Information Quality, Reporting and Organisational Performance

Maria Argyropoulou (argiropoulou@aueb.gr, argyropouloum@gmail,com)
Athens University of Economics and Business

Iain Reid
University of Huddersfield

Peter Wilkins
University of Liverpool

Geroge Ioannou
Athens University of Economics and Business

Abstract)

This study aims at the exploration of the statistical relationship between the quality of the Information produced by Information Systems (IS) such as ERPs and Organisational Performance. The definition of information quality encompasses measures such as accuracy, precision, currency, timeliness, conciseness, which aim at providing decision tools to the users of any Information System. Producing quality information /reports is the primary purpose of any IS. The results from a survey on 168 Greek companies show a strong correlation between Information Quality and Organisational Performance when this is expressed by financial and not financial measures.

Keywords: Organisational Performance, Information System effectiveness, ERP systems keywords

Information Systems Success

The most popular definition for IS success is "the extent to which a specific Information System actually contributes to achieving organisational goals, i.e. its effect on organisational performance" (Hamilton & Chervany, 1981) which is the basic research objective of this paper. Despite the extensive research and managerial effort to understand the underlying factors, the IS failure rate remains high as recently argued in the pertinent literature (Dwivedi et al., 2015).

There are several recent and older publications reporting successful as well as unsuccessful IS implementations, at an organisational level, which makes the impact of Information Systems one of the most prominent streams in IS research. Hendricks et al. (2007) for example explored the effect of investments in Enterprise Resource Planning (ERP), Supply Chain Management (SCM), and Customer Relationship Management

(CRM) systems on a firm's long-term stock price performance and profitability measures such as return on assets and return on sales. The results showed that ERP implementations had improvements in profitability but not in stock returns whereas adopters of SCM systems experienced positive stock returns as well as improvements in profitability. This relationship had been previously explored by Brynjolfsson and Hitt (1996) who studied 367 large firms and found that the investment in IS had made a statistically significant contribution to firm performance.

Other researchers, however, produced different results. The advances in technology had occasionally coincided with lower productivity and profitability in many companies in different sectors (e.g. Irani & Love, 2001). Implementation failures were also reported by more recent publications (Nelson 2007) describing negative consequences for the organizations in terms of financial losses.

IS success is one of the oldest research traditions in IS research. DeLone and McLean (1992;2003) concluded that this huge research could be gathered in six distinct categories/dimensions of information systems: (1) system quality, (2) information quality, (3) IS use, (4) user satisfaction, (5) individual impact, and (6) organisational impact (fig1). The authors did not provide empirical validation of the model; they concluded their study mentioning the need for empirical testing and validation of their taxonomy (DeLone & McLean, 1992). The model has been tested and validated in part or in full (meaning one or more of the categories identified) and has been validated as a measuring framework of IS success (Kulkarni et al. 2007; Petter et al.2013).

The evaluation of Information Systems (IS) success or effectiveness (both terms are used interchangeably) has attracted the academic interest/research but researchers are still trying to identify the constructs which can measure IS success in a comprehensive manner (Rai, Lang & Welker, 2002). For the purposes of this research, the remaining of the paper will focus on 2 of the identified categories: Information Quality and Organisational Impact which has been operationalised to measure Organisational Performance when using financial and non-financial measures. Both constructs are discussed in the subsequent paragraphs.

