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Critical Success Factors for IT/IS Implementation in the Construction Organisation

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Abstract: The utilising of information technology (IT) / information systems (IS) in construction has been widely reported in the literature. Even though a numbers of usage is relatively low compared to the other industry, many construction organisations has started to introduce IT/IS to cope to the change of business trend. The identification of critical success factors (CSFs) in the IT/IS implementation in the construction organisation become essential due to the high percentage of IT/IS projects failure reported in the industrial report and published paper. This scenario has led a wide investigation to attempt identifying those factors that contribute to IT/IS success/failure. Generally, many studies have been conducted during the last decade to identify the factors that critical to the IT/IS success, however majority of them focused on the hard issues such as quality, speed and accuracy of the information. The studies shows, an organisation or individual has different perceptions of what is favourable or satisfactory. In other words, everyone address unique definitions of successful factors in IT/IS implementations, and so makes the synthesis of successful measures more wide-ranging and complex. This paper present an effort to measure the influence of the fifteen critical success factors (CSFs) focusing on the soft issues (human aspects) to the success/failure of IT/IS implementation. The study anticipated contributes to knowledge by adding a soft issues-focused on the IT/IS implementation and provides indication for organisations to integrate hard issues (technological and process) and soft issues within their organisation's work environment. A set of questionnaires were sent to 250 organisations within the construction industry in the United Kingdom. Three factors were identified as key predictor variables of success/failure of IT/IS implementation business process, communication and senior management participation.

Key words: critical success factors (CSFs), IT/IS, soft-issues, IT/IS implementation

INTRODUCTION

The increased competition in the global marketplace, the reduction of trade barriers, the deregulation of markets, and foreign competition in local markets leaves many firms with no option other than to make investments in IT/IS for their continued business survival and future business expansion plans (Smithson & Hirschheim, 1998; Serafeimidis & Smithson, 2000). As a result of these new business trends, many firms have had to change their workflow and processes (Love & Irani, 2004). Irani & Love (2001) indicate the new millennium business environment is more responsive, dynamic and competitive, and is in a constant state of customer-centered change.

The past decade has seen a rapid development of IT/IS to facilitate such changes in many industries (Clegg, *et.al.*, 1997; Smithson & Hirschheim, 1998; Serafeimidis and Smithson, 2003). IT/IS has the potential to transform the organisation towards achieving competitive advantages such as automation, value chain and the transformation of activities towards differentiation (Farbey *et.al.,* 1994; Irani & Love, 2001; Spanos *et.al,* 2002). Avgerou (2000) defined IT/IS role in organisational changes as an "enabler" of organisational objectives. IT/IS is also well known as a tool to enable an organisation to quickly respond to market changes and therefore improve product/service quality (Porter & Millar, 1985). Lee (2004) listed the potential of recent IT/IS advances to organisational change such as: change the ways firms operate their businesses, redesign business processes, strengthen their customer relationship management, develop a new business model, create new knowledge, manage existing knowledge, distribute information, facilitate inter- and intra-organizational collaboration, improve productivity, and create highly competitive market environments across all industries,

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etc. Gyampoh-Vidogah *et al.,* (2003) suggest the implementation of new IT/IS in construction organization may requires them changes to information processing, reclassification and design of documents, implementing new processes based on a detailed process map and identify clear definition of roles and functions

