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ABSTRACT

This paper empirically investigates the popular theoretical model of DeLone & McLean (2004) to measure the perceived benefits of B2C e-commerce for individuals who acquire and manage their student loans online. This study is one of the earliest validation tests on DeLone & McLean's e-commerce success framework in the context of B2C information system. The result indicated fairly good fit of the model to data, though several relationships in the model were insignificant. It also suggested that System Quality was the least influential among three exogenous constructs and User Satisfaction much more directly influenced Net Benefit than System Use.

INTRODUCTION

Internet has brought about enormous growth in the web-based business-to-consumer (B2C) e-commerce (Van Slyke et al.,2004), which is defined as the activity in which consumers get information and purchase product or service using Internet technology (Olson & Olson, 2000; Pavlou & Fygenson, 2006). E-commerce has changed the way of marketing and sales process, from sales force-driven mass marketing to more customized and buyer oriented marketing. While there has been steady growth in the amount of online transactions, companies struggle to find ways to better reach customers ubiquitously and enhance customer retention.

The potential benefits of B2C e-commerce will not accrue to businesses until they have identified the factors that impact the consumers' willingness to engage in online exchange relationships (Pavlou & Fygenson, 2006). The success of e-commerce transactions between businesses and consumers is determined by several factors, including consumer trust in sellers, products, services, and electronic systems (Lee & Turban, 2001), perceptions of security when providing personal information through websites (Suh & Han, 2003; Boyle & Ruppel, 2006; Chen & Nath, 2008); perceptions of service quality (Jayawardhena, 2004); and perceptions of ease of use and usefulness (Lu, Liu, Yu & Yao, 2005; Pavlou & Fygenson, 2006).

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Past studies point that a customer-oriented e-business may enhance customer satisfaction and loyalty by providing numerous advantages such as convenience, a well designed user interface, customized information, a variety of product information, and competitive pricing (Verhoef & Langerak, 2001; Park & Kim, 2003). Further, researchers suggested that improving the overall quality of online retailers is essential to customer satisfaction in the rapidly growing world of B2C e-commerce (Liu & Arnett, 2000; Park & Kim, 2003). When making investments in web-based systems, companies need to be able to pinpoint the salient characteristics that will impact system usage, user satisfaction, and overall benefits derived from investing in such systems. Therefore, assessing the e-commerce business model performance and success is a strategic issue for the managers.

The importance of online system performance for its users as a determinant to e-commerce success has been an active topic in the area of information systems. It has led to the development of several instruments and theoretical models grounded in some well-established theories such as end-user customer satisfaction (EUCS) model developed by Doll & Torkzadeh (1988) and Information Systems Success Model (ISSM) developed by DeLone & McLean (1992). These models are very popular and have been frequently used in empirical studies to test the performance of information-based systems and applications (Somers et al. 2003). Despite the popularity of B2C e-commerce, it is surprising to note there have been very few attempts on empirically validating and testing models of B2C e-commerce success (Brown and Jayakody, 2008; April and Pather, 2008). As DeLone and McLean (1992) pointed out, if IS research is to make a contribution to the world of practice, a well-defined outcome measure (or measures) is essential.

The DeLone & McLean Information Systems Success Model (1992) is generally accepted as one of the most comprehensive IS assessment models available in the IS literature (Myers et al, , 1997; Bown & Jayakody, 2008). The model has informed a number of subsequent studies and has helped to integrate IS success models (Molla & Licker, 2001; DeLone & McLean, 2003). We extend IS success measurement challenges to the updated DeLone & McLean's e-commerce model (DeLone & McLean, 2004), in which DeLone & McLean applied new metrics in consideration of the differences between information technology and e-commerce.

A thorough literature review has revealed very few studies that have measured e-commerce success using this updated framework. This paper tests the model as recommended by DeLone & McLean (2004) to determine its adequacy as a B2C e-commerce success framework. Particularly, is the DeLone & McLean's IS Success Model a useful framework to measure B2C e-commerce success? If so, what is the impact of e-commerce to business and customers? We measure the success of B2C e-commerce in the student loan industry.

The remainder of this paper is organized as follows. The literature review section identifies related studies in the areas of e-commerce success, discussion on key constructs and hypotheses, and an overview of student loan system. Next, we explain the research methods we followed for instrument development, data collection, and results from our empirical analysis that used primary data from 292 respondents. The interpretations from our empirical analyses are detailed in the discussion section.

