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LINKAGE BETWEEN INFORMATION SYSTEMS IN SMES AND THE PERFORMANCE OF FIRMS: A CAUSAL PATH ANALYSIS

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Abstract

Rapid technological developments, shorter product life cycle, greater expectations of customers and globalization lead to many consistent developments in the business operations. An effective information system is needed to cope with the changes in the environment. SMEs in India should understand the facts and benefits flowing from the linkage between the implementation of Information Systems (IS) and the Performance of Firms. The present study was conducted among the SMEs in Madurai District. The findings of the study reveal that there is a direct influence of system quality, information quality and service quality of IS on the users' satisfaction which has a direct influence on the firms' performance. The indirect influence i.e., through users' satisfaction, was higher than the direct influence of all qualities in IS. Hence the study suggests that the quality of IS should focus on the users' satisfaction at first, so that it will generate the firm's performance automatically.

Key Words: *Information Quality, Service Quality, System Quality and Performance.*

1. INTRODUCTION

Rapid technological developments, shorter product life cycles, increased customer expectation and hectic competition, especially after globalization, have reshaped how business operates. To survive, it is essential for the firms nowadays to be able to meet the ever changing business situations. Firms need to adjust to the changes in the business environment without taking much time. The cost reduction is becoming one of the important strategies for the survival of any firm (Handfield and Nichols, 1998). SMEs are not exempted (Shaikh, et al 2007).

The adoption of emerging technologies has promised more business market opportunity for SMEs (Damier Power, 2006). Information technology (IT) encompasses the gathering,

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processing, storing, retrieving, displaying and communication of information or data (Willcock and Fitzgerald, 1993). Research and Development Planners and Technology Managers must acquire the flexibility to cope with expected and unexpected changes in their environment (Rothwell, 1992). SMEs often suffer due to lack of such suitable qualified technical specialists (Margi and Powell, 1998). It affects the performance of SMEs at a considerable level (David et al., 1984).

Hence it is essential to incorporate appropriate information systems in SMEs in order to enhance their performance. In this context, the present study has made an attempt to examine the linkage between information systems in SMEs and its consequences with the help of Causal Path Analysis.

2. REVIEW OF RELATED STUDIES

Rai et al (2002) and Kositanurit et al (2006) found significant positive impact of system quality on the usage of IS. Iivari (2005) and Kulkarni et al (2006) revealed the significant influence of system quality on user satisfaction. The positive relationship between the system quality and firms' performance was identified by Bharati and Chaudhury (2006) and Chau and Hu (2002). The relationship between information quality and use (Halain et al 2007); user satisfaction (Mc Gill, et al., 2003), and net benefits (Scheepers et al., 2006) have been exposed by the previous studies. The relationship between service quality of IS and use of IS, user satisfaction, net benefits has been found significant and positive by Caldeia and Ward (2002); Chin et al., (2007), Thong (1996) and Almutairi and Subramanian (2005). Even though there are so many studies related to the impact of information systems' quality on firms' performance, only a few studies are related to SMEs. Even those are related to the SMEs in western countries and there is no inclusive study on the impact of IS on firms' performance in India. Hence the present study has made an attempt to fill the research gap with the proposed research model.

3.CONCEPTUAL MODEL OF THE STUDY

The conceptual model of the present study is given in **Figure-1**.

4. OBJECTIVES OF THE STUDY

Based on the conceptual model of the study, the present study examined the objectives. These are: To measure the determinants of firms' performance in SMEs and the linkage between the information systems and the firms' performance.

5. HYPOTHESES OF THE STUDY

H_1 : There is a significant impact of users, satisfaction on firms' performance.

H_2 : Service quality in IS has a significant impact on users' satisfaction.

H_3 : Information quality in IS has a significant impact on users' satisfaction.

H_4 : Service quality in IS has a significant impact on firms' performance.

H_5 : System quality has a significant impact on firms' performance.

H_6 : There is a significant impact of systems quality on users' satisfaction

H_7 : Service quality has a significant impact on service quality in IS

H_8 : Service quality has a significant impact on information quality in IS

6. CONCEPTUAL FRAMEWORK OF THE STUDIES

In total, five concepts were used to examine the empirical study. These are: system, quality, information quality, ease of use of information system, skills and knowledge of users, service quality and organizational impact.

a. System Quality

Perceived ease of use is the most common measure of system quality (Davis, 1989). Rivard et al (1997) developed and tested an instrument that consists of 40 items that measure eight system quality factors. In the present study, the variables included by Coombs et al (2001) and Gable et al (2003) were used to measure system quality. These are reliability, portability, user friendliness, understandability, effectiveness, maintainability, economy and verifiability.

b. Information Quality

Information quality is a key dimension of user-satisfaction (Dolls et al 1994). It is a unique construct and is measured as a component of user satisfaction (Ives et al 1987). Fraser and Salter (1995) developed a generic scale of information quality and others. These were modified by Wixom and Watson (2001).