There are numbers of reports highlighting a huge spending on IT/IS investment in many industries (Graeser, *et al.,* 1998; Remenyi & Smith, 1999; May, 2001; Standish Group, 2001; Forrester Research, 2006). The utilisation of IT/IS in construction reported in the literature is slow compared to the other industries which results a negative consequences on productivity and innovation (Marsh & Flanagan, 2000; Mak, 2001; Stewart *et al*, 2002). In the past a few years, many construction organisations started to introduce IT/IS in their business practices (Seaden *et al*, 2003). However, there are also significant figures of reports indicating the failure of IT/IS investment in many industries including construction (Willcocks & Lester, 1993; Clegg, *et al.* 1997; Ewusi-Mensah, 1997; Standish Group,1995; Standish Group, 2001; Lientz & Larson, 2004; Xia & Lee, 2005; Forrester Research, 2006). Thus, the high percentage of IT/IS investment failures had attracted many researchers both in academia and industry towards to the cause of IT/IS investment failure. Significantly, many of them indicates that an organisation focusing more on the delivery of technology, and simply neglecting the organisational factors (soft issues) which directly contribute to the success or failure of the new IT/IS projects (Tornatzk & Fleischer, 1990; Kanter, *et al.,* 1992; Karake, 1994; Clegg, *et al.*, 1997; Smithson & Hirschheim, 1998; Al-Mashari & Zairi, 1999; Serafeimidis & Smithson, 2003; Jones, *et al.,* 2005; Saleh & Alshawi, 2005).

Whyte & Bytheway, (1996) highlight that the successful factors in IT/IS implementation can be categorised into three parts: *first*, the 'product' which is delivered to the users (for example the software and hardware systems, user documentation and training courses); *second*, the *'process'* that creates the system (traditionally including systems analysis, technical design, program coding, testing and final handover); and *third*, the 'service' which deals with the softer issues (answering questions, dealing with problems, and generally addressing the concerns and aspirations of users). Many efforts have been produced since then, however, the majority of them focusing on the product and process based factors (Remenyi & Smith, 1999). Therefore, this scenario has confirmed the significance of carrying out an investigation to determine the soft issues factors towards IT/IS success/failure.

Critical Success Factors:

Many studies highlighted a common problems in IT/IS implementation in construction; lack of IT expertise, perception towards IT/IS capability to increase competitiveness (Mak, 2001), supply chain fragmentation, resistance to change (Stewart et.al.2004; Marrosszeky et.al, 2000), low IT literacy (Stewart et.al, 2004), misaligned business strategies with IT/IS investment (Gyampoh-Vidogah et.al, 2003) etc. These common problems addressed to the question: what are the critical success factors (CSFs) the IT/IS implementation in construction organisation?

Such a CSFs should enable the identification of check-list prior the IT/IS project and facilitate formulation of IT/IS project success. Therefore, the main aim of the study to identify answers to the above research questions and offer potential solution that useful prior IT/IS investment in construction.

Various means were used to gather this information such as books, academic journal articles and research papers, conference proceedings, reports, magazines, etc. Apart of that, various local workshops and seminars has been attended to obtain directly an expert, practitioners and researchers' view on the experience, perception and attitudes towards IT/IS implementation issues. The literature review provides a basis for developing the research instruments through initial identification of the organisational factors of the successful IS/IT implementation.

The author identified 14 criteria (independent variables) as successful organisational factors in IT/IS implementation: the driver of IT/IS investment, system requirements definition, system focus, network communication, business process, types of skills, capability building, position of IT Head, Roles of IT department, User Involvement, characteristics of organisation behaviour, IT policy, communication and participation.

Table 1.1 lists those variables and authors that were referenced and used for extraction/adoption.
The following shows the criteria for each factor:

a) Drivers:

These are the factors that drive or trigger the management to make new IT/IS investments. For example, the management decide to invest in the new IT/IS to save operational costs, space reduction, reduce data duplication & redundancy, enhance the company image, etc.