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LITERATURE REVIEW

E-Commerce

E-commerce is defined as the use of Internet to facilitate, execute, and process business transactions (DeLone & McLean, 2004). It denotes the seamless application of information and communication technology from its point of origin to its endpoint along the entire value chain of business processes conducted electronically and designed to enable the accomplishment of business goals (Wigland, 1997). It involves exchanges among customers, business partners, and vendors (Molla & Licker, 2001). The fundamental role of e-commerce is similar to information technology (IT) in that both are tools for facilitating business transactions and communicating information to decision-makers (Kim, 1999). However, there are significant differences in terms of technical and managerial issues encountered (Kishore, Agrawal, & Rao, 2004). Information technology mainly focuses on internal functions such as desktop support, data center, and network operations. On the other hand, e-commerce systems enable an interface between a firm and its customers, and provide another channel to market products and services.

Prior studies indicate that there were no conclusive measures of e-commerce success; therefore, it has been difficult to measure the impact of e-commerce. A number of academic studies have attempted to examine e-commerce success in internet shopping and internet banking from a customers perspective (Aladwani & Palvia, 2002; Barnes & Vidgen, 2002; Jayawardhena, 2004; Lee & Turban, 2001; Pavlou & Fygenson, 2006; Schchiglik & Barnes, 2004; Schubert & Selz, 1997; Suh & Han, 2003). Jayawardhena (2004) developed a battery of measures that can be used to measure customer service quality in e-banking services. The results of the study revealed that service quality in e-banking can be measured using five dimensions: access, website interface, trust, attention, and credibility. Lee & Turban (2001) studied consumer trust perceptions and found that merchant integrity is a major positive determinant of consumer trust in Internet shopping. Schchiglik & Barnes (2004) developed an instrument to measure web information quality, web interaction quality, and site design specifically for customers using airline websites. Barnes and Vidgen (2002) designed an instrument to measure usability, design, information quality, trust, and empathy for customers using the website of online bookstores. Aladwani & Palvia (2002) developed an instrument to measure technical adequacy, content quality, and web appearance for customers using the websites of one of each of the following domains: a bank, a bookshop, a carmaker, and an electronics retailer.

Schubert & Seltz (1997) evaluated a total of eight websites to measure transaction phases instead of dimensions. The dimensions include information, agreement, settlement, community component, after-sales, and final section. Pavlou & Fygenson (2006) extended the theory of planned behavior to explain and predict the process of e-commerce adoption by consumers. The findings stress the importance of trust and technology adoption variables (perceived usefulness and ease of use) as salient beliefs for predicting ecommerce adoption. In addition, technological characteristics (download delay, Website navigability, and information protection), consumer skills, time and monetary resources, and product characteristics were also found to be important to consumers. Along with the dimensions identified so far, several other studies put the research effort on website design (Janda et al., 2002; Wang et al., 2001; Long & McMellon, 2004; Lim & Dubinsky, 2004; Kim & Stoel, 2004; Song and Zinkhan, 2003; McCarthy, Aronson & Petrausch,

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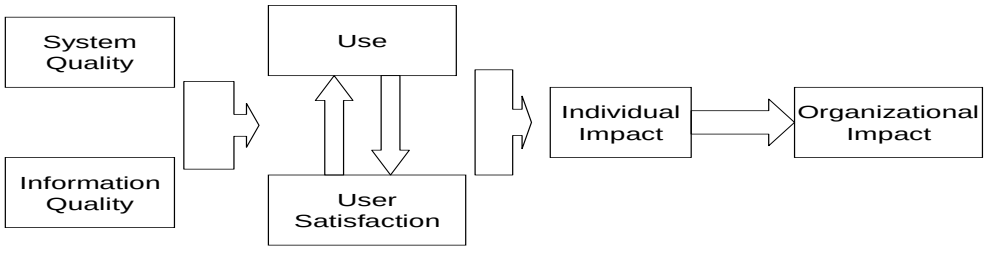
2004), information of product, payment and delivery (Szymanski & Hise, 2000; Barnes & Vidgen, 2002; Ranganathan & Ganapathy, 2002; Muylle et al., 2004; Wolfinbarger & Gilly, 2003), security (Cai & Jun, 2003; Surjadjaja et al., 2003; Yang & Jun, 2002; Yang et al., 2004; Long & McMellon, 2004; Janda et al., 2002), and, personalization (Madu & Madu, 2002; Yang et al., 2004; Surjadjaja et al. , 2003; Wolfinbarger & Gilly, 2003; Page & Lepkowska-White, 2002). Research interest is also growing on the impact of e-commerce vendors service on customer satisfaction, attraction, retention and profitability (Cai & Jun, 2003; Cox & Dale, 2001; Gurau, 2003).

A review of literature identified that e-commerce success research has been conducted in an incoherent way because of a lack of semantic consistence of variables, clear distinction between process and result dimensions, and general framework that renders holistic view of interrelationships of the variables. The inconsistency largely stems from the nature of nascent research area of e-commerce and this limitation impairs external validity and meaningful comparison of individual researches. In an attempt to seek more holistic B2C e-commerce research framework, this paper tests DeLone & McLean's e-commerce model for its validity and use, instead of adding extra confusion with an additional language to the Tower of Babel. Recognizing wide acceptance of its preceding DeLone & McLean's IS success model in IS research, the e-commerce version model possesses a potential to be a valid B2C e-commerce research framework.