The variables related to information quality used in the present study were derived from the study made by Venkatesh et al (2003). These are availability, usability, understandability, relevance, format and conciseness.

c. User Satisfaction

The most widely used user satisfaction instruments are the Doll et al., (1994), End User Computing Support (EUCS) instrument and Ives et al (1983) User Information Satisfaction (UIS) instrument. The user satisfaction on IS at SMEs in the present study was measured by the variables drawn from the reviews (Wixom and Todd, 2005, Klein, 2007). These are the attitude on reports, web sites, support services, network, automation, updation, immediate response, data base, storage, amount of use, frequency of use and appropriateness of use.

d. Service Quality

SERVQUAL is the most frequently used measure for service quality in IS (Van Dyke et al 1997). In the present study, the SERVPERF (Jiang et al 2002) was used to measure the service quality in IS. The variables used to measure the service quality of IS were derived from the previous studies (Yoon and Guimaraes, 1995; Gefen, 2000). These are related to various aspects of supportive staff, namely, skill, experience, capabilities, responsiveness, co-operativeness, assurance and empathy.

e. Firms' Performance

Firms' performance represents the organizational net benefits received from the adoption of IS (Adams et al 1992). The net benefits may be related to cost (Shih, 2004), requirements (Wu and Wang, 2006), productivity (Hsich and Wang, 2007), staff requirement (Yang and Yoo 2004) and others (Devaraj, et al 2002). In the present study, the variables selected were reduction of organizational cost, reduction of staff requirements, cost reduction, improvement of productivity, increased capacity, business process change, strategic advantage and reduction of communication costs.

7. SCOPE OF THE STUDY

The study was conducted in registered SMEs in the Southern Districts of Tamil Nadu, namely, Madurai, Ramnad, Tirunelveli, Tuticorin, Virudhunagar and Kanniyakumari. The study covered a period of 2011-12.

8. RESEARCH METHODOLOGY

Since the present study adopted its own pre-planned objectives and predetermined methodology, the applied research design was purely descriptive in nature. In total, 30 SMEs adopting the IS from each Southern District of Tamil Nadu were included for the study. In total, the sample size came to 180. A pre structured questionnaire was developed to collect the primary data from the SMEs. The questionnaire was divided into three important parts. Part-I included the profile of the SMEs whereas the second part covered the various components of qualities in IS. The third part consisted of the variables in firms' performance. A pilot study was conducted among 20 owners of SMEs at Madurai District. A final questionnaire was found on the basis of the comments from the pre-test. The response rate on the questionnaire at first and second attempt was only 32.78 and 38.33 per cent to the total respectively. The respondents were asked to rate the variables in each construct at five point scale according to their order of acceptance. Hence the usable sample size came to 128 SMEs. Appropriate statistical tools were used to measure the quality of IS and the impact of IS on firms' performance.

a. Descriptive Statistics

The important years of experience among the SMEs were only 15 whereas dominant years of experience in implementing IS at their SMEs were above 10 years. The important level of education among the owners of SMEs was under graduation. Majority of the

SMEs provided employment to an average of 15 employees at their SMEs.

9. RELIABILITY AND VALIDITY OF VARIABLES IN VARIOUS CONSTRUCTS

The constructs included in the present study were system quality, information quality, skills and knowledge of users, service quality and firms' performance. The variables in the above constructs varied from 5 to 8. Before summarizing the score of the variables under each construct, it was imperative to examine the reliability and validity of variables in each construct with the help of Confirmatory Factor Analysis. The overall reliability was tested with the help of Cronbach Alpha. The results are given in **Table-1**.

The standardized factor loading of the variables in each construct was greater than 0.60, which revealed the content validity. The significance of 't' statistics of the standardized factor loading of variables established the convergent validity (Anderson and Gertung, 1988). It was also confirmed by the composite reliability and average variance extracted since these co-efficients were greater than its minimum threshold of 0.50 and 50.00 per cent respectively (Bertler, 1995). The cronbach alphas of all constructs were greater than its standard minimum of 0.60 (Nunnally, 1978). All these results indicated the reliability and validity of variables under each construct.

a. View on Constructs in the Present Study

The level of view on each construct in the present study was based on the mean score of the variables under each construct. The mean standard deviation, co-efficient of variation and the inter correlation between the constructs were computed to exhibit the level of view on each construct and the discriminate validity among the constructs. The results are given in **Table-2**.

