measure of net benefits as we have seen in the previous review of literature. In the E-commerce environment, this task is not any easier. Different researchers have used completely different measures to operationalize the net benefits construct; however, these measures tend to cluster into three areas: financial outcomes, efficiency outcomes, and customer relationship outcomes (see Table 20 for a summary of the measures). This conceptualization makes sense since researchers have been trying to learn how quality improvement efforts are related to different measures of performance such as net revenues, customer growth, and sales (Sousa and Voss 2002). The idea, then, is that improving the quality of goods and services will decrease costs, increase customer loyalty, and ultimately lead to better financial outcomes. Several studies have offered support for the positive relationship between improving quality and increased performance outcomes of the firm (Buzzell and Gale 1987; Fornell 1992; Ittner and Larcker 1998; Kordupleski et al. 1993; Nelson et al. 1992). Since our analysis is based on website features that map to perceptions of quality at the system, service, and informational levels, we can assume that increasing the features that map to the quality perceptions of the website will in fact better the performance outcomes of the website.

Finally, to measure net benefits at the organizational level, the yearly sales, increase in sales, and growth rate are measures that can be used to operationalize the construct (Peppers and Rogers 1997; Teo and Too 2000). In this study, we use net sales to measure our dependent variable net benefits.

3.3. Data Collection

Data for our study were collected using the *Internet Retailer Top 500 Guide* for the 2008 year. From the Top 500 firms, only 448 were included in the study. Those companies

that had more than a single website running under the same company name were not included in the analysis so the reported sales and other objective measures can be directly linked to a single data point.

Table 20 - E-commerce Net Benefits Measures (Petter et al. 2008)

Construct	Historical E-Commerce Measures	Possible Measures
Net Benefits (Organizational Level)	Growth in Customer Base (Peppers and Rogers 1997) Increased Sales (Griffith and Krampf 1998) Profit, Economies of Scale (Teo and Too 2000) Return on Investment, Productivity (Barua et al. 2001) Costumer Lock-in (Shapiro and Varian 1999) Competitive Advantage (Takacs and Freiden 1998) Organizational Efficiency (Barua et al. 2000; Teo and Too 2000) Sales Process Efficiency (Hoffman and Novak 1997) Operational Excellence (Morash and Clinton 1998; Quinn 1999) Reduced Cycle Time (Barua et al. 2001; Hoogeweegen and Wagenaar 1996; O'Callaghan 1999) Global Reach, Stickiness (Demers and Lev 2001) Customer Loyalty (Demers and Lev 2001; Molla and Licker 2001) Customer Responsiveness (Hoogeweegen and Wagenaar 1996; Teo and Too 2000) Market Responsiveness (Teo and Too 2000) Customer Acquisition (Barua et al. 2001; Gonsalves et al. 1999) Customer Retention, Click to Buy Ratio (Parthasarathy and Bhattacherjee 1998)	Sales Increased Sales Growth Rate

3.4. Data Analysis

This study uses SPSS (v.15) and Structural Equation Modeling (SEM) with AMOS (v. 13) for measurement model and path model results. The structural equation modeling process

focuses on two different steps: first, a validation of the measurement model, and second, a fitting of the structural model. For the first step, the researcher conducts a measurement model analysis, and for the second step, the researcher performs a path analysis. In this study, we use an already theoretically-specified model, the DeLone and McLean Model of IS Success. Each construct or latent variable is conceptualized by the use of measured indicators. In this study, the majority of the indicators refer to website features such as absence or presence of an RSS feed or absence or presence of 360-degree spin for product images. For these features, only two values are possible, yes or no.

The first step will be to validate the measurement model by running a full model with all the paths specified. In the fitting of the structural model, the researcher compares two or more alternative models in terms of "model fit." Basically, this measures how well the covariances predicted by the model correspond to the observed covariances in the data. Modification indexes may be used to improve overall fit; however, this is not one of the goals of the study since the model itself is what is under study.

The overall model test and all the individual hypotheses are performed with SEM, using AMOS software. Model fit criteria include examination of goodness-of-fit indicators, modification indices, error variances, significance of loadings and residual indices (Kline 2004).

In a reflective structural equation model, hypothesis testing (fit of the internal structure of the model) is evaluated by examining individual item and composite reliability, average variance extracted, and finding significant path parameter estimates confirming hypotheses (Kline 2004). In a formative structural equation model, indicator and construct specification,

indicator collinearity, external validity, and significant path parameters assist evaluating the model (Diamantopoulos and Winklhofer 2001).

3.4.1 Missing Data, Normality, Outliers, and Linearity

The *Top 500 Guide of Internet Retailers* provided at least 92% of data per retailer. In some cases, if the missing data refers to a feature of the website (Mouse Over? Yes/No), the researcher visited the archived website for the year 2008 to gather the required information.

Tests were performed to examine the normality, outliers, and linearity of the data. Since the majority of the items utilized in the study were categorical (Yes/No) answers, there was a possibility that there would not be enough variability. However, due to the large sample (448 different retailer websites) the categorical data performed well in the normality tests.

The kurtosis levels of some of the non-categorical variables used in the second level measurement model were high (e.g., net sales and monthly visits). For those variables, logarithmic transformations were performed, and the new variables were included in the analysis.

No observations were dropped in the analysis due to outlier status; all 448 observations were included in the analysis.

3.4.2 Exploratory Factor Analysis

The first step to construct a measurement model should be to conduct an exploratory factor analysis with all the variables included in the sample. In this case, 112 variables that represent features of the retailer websites are included in the exploratory factor analysis. The researchers utilize SPSS to conduct the exploratory factor analysis, and since the model to be studied already has three defined constructs (system quality, service quality, and information quality), the exploratory factor analysis is set up to group the variables in three factors. The

factor analysis is set up with principal axis factoring, 3 factors, with Varimax (orthogonal) rotation (Bagozzi and Phillips 1982). Those variables that loaded on more than a single factor or with loadings of less than .3 are dropped from the analysis.

A secondary exploratory factor analysis is then run on each one of the three groups in separate turns to bring up the different dimensions of each factor. Again, those variables with low loadings or cross loadings are excluded from the study.

3.4.3 First Level Measurement Model

After the variables to be used with each construct are identified and grouped by the different dimensions of the construct, the researchers conduct an exploratory first level measurement model with AMOS to measure the model fit. This exploratory measurement model will help determine how the different measures relate to each other and the main construct. To conduct this analysis, the researcher creates a first level measurement model with the variables selected in each one of the exploratory factor analysis. Five common model-fit measures are used to assess the model's overall goodness-of-fit (Chi-Square/degrees of freedom, Incremental Fit Index, Tucker-Lewis Coefficient, Comparative Fit Index, and Root Mean Square Error of Approximation). These measures are reported for the first level measurement models, for the second level measurement model, and for the path models. For the structural/path model, causal paths including standardized path coefficients, p-values, and variance explained are also calculated.