DeLone and McLean model of IS success

The DeLone & McLean's IS Success Model (1992) was developed to identify critical information systems success factors (DeLone & McLean, 1992). Research prior to the presentation of the DeLone & McLean model had inconsistently addressed different aspects of information system success, making comparisons difficult. To organize the research, as well as to present a more integrated view of the concept of information system success, a comprehensive taxonomy was introduced. This taxonomy included six major dimensions or categories of information system success as depicted in Figure 1: system quality, information quality, use, user satisfaction, individual impact, and organization impact.

Figure 1: DeLone and McLean model of IS success (1992).



The model was revised in 2003 and extended to the application of e-commerce in 2004 (DeLone & McLean, 2003, 2004). DeLone & McLean (2004) proposed that the new model be used to measure the ultimate impact of e-commerce on a single user, a group of users, an organization, or an entire industry. The six dimensions of the revised model are system quality, information quality, service quality, usage, user satisfaction, and net benefits. According to DeLone &

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McLean (2004), these dimensions can be applied to the e-commerce environment as follows in Figure 2:

1. *System quality* measures the desired characteristics of an e-commerce system. These characteristics include factors such as reliability, adaptability, and usability. IT literature has focused on ease of use as an important predictor of IT acceptance and adoption. E-commerce use is an instance of IT use within a web-based setting and thus requires theorization from IT literature. When consumers feel that a system, whether IT or e-commerce, is easy to use, easy to navigate, and accessible, they will be more willing use the system. When e-commerce systems are reliable, this may act to reduce a consumers concerns regarding performance of the system and risk perceptions (Featherman, Valacich, & Wells, 2006). When businesses design web-based systems, these factors should be considered.

2. *Information quality* captures the e-commerce content issue. It measures the quality of the information produced through the e-commerce system. In an attempt to reduce operating expenses, companies are removing live customer service representatives from transactions. It is becoming common for companies to offer downloadable forms, online account information, online transactions, and e-mail as a contact alternative in place of encounters with live customer service representatives. When accessing information online, accuracy of information, ease of understanding, relevance, and security are important factors to consider.

3. *Service quality* is the overall support delivered by the provider of web-based services. Assurance, empathy, and responsiveness are considered as service quality measures. This is an important measure because as more and more financial institutions offer services online, competing banks will need to differentiate by delivering superior service quality compared to competitors in order to attract and retain customers (Jayawardhena, 2004).

4. *Use* measures everything from a visit to a Web site and navigation within the site to information retrieval and execution of a transaction.

5. *User Satisfaction* is an important means of measuring customer's opinions of an e-commerce system and should cover the entire customer experience cycle from information retrieval through purchase, payment, receipt, and service.

6. *Net benefits* are the most important success measures, because they capture the balance of the positive and negative impacts of e-commerce on customers, suppliers, employees, organizations, markets, industries, economies, and even society as a whole.

DeLone & McLean (2004) reviewed articles on e-commerce and electronic data interchange (EDI) in academic and trade journals (1996-2002) and found many existing measures of e-commerce success. All the proposed measures can be classified under the six dimensions of the new model. The new model is based on the assumption that even though new business models,

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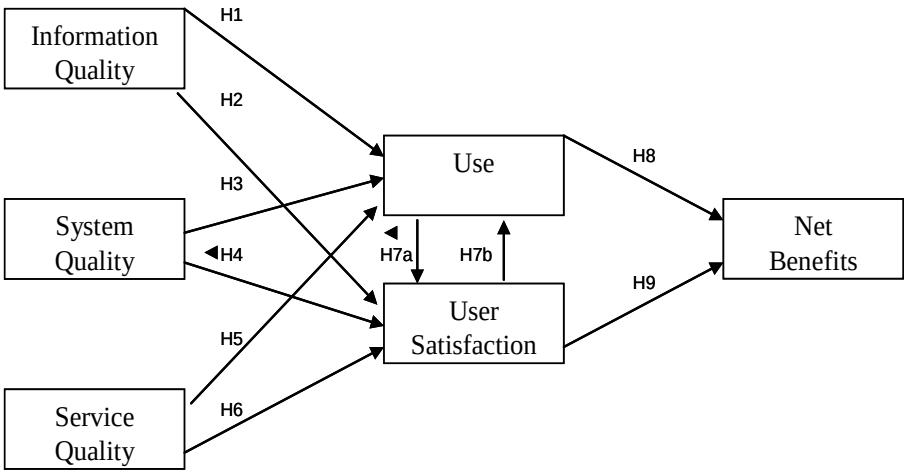
such as businesses that use e-commerce, are emerging, the fundamental role of IT has not changed, and thus the methodology for measuring the success of information systems should not change (Molla & Licker, 2001).