The level of view on skills and knowledge of users and the information quality was higher in SMEs since their mean scores were 3.1448 and 3.0268 respectively. The higher consistency in the view on system quality was noticed since their co-efficient of variation was 13.81 per cent. The significant inter-correlation between the constructs was noticed since their respective correlation co-efficients were significant at five per cent level. The mean of AVEs of each pair of construct was greater than its square of correlation co-efficient between the pair which reveals the discriminate validity among the constructs (Forenell and Larker, 1981). This established the mutual exclusiveness among the constructs.

b. Result of Causal Path Analysis

Causal Path Analysis was performed in order to investigate the impact of users' satisfaction, system quality, information quality and service quality on the ultimate dependent variable, firms' performance. The path model derived is shown in **Figure-2**.

The path co-efficients are the standard beta co-efficient taken from the regression analyses. The direct, indirect and total effects of each variable on the dependent variable, firms performance, are depicted in **Table-3**.

All hypothesized relationships were supported by the regression analysis since the regression co-efficient of independent variables on dependent variables were significant at zero per cent level. Further, model explains a substantial variance in the ultimate dependent variable of firms' performance (50%) and in the mediating construct, user satisfaction (62.44%). It reveals that users' satisfaction displayed a significant positive linkage with firms' performance, with a beta co-efficient of 0.31 (Pd"0.000), thus supporting H_1. For H_2 and H_3, the standardized beta co-efficient indicated that service quality as well as information quality exerted a significant, direct influence on users', satisfaction (0.33 and 0.17 respectively). Regarding H_4, the regression co-efficient for service quality was 0.29 (Pd"0.000), thus providing support for this hypothesis. The result

also supports H_5 and H_6 i.e., system quality recorded a significant, direct, positive impact on firms' performance and users' satisfaction ($\beta = 0.18$ and 0.42). The system quality also displayed an especially strong impact on perception of service and information quality ($\beta=0.64$ and 0.72). Therefore H_7 and H_8 are accepted.

c. Direct and Indirect Effects of Independent Variable on Firms Performance

The indirect effect was calculated by multiplying the sequential beta co-efficient along any given path following the method devised by Asher (1976). The direct effect indicates the beta co-efficient drawn from the multiple regression analysis (Neeru and Paul, 1999). The total effect was computed by the sum of direct and indirect effects of each independent variable (Asher 1976). The results are given in **Table-4**.

The indirect effect of information quality was $0.17 \times 0.31 = 0.05$ since it was mediated through users' satisfaction. The Table shows clearly that user satisfaction and service quality exerted the largest direct effect on firms' performance but overall system quality recorded the greatest impact due to its large indirect effects. It can be seen from Figure 2 that system quality exerted several indirect effects because it was found to impact on information quality as well as service quality and users' satisfaction. Its overall effect of 0.59 shows that it exercised the largest effect on firms performance.

10. FINDINGS AND DISCUSSION

This research has extended our knowledge of understanding of implementation of information systems in SMEs and its consequences, especially performance. After examining the relative impact of four key variables in IS, namely, system quality, information quality, service quality and users' satisfaction, the impact of service quality on firms performance was found to be significant whereas its impact through users' satisfaction on firms' performance was also considerable.

Hence the policy makers are advised to formulate suitable implementation strategy according to the needs of the users and maximize the total effect of service quality in IS.

The system quality has impact on the perception of information quality, service quality, users' satisfaction and firms' performance. System quality refers to the quality of IS as per the view of the users. Its purpose should be user friendly and help the users to use the IS with the fullest confidence. The system quality recorded the greatest overall impact on variations in firms' performance. Hence firms should keep up their information systems' quality before establishing them. They should consider all consequences of systems' quality, namely, information quality, service quality and users satisfaction.

Firms' Performance is instrumental in the implementation of IS at SMEs. The study findings suggest that system quality directly impacts firms' performance. This result is consistent with the views of Teo and Wong (1998) and Subramanian (1994). Further, effective systems' quality can help a sense of closeness by being user friendly and be instrumental in the frequency and extent of the usage of IS which would result in higher firms' performance. It seems clear that effective system quality needs to address issues such as reliability, portability, user friendly, understanding ability, effective, maintainability, economy and verifiability of system.

a. Guidelines for Managers

Several lessons emerge from the findings of this research that might be usefully applied in the implementation of any new technology in SMEs. The users' satisfaction is essential for the implementation of any new system anywhere. The qualities related to any new system should be segmented into several parts initially. Each part in each segment should be developed as per the needs of the users. Only then, an optimum system may be generated and implemented in any organization. It is not only

essential to see the direct effect of independent variables on dependent variables but also to consider the indirect effect and the mediating variables to enrich the performance of the organization since the indirect effects of independent variables may be higher than its direct effect.

