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Full Length Research

Influence of Technical Factors on In-House Software Quality Assurance in Strategic State Corporations in Kenya

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The purpose of the study was to determine the influence of Technical factors on In-house software quality assurance (SQA) in Strategic state corporations (SSCs) in Kenya. The study used both qualitative and quantitative research methods and applied Survey research design. The research population and target group comprised 6 large Strategic state corporations which are critical to the Kenyan economy and attainment of Vision 2030. These corporations have a combined ICT work force of approximately 300 personnel. From the research population, a sample of 169 respondents was selected and administered with questionnaires using a drop and pick method. A multiple linear regression model was used to analyze the data using statistical package for the social sciences (SPSS). The study found that 45.5% of the variation in in-house SQA in SSCs was explained by technical factors. The results of coefficients to the estimates was significant at the 0.05 level of significance. Indicating that Technical factors positively and significantly influence In-house software quality assurance in strategic state corporations. Government regulation was further found to have a partial intervening effect on the relationship between Technical factors and In-house software quality assurance in strategic state corporations. The findings of this study are useful to the Government, Strategic state corporations, Policy makers, Scholars, Software developers, IT consultants and other state corporations. There is need to develop policies and software development framework that incorporates Technical factors and associated inputs to support in-house development of quality software.

Keywords: Technical factors, in-house software development, software quality assurance, Strategic state corporations.

INTRODUCTION

Strategic state corporations (SSCs) operate a diverse inventory of software systems to support their day to day operations as they deliver on their crucial mandate in support of government functions and service delivery (Kimuyu et al, 2017). Due to the critical nature of the services offered and functions supported, these software systems must be robust and subjected through a stringent software quality assurance (SQA) process (Conklin, 2011). This ensures that there is a planned and systematic pattern of actions undertaken to provide adequate confidence that the developed software conforms to established technical requirements and defined user needs (Ashrafi, 2003). In developing their software in-house, SSCs must plan and execute the development process in such a way that they provide adequate confidence that the software product conforms to established technical requirements (Tomar & Thakare, 2012; Kovacs & Scarpino, 2010).

This paper will focus on Technical factors as key independent variable which will be investigated to understand its role and contribution in In-house SQA. According to Geethalakshmi (2009), the success or failure of software project consists of two components, namely the technical and non-technical components of

software development. The technical issues of software development include those directly related to hardware, software and the development process while the non-technical issues relate to people and other organizationally related issues (Kimuyu et al., 2017; Chen & Huang, 2009). Key among these Technical issues includes development methodologies, procedures and processes that support in-house software development. While organizations have the option of buying commercial off-the-shelf software or outsourcing software development to established software development firms, most functions and processes in SSCs are unique and require in-house developed software solutions to support them. Owoseni and Imhanyehor (2011), argue that in-house developed software is more efficient and is tailor made for unique business needs, functions and processes. It is therefore suitable to addresses end user requirements and needs in SSCs as the in-house software developers and the end users are colleagues and work in the same environment.

Problem Statement

In-house developed software is increasingly becoming an attractive option as a means of software acquisition in SSCs. However, it faces diverse challenges, key among them being an ever changing technical environment, lack of qualified software developers, poor remuneration, problem of retention of expertise, limited support from the management among others. Despite these challenges, in-house software development remains an attractive option due to the flexibility it offers in addressing unique operational and business environment (Kimuyu et al., 2017). Like all other software, in-house developed must abide to internationally recognized quality standards, organizational and technical specific standards, user requirements and expectation. Scholars have observed that poor software quality is one of the leading sources of software project failure (Nelson, 2007; Murugesan, 1994; Tuteja & Dubey, 2012). The quality of In-house developed software in SSCs has continued to lag behind despite great strides made in improving quality (April &Laporte, 2009; Geethalakshmi, 2009; Owens & Khazanchi, 2009). The escalating cost of software failure is a worrying trend and this situation is worsened when it involves tax payer funds and high mission critical software projects such as the ones in SSCs (Kimuyu et al., 2017).

Despite the importance and sensitivity of the software developed, their development process is still ad-hoc and unpredictable as the process is constantly changed or modified as the work progresses (Kimuyu*et a*l, 2017). It is made worse by incomplete software development teams. All this, causes delays in software project schedule, over expenditure on allocated budget, poor functionality and software product quality that is inconsistent (Kimuyu*et al*., 2017). To address this problem, this paper therefore seeks to examine the influence of Technical factors on in-house SQA in SSCs in Kenya.

Study Objectives

a. To establish the influence of Technical factors on In-house SQA in SSCs in Kenya.

b. To examine the intervening role of Government regulation on the relationship between Technical factors and In-house SQA in SSCs.