Unlike DeLone & McLean's IS success model (1992), DeLone & McLean's e-commerce success model (2004) has not yet received much of subsequent testing effort. Wang (2008) assessed e-commerce system with re-specified DeLone & McLean's model. The re-specified model included Information Quality, System Quality, Service Quality, Perceived Value, User Satisfaction and Intention to Reuse. Structural equation modeling result proved that the relationships in the model were significant. DeLone & McLean's e-commerce model needs more validation tests.

As recommended by DeLone & McLean (2004), we propose that the model depicted in Figure 2 may be used to measure the e-commerce success as perceived by consumers in the student loan industry.

Figure 2: DeLone and McLean e-commerce success model.



The hypotheses of this study correspond to the model in Figure 2:

Table 1: Hypotheses.

	Hypotheses
H1	Information Quality in the student loan e-commerce system is positively related to System Use.
H2	Information Quality in the student loan e-commerce system is positively related to User Satisfaction.
H3	System Quality of the student loan e-commerce system is positively related to System Use.
H4	System Quality of the student loan e-commerce system is positively related

	to User Satisfaction.
H5	Service Quality of the student loan e-commerce system is positively related to System Use.
H6	Service Quality of the student loan e-commerce system is positively related to User Satisfaction.
H7A	System Use of the student loan e-commerce system is positively related to User Satisfaction.
H7B	User Satisfaction of the student loan e-commerce system is positively related to System Use.
H8	System Use of the student loan e-commerce system is positively related to Net Benefits.
H9	User Satisfaction of the student loan e-commerce system is positively correlated to Net Benefits.

The student loan industry and e-commerce

The Student Loan Industry represents a nationwide network of guaranty agencies, lenders, loan servicers, collectors, schools, secondary markets, and other organizations involved in the administration of the loans insured by the federal government. These organizations compete as well as collaborate to offer federal loans to U.S. students requiring funds to attend schools in the U.S. and abroad. Web-based B2C e-commerce systems used to process student loans has made the loan application process faster, and more efficient.

Historically, the financial aid process started with a thick packet of papers called the Free Application for Student Aid, or the FAFSA. Loan applicants filled out the complicated forms and sent them to the Education Departments Office of Student Financial Assistance (SFA). The agency processed the forms and then sent the applicant a promissory note. After signing those loan papers, students received funds to attend school. SFA introduced the online FAFSA, a move that is increasingly popular with a generation of students accustomed to surfing the World Wide Web. The process improved even more in June 2001, when SFA introduced a system enabling students to electronically sign their loan documents without ever touching a sheet of paper (Dean, 2002).

Now, transactions in every phase of the student loan process can be done through e-commerce systems. The student loan borrower can apply for student loans, choose a lender, e-sign the promissory note, receive funds via online disbursement systems, update and manage account information, apply for deferments, forbearances, and consolidation loans, submit payments, and communicate with schools, lenders, and guarantors via email. An illustration of the student loan process taken from the Common Manual, a standardized set of current student loan rules and

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FFELP policy guidance for schools and lenders ("Common Manual: Unified Student Loan Policy,") is shown in Figure 3. The entire process is cheaper, quicker and easier. Officials have estimated that they will save as much as $35 on each application received online. This amounts to huge savings for organizations in the industry considering that in 2005, federal loans constituted 47 percent, 61.3 billion dollars, of the total aid to graduate and undergraduate students (CollegeBoard, 2005). Loan applicants enjoy the benefit of having a process that is less time consuming, more efficient, and more convenient.

