KEY DETERMINANTS OF INFORMATION SYSTEM EFFECTIVENESS – AN EMPIRICAL CASE IN LAC HONG UNIVERSITY

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ABSTRACT

Information Systems (IS) have played crucial roles for the survival of organizations in today's technology-focused environment. Therefore, due to the intense competition among educational institutions in Vietnam, Lac Hong University (LHU) has paid great investment in its web-based IS to improve its efficiency in terms of operation processes, planning and decision making. However, a formal evaluation of its effectiveness has never been considered. Hence, this study aims at providing practical insights of its current status by investigating the perception of its stakeholders towards some key attributes of the system effectiveness. Particularly, the effectiveness of LHU IS is found significantly affected by the information reliability, informative outputs provided by the system, the system quality itself, and service quality, whose relationships were statistically tested and found that the information reliability and service quality have the strongest impact on the use of LHU IS whereas the outputs influence user satisfaction the most. Moreover, service quality is also an important factor of user satisfaction. Additionally, there is a strong and positive correlation between the use of LHU IS and the user satisfaction which positively affect the perception of its stakeholders. These findings pave the way for the board of management of LHU to implement more proper policies for its sustainable growth and development.

Keywords: Information system, IS Effectiveness, Lac Hong University, Effectiveness assessment, Effectiveness Framework

1. INTRODUCTION

Nowadays, in a so-called information age, every organization needs to stay sensitive to change to well adapt to the continuous developments in information technologies, information exchange, increasing expectations of the society, modern managing perceptions and applications. The recent advances in the science and technology lead to the critical emergence of Information Systems (IS) in today's technology-focused environment. Thus, more and more organizations have paid special attention and investment in setting up good ISs. Roberts and Sikes (2011) has reported that the investment in information technologies (IT) are prioritized to not only improve the effectiveness and efficiency of business processes and reduce IT costs but also provide managers with valuable information to support their planning and decision making, as shown in Figure 1.

% of respondents[1]

Current IT priorities at respondent's company	Total, n = 927	Ranking by current priority		Ranking by ideal priority, total, n = 927
		Non-IT executives, n = 427	IT executives, n = 471	
Improving effectiveness of business processes	47	1	2	1
Improving efficiency of business processes	45	2	3	4
Reducing IT costs	44	5	1	7
Providing managers with information to support planning and decision making	40	3	4	3
Creating new products or services	29	4	6	2
Ensuring compliance with regulations	23	6	8	8
Entering new markets	20	7	5	5
Managing risk	14	8	7	6

Figure 1.1: Current IT priorities (Roberts & Sikes, 2011)

Practically, recent studies have focused on the contributions of information technologies to education (Webber, 2003; Flanagan & Jacobsen, 2003; Pelgrum, 2001; Yuen, Law, & Wong, 2003). As providing the most contemporary education in line with financial efficiency is always expected, big investment plans about the use of information systems have been put into action all over the world (Pelgrum, 2001; Yuen, Law, & Wong, 2003). The emergence of Internet and information technologies turns conventional ISs into web-based ISs (WISs), enabling everyone to access it through multiple channels in a dynamic and interactive environment (Tokdemir, 2009). As a consequence, several studies have investigated the effect of internet towards the effectiveness of WISs in terms of consumer satisfaction, organizational strategy, risk, and service quality and web-site assessment (Tokdemir, 2009). Conventionally, different stakeholders may have different expectation on the performance of the WISs. The broadband internet surfing allows users to easily and quickly access a broad range of valuable knowledge depository, indicating that the survival of an organization depends heavily on the success of WISs. Thus, getting to know the key determinants of the effectiveness of an IS becomes critical for its incessant improvement. By considering the new environment together with the increased need for system assessment, this study aims at identifying important affecting factors of the effectiveness of LHU IS in order to provide the board of management profound insights of its current operation so that more proper policies can be implemented to serve its stakeholders better in practice.

2. LITERATURE REVIEW

According to the latest forecast by Gartner Inc. in 2014, Worldwide IT spending is anticipated to total $3.8 trillion in 2014, a 3.1 percent increase from 2013 spending of $3.7 trillion (Rivera & Meulen, 2014). How this huge amount of expenditure provides competitive advantage for related firms is still questioned, i.e. IS expenditure and its benefits to the organization should be concurrently taken into consideration. Therefore, evaluation of the information system (IS) has been a popular research area over the past years in terms of effectiveness, efficiency and success which are used interchangeably creating an ambiguity in the field (Tokdemir, 2009). Efficiency is defined as the ratio of the output to the input of any system to get maximum benefit with less cost. On the other hand, effectiveness is more concerned with the influence on the environment, results caused by a system, thus has an external focus (Myers, Kappelman, and Prybutok,

1997). Hamilton and Chervany (1981) used effectiveness as the accomplishment of organizational goals. Meanwhile, Fitzgerald (1998) claimed that completing some tasks efficiently, with minimum possible cost, does not guarantee that those tasks satisfy their intending objectives. Thus, using efficiency as an assessment measure may not give correct results since systems that may not provide cost savings can provide significant opportunities to organizations in the future. Thus, an effective IS must support its organization to reach to its objectives as a whole (Malik, 2001). DeLone and McLean (1992) defined success in the context of information

systems. Due to the similarity between success and effectiveness, these two terms are used interchangeably.