Table 1.1: The resources used for factors extraction/adoption

Variables	Sources
· Drivers	· IT/IS expertise
· System requirements definition	· Currie & Willcocks (1998)
	· Tallon *et al*. (2004)
	· Cline *et al* (2001)
· Focus	· Tallon *et al*. (2004)
· Network Communication	· Cline *et al* (2001)
· Process	· Peppard and Rowland (1995)
	· Capability Maturity Model (CMM) (Paul *et al*, 1993)
· Skills	· Nelson (1991)
· Capability building	· Crossan *et al*. (1999)
· Position of IT/IS Head	· General Practitioner Information System (GPIS) Model (Salah, 2002)
· Roles	· IT/IS expertise
· User Involvement	· General Practitioner Information System (GPIS) Model (Salah, 2002)
	· IT/IS expertise
· Characteristics	· Leek (1997)
	· Ibbott & O'Keefe (2004)
	· Gunasekaran *et al* (2004)
· IT/IS activities control	· Peterson, (2003)
	· Karake (1994)
	· IT expertise
· Communication	· Project Management Maturity Model (Crawford, 2002)
· Participation	· IT/IS expertise

The CSFs relationship between successful factors can be described as follows:

IT/IS successful implementation (Y) = the driver of IT/IS investment + system requirements definition + system focus + network communication + business process + types of skills + capability building + position of IT Head + Roles of IT department + User Involvement + characteristics of organisation behaviour + IT policy + communication + participation.

b) Systems Requirements Definition (SRD):

To identify the requirements of the stakeholders (customers and users) for a new system or proposed system alteration such as *functional requirements* (specific behaviour; what the system can do such as data processing, data manipulation, graphical user interface, ease of use, security etc) and *non-functional requirements* (to judge the operation of a system such as reliability, performance and cost)

SRD is an important part of the system design process, whereby business analysts along with the stakeholders and system developers identify the needs of a client. Among popular techniques used to identify SRD are the stakeholder's interview, workshops, prototypes etc (Wikipedia, 2007).

c) Focus:

The utilisation of IT for the organisation's improvement such as to improve internal efficiency; enhance overall organisational effectiveness; extend geography and market reach; change the industry or market place. (Tallon *et al*, 2000)

d) Network Communication:

A computer *network coverage* within the organisation that is capable of exchanging information electronically between individuals, groups, and business units.

e) Process:

A workflow, or group of activities (sometimes called methods and procedures), that produce an outcome valued by an internal or external customer'. (Hammer & Champy, 1993; Harrington, 1991). They (a work flow or group of activities) are generally cross-functional and horizontal in nature with no single person having responsibility for the entire process. (Innovative Manufacturing Initiative, 1994).

f) Types of Skills:

A specific range of IT/IS skills needed by the user to maximise the potential of IT systems and meet the requirements of a specific job.

g) Capability Building:

The mechanism for an organisation improving their learning capabilities of IT/IS skills. (Murray and Donegan, 2003)

h) Position of IT/IS Head:

The position of the IT/IS Head in the organisation structure

i) Roles of IT Staff:

The roles and responsibility of IT staff including technician, programmers, analysts, managers, etc.

j) User Involvement:

The approach of user involvement in the IT/IS development process by an individual or members of the target user group.

k) Organisation Behaviour Characteristics:

The actual implementation pattern of IT/IS within working environments in the organization

l) Control of IT/IS Activities:

The pattern of enterprise decision making authority of IT resources (infrastructure and application) among IT Departments and business units

m) Communication:

The communication planning throughout the organisation at all levels of the management regarding the IT/IS implementation/activities

n) Participation:

The participation of top and middle management in the IT/IS initiatives

Research Methodology:

The main aim of this research was to identify CSFs of IT/IS implementation and develop a discrimination model that be able quantitatively measure the CSFs. Literature indicates there are many factors contribute to the success/failure of IT/IS project which some are more significant than other. Thus, the first step of this research is to examine CSFs in the literature across disciplinary and then develop a discrimination model reflects to the construction sector. The research questions are:

Q1. What are CSFs of IT/IS implementation in construction?
Q2. What are the relationships among the factors?

The constructs of CSFs were identified purely from the literature review. This study is not intended to investigate the cause-and-effect relationship between those criteria to the successful of IT/IS implementation. For example, does more training cause more chance of successful IT/IS implementation. This study however, is merely to investigate a correlation or the importance of those criteria to the success of IT/IS implementation. For example, is training related to the successful IT/IS implementation?