3.4.4 First Level Measurement Model to Second Level Model

To create the Second Level Measurement Model, the variables included in each dimension of each First Level Measurement Model are averaged, and the result becomes the second level measure for the dimension of the construct (e.g., in the SYQ_02 construct, the

values of the variables order status and account status are averaged to create the SYQ_02 value). These values are included as the items for each higher level construct in the second level model. This Second Level Measurement Model closely resembles DeLone and McLean's Model of IS Success. Apart from the three qualities (information, system, and service), the model also has the measurements for use, satisfaction, and net benefits (number of monthly visitors to the website, number of returning visitors, and net sales). All constructs are connected with correlation lines to provide a full measurement model. Creating a measurement model is a necessary step, and it needs to be performed before the path model is constructed (Bagozzi 1981). In the words of Anderson and Gerbing, "a proper specification of the measurement model is necessary before meaning can be assigned to the analysis of the structural model" (Anderson and Gerbing 1982). If the model is a reflective model, apart from the goodness-of-fit levels, some evidence of internal consistency reliability (e.g., Cronbach's alpha) and convergent and discriminant validity evidence should be given. However, our model is a mixed model that contains both reflective and formative indicators. In that case, the basic notions of validity and reliability of the measures utilized in models with only reflective indicators cannot be used. Instead, we follow Diamantopoulos and Winklhofer's recommendations to build a solid formative model (Diamantopoulos and Winklhofer 2001).

3.5 Formative vs. Reflective Models

When charged with the difficult task of testing a theory, a researcher can choose between two different paths, both important. The researcher can decide to analyze the relationships between the theoretical constructs and its measures, or the relationships between the theoretical constructs themselves (Bagozzi and Phillips 1982). It is obvious that path analysis receives a great amount of discussion in the research literature; however, it is

important to notice that it is the first link—the relationships between the constructs and their measurement items—that brings the theory to reality, and as such, it should not be overlooked. For this reason, many researchers have analyzed the nature and relationships between constructs and their measures (Blalock 1971; Bollen 1989b; DeVellis 1991). Constructs are named to be "reflective" when the variation in the scores on measures of a construct is normally a function of the true score plus an error term. These measures "represent reflections or manifestations, of a construct" (Fornell and Bookstein 1982). The underlying latent construct is the one responsible for causing the variation in the observed measures (Bollen 1989b; Nunnally 1978). In a reflective model, observed variables are seen as effect indicators on an underlying latent construct. The underlying construct or latent variable is seen as the cause of the effects we can see or measure (Diamantopoulos and Winklhofer 2001). In the opposite case, formative measures are viewed as causes of the construct (Bagozzi and Phillips 1982; Blalock 1971; Bollen and Lennox 1991; MacCallum and Browne 1993). In the case of a formative construct, the indicators are the cause of the underlying variable. Normally, formative constructs are perceived as "composites of specific component variables" (Edwards and Bagozzi 2000). An example is the construct Socioeconomic Status (SES), which is normally formed as a combination or index of four indicators: education, income, occupation, and residence (Hauser 1971). SES increases when any of the four indicators increases, but if the SES changes, it does not mean that the four indicators will also change. Thus, according to Bollen (1989b), the main difference or choice between a formative and a reflective specification is based on a causal priority between the indicators and the latent variables (Cohen et al. 1990; Fornell et al. 1991; Krishnan Namboodiri et al. 1975). According to Fornell and Bookstein (1989),

> constructs such as ‘personality’ or ‘attitude’ are typically viewed as underlying factors that give rise to something that is observed. Their indicators tend to be realized then as reflective. On the other hand, when constructs are conceived as explanatory combinations of indicators (such as population change, or marketing mix) that are determined by a combination of variables, their indicators should be formative.

Working out of the above definition, we believe that system quality, service quality, and information quality can be specified as formative constructs in our model. Our basic data represents the absence or presence of a feature in a website. At the most basic level, specifying our model as a formative model indicates that the presence or absence of a feature in a website causes an increase or decrease in the quality index of the website. Basically, the decision of including or not including a feature in the website gives rise to the quality of the website as perceived by the webmaster and the users. Ultimately, the feature has to be included or not included to actually cause a change in the quality of the website. Viewing this model as a formative model means that the quality of the website can change due to one or more features being added or removed from the website (e.g., shipment tracking is added to the website). It is important to notice that not all features (our indicators in the model) have to change for the website quality to change. It is also important to note that these features do not have to be related since a website may decide to apply or remove a feature no matter what other features already exist.

According to Diamantopoulos and Winklhofer (2001), there are five main characteristics that define a formative specification. First, in a formative model, indicators are not interchangeable. Removing or changing an indicator produces an internal change in the latent variable. Second, since the indicators in the model are completely exogenous (external), it cannot explain any correlations among formative indicators. Third, since the model does not

explain any correlations among indicators, the magnitudes or directions (positive vs. negative) do not have to follow a specific pattern (all positive, all negative, high or low). Fourth, all formative indicators do not have error terms. Instead, error variance is represented at the construct level and is uncorrelated with the indicators. Fifth, the formative model needs to be "wrapped" in a larger model with reflective constructs to achieve proper identification. The formative model is unidentified by itself. Our formative model follows these five important constraints for identification. First, we test several models to make sure the model specification is correct and our indicators will not function correctly in any other specification. To do so, we test the model in three different ways: (1) a model without formative latent variables, (2) a model with a single formative latent variable (quality), and (3) a model where the three formative latent variables are specified (system quality, service quality, and information quality). Second, correlations among formative latent variables are not specified in any of our three models. Third, we expect the indicators not to follow any specific pattern since by definition they do not have to be correlated. Fourth, we do not specify any error terms for the formative indicators. And fifth, the model is wrapped in a larger model that contains reflective indicators.