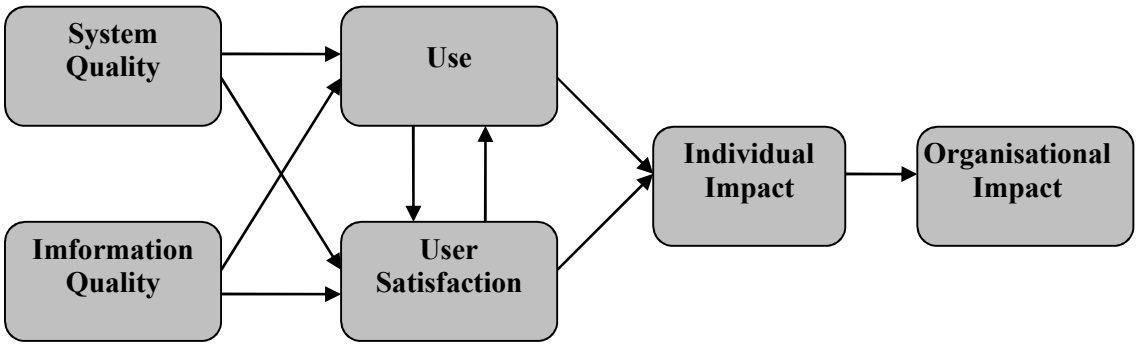

Figure 1-The DeLone and McLean Model (1992; 2003)

Organisational Performance

Organisational Performance is a continuous open research question with many studies using it as their 'ultimate dependent variable' (Cameron & Wheeten, 1983, p.200) as a multidimensional construct (Venkatraman & Ramanujam, 1986) with diverse measures and different definitions (see Kirby, 2005). Scholars have utilised a variety of indicators and variables to define and measure Organisational Performance reflecting their research backgrounds. Neely, Gregory and Platts (1995, p.80) defined it as the "Process of

quantifying the efficiency and effectiveness of action". In this regard, the most popular definition is given by Yamin, Gunasekaran & Mavondo (1999) according to which "Organisational Performance refers to how well an organisation accomplishes its market-oriented goals as well as its financial goals".

Scholars and practitioners have used different measures to evaluate the performance of organisations. Business and strategic management scholars relied "almost solely on financial measures of effectiveness" (Hitt, 1988, p.29). On the other hand, marketing scholars have utilised both economic and non-economic as well as generic measures to assess effectiveness (e.g. Katsikeas et al., 2000). Modern theories and concepts as well as the implementation of balanced scorecards have identified the need for the use of financial and non-financial measures for the operationalisation of Organisational Performance so that valuable conclusions can be derived for the company and the employees (Amir & Lev, 1996). In a more recent research, Richard et al. (2009) view organisational performance "as a term that encompasses three specific areas of firm outcomes: (a) financial performance (profits, return on assets, etc.); (b) product market performance (sales, market share, etc.); and (c) shareholder return (total shareholder return, etc.)".

The construct of Information Quality

Information quality is conceptualised as the quality of outputs produced by the information system (DeLone and McLean, 1992; 2003), which means the reports but it can refer to how users value the overall information that is available to them. Information quality has been used widely either as a construct or as a dimension of user satisfaction measuring instruments (Baroudi & Orlikowski, 1988; Doll et al., 1994). Exploring through a different perception, Larcker and Lessig (1980) formulated six questionnaire items for measuring the perceived importance and usability of information. Some researchers modified the D&M (2003) construct adding items from other relevant frameworks (Argyropoulou, 2012; Gorla, Somers & Wong, 2010,).

The Literature Gap and Research Propositions

There are limited studies that have explored the influence of information systems and used organisational performance measures for their dependent Variable (Argyropoulou, 2012, Chang & King, 2005; Bernroider, 2008). However, they produced conflicting findings (Sircar, Tumbow & Borodoli, 2000; Peter, DeLone and McLean 2012). The description of the dependent variable (Organisational Performance) as well as the variables measuring it, still attract research attention. Melville et al. (2004, p. 285) note that "*IT business value scholars are motivated by a desire to understand how and to what extent the application of IT within firms leads to improved organisational performance*"

Treating reports as the main product of any Information System, (Gorla et al., 2010) it is easy to understand that these products should have the basic characteristics of timeliness and reliability that affect performance. Poor data and reporting quality will affect negatively the customers, the decision making process and strategic objectives will be difficult to archive (Law & Ngai, 2007). In addition, the information should have the attributes of usefulness to the users (Calisir & Calisir, 2004) as the IS success is based on the needs of current and future users (Wu & Wang, 2007). Thus, we propose that:

P1: Information quality is positively related to organisational performance when this is measured by financial terms.