11. SCOPE FOR FURTHER RESEARCH

The present study provides a base for future research works. The possible research work in future could be: (i) Study on Information Systems Quality and Users' Satisfaction at various industries (ii) A comparative study on Information Systems and its usages in Small Scale Industries (iii) Impact of Information Systems and its Quality on Performance of the SSI units (iv) Measurement of Information System Quality: Factor Analytics Approach and (v) Uses of Information Systems in corporate and its consequences at corporate level.

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Table-1
Result of Confirmatory Factor Analysis

Sl. No.	Name of constructs included	Number of variables in	Range of Standardized factor loading	Range of 't' statistics	Cronbach alpha	Composite reliability	Average variance extracted
1.	System quality	8	0.9042–0.6548	4.0173*–2.5668*	0.7826	0.7691	53.93
2.	Information quality	6	0.8677–0.6609	3.6914*–2.7032*	0.7697	0.7429	52.14
3.	User satisfaction	12	0.9118–0.6844	4.0986*–2.9811*	0.8104	0.7914	55.08
4.	Service quality	7	0.8903–0.6291	3.8967*–2.3394*	0.7739	0.7526	53.25
5.	Firms' performance	8	0.9247–0.6494	4.1897*–2.4517*	0.7917	0.7702	54.11

*Significant at five per cent level.

Source: Primary data (SPSS 12.0)

Table-2
Level on Constructs in SMEs

Sl. No.	Constructs	Mean	Standard deviation	Co-efficient of variation (in%)	Inter-correlationship between				
					1	2	3	4	5
1.	System quality	2.8917	0.3994	13.81		0.5148*	0.4704*	0.3969*	0.4179*
2.	Information quality	3.0268	0.4244	14.02			0.3568	0.5118*	0.4029*
3.	Users satisfaction	3.1448	0.5648	17.96				0.4087*	0.4918*
4.	Service quality	2.6694	0.4681	17.54					0.5244*
5.	Firms' performance	2.7388	0.3899	14.24					

Source: Primary data (SPSS 12.0)

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Table-3
Result of Regression Analysis

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Sl. No	Dependent variable	Independent variable	R^2	Adjusted R^2	Beta	't' statistics	Significance	'F' statistics
1.	Firms' performance	Users satisfaction	0.5417	0.5217	0.31	3.8242	0.000	64.9817
		Service quality			0.29	4.01249	0.000	
		System quality			0.18	2.4682	0.0145	
2.	Users satisfaction	System quality	0.6244	0.6121	0.42	5.8647	0.000	92.4509
		Service quality			0.33	5.4146	0.000	
		Information quality			0.17	2.7025	0.004	
3.	Service quality	System quality	0.3714	0.3616	0.64	8.9331	0.000	114.9345
4.	Information quality	System quality	0.4709	0.4612	0.72	11.09652	0.0000	139.0817

Source: Primary data (SPSS 12.0)

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Table-4
Direct and Indirect Effect of Independent Variables on Firms' Performance

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Sl.No.	Variable	Direct effect	Indirect effect	Total effect
1.	Users' satisfaction	0.31	–	0.31
2.	Systems quality	0.18	0.42	0.59
3.	Service quality	0.29	0.10	0.39
4.	Information quality	–	0.05	0.05

Source: Primary data (SPSS 12.0)

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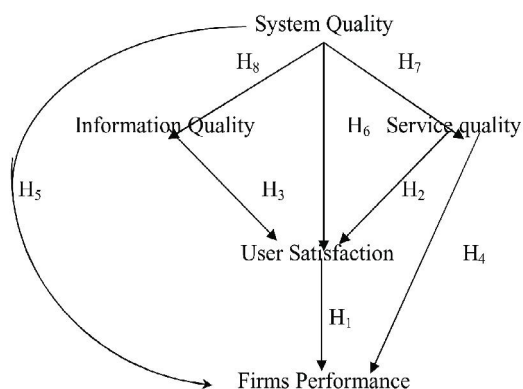**Figure-1 Conceptual Model of determinants of Firms Performance.**   **Figure-2 Path Model of determinants of firms performance**

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