In order to provide a general and comprehensive definition of IS success that covers different perspectives of evaluating information systems, DeLone and McLean (1992) reviewed the existing definitions of IS success and their corresponding measures, and classified them into six major categories, including System Quality, Information Quality, Use, User Satisfaction, Individual Impact and Organizational Impact (D&M model) as shown in Figure 2.
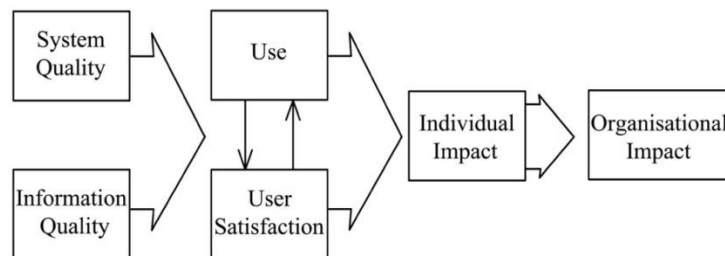

Figure 2: DeLone & McLean's Success Model (DeLone & McLean, 1992)

An updated model was proposed in (DeLone & McLean, 2003, 2004). Based on D&M IS success model, the associations among the measure have been considered in several empirical studies by Etezadi-Amoli and Farhoomand (1996), Goodhue and Thompson (1995), Guimaraes and& Igbaria (1995), Igbaria and Tan (1997), and Teo and Wong (1998). Other empirical studies implicitly examined the multiple success dimensions and interrelation of this model (Wixom & Watson, 2001; Gelderman, 1998; Igbaria et al., 1997; Teng & Calhoun, 1996; Torkzadeh & Doll, 1999; Weill & Vitale, 1999; Yoon, Guinmaraes, & Clevenson, 1998; Yuthas and Young, 1998). These IS researchers suggested several improvements to the D&M IS success model. Many of them studied the multidimensional of information system success, including information quality, system quality, service quality, system use, user satisfaction, individual impacts, and organizational impacts. Information quality is used to measure the quality of the information that the system produces while system quality is used to measure the information processing system itself with its focus on system integration, flexibility, reliability, and response time (DeLone & McLean,

1992, 2003). System use is a measure on how the system is used to make decision, the frequency use of the report, and the frequency use of the system (Bailey & Pearson, 1983). And, user satisfaction is a measure on users' pleasant-unpleasant continuum (Seddon, 1997), whereas net benefits are composted by individual impacts and organizational impacts and works as a measure of the sum of profits and costs to the use of an information technology application (DeLone & McLean, 2003; Seddon, 1997).

Thus, after their comprehensive analysis and discussion of more than 100 existing articles, DeLone & McLean (2003) proposed an updated D&M IS success Model where a system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will either positively or negatively influence user satisfaction and the further use of the information system. However, as the dimensions of IS effectiveness are broad and multifaceted, each should be carefully defined, selected, and measured because of complex, multidimensional and

interdependent nature of IS success. Hence, the updated D&M IS Success Model is a useful model for developing e-commerce success measures and should continue to be rested and challenged (Shiau et al., 2006).

The emergence of Internet and information technologies turns conventional ISs into web-based ones (WISs), enabling everyone to access them through multiple channels. Thus, IS assessment should be investigated from a new approach to adapt to this new dynamic environment. For the web-based IS assessment, the initial trend was to apply traditional IS conceptual models like D&M model to WISs. The interface quality of WIS interacting with users has also become a popular subject studied by many researchers (Schonberg et al., 2000; D'ambra, 2001; Park & Baek, 2007; Aladwani & Palvia, 2002; Seethamraju, 2004; Loiacono, Watson, & Goodhue, 2007). In assessing enterprise resource planning (ERP) system, Shiau et al. (2006) modified the updated D&M IS success model by not considering "Service quality" as the most important variable to measure the success of the IS department because the IS department is a single large system only. Instead, they considered "information quality" and "system quality" as the most important quality components. They focused on firms that already implemented and used an ERP system. They found that: (1) Information quality significantly affects system use; (2) Information quality is not significantly related to user satisfaction; (3) System quality significantly affects system use and user satisfaction; (4) System use significantly affects user satisfaction and net benefits; (5) User satisfaction is not significantly related to net benefits; and (6) System quality significantly affects net benefits.

3. CONCEPTUAL FRAMEWORK

In Vietnam, because the number of new students enrolled is based on the so-called "quota", LHU has recently been aware of the importance of attracting good high school students and training them well to make LHU a well reputed university. From the above reviews, this paper would like to further investigate the performance of the updated DeLone & McLean IS success model in the practical case of LHU IS which is actually a WIS. The existence of LHU IS changes the organization's internal business processes and provides more time savings and efficiency because users can easily find necessary

information and complete their applications and registrations electronically. From the aforementioned issues, we will further investigate the key determinants of the effectiveness of LHU IS based on the conceptual framework presented in Figure 3.
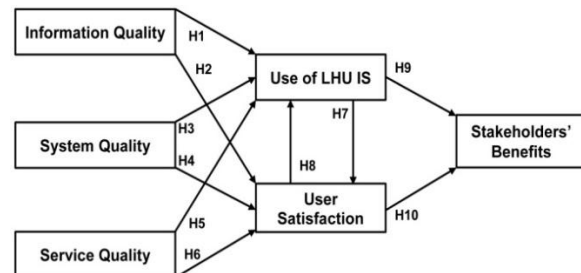