Due to all the above constraints placed in the specification of the formative model, the conventional procedures utilized to asses validity and reliability of a reflective model are not appropriate for models that have formative indicators (Bagozzi 1994; Bollen 1989a; Bollen 1989b). Instead, Bollen (1989a; 1989b) proposes four areas upon which a formative model can be evaluated: content specification, indicator specification, indicator collinearity, and external validity. Content specification refers to the scope of the latent variable, especially what specific area the index is going to capture. This is linked to the second item, indicator

specification, because since a formative construct is defined by its indicators, the indicators have to measure the area we want to cover with the construct. Due to the attempt to cover the construct definition completely, the formative model can have multicollinearity issues. It is important to notice that even though correlations are not a requirement in formative models, indicators can correlate highly and, thus, create multicollinearity issues that would either provide redundant information or create effects that are difficult to separate. Finally, the model has to be able to work with other previously validated measures or in the context of already validated models. If embedded into a greater model with reflective indicators, goodness-of-fit measures may be used to assess the fit of the formative indicators to the overall model and to the reflective measures. First, we believe that all significant facets of the formative construct have been identified and included in the model based on the following: (a) we identify 144 different features of the website that can be paired with the three perception qualities that have been identified by the DeLone and McLean Model of IS Success and have been used in the IS literature; (b) factor analysis on the website features has been performed and the variables do line up with the three identified qualities; (c) secondary factor analysis has been performed to raise the different dimensions of each one of the qualities; (d) in each step, only the variables with low loadings or double loadings have been removed (Diamantopoulos and Winklhofer 2001). Hence, the breadth of definition and the possible multicollinearity of the measures have been observed and controlled. Finally, by wrapping the model into a larger model that contains reflective indicators, we both make it work with other measures and in the context of a model that has been validated (if only at the individual level) successfully.

3.6 Second Level Model to Path Analysis.

To analyze the relationships between the different dimensions of IS success we will use path model analysis. We utilize path analysis instead of regression analysis because the model has two stage relationships (website features to use and satisfaction, then use and satisfaction to net benefits) that would have been complicated to analyze with regression. To run the path analysis, summated indexes of the website quality features are calculated and included in the model, and no latent variables are included. For the model definition, only correlations between exogenous indicators (information quality, system quality, and service quality), and hypothesized paths are included.

Our first model to be tested is a slightly modified version of the 2004 DLML model of IS Success. Two modifications are necessary to test the model at a higher level of analysis. First, since the model is to be tested at the organizational level of analysis, the researchers believe that intent to use should not be included in the analysis. According to DeLone and McLean (2002), intent to use was introduced in the model to account for those situations where use could not be measured appropriately. Basically, intent to use can be utilized as a proxy for the actual use of the system. Moreover, we believe that intent to use focuses on the individual level of analysis rather than the organizational level. Hence, since we already have an objective measure of use (number of visits to the website), we believe intent to use is not necessary in the analysis. Second, the paths from net benefits to use and satisfaction and satisfaction to use have been removed from the analysis. We believe that to accurately and correctly measure those relationships, data would have to be gathered at two different points in time. Since we did not gather any cross-sectional data, the analyses of those relationships are not possible.

Our second model to be tested is an extension of the 2004 DLML model of IS Success that contains direct paths from system quality, service quality, and information quality to net benefits. As we have stated before, direct effects from system quality, information quality, and service quality have received mixed support in the literature. However, those tests have been made in isolation and never with those effects as part of the complete model. We will compare both models in terms of path significance and R-square results.

It is expected to at least match the results that both meta-analyses reported (Petter et al. 2008; Petter and McLean 2009). According to the meta-analyses, all relationships between constructs in the Updated DLML Model yielded significant results except Service Quality → Use and Service Quality → User Satisfaction. Overall, the researcher expects to validate the Updated DLML Model to be used at the organizational level of analysis and expects to find more explanatory power in the extended model than in the original model.

CHAPTER 4: RESEARCH FINDINGS

In this chapter, first we will review the results of the first level exploratory measurement model of the three quality constructs (service quality, system quality, and information quality). Second, we will present the results of the three formative structural models; and third, we will present the results of the path analysis for the original 2004 DLML model and the extended model.

Since our website feature data is formed by dichotomous variables, a first step to simplify the analysis is performing an exploratory factor analysis with all the dichotomous variables in the data set. Results of the factor analysis show variables successfully grouping in three different constructs. The feature groupings are consistent with the previous literature definitions and scope for system quality, service quality, and information quality.

Website features that have loadings in two or more factors (cross-loadings) are removed from the analysis. Also, website features with low loadings (less than .3) are removed from the analysis (Table 21). Since the results of the exploratory factor analysis suggest a three factor structure, the variables subsequently divided into the three factors and a secondary factor analysis is performed to raise possible dimensions of each separate construct. For each one of the three constructs, the secondary factor analysis suggests a three item structure. It is this three dimension structure that is used in the first level measurement models as we enter the data and the model into AMOS. By entering each individual construct with its dimensions and items into AMOS, we create a first level measurement model that allows us to acknowledge the selection of the different items as part of the latent variable. Results of the first level measurement model for each one of the three quality constructs follow.

Table 21 - Factor Analysis Results of Measured Website Features

Website Features	Component		
	1	2	3
Reviews Ratings	.818		
Customer Reviews	.808		
Product Ratings	.805		
Top Sellers	.496		
RSS Feeds	.467		
Blogs	.440		
Social	.431		
Coupons Rebates	.424		
Product Comparisons	.368		
Bill Me Later	.312		
Pre Orders	.306		
Mapping		.591	
What's New		.518	
Site Personalization		.500	
Store Value Cards		.482	
Dynamic Imaging		.467	
Guided Navigation		.457	
Frequent Buyer Program		.441	
Online Gift Certificate		.437	
Outlet		.434	
Daily Seasonal Specials		.432	
Online Circular		.399	
Recently Viewed Searched	.	.339	
Enlarged Product View		.302	
Mouse Over			.464
360-Degree Spin			.439
Widgets			.427
Gadgets			.411
Account Status			.400
Zoom			.383
Order Confirmation			.331
Estimated Shipping Date			.318
Shipment Tracking			.317
Order Status			.310

4.1 First Level Measurement Model: System Quality

The exploratory secondary factor analysis for the website features identified as part of system quality shows three distinct dimensions (Table 22). The three dimensions correspond with the technical ability of the website to perform not only during an interaction with the user but also after the interactions have occurred. First, it refers to the interactivity that the system offers to the user with features such as gadgets, 360-degree spin, and zoom. Second, it refers to those features of the system that allow users to track their activity with the system (order status and account status). Finally, it refers to those features that allow the user to follow up on any orders with the system (order confirmation and shipment tracking).

Table 22 - Secondary Factor Analysis Results - System Quality

	Factor Component		
	1	2	3
360-Degree Spin	.700		
Gadgets	.643		
Widgets	.564		
Zoom	.535		
Account Status		.796	
Order Status		.775	
Order Confirmation			.826
Shipment Tracking			.718

After the dimensions of system quality are identified, the indicators are included into the AMOS model (Figure 10). To measure the fit of the model, first, we use the ratio of Chi-square to degrees of freedom introduced by Medsker et al. (1994) and its related P value. Medsker treats ratios between 2 and 5 as a good fit, but Carmines and McIver (1981) and Byrne (1989) suggest a value of less than 2 as an optimal fit. This measure tests the hypothesis that an unconstrained model fits the covariance matrix as well as the given model. The second measure is Bollen's Incremental Fit Index (IFI) with a recommended value of

more than .95 (Bollen 1989a). The third measure is the Tucker-Lewis Coefficient (TLI) or Bentler-Bonett Non-normed Fit Index (NNFI) (Bentler and Bonett 1980) with a recommended value or more than .95. The fourth measure is Bentler's Comparative Fit Index (CFI) (Bentler 1990) with a recommended value greater than .95. This measure is sometimes stated as the McDonald and Marsh's Relative Noncentrality Index (RNI) (McDonald and Marsh 1990). Finally, the Root Mean Square Error of Approximation (RMSEA) developed by Steiger (1990) with a value lower than .05 or less "would indicate a close fit of the model in relation to the degrees of freedom" (Browne and Cudeck 1993).