The perception of success/failure in IT/IS implementation is a contradiction. Indeed, this perception is confined to various perspectives of success across individual researchers and practitioner (Coombs, 1999). The objective of this survey is to measure the statistical influence of the variables on the success/failure implementation through a general survey:

1. to determine the correlation coefficient computed from SPSS software which describes the relative importance of 15 factors as discriminating variables to the successful/failure of IT/IS implementation
2. to determine the model of multiple regression computed from SPSS software for predicting the success/failure of IT/IS implementation.
3. to determine the stepwise multiple regression models computed from SPSS software for minimising, and considering only an important variable to be used for predicting success/failure status
4. to determine the coefficient of determination (r^2) computed from SPSS software for calculating how much error has been reduced finding the regression line.

5. to evaluate the independence of success/failure of IT/IS implementation to the selected level of maturity indicated by the respondents.

A set of questionnaires were developed and distributed with a stamped addressed return envelope enclosed to 250 medium and large companies in the construction industry based in different locations in United Kingdom. Fifteen factors were included in the study. The factors were derived from the literature and tested in the case studies. Respondents were asked to specify one of their selected IT systems and to indicate, using a 5-point Likert scale, the extent to which the fifteen factors were undertaken or had been experienced with 1 indicating 'not important' and 5 indicating 'extremely important'. Respondents were also asked to indicate their successful level (y) with regard to IT system implementation:

Successful level (y = 10) = *full success* - the system has/will successfully met/meet its intended business objectives,

Successful level (y = 5) = *partial success* - the system has/will met/meet a few of its intended business objectives,

Successful level (y = 3) = *technical success* - the system is operational but has/will not satisfied/satisfy users needs; and

Successful level (y = 1) = *full failure* - the system was/will be terminated before completion.

41 responses were received out of 250 which represent a 16.4% response rate. Although this response rate is considered low, it indicates an initial idea of the industry's experience with their IT/IS implementation.

The Importance of the Research:

It is anticipated that the generation of the model of multiple regression computed from SPSS software for predicting the success/failure of IT/IS implementation can be used by the organizations prior IT/IS investment and therefore may save the IT expenditure cost spend each year. The model will significantly contribute to knowledge of IT project management for predicting the feasibility of the IT project prior investment. The model is also a unique attempt to predicting the influence of the CSFs to the successful/failure of IT project which focusing on human issues.

The Results:

A) General Findings on the Respondents and it System Background:

1. Main Speciality:

All the respondents were asked about their company's main activities. The largest number of respondents came from surveying firms at 24% of the total respondents. This was followed by construction developers - 20%, integrated services – 17%, contractors – 15%, mechanical and electrical – 10%, civil & structural – 7% and architects – 7%. (Figure 1.1)

2. The Annual Turnover:

The majority of the respondents gained an annual turnover around £10 million to £50 million which represents 63% of the total respondents and followed 22% of less than £10million and 15% of £50 million to £100 million. No respondents indicated their annual turnover was more than £100million. (Figure 1.2)

3. IT System Specified:

The type of IT system specified the most by the respondents was a document management system with 41%, followed by a wireless system – 15%, database – 12%, networking – 10%, enterprise resource planning – 10%, supply chain – 7% and decision support – 5%. This data shows that most of the respondents focus on efficiency in their internal operations by improving organisation communications, and tasks requirements. (Figure 1.3)

4. Intended Business Objectives of the IT System:

46% of respondents indicated that their intended business objective in implementing their IT system was to improve organisational communication, followed by work task requirements – 22%, competitive advantage – 15%, business process improvements and global competition – 7%. (Figure 1.4)

5. The Stage of IT System:

49% of respondents specified that their selected IT system was being assessed at being at the full implementation stage, whereas 22% were at the planning stage and the remaining 29% were currently being implemented. (Figure 1.5)