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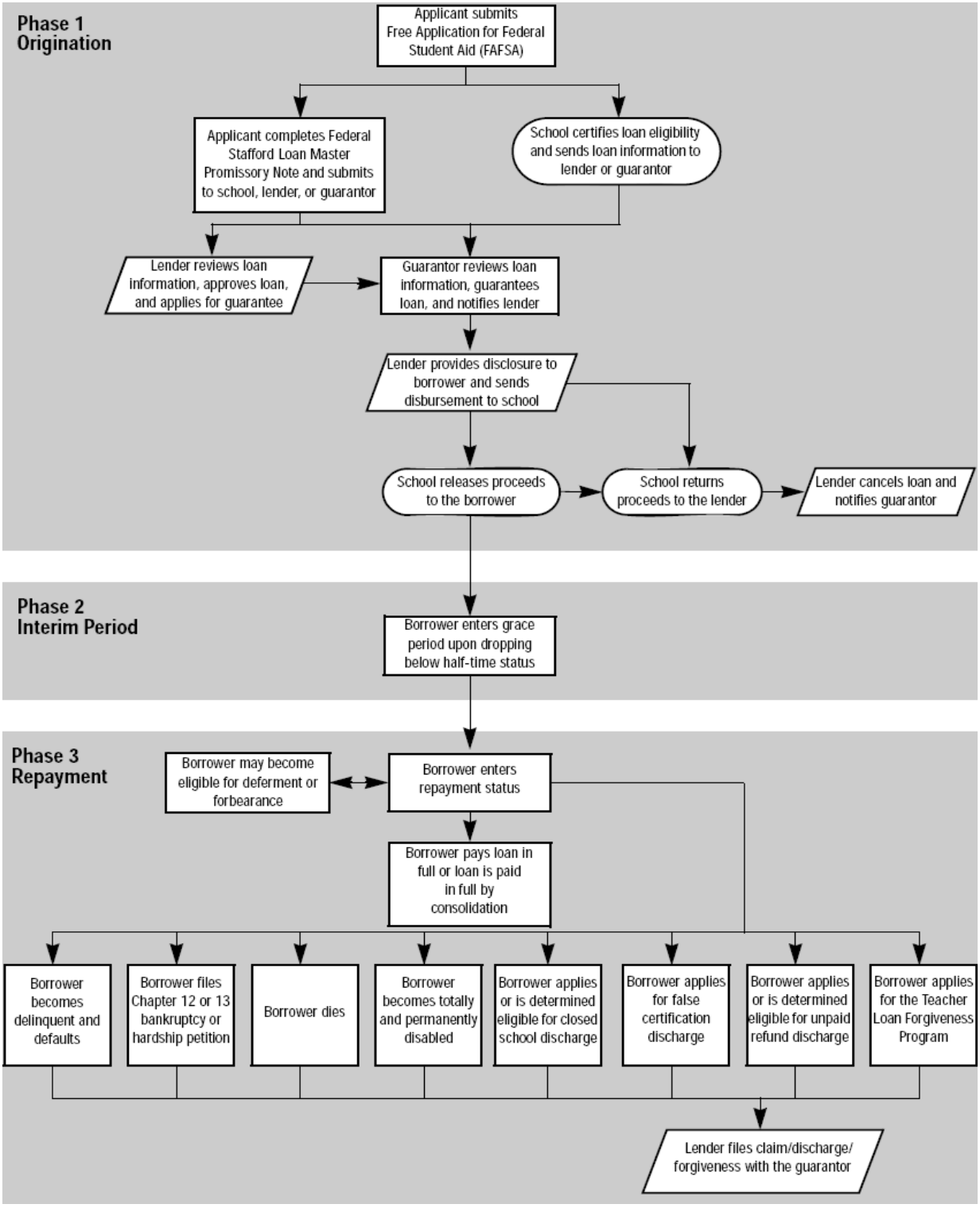
Figure 3: Life of a student loan.



The development of technology and e-commerce in the student loan industry is an industry-wide initiative to facilitate transactions with consumers. Therefore, research evaluating web-based systems in this industry is not only important, but is also timely. Since most organizations in the

student loan industry offer a complete web-based process for obtaining student loans, factors such as trust, security, service quality, data integrity, website design, and technology acceptance are most likely very important issues when implementing e-commerce systems. Organizations in this industry need to be aware of the characteristics of e-commerce systems that are of most important to their consumers in order to increase the use, satisfaction, and benefits of using e-commerce.

SAMPLING AND MEASURES

A thorough literature review has helped to generate 28 items for the various constructs and variables. This study uses e-commerce metrics suggested by DeLone & McLean (2004) as a survey instrument foundation. The actual instruments were derived from the model criteria through literature review to reflect the context of specific web-based processes.

Table 2: Measures.

Variables	Items
System Quality	1. Ease of Use 2. Reliability 3. Accessibility 4. Usefulness 5. Flexibility 6. Ease of Navigation
Information Quality	1. Content 2. Availability 3. Accuracy 4. Timeliness 5. Conciseness 6. Convenience
Service Quality	1. Service Availability 2. Security 3. Responsiveness 4. Service Quality
Use	1. Updating account information 2. Accessing information to solve problems 3. Information retrieval to solve problems 4. Completion of transaction
User Satisfaction	1. Meets customer needs 2. Efficient exchange of information 3. Satisfaction with service
Net Benefits	1. Reduction of administrative costs 2. Reduction in time 3. Enhancement of service 4. Enhancement of customer relationship 5. Improved communication

The large-scale study was carried out to collect responses from student loan customers from seven student loan lending institutions from southern states. An invitation e-mail was sent to

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3372 customers, either students or parents, who have used the web-based student loan systems, asking participation on web survey. Six hundred sixty eight e-mail addresses were undeliverable. Total of 302 out of 2704 e-mail recipients participated and responded in the Web-based survey, resulting response rate of 11.2%. After data cleaning and purification process, 292 responses were selected to be used for data analysis. Demographic of the respondents is summarized in Table 3.