Figure 3: Conceptual Framework

Basically, the term "information quality" mainly relates to the accuracy, value, usefulness, timeliness, and relevance of the information for efficient decision-making. Thus, good information quality usually leads to good usage attitude of IS users and usage frequency of the IS (Teo & Wong, 1998; Teng & Calhoun, 1996). In addition, information quality closely relates to the user satisfaction (Seddon & Kiew, 1994). In the framework, user interface, ease to use, usefulness, performance, and quality of document are the key aspects of system quality (Seddon, 1997). A system with slow response time, incorrectness and incompleteness system output, and system crash, has detrimental effect the usage attitude of the users; for instance, users spend more time on a system and get nothing, they will feel more distressed. Moreover, a system with high system quality can be of great benefit to individuals and organizations (Seddon, 1997; Wixom & Watson, 2001). Users tends to intensively use an IS if it meets their needs and facilitates their own goals (Gelderman, 1998) because they have better sensation towards the IS. They are also able to evaluate the value of the IS when they use it pleasantly or unpleasantly (Teo & Wong, 1998). An effective IS provides its organization more benefits than costs in terms of better understanding context, increase decision-making productivity, reduce the cost, and increase net benefit (Wixom & Watson, 2001). Moreover, Oliver (1997) argued that service quality can be described as the result from a

comparison between user expectations about the service they will use and their perceptions about the service they experience. If the perception is higher than the expectation, the service is considered excellent; if the expectation is equal to the perception, the service is considered good; and otherwise, the service is considered bad. Thus, service quality is one the major factors affecting the user satisfaction.

Furthermore, system use is usually referred as frequency of use, time of use, number of accesses, usage pattern, and dependency (DeLone & McLean, 2003) whereas Ives, Olson, and Baroudi (1983) claimed that a system providing enough necessary information makes its users satisfied. Thus, user satisfaction is a measure that reflects the extent to which users believe that the information provided by the system meets their needs, i.e. user satisfaction is an indirect measure of the effectiveness of an IS. Additionally, Bailey & Pearson (1983) believed that user satisfaction is also a measure of IS productivity which involves efficient and effective provision of information; hence, user satisfaction can be a meaningful indicator of system performance. Importantly, the benefits brought by an IS can be assessed from different perspectives, such as: time-saving, cost-saving, better efficiency, quicker responsiveness, etc. Besides, with an effective IS, an organization can identify its strengths and weaknesses through the presence of revenue reports, employees' performance record etc. Consequently, the organization can not only improve its business processes and operations but also provide its overall picture by using the IS as a communication and planning tool.

From the above considerations, this study will investigate the following hypotheses.

- H1: Information quality has a positive impact on the use of the LHU IS.
- H2: Information quality has a positive impact on the user satisfaction.
- H3: System quality has a positive impact on the use of the LHU IS.
- H4: System quality has a positive impact on the user satisfaction.
- H5: Service quality has a positive impact on the use of the LHU IS.
- H6: Service quality has a positive impact on the

user satisfaction.
- H7: The use of LHU IS has a positive impact on the user satisfaction.
- H8: User satisfaction has a positive impact on the use of LHU IS.
- H9: The use of LHU IS has a positive impact on the stakeholders' benefits.
- H10: The user satisfaction has a positive impact on the stakeholders' benefits.

4. RESEARCH METHODS

Based on the key attributes discussed above, we developed a self-completion questionnaire which was first delivered to three experts in LHU to ask for their advices. After that, a preliminary interview of some stakeholders was conducted in order to check the appropriateness of the statements. The revised version was then doubled checked by other two experts for their further improvement. The final version of the questionnaire includes two major parts. The first part consists of five items about general information of the participant, including gender, age, position, usage duration, and usage purpose. And, the second part consists of six different constructs with 38 components which are coded as the following:

- ❖ Information Quality Construct (IN) consists of ten components, including:
  - *IN1: The information addresses your needs.*
  - *IN2: Most of the displayed information on LHU IS is accurate.*
  - *IN3: The information on LHU IS is updated.*
  - *IN4: The information provided is complete.*
  - *IN5: Provided information is linked together.*
  - *IN6: The outputs are put in the sequence that you find it useful.*
  - *IN7: The outputs are easy to understand.*
  - *IN8: The information can be easily accessed.*
  - *IN9: The outputs are relevant to the decision you make.*
  - *IN10: The information can be easily verified.*
- ❖ System Quality Construct (SY) consists of

eight components, including:

- *SY1: The system has been operated reliably.*
- *SY2: The system response time is short.*
- *SY3: The system can be rapidly changed or upgraded.*
- *SY4: The system is highly secured.*
- *SY5: The system provides clear instruction for users to operate, prepare inputs for, and interpret outputs.*
- *SY6: The system can be legally accessed anytime.*
- *SY7: The system can be legally accessed on different devices.*
- *SY8: Any system error is quickly repaired.*

❖ Service Quality Construct (SE) consists of five components, including:

- *SE1: Several documents can be applied online via the LHU IS.*
- *SE2: Queries and/or questions are quickly replied.*
- *SE3: The replies/responses are polite and informative.*
- *SE4: System administrators are willing to help users.*
- *SE5: Available services are provided with clear procedures.*

❖ System Use Construct (SU) consists of five components, including:

- *SU1: The system is used to help making decisions.*
- *SU2: Several reports can be generated for reference.*
- *SU3: You usually use the system for your needs.*
- *SU4: The time you spend on each time of use is reasonable.*
- *SU5: You regularly get onto the system to get information.*

❖ User Satisfaction Construct (US) consists of seven components, including:

- *US1: You are usually satisfied with the responses from the system.*
- *US2: You are satisfied with the replies from in-charge persons.*
- *US3: You are satisfied with quick helps from others on the system.*
- *US4: The system interface is professionally designed.*
- *US5: The description of the functions*

displayed on screen is clear.
- *US6: The connection to the system is good.*
- *US7: The procedures provided are clear and detailed.*

❖ Stakeholders' Benefits Construct (SB) consists of three components, including:

- *SB1: Using the system, you can save a lot of time.*
- *SB2: Using the system, you can reduce a lot of expenditures.*
- *SB3: You can manage your work/study effectively with the system.*

The above 38 components are assessed based on a Likert scale of 5. The questionnaire was posted online on the website of LHU www.lhu.edu.vn from early June to the end of August 2014. There were 1,383 valid observations collected.