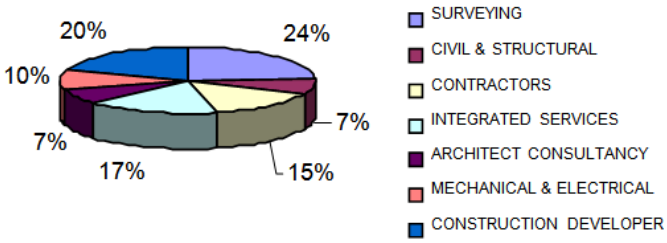

Fig. 1.1: Main Specialities of Respondents.

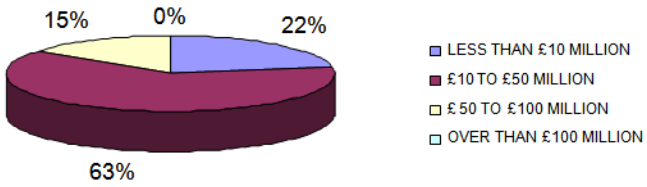

Fig. 1.2: the Annual Turnover.

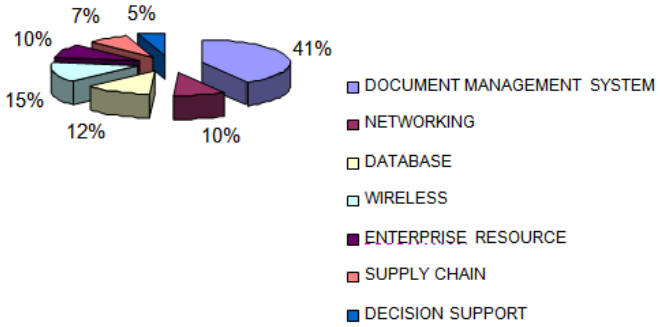

Fig. 1.3: Specify it System.

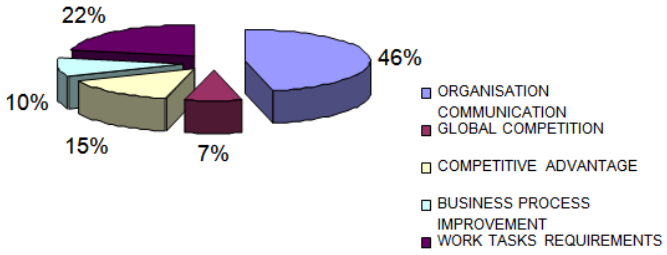

Fig. 1.4: Intended Business Objectives of it System.

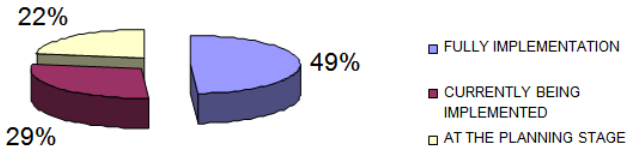

Fig. 1.5: it System Stage of Implementation.

6. Number of Users:

51% of the IT systems specified by the respondents had more than 30 users and this was followed by 27% at 20 to 30 users, 17% - less than 10 users, and 5% - 10 to 20 users. (Figure 1.6)

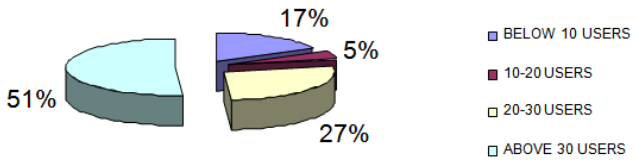

Fig. 1.6: Number (Or Expected Number) of Users.