P2: Information quality is positively related to organisational performance when this is measured by non-financial terms.

Operationalisation of constructs

The study uses the Chang and King (2005) items for Information Effectiveness, along with several new items found in older and more recent research. For the operationalisation of Organisational Performance (dependent construct), the study used 26 items representing the four Balanced Scorecard (BSC) perspectives (Kaplan and Norton, 1992; 2005). Financial measures incorporated traditional measures like income, profit, and costs. Non-financial measures, on the other hand, meant to measure the organisational performance in relation to customers (e.g. customer satisfaction-retention), innovation and forecasting ability, organisational flexibility etc. 7-point Likert scale was adopted.

Research Design

Data for this study were collected by means of a web questionnaire and a sample of 700 Greek companies of different sizes operating in various industries. A web link was provided to the IT managers of the targeted companies who were considered to be the most knowledgeable respondents (Forza, 2002). This web survey started on April 2010 with a pre-notification inviting the IT managers to participate in our research and a link to the survey was sent one week later with another cover letter. Two reminders were issued subsequently one week after the first call notifying those that had not responded of a forthcoming deadline for the closing of the questionnaire. 168 usable responses were collected from different industries and company sizes. The Mann–Whitney test was run between late and early respondents to examine the null hypothesis that there is similarity in all the variables across the early and late respondents. The test showed that no significant differences were found among the variables used. As a result, we could argue that non-response bias was not an important issue and the data were unlikely to be biased of non-response errors.

It should be noted that we took all possible measures, suggested by the literature, to avoid Common, Method Variance: "identification of the most informative person, attempt to motivate key informants to co-operate with the study, minimisation of elapsed time, consideration of the impact of alternate framing of questions and finally, the use of pre-tested and structure questions" (Podsakoff et al., 2003; Reio, 2010). In addition, the Harman's single factor test, when using exploratory factor analysis, showed that no single factor accounted for the majority of the variances explained, which means that common method bias was not a major concern in our research (Podsakoff et al., 2003).

Sample characteristics

Table 1 shows that the participating companies represent many different industries with nearly 60% of the companies in manufacturing, pharmaceuticals and diary firms followed by commercial firms /retailers (25%) and services like banking, hospitals and consulting companies (15%). As it is seen in table 1, our sample comprised mainly companies employing more than 50 people which was expected as this had been determined for our targeted group as micro SMEs were unlikely to have implemented IS for our research.

Table 1-Industry classification

Type of industry	**Number of responses**	**Percentages**
Manufacturing and construction	99	60%
Commercial	42	25%
Services	27	15%

Data analysis and findings

Before proceeding to any statistical test, the variables were tested for normality. All skewness values were much less than ± 2 and all kurtosis values were much less than ±7. The cut off points are: for skewness < ± 2 and kurtosis < ± 7 (Curran et al. 1996). 57 variables were used in this study: 26 variables aimed at measuring Organisational Performance and 31 measured Information System Quality. Exploratory Factor Analysis (EFA) was followed as there was limited empirical basis regarding the number of the a priori factors that could exist (Fabrigar et al. 1999).

We followed the steps and advice recommended by Fabrigar et al (1999) to "arrive at parsimonious model and extraction of the common factors needed to account for the pattern of correlations among the measured variables" (p. 277). Varimax and Promax rotation techniques were employed but the final decision favoured Promax to test the reliability of the scales and obtain the minimum number of factors. The latent root criterion, the scree test and the percentage of variance explained were used in the analysis (Hair et al, 2010). Cut off point for item loading was 0.5 and the initial 57 variables were reduced to 51. Following the Promax rotation, the pattern mix indicated 8 extracted factors: 4 factors could be attributed to the construct of Information System Quality and 4 factors were extracted for the measurement of Organisational Performance. The reliability test results along with the new factor names are depicted in table 2.