The key constructs in our conceptual framework have been well identified in several researches. Therefore, this study only investigates the consistency of the components in each of them by using reliability analysis which is an assessment of the degree of consistency among multiple measurements of a variable. One of the popular measures of the degree is Cronbach's alpha which is most appropriately used when the items measure different substantive areas within a single construct (Cronbach, 1951; Green, Lissitz, & Mulaik, 1977; Revelle, 1979; Schmitt, 1996). Gorge and Mallery (2003) provided a commonly accepted rule of thumb for describing internal consistency using Cronbach's alpha in exploratory research as illustrated in Table 1. Besides the rule of thumb, it is also required that the Corrected item-total Correlation of each item be at least 0.3 so that the items are capable to measure the construct.

Table 1: Cronbach's Alpha- Rule of thumb

Cronbach's Alpha	Internal consistency
$0.90 \leq \alpha$	Excellent
$0.70 \leq \alpha < 0.90$	Good
$0.60 \leq \alpha < 0.70$	Acceptable
$0.50 \leq \alpha < 0.60$	Poor
$\alpha < 0.50$	Unacceptable

However, as each construct has several variables, we employ "Exploratory Factor Analysis- EFA"

which groups highly correlated variables together into a factor which is assumed to represent a dimension within the data set, i.e. EFA approach is used to identify representative variables from a much larger set of variables for use in subsequent multivariate analysis and create an entirely new set of variables which are fewer than the original set (Hair et al., 2010). Moreover, we also use regression analysis method to identify the existing relationships in the following three models:

$$(1) \quad SU = f (IN, SY, SE).$$
$$(2) \quad US = f (IN, SY, SE).$$
$$(3) \quad SB = f (SU, US).$$

Before using the regression analysis, we need to convert the extracted constructs into appropriate variables, which can be done through the computation of factor scores in SPSS (Statistical Package for Social Science).

5. RESULT

5.1. Brief introduction about Lac Hong University

Currently, Vietnam has a large population of more than 93 million people (World Population Statistics, 2014); thus, the high demand of jobs makes the labour market intensively competitive. To survive in that competitive environment, it is well believed that better chances of finding good jobs are usually offered to those with a higher education. So, in the last decade, the higher education in Vietnam has expanded at a tremendously fast pace (Nguyen et al., 2014). Particularly, the growth rates of the number of university/college, lecturers and students in 2013 compared to those in 2000 are 239.89%, 280.50% and 228.89%, respectively (General Statistics Department, 2014), indicating the high demand of well-educated human resources to support the quick development of Vietnam in the recent and coming years.

In order to meet the imperative needs for technical human resources of Dong Nai province, the fast socio-economic growing province with several large industrial parks, many big industrial factories and service enterprises, LHU was established in 1997 and recognized as the first higher education institution in the province. LHU, a private university located in the Southern key economic zone of Vietnam, plays an important role in providing high quality bachelors and engineers for more than 550 companies, many of which are FDI enterprises, in South East region of Vietnam. Its achievements in scientific researches and technology transfers have been highly appreciated and applied in practice. Some remarkable projects includes "IT management" project used in Jujitsu Vietnam (Japan), "Automatic assembly of spark-coil" transferred to NecTokin Electronics Vietnam (Japan), "producing buttons made of Areca shell" applied in Italia Co., Ltd., "Enterprise management" software used by Electronics Solution Vietnam (Singapore), Epoxy Paint without Solvent highly appreciated by Dong Nai Paint Corporation (Dong Nai), "Robot cleans glass of high buildings" bought by Thai Son Glass (Dong Nai), "E-Library management" software transferred to Le Quy Don High school (Quang Tri), "E-order- comprehensive solution for cafe and restaurants" transferred to Coi Nguon Cafe, Coi Rieng Cafe, Ngoc Phat Cafe (Dong Nai). Especially, LHU has been the national champion in Asia-Pacific Robot Contest (ABU Robocon) since 2010 and became the international champion in August 2014.

Currently, LHU offers 11 faculties and 21 majors with an enrollment of more than 20,000 students for several interdisciplinary and multi-level training programs in vocational training, bachelor and postgraduate degrees. In order to handle the huge administration job effectively and efficiently, LHU has launched its Information Technology System which is kept continuously updated by LHU Information & Resource Center. The management board of LHU has well recognized the importance of utilizing IT in: (1) marketing training services to more prospective students and parents; (2) serving their students better; and, (3) updating curriculum to adapt to market changes.