7. The Perception Towards IT Systems:

The majority of respondents perceived that the specific IT systems are a partial success with 32%, followed by 27 who perceived that their IT systems are full success. 24% assessed themselves as being a technical success, and the remaining 17% perceived their IT system are a failure. (Figure 1.7)

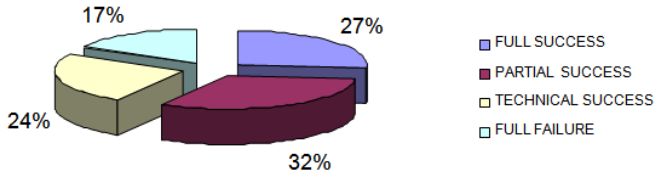

Fig. 1.7: Perceptions Towards it System.

b) Statistical Analysis on the Factors Using SPSS Software:

1. Discriminant Analysis on Statistical Influence of Successful Factors of IT/IS Implementation:

The relative strength of the relationship between successful/failure status and the success factors were examined. The Sperman rank correlation coefficient computed from the SPPS software was used to analyse the relative importance of 15 factors as discriminating variables. These factor are driver, systems requirements definition, ownership, focus, network communication, business process, IT skills, capability building, the position of the IT/IS Head, roles of IT staff, the user's involvement, organisational behaviour, IT policy, communication, and senior management participation. Table 7.1 summarises the rank order of the 15 individual successful criteria according to the Sperman rank correlation coefficient. It indicates that the criteria, such as business process, senior management participation, IT skill, and capability building band, showed considerably more discriminating power, with business process providing the highest. The highest correlation coefficients between success/failure level classes and the successful criteria, were obtained from business process, senior management participation, skills and capability building (r^2 = 0.87, 0.75, 0.64 and 0.56) respectively, which were significant at the 95% confidence level. The relationships obtained from process, senior management participation, skills and capability building were stronger and statistically more significant than the other criteria. The criteria that displayed insignificant correlation ($p < 0.05$) are systems requirements definition, ownership, position of IT/IS Head, focus, driver, roles of IT staff, networks communication and IT policy.

Table 7.1: Spearman rank correlation coefficients ($p < 0.05$) between success/failure levels and the elements of the IT/IS readiness model

Variables	Correlation
(business process)	0.872
(senior management participation)	0.748
(IT skills)	0.635
(capability building)	0.551
(communication)	0.434
(users involvement)	0.342
(organisation behaviour)	0.33
(IT policy)	0.170
(network communication)	0.151
(roles of IT staff)	0.117
(driver)	0.112
(focus)	0.104
(position of IT/IS head)	0.091
(ownership)	0.081
(systems requirements definition)	0.009

2. Multiple Linear Regression (MLR) for Predicting the Success/failure of IT/IS Implementation:

The MLR equation is expressed mathematically as:

$$y = \beta_0 + \beta_1 X_1 + \ldots \beta_n X_n$$

Where: y = the dependence variable (success/failure status); being predicted by partial regression coefficient (β_n); each being multiplied by the independent (X_n) predictor variables; and β_0 is a constant (the "y" intersect)

The regression model was computed and the statistical summaries are given in the table below:

Table 7.2: The Summary of Multiple Linear Regression (MLR)

	β	Std. Error
(Constant)	-5,518	1,854
Driver (x_1)	-0,186	0,231
Systems requirement definition (x_2)	-0,208	0,232
Ownership (x_3)	0,368	0,237
Focus (x_4)	-0,452	0,262
Network communication (x_5)	0,119	0,235
Business process (x_6)	1,59	0,328
IT skills (x_7)	-0,163	0,355
Capability building (x_8)	0,062	0,293
Position of IT/IS head (x_9)	0,185	0,192
Roles of IT staff (x_{10})	-0,073	0,200
Users involvement (x_{11})	0,435	0,279
Organisational behaviour (x_{12})	0,171	0,184
IT policy (x_{13})	-0,152	0,243
Communication (x_{14})	0,202	0,288
Senior management participation (x_{15})	1,429	0,391