Table 3: Demographics.

Status		student	parent	no response					*total*
	n	233	46	13					*292*
	%	79.8	15.8	4.5					*100.0*
Degree Program		Undergr.	graduate	continuing ed.	no response				
	n	176	83	16	17				*292*
	%	60.3	28.4	5.5	5.8				*100.0*
Gender		Male	Female	no response					
	n	65	207	20					*292*
	%	22.3	70.9	6.8					*100.0*
age		=<20	21-25	26-30	31-40	41-50	> 50	no response	
	n	57	70	41	51	38	14	21	*292*
	%	19.5	24.0	14.0	17.5	13.0	4.8	7.2	*100.0*
Institution Type		Public col.	private col.	Comm. col.	no response				
	n	166	20	91	15				*292*
	%	56.8	6.8	31.2	5.1				*100.0*

DATA ANALYSIS

Validity and reliability

Factor validity was assessed for exogenous and endogenous constructs using SPSS 15.0. The result of pattern matrix for exogenous constructs is reported in Table 4 (a & b). An overall value of 0.959 for the KMO measure suggests that the correlation matrix of questionnaire items is appropriate for factoring. Also Bartlett's test statistic is highly significant (p=0.000) and implies that the correlation matrix is not orthogonal. Therefore, the data set is appropriate for factoring. Exploratory factor analysis (principal axis analysis with promax rotation) on exogenous constructs (system quality, information quality, and service quality) resulted in three separate factors representing items for system quality, information quality, and service quality respectively. All items clearly loaded onto corresponding factors with factor loading greater than 0.50 except ServQual4, which will be excluded on the further analysis.

Then endogenous variables were analyzed using principal axis factoring with promax rotation. The result is summarized in Table 4. An overall KMO value of 0.922 and significant Bartlett's test statistic (p=0.000) together implies that the data set is appropriate for factoring.

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Table 4: Factor loadings.

Pattern Matrix (a)

	Factor		
	1	2	3
SysQual1	0.891	0.062	-0.032
SysQual2	0.733	0.041	0.148
SysQual3	0.939	0.014	-0.007
SysQual4	0.845	0.216	-0.092
SysQual5	0.64	0.084	0.247
SysQual6	0.726	0.111	0.129
InfoQual1	0.114	0.869	-0.026
InfoQual2	0.121	0.655	0.172
InfoQual3	0.162	0.613	0.183
InfoQual4	0.234	0.549	0.171
InfoQual5	0.156	0.759	0.047
InfoQual6	0.03	0.877	0.012
ServQual1	0.032	0.345	0.516
ServQual2	0.014	0.099	0.78
ServQual3	0.046	-0.022	0.823
ServQual4	0.2	0.448	0.316

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
a Rotation converged in 7 iterations.

Pattern Matrix (b)

	Factor		
	1	2	3
SysUse1	-0.048	0.76	0.111
SysUse2	0.074	0.736	0.075
SysUse3	0.022	0.86	-0.019
SysUse4	0.532	0.252	0.024
UseSat1	0.924	0.095	-0.104
UseSat2	0.873	0.134	-0.1
UseSat3	0.95	0.05	-0.091
NetBen1	0.723	-0.151	0.273
NetBen2	0.698	-0.163	0.325
NetBen3	0.773	-0.03	0.207
NetBen4	0.046	0.111	0.806
NetBen5	0.04	0.099	0.84

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
a Rotation converged in 6 iterations.

Most items clearly loaded onto corresponding factors without significant cross-loading. However, SysUse4 was significantly loaded on User Satisfaction factor and decided to be removed. Net Benefit items had interesting factor loading result. The first three and the other two showed different loading pattern, however this seemingly discrepancy deems acceptable considering various definitional arrays of Net Benefit. The first three measure operational improvements while the other two represent improved relationship with stakeholders. Also it explains close relationship between the first three items and user satisfaction level. All five Net Benefit items will remain on the subsequent analysis due to theoretical importance and explanation power.

Construct reliability can be assessed using two measures of internal consistency: Cronbach's alpha and composite reliability. The interpretation of both values is similar. We can use the guidelines offered by Nunnally (1994) that suggests 0.7 as a benchmark for a modest reliability applicable in early stages of research. The diagonal values tabulated in Table 5 represent the composite reliability of each construct. The high values suggested that the constructs demonstrated a higher level of reliability.

Convergent validity was assessed by examining the average variance extracted (AVE) measure as suggested by Fornell and Larcker (1981). AVE values should be greater than 0.50 (Segars, 1997). Consistent with this suggestion, AVE measures for all constructs exceed 0.50. The AVE values for each construct are also reported in the diagonals of Table 5.