5.2. Empirical data analysis

a) Structure of the survey objects

Table 2: Descriptive statistics

	Aspects	Freq.	Pctg.		Aspects	Freq.	Pctg.
Gender	Male	703	50.8%		18-25	465	33.6%
	Female	680	49.2%		26-35	295	21.3%
Usage Duration	<6 months	153	11.1%	Age	36-45	305	22.1%
	6-12 months	272	19.7%		46-55	162	11.7%
	12-24 months	413	29.9%		>56	156	11.3%
	>24 months	545	39.4%		For reference materials	1051	14.4%
Current Position	Current student	476	34.4%		For sharing knowledge	910	12.4%
	Future student	91	6.6%		For announcements	913	12.5%
	Faculty & Staff	328	23.7%	Usage Purpose	For news/reports	934	12.8%
	Student's parent	91	6.6%		For my applications	1078	14.7%
	Administration	48	3.5%		For my registration	1048	14.3%
	LHU alumni	186	13.4%		For my registration	712	9.7%
	LHU partner	80	5.8%		Other purposes	673	9.2%
	Other	83	6.0%				

As shown in Table 2, among the 1,383 valid observations, male accounts for 50.8% of the total investigated sample and most of the participants are young people (18-35) who usually well adapt to the advance in information technology. As the LHU IS is designed to make the students and LHU employees more satisfied, the majority of the participants are students and the faculties & staffs. Besides, many graduated students usually visit LHU's website to check for some short-term training sessions, so 186 alumni joined the survey. 91 future students took part in the survey as there are several interesting information resources available on the LHU website and they want to keep updated during their high school study before officially enrolling in the university. Moreover, as LHU IS provides updated records of every student, their parents can easily access to the LHU IS to keep tracks of their children's performance; thus, 91 people joined the survey as students' parents. Additionally, most of the

participants have used the LHU IS for more than one year because students, faculties & staffs, and alumni usually access the IS to search for relevant information from the school policy and available resources. More importantly, as LHU IS offers many different functions, one participant can have several purposes in using it. Therefore, among the 7,319 selections, as shown in Table 2, the major purposes for using the LHU IS are for downloading/uploading reference materials, applying their certificates, registering courses, sharing their knowledge with other students/colleagues, and making or reading announcements. These figures also indicate the appropriate utility of the LHU IS as its design target.

b) Exploratory Factor Analysis
Among the six constructs discussed in Section 4, only the "Information Quality" is extracted into two factors, INQ1 and INQ2 whose components are listed in Table 3.

Table 3: Extracted factors of "Information Quality"

Factor	Components
	IN10: The information can be easily verified.
	IN8: The information can be easily accessed.
INQ1	IN3: The information on LHU IS is updated.
	IN4: The information provided is complete.
	IN9: The outputs are relevant to the decision you make.

INQ2	IN1: The information addresses your needs. IN7: The outputs are easy to understand. IN5: Provided information is linked together. IN2: Most of the displayed information on LHU IS is accurate. IN6: The outputs are put in the sequence that you find it useful.

c) Reliability Analysis

Table 4 briefly illustrates the numerical results based Cronbach's Alpha measure in the reliability analysis. Specifically, the Cronbach's Alpha values of the seven extracted factors are all greater than 0.7, indicating that the items have strongly high internal consistency; and, their values in column "Corrected item-total correlation" are also greater than 0.3; hence, we can conclude that these seven factors are all reliable for further analysis. Besides, because INQ1 mainly focuses on the reliability of the information offered, it is named as "Information Reliability"; whereas INQ2 mainly focusing on the informative outputs provided by the system is named as "Informative outputs". Therefore, the conceptual framework in Figure 3 should be accordingly modified as presented in Figure 4.
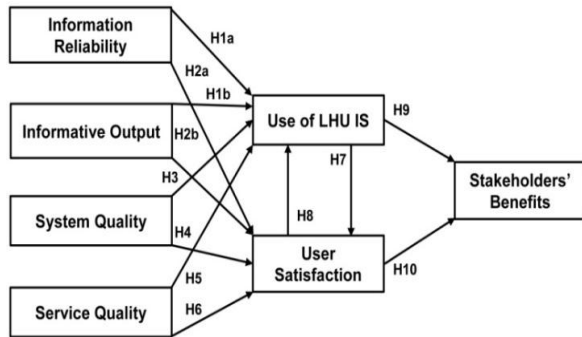

Figure 4: Modified Framework

Therefore, the first two hypotheses stated in Section 3 are accordingly revised as the followings:

- H1a: Information reliability has a positive impact on the use of the LHU IS.
- H1b: Informative output has a positive impact on the use of the LHU IS.

- H2a: Information reliability has a positive impact on the user satisfaction.
- H2b: Informative output has a positive impact on the user satisfaction.

In order to test the hypotheses of H1a, H1b, H3, and H5, a regression model $SU = f(INQ1, INQ2, SY, SE)$ is considered; whereas the H2a, H2b, H4, and H6 are tested with a regression model $US = f(INQ1, INQ2, SY, SE)$. H7 and H8 are tested with a correlation matrix. H9 and H10 will be validated with a regression model $SB = f(SU, US)$. Each of these models is investigated in separate sections that follow.

d) Regression model SU = f(INQ1, INQ2, SY, SE)

In this analysis, the use of LHU IS *(SU)* is considered as the dependent variable and the four factors: "information reliability" *(INQ1)*, "informative outputs" *(INQ2)*, "system use" *(SY)*, and "user satisfaction" *(SE)*, are independent variables. The analysis results are as in Table 5. The significance of the F-statistics of the regression model is extremely small (<<5%), indicating the regression model is applicable for practical data. In addition, among the four factors, *INQ1* has the highest value of standardized coefficient "Beta", *SE, SY,* and *INQ2* respectively come in second, third, and last position. Thus, we can conclude that the information reliability and service quality have the strongest impact on the use of LHU IS. Moreover, the coefficients of these factors are all positive, meaning that the hypotheses H1a, H1b, H3, and H5 are all supported.