Overall, results of the analysis were good with a high coefficient of determination (R-square) value of 0.897. The MLR model for predicting the success/failure of IT/IS implementation is simplified by the following equation:

$$\text{Successful level } (y) = -0.186\,(x_1) - 0.208\,(x_2) + 0.368\,(x_3) - 0.452(x_4) + 0.119(x_5) + 1.590(x_6) - 0.163(x_7) + 0.062(x_8) + 0.185\,(x_9) - 0.073(x_{10}) + 0.435(x_{11}) + 0.171(x_{12}) - 0.152(x_{13}) + 0.202(x_{14}) + 1.429(x_{15}) - 5.518$$

r^2 (adj) = 0.897

Std error of the estimates = 1.321

3. Stepwise Multiple Linear Regression (SMLR):

Using the stepwise procedure computed by SPSS software, three variables were identified as key predictor variables of the success/failure of IT/IS implementation.

These predictor variables were:

x_6: business process

x_{14}: communication

x_{15}: senior management participation

The stepwise procedures allow us to minimize and consider only an important variable to be used for predicting the successful level. The regression coefficients and R-Square values of all sets of data have been considered for the study from this analysis. The regression model was computed and the statistical summaries are given in the table below:

SMLR equation model 3 was generated with the highest coefficient determination (r^2**)** to the practice, as the closer r^2 is to one, the better the fit is of the regression line.

Discussion and Conclusion:

The pattern of correlation coefficient results computed from SPSS software can be divided to three categories according to the relative importance of 15 factors as discriminating variables for the success/failure of IT/IS implementation:

Table 7.3: The Summary of Stepwise Multiple Linear Regression (SMLR)

Model		Unstandardised Coefficients	
		B	Std. Error
1	(Constant)	-3,707	0,839
	Business process (x_6)	2,696	0,243
2	(Constant)	-4,742	0,741
	Business process (x_6)	2,043	0,254
	Senior management participation (x_{15})	0,989	0,233
3	(Constant)	-5,53	0,79
	Business process (x_6)	1,85	0,257
	Senior management participation (x_{15})	1,022	0,222
	Communication (x_{14})	0,478	0,215

It can be simplified by the following three equations (Table 7.4)

Table 7.4: The SMLR equation models

Model	Algorithm	r^2	Standard Error of estimation
1.	$y= 2.696(x_6)$ -3.707	0.760	1.62
2	$y= 2.043(x_6) + 0.989\ (x_{15}) - 4.742$	0.837	1.35
3	$y= 1.85(x_6) + 1.022(x_{15}) + 0.478(x_{14}) - 5.53$	0.856	1.29

1. category I - *correlation coefficient between 0.500 to 1.000* - x_6 : business process – 0.872, x_{15} : senior management participation – 0.748, x_7 : IT skills - 0.635, x_8 : capability building - 0.551;
2. category II - *correlation coefficient between 0.200 to 0.500* – x_{14} : communication – 0.434, x_{11} : users involvement – 0.342, x_{12} : organisational behaviour – 0.33;
3. category III - *coefficient between 0.001 to 0.200* - x_{13} : IT policy – 0.170, x_5 : network communication – 0.151, x_{10} : roles of IT staff – 0.117, x_1 : driver – 0.112, x_4 : focus – 0.104, x_9 : position of IT/IS head – 0.091, x_3 : ownership – 0.081, x_2 : systems requirements definition – 0.009. The pattern shows three categories of success/failure factors that an organisation would prioritise during their IT/IS implementation.