For this first level model, AMOS reports a strong goodness-of-fit test with a CMIN/DF of 1.017, which is lower than the required 2 (Chi-square of 17.288 with 17 degrees of freedom). P-value reported is .435. IFI, and CFI results are above the .95 level. RMSEA at .009 also supports the good fit of the model with a level lower than the required .05 (Table 23).

4.2 First Level Measurement Model: Information Quality

The secondary exploratory factor analysis also suggests a three-dimension structure for information quality (Table 24). Items included are website features that provide information about the product in terms of rankings and reviews (reviews and ratings, customer reviews, and product ratings); features that provide a social connection between the company and any current or potential users (social, blogs, and RSS feeds), and information that specifically deals with product sales (top sellers, pre-orders, and coupons / rebates).

These three dimensions are imported into the AMOS software to create the first level measurement model for information quality (Figure 11). The results of the first level measurement model for information quality follow.

Table 23 - Goodness-of-Fit Measures: System Quality

Goodness-of-Fit Measure	Recommended Value	First Level Measurement Model
Chi-square/degrees of freedom	< 2	17.228/17 = 1.017
P-value	Non significant	.435
IFI	>.95	.996
TLI	>.95	.993
CFI	>.95	.996
RMSEA	<.05	.009

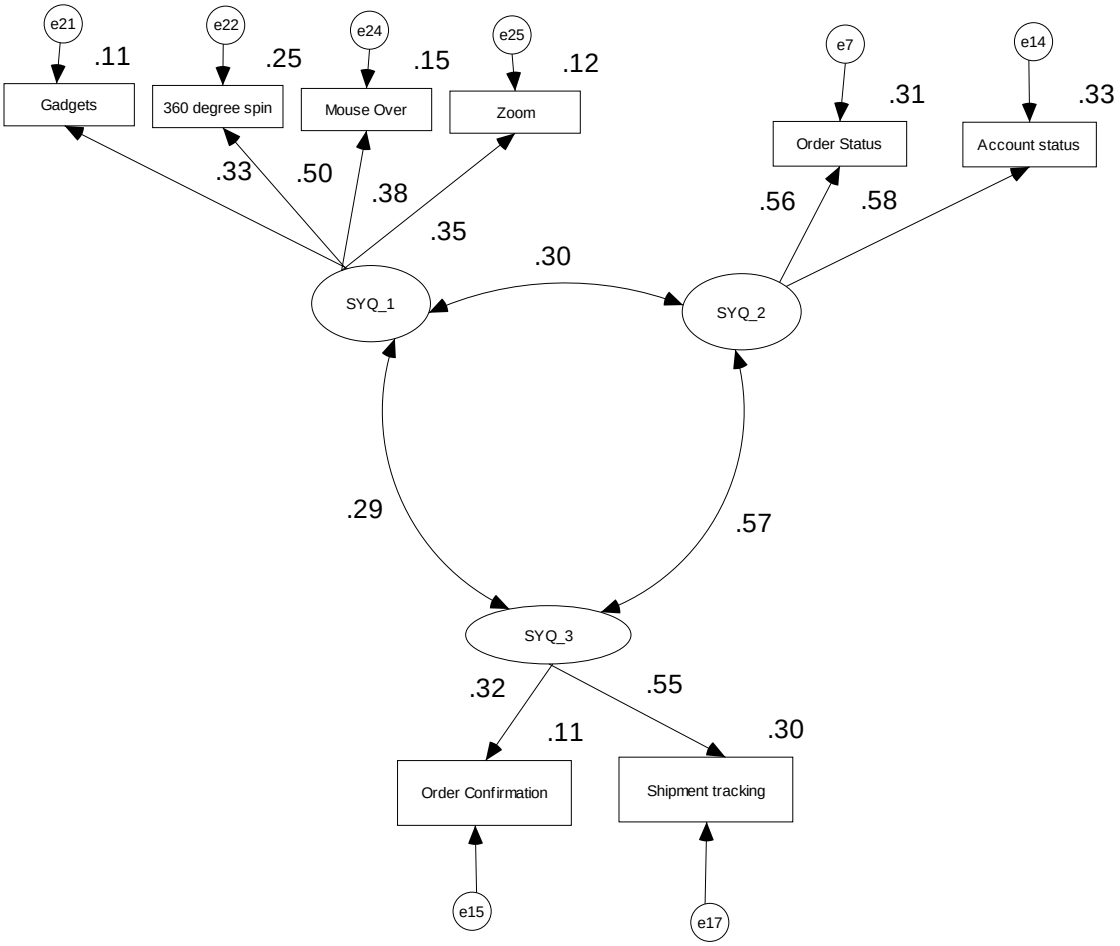

Figure 9 - First Level Measurement Model: System Quality

The first level model, AMOS reports a strong goodness-of-fit test with a CMIN/DF of 1.178, which is lower than the required 2 (Chi-square of 28.263 with 24 degrees of freedom). P-value reported is .249. IFI, and CFI results are above the .95 level. RMSEA at .028 also supports the good fit of the model with a level lower than the required .05 (Table 25).

4.3 First Level Measurement Model: Service Quality

The secondary exploratory factor analysis suggests that at the website level service quality also has three different dimensions: see Table 26 for results.

Table 24 - Secondary Exploratory Factor Analysis Results - Information Quality Features

	Component		
	1	2	3
Reviews Ratings	.919		
Customer Reviews	.918		
Product Ratings	.888		
Social		.769	
Blogs		.739	
RSS Feeds		.669	
Coupons Rebates			.743
Pre-Orders			.648
Top Sellers			.628

The first dimension refers to features that provide regular communication between the website and the users (online circular, what's new, daily seasonal specials). The second dimension includes features that are not necessary for the correct function of the website but provide an extra level of interactivity between the website and the user in terms of product experience (dynamic imaging, enlarged product, guided navigation). The third dimension includes features that allow the company to track the purchasing history of the user, but at the same time, they may provide an extra level of incentives for the user (store value cards, frequent buyer program, mapping).