Table 4: Summary of Reliability Analysis of seven extracted factors

Factor	*Item code*	*Corrected Item-Total Correlation*	*Cronbach's Alpha if Item Deleted*	*Cronbach's Alpha*
INQ1	IN10	0.842	0.871	0.877
	IN8	0.836	0.872	
	IN3	0.834	0.872	
	IN4	0.825	0.873	

	IN9	0.820	0.873	
INQ2	IN1	0.679	0.771	
	IN7	0.672	0.773	
	IN5	0.667	0.774	0.799
	IN2	0.646	0.778	
	IN6	0.591	0.791	
SY	SY1	0.671	0.733	
	SY2	0.752	0.835	
	SY3	0.705	0.838	
	SY4	0.661	0.841	
	SY5	0.628	0.843	0.846
	SY6	0.642	0.842	
	SY7	0.708	0.838	
	SY8	0.749	0.835	
SE	SE1	0.602	0.798	
	SE2	0.721	0.773	
	SE3	0.853	0.765	0.806
	SE4	0.785	0.781	
	SE5	0.561	0.806	
SU	SU1	0.811	0.833	
	SU2	0.743	0.843	
	SU3	0.749	0.842	0.851
	SU4	0.748	0.842	
	SU5	0.782	0.836	
US	US1	0.831	0.835	
	US2	0.776	0.841	
	US3	0.702	0.846	
	US4	0.667	0.849	0.822
	US5	0.672	0.849	
	US6	0.706	0.846	
	US7	0.785	0.839	
SB	SB1	0.715	0.841	
	SB2	0.814	0.761	0.833
	SB3	0.762	0.805	

e) Regression model US = f(INQ1, INQ2, SY, SE)

By using the same token, in this regression model, the satisfaction of users of LHU IS (US) is considered as the dependent variable and the four factors are also independent variables which are all statistically significant (at the level 5%) as displayed in Table 6.

Among the four factors in Table 6, *INQ2* has the highest value of standardized coefficient "Beta", *SE, INQ1,* and *SY* are respectively ranked the second, third, and last positions. The difference in the importance level of these four independent variables in the above two regression models indicates that

there is a difference in the concepts between "system use" and "user satisfaction", i.e. that a user usually uses the LHU IS doesn't mean that he/she is satisfied with the system (even if he/she is not satisfied with the system, he/she must use it anyway because he/she doesn't have alternative choice); or, that a user is satisfied with the system doesn't mean that he/she usually uses the system (although he/she rarely uses the system, good performance of the system whenever he/she uses it can easily make him/her satisfied). Also, Table 6 clearly implies that the outputs provided by the system have the most significant influence on the user satisfaction. The service quality also plays important role in satisfying the users of LHU IS. Moreover, the coefficients of

these factors are all positive, meaning that the hypotheses of H2a, H2b, H4, and H6 are all supported.

Table 5: Regression Coefficients of SU = f(INQ1, INQ2, SY, SE)

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.
	B	Std. Error	Beta	
(Constant)	0.000	0.104		0.000
INQ1 The information reliability	0.914	0.104	0.914	0.015
INQ2 The informative outputs	0.368	0.104	0.368	0.041
SY System quality	0.539	0.104	0.539	0.038
SE Service quality	0.801	0.104	0.801	0.025

Dependent variable: SU System use

Table 6: Regression Coefficients of US = f(INQ1, INQ2, SY, SE)

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.
	B	Std. Error	Beta	
(Constant)	0.000	0.132		0.000
INQ1 The information reliability	0.638	0.132	0.638	0.024
INQ2 The informative outputs	0.845	0.132	0.845	0.029
SY System quality	0.628	0.132	0.628	0.048
SE Service quality	0.791	0.132	0.791	0.019

Dependent variable: US User satisfaction

Through these two regression models, we could conclude that the quality of the information and the service provided by the LHU IS are the key factors affecting the user satisfaction and the system utility of the LHU IS.

f) Correlation between SU and US

In this empirical study, the Pearson correlation coefficient between SU and US is 0.736 with the attained significance level of 0.038, meaning that there is a strong and positive correlation between the two constructs; thus, the hypotheses H7 and H8 are all supported by this test.

g) Regression Model of SB=f(SU,US)

In this model, the stakeholders' benefit *(SB)* is considered as the dependent variable and the two factors: "system use" *(SU)* and "user satisfaction"

(US), are independent variables. The analysis results are shown in Table 7 where the two independent factors are statistically significant. Moreover, between these two factors, "user satisfaction" plays a more important impact on the benefits perceived by various stakeholders, meaning that the more users are satisfied, the more benefits they perceive. The positive coefficients of these two factors obviously support the hypotheses H9 and H10.

Along with the above analyses, all of the stated hypotheses are firmly tested and supported. Besides, we found that the information quality, including information reliability and informative outputs, and the service quality offered by the LHU IS are the key factors affecting the user satisfaction and the system utility of the LHU IS. Our proposed model for assessing the effectiveness of LHU IS and their relationships are briefly shown in Figure 5.
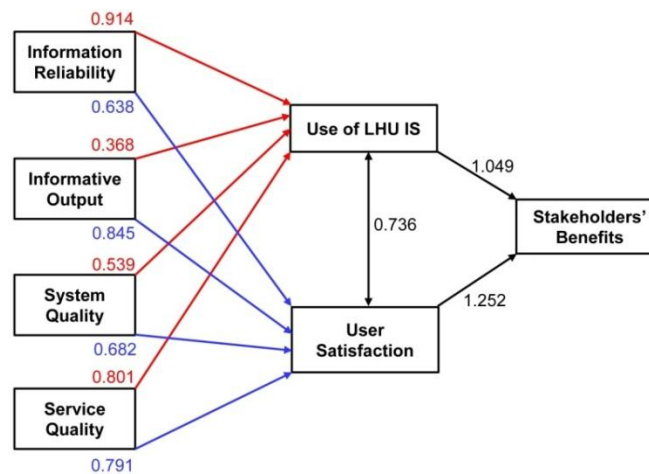
Figure 5: Proposed Framework for the LHU IS Effectiveness Assessment