Table 2- Factors measuring IS effectiveness and Organisational Performance

Constructs	Factor Name	Cronbach a	
Information Quality	Information usefulness timely	0.958	**Independent factors**
	Information validity reliable	0.942	
	Report effectiveness	0.863	
	Report usefulness	0.958	
Organisational performance	Growth and development	0.953	**Dependent Factors**
	Dynamism and Vigilance	0.948	
	Financial performance	0.957	
	Marketing performance	0.943	

Organisational performance factors

The growth and development factor contained variables that measure the organisation's ability and flexibility to grow and achieve strategic goals by sharing information in a timely manner. The dynamism and vigilance factor contained variables that measure the organisation's ability and flexibility to learn and respond fast to changes (new product/service development, defect free deliveries, range of new products, innovation capability etc). The marketing performance factor referred to a firm's ability to meet customer needs e.g. customer retention, customer satisfaction, on time delivery, customer complaints etc. The financial performance factor referred to typical financial measures such as income, various costs and gross profit.

Information quality factors

Information Usefulness factor contained variables such as accuracy, importance and relevance that measure the practicality/utility of the information provided by the system. Information Validity referred to the information's validity and reliability for the decision making process. Report Quality measured how the reviewed data could help the decision

making process whereas Report Effectiveness indicated how easily reports could be changed and updated.

All factors satisfied the statistical and conceptual criteria for acceptance, and were included in the proposition tests. In this research, reliability analysis was performed in order to assess the internal consistency of the factors. Reliability was assessed by using Cronbach's Alpha coefficient (Cronbach, 1951), which is the most common way to estimate the reliability of such scales (Nunnally, 1994). Nunnaly's (1994) threshold level of acceptable reliability being an alpha coefficient of 0.70 or greater was adopted. All scales were found to satisfy this criterion with Cronbach's a coefficient comfortably higher than the cutoff point of 0.70 (Hair et al, 2010).

In light of the extracted dependent factors, 4 hypotheses were formed (see table 3). For the purposes of this research, the Information Quality factors were considered as the independent variables (IVs) and the factors that measured Organisational Performance became the dependent variables (DVs). In order to test and quantify the relationship between the IV and the DVs, multiple regression analysis was performed. Table 3 summarises the model evaluation and ANOVA results.

Table 3- Results from the regression analysis

		Rsquare	F	Sig	Result
H1	Financial Performance increases if Information Quality increases	0.594	46.017	0.000	accepted
H2	Marketing Performance increases if Information Quality increases	0.523	32.939	0.000	accepted
H3	Growth and Development increase if Information Quality increases	0.500	29.758	0.000	accepted
H4	Dynamism and Vigilance increase if Information Quality increases	0.570	42.071	0.000	accepted

Discussion - Contribution

The results from the statistical tests (H1-H4) showed a statistically significant positive relationship between Information Quality and Organisational Performance factors. Specifically:

Information quality is positively related to growth and development

The impact of information quality on organisational performance has been evaluated by previous studies. Relevant papers focused either on the use of the information (e.g. Kositanurit et al., 2006; Shih 2004; Wu & Wang, 2006) or on the quality of the reports produced by any Information System (Gorla et al., 2010). This research, however, demonstrated how four validated factors, attributed to Information Quality, can help a company grow with improved flexibility and information sharing.

Information quality is positively related to dynamism and vigilance

A statistically significant relationship was found which coincides with previous findings in a sense, that the information/reports produced by any IS will enhance innovation, forecasting as well as R&D if they are perceived to enhance problem solving and decision making (Chang and King, 2005; Kahn et al., 2002).

Information quality is positively related to marketing performance
The model indicated a statistically significant relationship between Information Quality and Marketing Performance which contradicts the limited previous findings of no statistical relationship between Information Quality and competitiveness (Teo & Wong, 1998). According to our results accuracy, timeliness and clarity of information can contribute to better customer service, retention, less complaints and increased satisfaction.