The relationships obtained from process, senior management participation, skills and capability building were stronger and statistically more significant than the other criteria. The result showed that any changes to the criteria, particularly business process, senior management participation, IT skill, and capability building, may have a large influence on the success of IT/IS implementation than those criteria that show lower correlation coefficients such as: systems requirements definition, ownership, position of IT/IS Head, focus, driver, roles of IT staff, networks communication and IT policy. A few previous empirical studies also show the significance of those criteria to the successful IT/IS implementation. Seaden et.al. (2003) highlight in their study, most of construction organisations have to change their business practice every times introduce new IT/IS. The finding from Yetton, *et al.* (2000) in a survey of IT/IS projects in the UK and New Zealand, highlights the significance of correlation coefficients of 0.37 and 0.36 for senior management participation and user involvement in ensuring a successful IT/IS project performance. Whereas, Betts (1999) suggest the successful or failure of new IT/IS implementation in construction organization requires the development of strategic implementation plans prior to IT/IS project commencement. This can only be achieved by high commitment of senior management participation during the planning stage (Stewart et.al.,2004; Miozzo *et al*., 1998). The absence of senior management participation during the early stage of planning will results misaligned of business strategy and IT strategy which may result the failure of IT/IS projects. Grant et.al (1998) highlight the aligning between business strategy and IT strategy, the senior management contribution to redesign their business process is significant in order to define key business process, assess their value and make priority for the IT/IS investment. Doherty *et al.,* (2003) in their study '*a systems' failure of organizational issues from 344 senior information system (IS) executives' perspectives',* found that there is a positive relationship between the users involvement (the number of issues that are treated by user) and the overall success of the systems development process by using the Pearson correlation of 0.15, which is statistically significant at the 0.01 level (r = 0:15, P= 0:005).

The MLR mathematical equation was computed from SPSS and scored high prediction algorithms (r^2 = 0.897) as follows: $y = -5.518 - 0.186\ (x_1) - 0.208\ (x_2) + 0.368\ (x_3) - 0.452(x_4) + 0.119(x_5) + 1.590(x_6) - 0.163(x_7) + 0.062(x_8) + 0.185\ (x_9) - 0.073(x_{10}) + 0.435(x_{11}) + 0.171(x_{12}) - 0.152(x_{13}) + 0.202(x_{14}) + 1.429(x_{15})$. The MLR mathematical equation can be used to predict the success/failure of IT/IS implementation in the organisation. By following this equation, the organisation can predict the success/failure of their IT/IS project according to the pre-determined by: i) successful level (y = 10) = *full success* - the system has/will successfully met/meet its intended business objectives, ii) Successful level (y = 5) = *partial success* - the

system has/will met/meet a few of its intended business objectives, iii) Successful level (y = 3) = *technical success* - the system is operational but has/will not satisfied/satisfy users needs; and iv) Successful level (y = 1) = *full failure* - the system was/will be terminated before completion. For example, if the successful level ($y = 7.45$), the prediction of IT/IS implementation is between full success (value 10) and partial success (value5)

Three variables were identified as key predictor variables of success/failure of IT/IS implementation through a stepwise procedure computed by SPSS software. These predictor variables are: x_6: business process, x_{14}: communication, x_{15}: senior management participation. Three mathematical equations produced in stepwise procedure as follows y= 2.696(x_6) -3.707, y= 1.85(x_6) + 1.022(x_{15}) + 0.478(x_{14}) – 5.53 and y= 2.043(x_6) + 0.989 (x_{15}) – 4.742 with the r^2: 0.760, 0.837 and 0.856 respectively. The stepwise procedure allows an organisation to minimize and considers only an important variable to be used for predicting successful levels compared to the complicated MLR mathematical equation.

The choice of samples was based on the construction sector population. It is expected that the equation will change when more samples can be collected through different sectors. The effect of different size of organisation and different IT system being assessed will also have influenced the statistical analysis. The effect of the stages of IT system implementation during the survey also plays a vital role. The respondents answered that in some areas, such as organisation behaviour is mainly on prediction, based on the case of their IT system being at the planning stage (22%) or currently being implemented (29%). Other errors such as the perception of the individual who was completing the survey towards the status of IT system also had a major influence on the analysis. This is true when Galloway & Whyte (1989) and Lyytinen, (1988) highlight that the IT staff associated the successful IT/IS implementation with the successful use of the latest technology, whereas the IT/IS project manager perceived success as to complete the project within time and budget.

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