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In addition to mean and standard deviation, the Table 5 also reports correlation matrix. All the correlation values were found to be significant at $p < 0.001$ level. Discriminant validity is demonstrated when a measure does not correlate very highly with another measure from which it should differ (Venkatraman, 1989). The differences in chi-square values between restricted and freely estimated models provide statistical evidence of discriminant validity (Segars, 1997). To assess discriminant validity, differences in chi-square values were computed for each set of the constructs. The results are presented in Table 5. The chi-square difference between restricted and freely estimated models was high and significant at $p < 0.01$ which suggests that the constructs are distinct and that their underlying scales exhibit the property of discriminant validity.

Table 5: Composite reliability, average variance extracted, correlation, and chi-square difference.

	SysQual	**InfoQual**	**ServQual**	**SysUuse**	**UserSat**	**NetBen**
SysQual	**reliability =.95** **AVE=.78**					
InfoQual	correlation =0.83 chi sq difference =19.80	**0.93** **0.73**				
ServQual	0.74 25.60	0.82 23.30	**0.83** **0.63**			
SysUse	0.52 11.30	0.58 10.70	0.64 9.90	**0.89** **0.83**		
UserSat	0.66 14.50	0.84 8.70	0.75 13.50	0.65 0.60	**0.93** **0.81**	
NetBen	0.60 40.60	0.70 38.60	0.68 41.30	0.62 12.70	0.69 21.40	**0.87** **0.73**
Mean	6.06	6.04	5.85	5.13	6.01	5.80
Standard deviation	0.97	0.89	1.04	1.57	1.06	1.23

Structural equations modeling

With measurement model test, all paths between indicator and construct were found to be significant. T-values of the paths ranged from 14.837 to 27.305 which well exceed critical value of 1.96.

We proceeded to test the structural model of Figure 2. Both in their original 1992 and the modified 2004 models, DeLone & McLean suggest a bi-directional relationship between the System Use and the User Satisfaction. Within SEM, such relationships can be termed as indeterministic and this study runs two separate structural models, one model with causal relations from Use to Satisfaction (H7a) and another from Satisfaction to Use (H7b).

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During the first full structural model run, all hypotheses were tested but H7B. The result is summarized in Table 6. Goodness-of-Fit index (GFI) of 0.853, adjusted goodness-of-fit index (AGFI) value of 0.815, and Comparative-Fit-Index (CFI) of 0.990 indicate that the overall model fits well. The root mean square error of approximation (RMSEA) value of 0.0678 is within acceptance range and implies a satisfactory model fit. The fit indices indicate that the model reproduces the covariance matrix well. All the loadings (squared multiple correlations) between indicator and latent variables are above 0.5 indicating significant construct validity. Overall, most of the measures showed a moderate fit except high chi-square value, which probably is due to SEM's sensitivity to large sample size. The path coefficients were examined to determine whether or not they implied significant relationships between the corresponding constructs. T-value higher than 1.96 indicates significant causal relationship at 0.05 alpha level. However, our data did not support hypotheses H1, H3, H4, and H8 (Table 7). The rest of the hypotheses was supported at $p<0.001$ level. Standardized regression coefficient suggested that compared to the System Use, User Satisfaction was more dependent on the three exogenous variables. The Net Benefit for the organization was also driven more from the User Satisfaction as compared to the System Use. In the next structural model run, we excluded H7A, and instead tested for H7B.

Table 6: SEM statistics summary.

Measures	Model with H 7A	Model with H 7B
Degrees of Freedom	278	280
Chi-Square	639.512 (P = 0.0)	662.578 (P= 0.0)
Normed Fit Index (NFI)	0.983	0.983
Non-Normed Fit Index (NNFI)	0.989	0.988
Root Mean Square Error of Approximation (RMSEA)	0.067	0.069
Parsimony Normed Fit Index (PNFI)	0.841	0.847
Incremental Fit Index (IFI)	0.990	0.990
Relative Fit Index (RFI)	0.980	0.980
Root Mean Square Residual (RMR)	0.063	0.036
Goodness of Fit Index (GFI)	0.853	0.849
Adjusted Goodness of Fit Index (AGFI)	0.815	0.810
Comparative Fit Index (CFI)	0.990	0.990
Parsimony Goodness of Fit Index (PGFI)	0.676	0.677

With the second model run, goodness of fit result was pretty similar as the first run. H3, H4, H5, and H8 were found insignificant relationships (Table 8). All other hypotheses were strongly supported. Again, User Satisfaction was found to be more influential than System Use in the causal relationship model.

In both SEM runs, it was found that System Quality was the least influential among three exogenous constructs and Net Benefit was much more directly influenced by User Satisfaction than System Use.

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Table 7: Result from first structural model.