Information quality is positively related to financial performance
The acceptance of H1 can be considered a key finding form this papers as previous research has shown contradicting and insufficient results (Peter et al., 2008).

Contribution of the Exploratory Factor Analysis to the field of Organisational Performance
Based on the net benefits concept (DeLone and McLean, 1992; 2003) as well as on the Balanced Scorecard approach, this study measured Organisational Performance using financial and non-financial measures. The financial measures that were used, captured the way the key informants see the impact of IS on the financial performance of a firm. Having identified many different variables in the pertinent literature, the use of EFA was deemed the "most appropriate form of analysis given the goal of this specific research" (Fabrigar, et al., 1999, p.273).

One purpose of this research was the development of an instrument that could measure organisational performance in a holistic manner, and "EFA served this purpose by refining the instrument's scales" (Conway and Huffcutt, 2003). Four distinct factors were extracted from the Exploratory Factor Analysis that can be related to the four BSC perspectives. These factors can now be used in several models for confirmatory factor analysis. Future IS researchers can use our Organisational Performance factors to measure the impact of different IS keeping pace with the IT advances.

For many years researchers have been troubled with the evaluation of Information Systems concluding wth a lack of understanding as to why, how, and when to evaluate IS systems (Gorla et al 2010). Our findings can trigger new directions to an old but enduring question. After many months of desk and empirical research, we can now say that this paper has shed some light into the IS field by focusing on how Information Quality may affect Organisational Performance.

Acknolwdgements
This research has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.

References

Amir, E. and Lev, B. (1996), "Value-relevance of non-financial information: The wireless communication industry", *Journal of Accounting and Economics*, Vol. 22, No.1, pp.3-30.

Argyropoulou, M. (2012), *Information System's Effectiveness and Organisational Performance*, PhD Thesis, Brunel University, London UK.

Baroudi, J.J. and Orlikowski, W.J. (1988), "A Short-From Measure of User Information Satisfaction: A Psychometric Evaluation and Notes on Use", *Journal of Management Information Systems*, Vol. 4, No.4, pp.44-59.

Bernroider, E. (2008), "IT governance for enterprise resource planning supported by the DeLone-McLean model of information systems success", *Information & Management*, Vol. 45, No.5, pp. 257-269.