6. CONCLUSION

As an education and training institute, Lac Hong University (LHU) has several operational processes, including admission, training, exam organization, accounting processes, etc. While most of the main processes are IT managed, how effectively the current LHU Information System (IS) works should be known so that corrective actions can be undertaken. This study searches for the key determinants of the effectiveness of the information system in Lac Hong University in the consideration of the recent advances in the science and technology. Specifically, the information reliability and service quality have the strongest impact on the use of LHU IS whereas the outputs provided by the system have the most significant influence on the user satisfaction. The service quality also plays important role in satisfying the users of LHU IS. Moreover, there is a strong and positive correlation between the use of LHU IS and the user satisfaction, between which "user satisfaction" plays a more important impact on the benefits perceived by various stakeholders, meaning that the more users are satisfied, the more benefits they perceive. Hence, we suggest the following managerial implications for the sustainable growth of LHU IS as well as LHU itself.

Firstly, as the information reliability has the strongest impact on both the use of LHU IS and the user satisfaction, it is strongly recommended that whatever published on the website must be valid and fully controlled. There should be a special team to monitor the contents of the articles before they are

officially posted. All information must be double checked and validated in accordance with the existing rules, regulations and advanced customs of Vietnamese people. Especially, no typo and/or syntax error is allowed in the posts. This issue should be considered as an extreme concern because the posts are from a professional education institution. By this way, the validity and reliability of the information posted are kept at the utmost care to satisfy the need of the users and make them feel reliable with the achieved information from the IS.

Secondly, the outputs provided by the system must be kept well arranged in an appropriate layout so that the users find it informative and satisfactory. All forms offered by the system must be scientifically designed for the sake of user's convenience and satisfaction. Due to the advances in the science and technology these days, people tend to access the internet through different equipment such as mobile phones, tablets, etc. Hence, LHU IS should be designed to work well on all possible applications and be compatible to any operating system of the equipment. This is also an important concern to provide nice outputs and layouts to make users satisfied.

Thirdly, to improve the service quality, it is suggested that more procedures should be done electronically instead of traditional documentations. Along with the online procedures, clear instruction/guidance must be accompanied. Besides, instant help from system administrators is also important to make users satisfied. Especially, the bossy working style of

the in-charge persons in all related offices must be changed towards serving style. All of the queries and/or questions should be responded within 24 hours in a polite and informative manner. The board of management should regularly check the claim box to collect the complaints from different stakeholders in order to implement suitable corrective actions to improve the service quality of not only the school itself but also the IS.

Because there is a strong correlation between the usage of LHU IS and the user satisfaction, if the above recommendations are seriously considered, more users will use the IS more frequently and more satisfactorily. This will obviously make the administration of this school easier and more efficient since the user satisfaction has the strongest impact on the perception of the benefits offered by LHU IS. Therefore, we strongly believe that the above three suggestions will greatly assist the sustainable applications of LHU IS as well as the sustainable development of Lac Hong University for the time being.

REFERENCES

1. Aladwani, A., & Palvia, P. (2002). Developing and validating an instrument for measuring user perceived web quality. *Information and Management,* 39:467-476.
2. Bailey, J.E., & Pearson, S.W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science,* 29(5):530 – 545.
3. Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika,* 16:297-334.
4. D'ambra, J. (2001). Measuring the effectiveness of the WWW as an information source. *Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics.*
5. DeLone, W.H., & McLean, E.R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research,* 3(1):60-95.
6. DeLone, W.H., & McLean, E.R. (2003). The Delone and McLean model of information systems success: A ten-year update. *Journal of Information Systems,* 19(4):9-30.
7. DeLone, W.H., & McLean, E.R. (2004). Measuring e-commerce success: Applying the Delone and Mclean model of information systems success model. *International Journal of Electronic Commerce,* 9(1):31-47.
8. Etezadi-Amoli, J., & Farhoomand, A.F. (1996). A structural model of end user computing satisfaction

9. and user performance. *Information & Management,* 30(2):65-73.
9. Fitzgerald, G. (1998). Evaluating information systems projects: A multidimensional approach. *Journal of Information Technology,* 13:15-27.
10. Flanagan, L., & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration,* 42(2):124-142.
11. Gelderman, M. (1998). The relation between user satisfaction, usage of information systems, and performance. *Information & Management,* 34(1):11-18.
12. General Statistics Department (2014). *Statistics of national higher education*. Retrieved on September 16, 2014 URL http://www.gso.gov.vn/default.aspx?tabid=395&idmid=3 &ItemID=15225.
13. George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference 11.0 update (4th Ed.)*. Allyn & Bacon, Boston.
14. Goodhue, D.L., & Thompson, R.L. (1995). Task-technology fit and individual performance. *MIS Quarterly,* 19(2):213-236.
15. Green, S.B., Lissitz, R.W., & Mulaik, S.A. (1977). Limitations of coefficient alpha as an index of test uni-dimensionality. *Educational and Psychological Measurement,* 37: 827-838.
16. Guimaraes, T., & Igbaria, M. (1997). Client/server system success: Exploring the human side. *Decision Sciences,* 28(4):851-875.
17. Hair, J.J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate Data Analysis: A Global Perspective.* Pearson, London.
18. Hamilton, S., & Chervany, N. (1981). Evaluating information systems effectiveness- part 1: Comparing evaluation approaches. *MIS Quarterly*.
19. Igbaria, M., & Tan, M. (1997). The consequences of the information technology acceptance on subsequent individual performance. *Information & Management,* 32(3): 113-121.
20. Igbaria, M., Zinatelli, N., Cragg, P., & Cavaye, A. (1997). Personal computing acceptance factors on small firms: A structural equation model. *MIS Quaterly,* 21(3):279-302.
21. Liu, C., & Arnett, K.P. (2000). Exploring the factors associated with web site success in the context of electronic commerce. *Information and Management*, 38:223-33.
22. Loiacono, E.T., Watson, R.T., & Goodhue, D.L. (2007). WebQual: An instrument for consumer evaluation of web sites. *International Journal of Electronic Commerce,* 11(3):51-87.
23. Malik, K. (2001). Information systems effectiveness: An integrated approach. *Proceedings of the Change Management and the New Industrial Revolution, IEMC'01*.
24. Myers, B.L., Kappelman, C.K., & Prybutok, V.R.