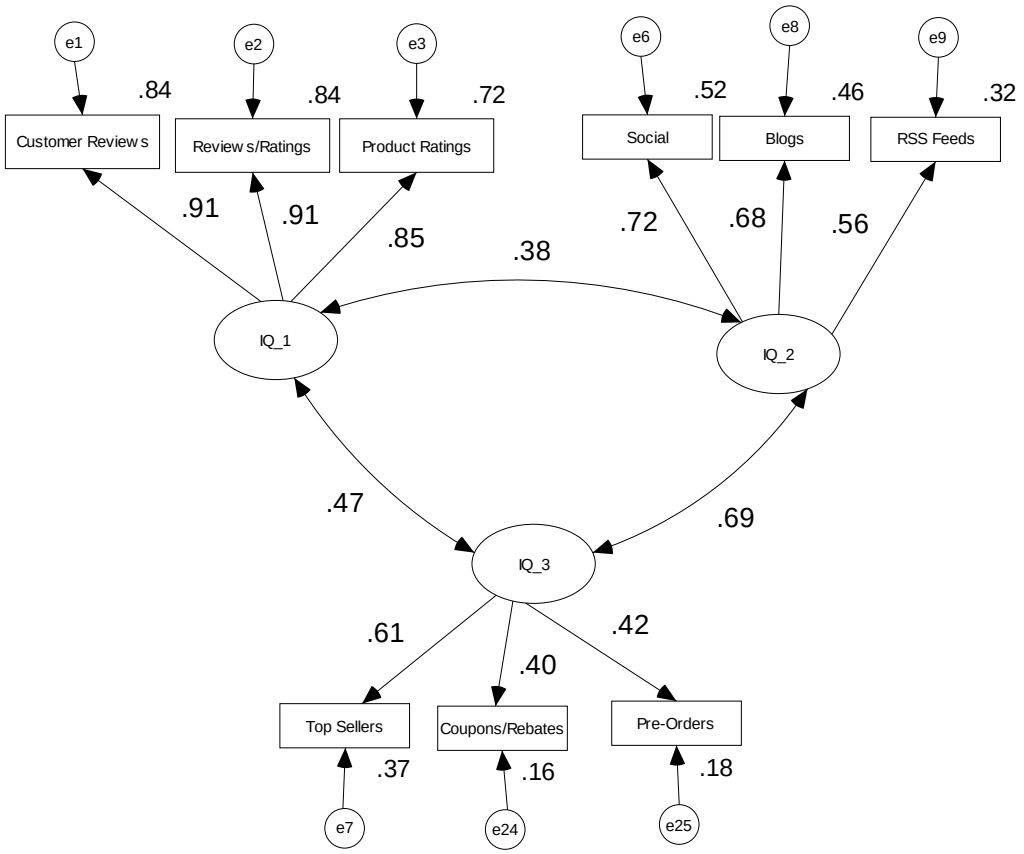

Figure 10 - First Level Measurement Model: Information Quality

Table 25 - Goodness-of-Fit Measures: Information Quality

Goodness-of-fit Measure	Recommended Value	First Level Measurement Model
Chi-square/degrees of freedom	< 2	28.263/24=1.178
P-value	Non-significant	.249
IFI	>.95	.994
TLI	>.95	.991
CFI	>.95	.994
RMSEA	<.05	.028

Table 26 - Secondary Exploratory Factor Analysis Results - Service Quality Features

	Component		
	1	2	3
Mapping	.689		
Store Value Cards	.676		
Frequent Buyer Program	.639		
Dynamic Imaging		.844	
Enlarged Product view		.641	
Guided Navigation		.578	
Recently Viewed Searched	.	.339	
Daily Seasonal Specials			.743
Outlet			.686
Online Circular			.302
What's New			.326

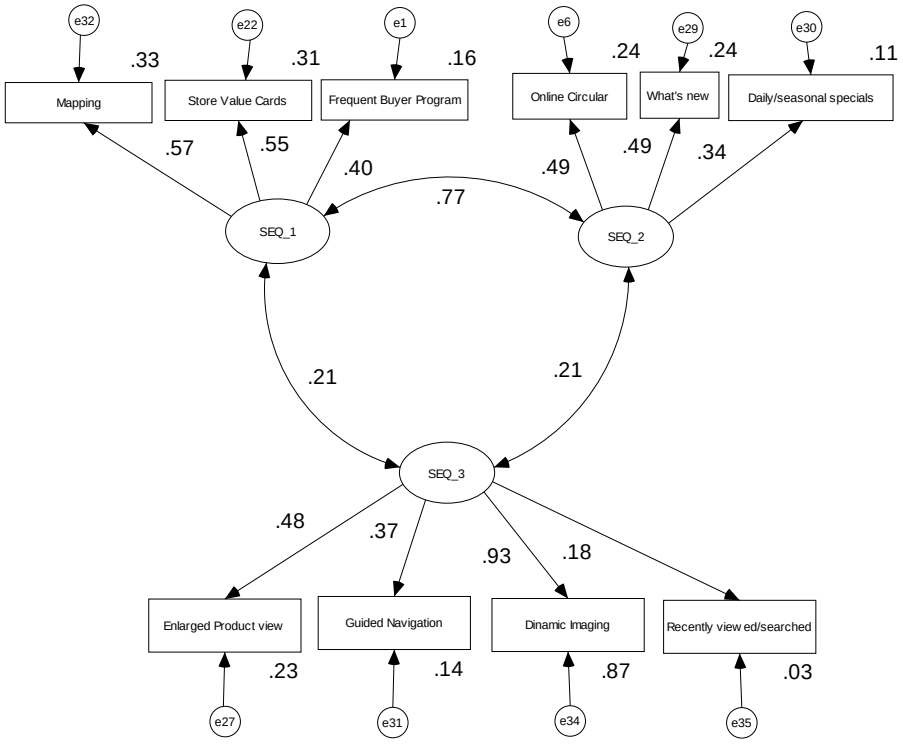

Figure 11- First level Measurement Model: Service Quality

Once we import the different dimensions into a first level measurement model, AMOS (Figure 12) reports a strong goodness-of-fit test with a CMIN/DF of 1.426, which is lower

than the required 2 (Chi-square of 45.624 with 32 degrees of freedom). P-value reported is .056. IFI, and CFI results are above the .90 level. RMSEA at .044 also supports the good fit of the model with a level lower than the required .05 (Table 27).