Brynjolfsson, E. and Hitt, L. (1996), "Paradox lost? Firm-level evidence on the returns to information systems", *Management Science*, Vol. 42, No.4, pp.541-558.
Calisir, F. and Calisir, F. (2004), "The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning (ERP) systems", *Computers in Human Behaviour*, Vol. 20, No.4, pp.505–515.
Cameron, K. and Whetten, D. (1983), "Organisational effectiveness: One model or several?', in: Cameron, K. and Whetten, D. (Eds.) *Organisational effectiveness: A comparison of multiple methods*: 1–24. New York: Academic Press, pp.1-24.
Cha-Jan Chang, J. & King, W. R., (2005), "Measuring the Performance of Information Systems: A Functional Scorecard", *Journal of Management Information Systems,* Vol. 22**,** No. 1, pp. 85-115.
Conway, J.M and Huffcutt, A.I. (2003), "A Review and Evaluation of Exploratory Factor Analysis Practices in Organizational Research", *Organizational Research Methods* Vol. 6, No.2 pp147-168.
Cronbach, L.J. (1951), "Coefficient alpha and the internal structure of tests", *Psychometrika*, Vol 16, No. 3, pp.297-335.
Curran, P.J., West, S.G. and Finch, G.F. (1996), "The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis", *Psychological Methods*, Vol. 1, No.1, pp 16–29.
Forza, C. (2002), "Survey research in operations management: a process-based perspective", *International Journal of Operations & Production Management*, Vol.22, No.2, pp. 152-194.
DeLone, W.H. and McLean, E.R. (1992), "Information systems success: The quest for the dependent variable", *Information Systems Research*, Vol.3, No.1, pp.60-95.
DeLone, W.H. and McLean, E.R. (2003), "The DeLone and McLean Model of Information Systems Success: A ten-Year Update", *Journal of Management Information Systems*, Vol.19, No.4, pp.9-30.
Doll, W.J., Xia, W. and Torkzadeh, G. (1994), "A confirmatory factor analysis of the end-user computing satisfaction instrument", *MIS Quarterly*, Vol. 18, No.4, pp.453–461.
Dwivedi, Y.; Wastell, D.; Laumer, S.; Henriksen, H., Myers, M.; Bunker, D.; Elbanna, A. Ravishankar, M.; Srivastava, S..(2015), "Research on information systems failures and successes: Status update and future directions", *Information Systems Frontiers*, Vol. 17. No.1, pp.143-157. 15.
Fabrigar, L.R.; Wegener, D.T.; MacCallum, R. C& Strahan, E.J. (1999), "Evaluating the use of exploratory factor analysis in psychological research", *Psychological Methods*, Vol. 4, No.3, pp 272-299.
Forza, C. (2002), "Survey research in operations management: A process-based perspective", *International Journal of Operations & Production Management*, Vol. 22, No.2, pp.152-194.
Gable, G.G., Sedera, D.& Chan, T. (2008), "Re-conceptualizing information system success: The IS-impact measurement model" , *Journal of the Association of Information Systems* Vol9. No. 7, pp 377-408.
Gorla, N., Somers, T.M. & Wong, B. (2010), "Organisational impact of system quality, information quality, and service quality", *The Journal of Strategic Information Systems*, Vol.19, No.3, pp. 207-228.
Hair, J.F., Black, W.C., Anderson, R.E., Babin, B.J (2010), *Multivariate Data Analysis with Readings*. 7th edn. New York: Pearson Publishing.
Hamilton, S. and Chervany, L.N. (1981), "Evaluating Information System Effectiveness - Part I: Comparing Evaluation Approaches", *MIS Quarterly*, Vol. 5, No.3, pp.55-69.
Hendricks, K.B., Singhal, V.R. and Stratman, J.K. (2007), "The impact of enterprise systems on corporate performance. A study of ERP, SCM, and CRM system implementations*", Journal of Operations Management*, Vol. 25, pp.65–82.
Hitt, M.A. (1988), "The measuring of organisational effectiveness: Multiple domains and constituencies", *Management International Review*, Vol28, No.2, pp.28-40.
Kahn, B.K., Strong, D.M. & Wang, R.Y. (2002), "Information quality benchmarks: product and service performance", *Communications of the ACM*, Vol. 45, pp.184-192.
Katsikeas, C.S., Leonidou, L.C. and Morgan, N.A. (2000), "Firm-level export performance assessment: review, evaluation, and development", *Journal of Academy of Marketing Science*, Vol28, No.4, pp. 493-511.
Larcker, D.F. and Lessig, V.P. (1980), "Perceived Usefulness of Information: A Psychometric Examination", *Decision Sciences*, Vol. 11, No.1, pp. 121-134.
Law, C.C.H. and Ngai, E.W.T (2007), "ERP systems adoption: An exploratory study of the al factors and impacts of ERP success", *Information and Management*, Vol. 44, pp.418-432.

Irani, Z. and Love, P.E.D. (2001), "The propagation of technology management taxonomies for evaluating investments in information systems", *Journal of Management Information Systems*, Vol. 17, No.3, pp.161–177.

Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard-measure that drive performance", *Harvard Business Review*, Vol. 70, No. 1, pp.71–79.

Kaplan, R.S. and Norton, D.P. (2005), "The balanced scorecard: measures that drive performance", *Harvard Business Review*, Vol. 83, No. 7, p.172.

Kirby, J. (2005), "Toward a theory of high performance", *Harvard Business Review*, Vol. 83, pp.30–39.