www.jitbm.com

(1997). A comprehensive model for assessing the quality and productivity of the information systems function: Toward a theory for information systems assessment. *Information Resources Management Journal,* 20(1):1-15.

25. Nguyen, T.L., Lam, T.H., Shu, M.H., & Nguyen, V.Q. (2014). Measuring lecturer's quality based on students' evaluation - An empirical case of Lac Hong university. *Procedings of 2014 Asia-Pacific Quality Network Conference and Annual General Meeting,* Hanoi, Vietnam on March 07-08, 2014.

26. Oliver, R.L. (1997). *Satisfaction: A Behavioural Perspective on the Consumer.* McGraw Hills, New York.

27. Park, H., & Baek, S. (2007). Measuring service quality of online bookstore with WebQual. *Proceedings of the Human-Computer Interaction HCII.*

28. Pelgrum, W.J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education,* 37:163-178.

29. Revelle, M. (1979). Hierarchical cluster analysis and the internal structure of tests. *Multivariate Behavioral Research,* 14:57-74.

30. Rivera, J., & Meulen, R.V.D. (2014). Gartner Says Worldwide IT Spending on Pace to Grow 2.1 Percent in 2014. Accessed on September 28, 2014 from URL: http://www.gartner.com/newsroom/id/2783517

31. Roberts, R., & Sikes, J. (2011). A rising role for IT: McKinsey global survey results. *Insights & Publications,* Retrieved on February 14, 2014 from URL: http://www.mckinsey.com/insights/business_technology/a_rising_role_for_it_mckinsey_global_survey_results.

32. Schmitt, N. (1996). Uses and abuses of coefficient alpha. *Psychological Assessment,* 8: 350-353.

33. Schonberg, E., Cofino, T., Hoch, R., Podlaseck, M., & Spraragen, S. (2000). Measuring success. *Communications of ACM,* 43(8).

34. Seddon, P.B. (1997). A respecification and extension of the Delone and McLean model of is success. *Information Systems Research,* 8(3):240-253.

35. Seddon P.B., & Kiew, M.U. (1994). A partial test and development of the delone and mclean model of is success. *Proceedings of the International Conference on Information Systems, Atlanta, GA: Association for Information Systems,* pages 99-110.

36. Seethamraju, R.C. (2004). Measurement of user-perceived web quality. *Proceedings of the 12th European Conference on Information Systems (ECIS).*

37. Shiau, W.L., Tsai, W.H., Hsu, P.Y., Cheng, M.S., Leu, J.D., & Fan, Y.W. (2006). Assessing the validity of is success model: An empirical investigation on ERP systems. *Proceedings of the Second Workshop on Knowledge Economy and Electronic Commerce,*

42:430-447.

38. Teng, J., & Calhoun, K. (1996). Organizational computing as a faciliator of operational and managerial decision making: An exploration study of managers' perceptions. *Decision Sciences*, 27(4):673-710.

39. Teo, T.S.H., & Wong, P.K. (1998). An empirical study of the performance impact of computerization in the retail industry. *Omega- The International Journal of Management Science,* 26(5):611-621.

40. Tokdemir, G. (2009). *An assessment model for web-based information system effectiveness. Ph.D. thesis,* Ankara, Turkey: The Middle East Technical University.

41. Torkzadeh, G., & Doll, W.J. (1999). The development of a tool for measuring the perceived impact of information technology on work. *Omega - The International Journal of Management Science,* 27(3):327-339.

42. Webber, C.F. (2003). New technologies and educative leadership. *Journal of Educational Administration,* 41(2):119-123.

43. Weill, P., & Vitale, M. (1999). Assessing the health of an information system portfolio: An example from process engineering. *MIS Quarterly,* 23(4):601-624.

44. Wixom, B.H., & Watson, H.J. (2001). An empirical investigation of the factors affecting data warehousing success. *MIS Quarterly,* 25(1):17-41.

45. World Population Statistics (2014). Population of Vietnam 2014. Retrieved on September 16, 2014 from URL http://www.worldpopulationstatistics.com/population-of-vietnam-2014.

46. Yoon, Y., Guinmaraes, T., & Clevenson, A. (1998). Exploring expert systems success factors for business process reengineering. *Journal of Engineering and Technology Management,* 15(2-3):179-199.

47. Yuen, A.H.K., Law, N., & Wong, K.C. (2003). ICT implementation and school leadership: Case studies of ICT integration in teaching and learning. *Journal of Educational Administration,* 41(2):158-170.

48. Yuthas, K., & Young, S.T. (1998). Material matters: Assessing the effectiveness of materials management is. *Information & Management,* 33(3):115-124.