Table 27 - Goodness-of-Fit Measures: System Quality

Goodness-of-Fit Measure	Recommended Value	First Level Measurement Model
Chi-square/degrees of freedom	< 2	20.067/17 = 1.180
P-value	Non-significant	.271
IFI	>.95	.981
TLI	>.95	.967
CFI	>.95	.980
RMSEA	<.05	.02

4.4 Second Level Formative Models

Following the recommendations stated by Diamantopoulos and Winklhofer, we test several models to make sure our selected model is correct (Diamantopoulos and Winklhofer 2001). We test three different models. Model A contains all our formative indicators with causal paths to the reflective indicators in the model. Model A does not contain latent variables for the formative indicators. Model B contains all the formative indicators loading into a single latent variable. Model C contains all the formative indicators loading into their respective latent variables as suggested by the preliminary factor analysis.

Out of the three models tested, only Model C achieves the required levels of the goodness-of-fit measures needed to acknowledge the model as appropriate. Model C passes 6 out of the 6 values required. Model B reaches 2 of the 6 required levels (IFI and CFI), but fails to achieve good levels in the other four tests. Model A does not reach any of the required goodness-of-fit levels. Table 28 presents the results of the three models:

Table 28 - Goodness-of-Fit Results: Formative Models

Goodness-of-Fit Measure	Recommended Value	Model A	Model B	Model C
Chi-square/degrees of freedom	< 2	76.684/20= 3.834	69.476/28= 2.481	33.560/25= 1.342
P-value	Non-significant	.000	.000	.118
IFI	>.95	.934	.951	.990
TLI	>.95	.725	.856	.967
CFI	>.95	.929	.948	.989
RMSEA	<.05	.080	.058	.028

4.5 Path Model: 2004 DeLone and McLean IS Success Model

For this first path analysis, we modeled the relationships stated by DeLone and McLean in their 2004 revision for the E-commerce environment. Results from the path model analysis suggest strong support for the relationships between system quality and use, service quality and use, use and net benefits, and use and satisfaction. See table 29 for a summary of the standardized regression weights estimates and their P-values.

Table 29 - 2004 DLML IS Success Model – Standardized Regression Weights

Path			Estimate	P
Use	<---	System Quality	.163	***
Use	<---	Service Quality	.347	***
Use	<---	Information Quality	.007	.873 (NS)
Satisfaction	<---	Use	.104	.046 **
Satisfaction	<---	Service Quality	-.010	.848 (NS)
Satisfaction	<---	System Quality	-.011	.838 (NS)
Satisfaction	<---	Information Quality	-.005	.926 (NS)
Net Benefits	<---	Use	.788	***
Net Benefits	<---	Satisfaction	-.030	.307 (NS)

*** Significant at the .005 Level; ** Significant at the .05 level; N.S: Non Significant

Squared multiple correlation results suggest that our indicators explain only a 1% of the variability in satisfaction, 18% of the variability in use, and more than a 60% of the variability in net benefits (Table 30).

Table 30 – 2004 DLML Model - Squared Multiple Correlations

IS Success Dimension	Estimate
Use (Monthly visits)	.182
Net Benefits (Sales)	.618
Satisfaction (E-loyalty)	.009

4.6 Path Model: Extended 2004 DeLone and McLean IS Success Model

In terms of path significance, paths from system quality and service quality to use, use to sales, and system quality to sales are significant at the .005 level. Paths from information quality to sales and use to satisfaction are significant at the .05 level. The analysis suggested that no other paths in the model were significant

Table 31 – Extended DLML IS Success Model - Regression Weights

Hypotheses	Path			Estimate	P
H1	Use	<---	System Quality	.163	***
H2	Use	<---	Information Quality	.007	.873 (NS)
H3	Use	<---	Service Quality	.347	***
H4	Satisfaction	<---	Use	.104	.046**
H5	Net Benefits	<---	Use	.741	***
H6	Net Benefits	<---	Satisfaction	-.028	.332 (NS)
H7	Net Benefits	<---	Information Quality	.097	.048**
H8	Net Benefits	<---	System Quality	.112	***
H9	Net Benefits	<---	Service Quality	.023	.466 (NS)
	Satisfaction	<---	Information Quality	-.005	.926 (NS)
	Satisfaction	<---	System Quality	-.011	.838 (NS)
	Satisfaction	<---	Service Quality	-.010	.848 (NS)

*** Significant at the .005 Level; ** Significant at the .05 level; NS – Non Significant

According to the results, there is support for hypotheses H1 (system quality → use), H3 (service quality → use), H4 (use → satisfaction), and H5 (use → net benefits). Two of the three direct paths to net benefits added by the extended model are also supported which gives us grounds to accept hypotheses H7 (Information Quality → Net Benefits) and H8 (System Quality → Net Benefits). Three of our proposed hypotheses are not supported by the results provided by the model: H2 (Information Quality → Use), H6 (Satisfaction → Net Benefits), and H9 (Service Quality → Net Benefits). See Figure 12 for a summary of significant paths and squared multiple correlations.

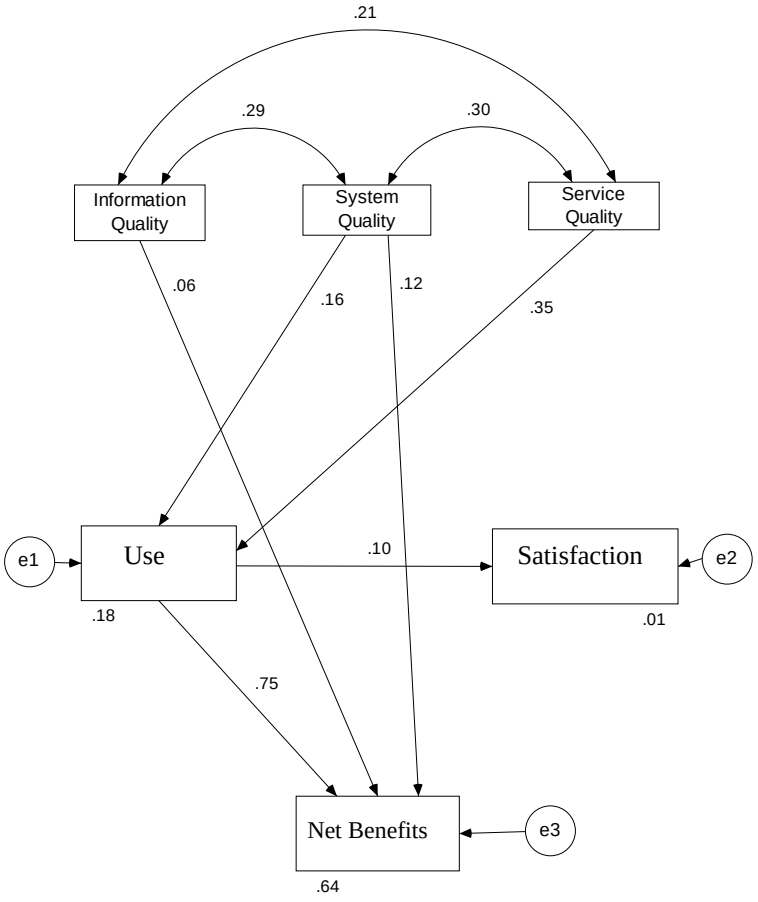

Figure 12 - Extended 2004 DLML Model with significant paths and squared multiple correlations.