Kulkarni, U., Ravindran, S. & Freeze, R. (2007), "A knowledge management success model: theoretical development and empirical validation", *Journal of Management Information Systems*, Vol. 23 No. 3, pp. 309-347.

Kositanurit, B., Ngwenyama, O. & Osei-Bryson, K.M. (2006), "An exploration of factors that impact individual performance in an ERP environment: an analysis using multiple analytical techniques", *European Journal of Information Systems*, Vol.15, No.6, pp.556–568.

Melville, N., Kraemer, K. & Gurbaxani, V. (2004), "Information technology and organisational performance: an integrative model of IT business value", *MIS Quarterly*, Vol.28, No.2, pp.283-322.

Nunnally, J.C. and Bernstein, I.H. (1994), *Psychometric theory*, 3rd ed. New York: McGraw-Hill.

Neely, A. Gregory, M. and Platts, K. (1995), "Performance measurement system design: A literature review and research agenda", *International Journal of Operations and Production Management*, Vol. 15, No. 4, pp.80-116.

Nelson, R. R. (2007), "IT project management: infamous failures, classic mistakes, and best practices", *MIS Quarterly Executive*, Vol. 6, No.2, pp.67–78.

Petter, S., DeLone, W. and McLean, E. W. (2008), "Measuring information systems success: models, dimensions, measures, and interrelationships", *European Journal of Information Systems*, Vol. 17, No. 3, pp.236–263.

Petter, S., DeLone, W. & McLean, E. (2012), "The Past, Present, and Future of "IS Success", *Journal of the Association for Information Systems*, Vol. 13, Special Issue, pp. 341-362.

Peter, S., DeLone, W. & McLean, E.W. (2013), "Information Systems Success: The Quest for the Independent Variables", *Journal of Management Information Systems*, Vol. 29, No. 4, pp. 7–61.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. & Podsakoff, N.P. (2003), "Common method biases in behavioural research: A critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88, No.5, pp.879-903

Rai, A., Lang, S.S. & Welker, R.B (2002), "Assessing the validity of IS success models: An empirical test and theoretical analysis", *Information Systems Research*, Vol. 13, No.1, pp.50–69.

Reio, Jr.T.G. (2010), "The Threat of Common Method Variance Bias to Theory Building", *Human Resource Development Review*, Vol. 9, No.4, pp.405-411.

Richard, P.J., Devinney, T.M., Yip, G.S. and Johnson, G. (2009), "Measuring Organisational Performance: Towards Methodological Best Practice", *Journal of Management*, Vol.35, No.3, pp.718 – 804.

Shih, H.P. (2004), "Extended technology acceptance model of internet utilization behavior", *Information & Management*, Vol. 41, No.6, pp.719–729.

Sircar, S., Turnbow, J.L. & Bordoloi, B. (2000), "A framework for assessing the relationship between information technology investments and firm performance", *Journal of Management Information Systems*, Vol.16, No.4, pp.69–97.

Teo, T.S.H. and Wong, I. (1998), "An empirical study of the performance impact of computerization in the retail industry", *Omega*, Vol. 26, No.5, pp.611–621

Venkatraman, N. and Ramanujam, V. (1986), "Measurement of business performance in Strategy research: A comparison of approaches", *Academy of Management Review*, Vo. 11, No.4, pp.801-814

Yamin, S. Gunasekaran, A. and Mavondo, F.T. (1999), "Relationship between generic strategy, competitive advantage and firm performance: an empirical analysis", *Technovation*, Vol. 19, N0.8 pp.507–18.

Wu, J-H. and Wang, Y-M. (2006), "Measuring KMS success: a respecification of the DeLone and McLean model", *Information & Management*, Vol.43, No.6, pp.728–739.

Wu, J-H. and Wang, Y-M. (2007), "Measuring ERP success: The key-users' viewpoint of the ERP to produce a viable IS in the organization", *Computers in Human Behaviour*, Vol. 23, No. 3 pp.1582-1596