Literature Review

Theoretical literature review

This research applied Total Quality Management (TQM) theory in in-house Software development in SSCs. This is management philosophy that seeks to achieve quality by entrenching quality delivery as a culture into the organization. It focuses all the organizational efforts into delivering quality by empowering individual employees and software developers in ensuring that quality is achieved (Talib et al., 2012). Its basic principle is that the cost of prevention is less than the cost of correction and therefore focuses on doing things right from scratch (Seetharaman, 2006). The use of TQM in in-house software development in SSCs will improve software development process, reduce waste, optimize business and development processes and also guarantee quality in software product and its performance (Talib, 2013).

According to Li et al. (2000), the TQM philosophy can be applied to any development process, this includes software development. Therefore, the adoption of TQM in in-house software development in SSCs will allow quality to be built into the software development process ensuring that software bugs are identified and corrected well in advance instead of waiting to correct them when the software product is at very advanced development stage or already in use (Kimuyu et al., 2017).

Empirical Review

Technical factors such as software development methodologies, programming languages, development tools, software complexity and size, vendor support and the whole software development project managementplay a critical irreplaceable role in SQA (Kimuyu et al., 2017; Hribar, 2009). It is the primary responsibility of the top management despite their non-technical background and the development team leaders to ensure that in-house software developers in SSCs have got the pre-requisite technical capability as well as ensure that quality is embedded at the technical level (Javed et al., 2012).It should be noted that software development is a very complex process and the management should not ignore or assume that software developers will comply with SQA requirements without their involvement (Kimuyu et al, 2017).

Verner and Evanco (2005), add weight to this requirement by arguing that when it comes to in-house

Conceptual framework

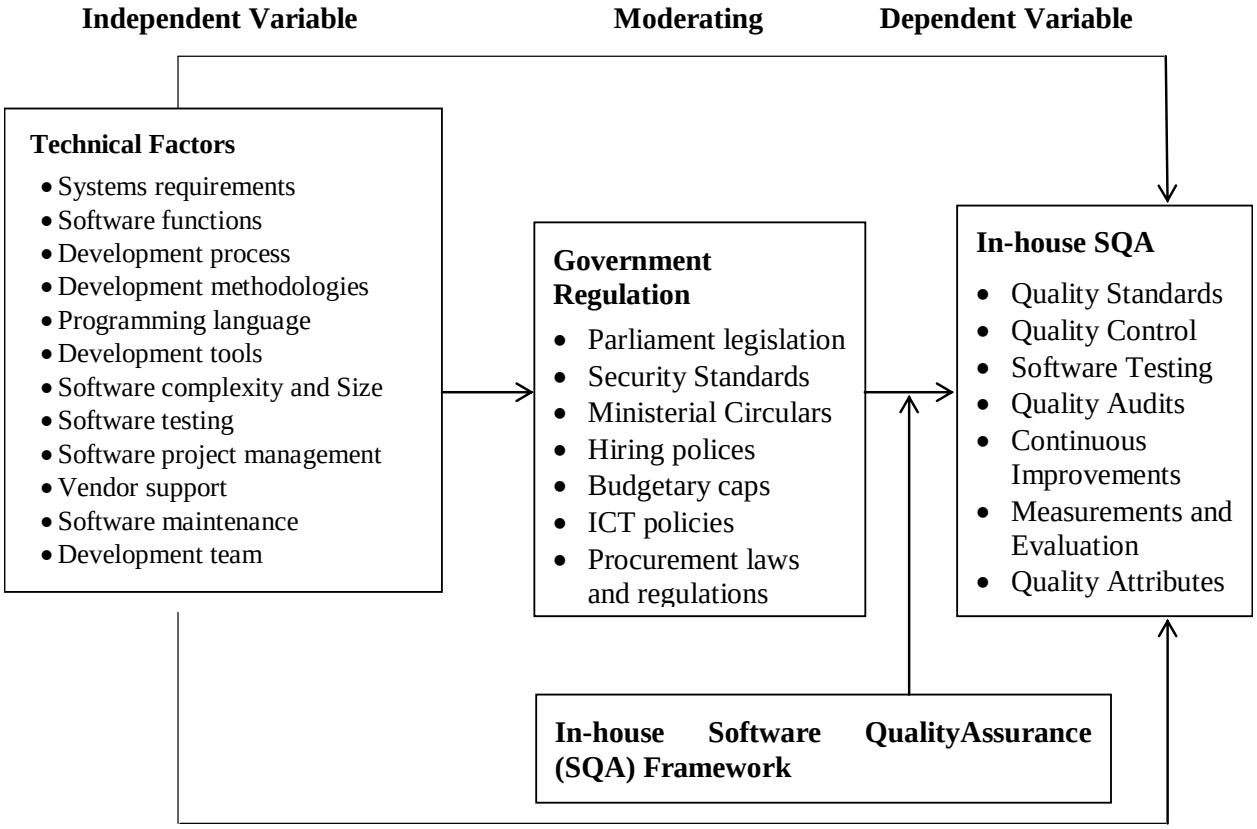

Figure 1: Conceptual framework

software development, most organizations continue to make the same mistakes. They further add that there is need to understand all the steps necessary to successfully execute a software development project. Royce (1970), argues that during software development, there is need to enforce the software development process and compliance on the part of the development team. While, independence of work is encouraged at all organizational and technical levels, there is need for the technical personnel to spearhead the development of quality software as the bulk of the blame will rest on them (Kimuyu, et al., 2017). In doing so, SSCs in Kenya will produce high quality software (Njiru, 2008; Maluti et al., 2011).