Squared multiple correlation results suggest that the extended model improved the variance explained in net benefits from a .60 to .64 (Table 32). The extended model did not modify any of the variance explained results for the other two dependent variables (use and satisfaction). Results provided by AMOS show a strong goodness-of-fit of the path model. CMIN/DF test reports a value of .273 (Chi-square of 1.641 with 6 degrees of freedom). P-value is non-significant at the .005 level with a value of .950. IFI, TLI, and CFI are over the .95 threshold. RMSEA is under the .05.

Table 32 - Extended 2004 DLML Model - Squared Multiple Correlations

IS Success Dimension	Estimate
Use (Monthly visits)	.182
Net Benefits (Sales)	.640
Satisfaction (E-loyalty)	.010

CHAPTER 5: DISCUSSION OF FINDINGS

While describing the limitations of their study (meta-analysis of the DLML model research) Petter et al. explain, "[this study] found that there is insufficient empirical evidence to evaluate most of the relationships at the organizational level" (Petter et al. 2008). Their study found that not only the number of studies that utilized the Updated DLML model at the organizational level of analysis were significantly inferior to the number of studies utilizing the same model at the individual level of analysis but also that those studies at the organizational level did not provide enough data to validate the complete model. This study attempts to fill that void.

First, a measurement model based on objective features present or not present in the websites included in the study is created. It is important to notice that these measures are not real psychometric measures; they are objective dichotomous variables that reflect the existence or non existence of a feature in a specific website. As such, they are real objective website features indices, and not perceptions of the users. By combining them into higher level dimensions, we try to increase the variability of the sample. However, we still have to understand that the characteristics of these measures are not the same as those collected and reported by studies that use validated instruments of psychometric measures. The objective measures are more useful than psychometric measures because they affect real outcomes. We were able to construct a first-level measurement model for each identified quality that satisfactorily passed all the goodness-of-fit measures required for the psychometric measures. Hence, we provided enough support for the use of individual features of each website as an organizational measure for system quality, service quality, and information quality. By pairing up these measures with objective measures of use (monthly visitors), user satisfaction

(return visitors), and net benefits (sales), the measurement model does not include any indicators that come from an individual level of analysis. All the indicators are at the organizational level.

The first level measurement models are constructed to provide appropriate support for the identification of each individual feature to its corresponding quality (system quality, service quality, and information quality). Results from these first level measurement models are two-fold. First, they support the existence of three different qualities with different dimensions. Both a preliminary factor analysis and the first level measurement model goodness-of-fit levels support this conclusion. Moreover, results from a secondary measurement model suggest that a model where all indicators form a single quality construct does not fit the data successfully. Results from a third model tested where all formative indicators were included without any latent variable also support our results. Due to these reasons, we can state that at the organizational level, website features do group into one of three different qualities: system quality, service quality, and information quality. We believe that this is a significant addition to the e-commerce literature because of its implications for practitioners in terms of website development and maintenance, educators in terms of website instructional design and development, and finally for researchers in terms of mapping specific and objective features to subjective and already existing qualities.

In terms of the path model, out of our nine hypotheses, we find significance for 6 of them. Three of our hypotheses are not supported by the results provided by the model. We find significant paths from system quality to use (H1) and service quality to use (H3). This information is very useful in the E-commerce environment. Our model suggests that websites that have features related to service quality and system quality dimensions will increase the

amount of visitors, which in turn, will translate into higher sales, since we also find a significant path between use and net benefits (H5). In the e-commerce environment, the higher the level of visits that a retailer receives, the higher the level of sales posted by the retailer.

The model also suggests significant paths from information quality to net benefits (H7) and system quality to net benefits (H8). By increasing the features that are related to perceptions of system quality and information quality, websites will be able to increase their net benefits, which in this model is measured by sales. This is a very important finding for any retailer whose goal is to increase sales. According to our results, features that map with the quality of the system and features that map with the quality of the information provided by the system do have a significant positive effect on sales, reinforcing the added value of system components. Summarizing, website features that map to perceptions of service quality and system quality explain over 18% of the variability in use. At the same time, website features that map perceptions of information quality and system quality directly affect the number of sales posted by the retailer. The implications for practitioners, web developers and designers seem clear. It is important to pay special attention to what features of the website are included because they affect visits and ultimately sales. This result corroborates Petter et al. (2008).

It is also important to note the strong relationship between use and net benefits (H5). In the E-commerce environment, this does make sense. The E-commerce environment is volitional. Visits to the website are not mandated by a higher power so the negative reactions that we normally have when a use is mandatory do not exist in this environment. The implications for practitioners, web designers and developers are clear. For an E-commerce website, sales are largely driven by visits to the website. Retailers have to be able to lure

visitors to their websites. Retailers have to constantly benchmark their website features against other retailers to make sure they do not fall behind. But what is more important, and as we have stated before retailers can increase visits by offering those website features that map directly to user perceptions of system quality and service quality. This significant relationship is also consistent with the results provided by Petter et al. (2008).

In terms of satisfaction, basic correlations between satisfaction and the rest of the dimensions of the model suggest that there exist a relationship between them. However, when placed in the model, only use appears to have a significant positive effect on satisfaction (H4). This is also important in the e-commerce environment. It seems that at the organizational level, users will come back to the website only after they have visited once (having made or not made a purchase) so that the first visit becomes imperative for a user to come back. This result is similar to Sedera et al. (2004), where satisfaction is eliminated from their model of success because of lack of significance. It is also important to observe that none of the qualities directly and significantly affect satisfaction as measured by returned visits to the website. Instead, the effect appears through use. None of the three qualities (information quality, system quality, and service quality) affect user satisfaction significantly. At the individual level of analysis, it is the user that provides perceptions of the website in terms of information quality, system quality and service quality; thus, individual satisfaction is closely related to the satisfaction that the individual user may feel from using the website, completing a purchase, coming back as a loyal customer, and promoting the website to friends and family. At the organizational level of analysis, this is a more complicated dimension to include in the model. If, at the individual level of analysis, the variability comes from the individual utilizing the website, at the organizational level, the variability has to come from