Hypothesis #				t-value	Hypothesis Supported?
H1:	Information Quality	→	System Use	0.03	No
H2:	Information Quality	→	User Satisfaction	5.30	Strong Support
H3:	System Quality	→	System Use	0.45	No
H4:	System Quality	→	User Satisfaction	-0.40	No
H5:	Service Quality	→	System Use	3.28	Strong Support
H6:	Service Quality	→	User Satisfaction	3.42	Strong Support
H7A:	System Use	→	User Satisfaction	3.99	Strong Support
H8:	System Use	→	Net Benefit	-1.23	No
H9:	User Satisfaction	→	Net Benefit	14.47	Strong Support

Table 8: Result from second structural model.

Hypothesis #				t-value	Hypothesis Supported?
H1:	Information Quality	→	System Use	2.91	Strong Support
H2:	Information Quality	→	User Satisfaction	5.11	Strong Support
H3:	System Quality	→	System Use	0.61	No
H4:	System Quality	→	User Satisfaction	-0.19	No
H5:	Service Quality	→	System Use	0.41	No
H6:	Service Quality	→	User Satisfaction	4.82	Strong Support
H7B:	User Satisfaction	→	System Use	4.15	Strong Support
H8:	System Use	→	Net Benefit	-1.40	No
H9:	User Satisfaction	→	Net Benefit	14.47	Strong Support

DISCUSSION

SEM was run on data twice because of inability of SEM software to handle bidirectional relationship between two constructs (System Use and User Satisfaction), one run for model with H7A (System Use → User Satisfaction) and another with H7B (User Satisfaction → System Use). In overall, goodness of fit of the DeLone & McLean e-commerce model was fairly good, indicating that it has a great potential for e-commerce research framework. However, on each SEM analysis four of nine hypotheses were found to be insignificant, but not negatively significant which might be the worst case. Interestingly the three of the four insignificant relationships in both analyses relate to System Use construct. And this result is consistent with our previous B2B research (Cates et al, 2009). Explanation for this weak linkage of System Use in the model would be either specification error or just a representation of real phenomena, or would be both.

First, the problem can be due to model specification error. SEM cannot measure bidirectional relationships (H7A and H7B) simultaneously in one analysis, failing to represent original

conceptual relationship in DeLone & McLean e-commerce model. In this case it would better be referred to as specification inability, instead of specification error. The real phenomena of how constructs interrelate in the model might not be represented well in the absence of another reciprocal relationship between the two constructs. Evidence that would help support this issue is bi-construct correlation presented in the Table 5. All correlations between System Use and other constructs were highly significant (<0.001) but many of the high relationships diminished to insignificant level in SEM result. This explanation is also subjected to issues of muticollinearity and limited causation power of correlation but, at least, it is clear that SEM cannot run the conceptual model as exactly as specified.

Secondly, the weak linkage of System Use might be a proper reflection of idiosyncratic characteristic of student loan industry. Unlike merchandise B2C or other B2C sectors, customers of student loan industry usually keep long-term relationship with lender. Once the relationship is established, choice is not left much on customers to switch to others. Thus actual system use may not be greatly influenced by features and characteristics of B2C e-commerce system. If true, the weak relationship around System Use dimension can be true representation in the industry. Thus it is suggested that future B2C research pay more attention to System Use in the relation to the industry type which can affect characteristics of consumers' system use behavior.

The result showed that Information Quality and Service Quality were strong contributors to Customer Satisfaction but System Quality was not in student loan B2C. In identifying key contributor to System Use, none of its indicator was found to be consistent and significant. System Use and User Satisfaction had a significant impact on each other and Net Benefit was greatly influenced by User Satisfaction. In a summary of these findings, an organization should focus more on the quality of information and service provided on website to be successful in student loan B2C. This effort will lead to a higher customer satisfaction and ultimately to a better performance.

CONCLUSION

This study examined validity of DeLone & McLean's e-commerce success framework in B2C student loan industry. The result indicated fairly good fit of the model to data, though several relationships in the model were insignificant. It also suggested that System Quality was the least influential among three exogenous constructs and Net Benefit was much more directly influenced by User Satisfaction than System Use. Weak relationship around System Use construct pointed out potential problems where customers use B2C e-commerce system with limited switching option to other service provider.

One limitation of this study was an inability to measure reciprocal relationship between system use and user satisfaction at one structural equation modeling analysis. Another limitation or an interesting issue suggested by the result was regarding measurement of system use when user's choice to switch to other service provider is very limited. In such case, frequency of system use would not clearly indicate user's preference for the system. More research is expected on these issues for further clarification.

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This study is presumed to be one of the earliest validation efforts on DeLone & McLean's e-commerce success framework. Thus more collective research replication effort is expected on other industries, especially where B2C is most flourishing such as commodity and digital merchandise sectors.

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