differences in satisfaction among the websites. How can satisfaction be measured to bring up differences between organizations? It seems that satisfaction is a feeling that cannot be translated to a website itself. Our study utilizes E-loyalty as measured by returned visitors. However, results suggest that this measure is not affected by the actual system quality, service quality, or information quality of the website. Moreover, the measure does not significantly affect net benefits; therefore, it does not have much explanatory power in terms of IS success at the website level. The only redeeming feature of the measure is its relationship with use. If the organization considers loyalty to be an important feature to have, even if it is not related to net benefits then it is important to notice that use does significantly affect user satisfaction as measured by E-loyalty (return visitors). At the organizational level, we can argue that a company will be satisfied with the system if customers come back (repeated visits). Customers that are not satisfied, will not come back to purchase from the same retailer. We believe that it is difficult to find a good surrogate for satisfaction at the organizational level of analysis because the construct is so closely related to individual perceptions and individual behaviors. A different approach to measure this construct could be to aggregate individual perception measures instead of real objective data; however, we still have to be clear in identifying the recipient of the satisfaction. If at the individual level, satisfaction is a perception that comes directly from the user, who is satisfied at the organizational level? How might an organization be satisfied? The issue with the surrogate measure of satisfaction then could not be conceptual, but operational. Return visits can be measured in many different forms depending on who is reporting (measures reported by the company itself or measures reported by a third company that employs its own measuring techniques). Even though

conceptually the measure of E-loyalty fits the model, its measurement approach may not be adequate for the model.

Finally it is important to observe how service quality does not seem to have a significant effect on sales at this level of analysis (H9). At the individual level, service quality is measured by the individual experience of each user with the company that the user is measuring. At the organizational or website level, the variation comes from differences between websites. The results reflect that there is not enough variation in terms of satisfaction as measured by return visits between these websites. This may be explained by the sample used in the study, as the relationships would be stronger with a random sample of web sites with a wider range of sales. The sample contains retailers that are ranked in the top 500. For these companies, both the information they can provide about their product(s) and the quality of the system they have for their clients can differ significantly. Technology is rapidly changing this. Every time a company offers a new gadget, a new personalization feature, or a new type of interaction with the website, it is rapidly copied by competitors. In terms of service quality, however, the rules are clearly stated. Users expect to be able to contact the company if a problem arises; they expect to be able to receive a confirmation of their order and tracking information; they expect to be able to see the status of their account and modify it online if necessary. All these features have become so popular that the majority of websites have them, and if the website is in the list of the top 500 retailers, the site is highly likely to have it. The variability between these websites is so small that the model does not find it significant.

CHAPTER 6: CONCLUSION

This study provides support for using the DeLone and McLean Model of IS Success to explain variation at the organizational level of analysis in the E-commerce environment. To construct our measurement model, we utilize all measures of website variability at the organizational level. By not providing any measure at the individual level of analysis, we can be certain that the variability comes from differences among the websites included in the analysis and not from individual differences of the users/raters.

As we have seen, the results of the path model provide significant support for the relationships between service quality, system quality, and use; use and satisfaction; and use and net benefits. The results also provide significant support for positive relationships between information quality, system quality, and net benefits. Correlation results suggest that there is a relationship between information quality, system quality, service quality and satisfaction. However, when these relationships are placed in the context of the model and study, the results do not provide significant evidence to support a relationship between satisfaction and any of the three website qualities (system quality, service quality, and information quality). This is also the case between satisfaction and net benefits. Even though correlations suggest a relationship, when placed in the model, the relationship is not significant. These results are consistent with Petter's meta-analysis (2009) and Sedera et al. (2004).

It is important to note that there may be a series of confounding factors that affect net benefits and have not been identified in this study. Market forces, product characteristics, even company strategy can have strong influence on sales; however, we believe that the specific website features that we have identified in the study do have an effect on sales, too.

We acknowledge that these features are not the only factors affecting sales, but at the same time, the results show a relationship between our measured qualities, use, and sales that cannot be overlooked. Website features that map to perceptions of system quality, service quality, and information quality do provide value to the customers.

One may believe that one limitation of the study is the fact that only objective website features, not validated psychometric measures, have been used to test the model. However we believe that this is strength, rather than a limitation of our study, because our study uses objective measures and real-world outcomes. Our basic indicators are features of the websites. The measure itself is dichotomous, basically an objective feature-based measurement of the website. As a measure, it is error free because it depicts reality, not a perception; and it can be easily matched with already validated perceptions of system quality, information quality and service quality if necessary. Our model matches dollars and cents with website features, and this is, we believe, a strength. The type of data gathered may have stopped us from utilizing latent variables in a sophisticated structural analysis, but we believe that our path analysis is valid, shows strong results, and explains the strength and direction of the relationships in the model; basically, it helps us understand how website features affect use and net benefits.

Another limitation to the study is related to the type of data and the techniques utilized to simplify the website features to a manageable set. Since we utilized a factor analysis as a data reduction tool, the result creates groups of features that are similar among themselves and different among each other. As stated before, features with double or triple loadings were discarded from the set. This gives us a set of distinctive and differentiating features; however, features that may be important to the website (as reflected by loadings in all qualities) are not included in the analysis. For this reason, we may be losing website features that are important

to the website, but because they appear across the set, they are not distinctive enough because, basically, those features have been assimilated by all websites due to their importance and do not provide any more variance.

Our study may also suffer from sample bias which may lead to weaker results than expected. Our sample contains 448 websites from the top 500 list of most successful retailers in the E-commerce environment. These retailers already have successful websites, so the features they offer are features already recognized to extend or improve the quality of the website in any of the three areas studied. The variability in these websites may be minimal. We believe that the results would have been stronger and more variability could have been found if the sample would have contained not only the top E-commerce retailers, but also retailers that do not appear in the list. Basically, if instead of a sample from the top 500 a random sample from all online retailers would have been drawn, we believe that it would have given more feature variability and stronger results.

It would also be interesting to see if, at the measurement model level, the features included in the model are the same over time. It seems logical that improvements in technology would drastically change the make-up of these constructs and how the technology affects the structural model itself.

Another important extension of the study would include not only retailers but also websites that provide a service (e.g., income tax services, printing and editing services). It would be interesting to compare what features of the service websites are important and if they actually increase the overall quality of the websites.

A third extension of this study could include data at different points in time. This type of data would allow researchers to analyze the relationships between net benefits and use, and

net benefits and satisfaction; as well as a path from satisfaction back to use. Having yearly data points would also give important insights on feature changes across time. Researchers could analyze what website features seem to be necessary across time and which ones seem to change as time passes. Moreover, this type of data could elicit what retailer websites are considered "trend-setters" and provide support for benchmarking.

In conclusion, we believe that this study has advanced research in the IS field by (1) providing support for using the DLML model of IS Success at the organizational level of analysis on its entirety; (2) shown support for the use of objective, real features to be used both as dependent and independent variables in the analysis to provide practical results that can be used immediately by practitioners in the real world, and by researchers in further analysis.

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