RESEARCH METHODOLOGY

The study used quantitative research methodand applied Survey research design. The research population comprised 6large SSC which are critical to the Kenyan economy and attainment of the country's vision 2030. These corporations have an estimated combined ICT work force of 300 personnel. Utilizing Yamane's (1967) scientific calculation of the sample size at 95% confidence level, p = 0.05 and an assumption of 5% allowable error provided a sample of 169 respondents. These were administered with questionnaires using a drop and pick method. A multiple linear regression model was used to analyze the data using Statistical Package for the Social Sciences (SPSS).

RESULTS AND DISCUSSIONS

Technical Factors and In-House Software Quality Assurance

Ordinary least squares regression was carried out to determine the relationship between Technical factors and In-house SQA. The regression model $Y= \beta 0 + \beta_1 X$was thus fitted from the data where X represented Technical factors and Y denoted in-house SQA.

From table1, the value of R and R^2 were 0.675 and 0.455 respectively. The R value of 0.675 showed that there was a positive linear relationship between technical factors and In-house SQA. The R^2 value indicated that the explanatory power of the independent variables was 0.455. This means that 45.5% of the variation in In-house SQA was explained by the model $Y= \beta 0 + \beta 1X$.

An ANOVA was carried out and the results showed the

Table 1: Regression Analysis for Technical factors and In-House SQA

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.470	0.235		6.244	0.000
Technical Factors	0.623	0.061	0.675	10.219	**0.000**
R (R^2)	0.675	(0.455)			
F(p value)	104.424	(0.000)			

Dependent Variable: In-house SQA

Table 2: Mediating effect of Government regulation on the relationship between Technical Factors and In-house SQA (First Step)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.470	0.235		6.244	0.000
Technical Factors	0.623	0.061	0.675	10.219	**0.000**
Dependent Variable: In-house SQA					

F statistic that had a p value of 0.000. Since the p value of the F- statistic was less than 0.05 it showed that the coefficient in the equation fitted was not equal to zero implying a good fit. This implied that considering the simple regression fitted, Technical factors had an effect on in-house SQA.

The results of coefficients to the model Y= 1.470 + 0.623 Xestimates were both significant at the 0.05 level of significance as shown on table1. This was because the significance was 0.000, which were less than 0.05. The constant term implied that at zero Technical factors, In-house SQA is at 1.470 measures, improvement in exercising of Technical factors by a unit increases the In-house SQA by 0.623 measures.

Hypothesis Testing

The hypothesis was tested by using simple linear regression (Table 1). The acceptance/rejection criteria were that, if the p value is greater than 0.05, the Ho is not rejected but if it's less than 0.05, the Ho fails to be accepted.

Based on this objective and literature review, the following null hypothesis was formulated for testing.

H0: There is no significant relationship between Technical factors and In-house SQA in SSCs.

Results in table 1 show that the p-value was 0.000<0.05. This indicated that the null hypothesis was rejected hence there is a significant relationship between technical factors and In-house SQA in SSCs.

This study is consistent with the studies conducted by Ichu and Nemani (2011), on the role of quality assurance in software development projects: project failures and business performance and Kaur and Sengupta (2011) on software process models and analysis on failure of software development projects. Some of the key findings are that, SQA and the project management of the whole software development process among other technical factors are key contributors to software project quality and its success or failure.

Mediating effect of Government regulation on the relationship between Technical Factors and In-house SQA

The results in table 2 show that the influence of technical factors on In-house SQA is significant (p=0.000). The first mediation condition which states that the independent variable should be significantly related to the dependent variable in the absence of the mediating variable is thus satisfied.

The second step as presented in table 3 indicates that the influence of Technical factors on Government regulation is significant (p=0.000) thus satisfying the second condition which states that the independent variable should be significantly related to the mediator variable.

The third step was presented in table 4. In the third step the influence of Government regulation onIn-house SQA was significant (p=0.000) thus satisfying the third condition which states that the mediator variable should be significantly related to the dependent variable.

In the fourth step, the influence of the independent variable (technical factors) on the dependent variable (In-house SQA) was significant in the presence of the mediating variable, government regulation (p=0.000) and thus not satisfying the fourth condition which states that the effect of the independent variable on the dependent

Table 3: Mediating effect of Government regulation on the relationship between Technical factors and In-house SQA (Second Step)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.081	0.300		0.269	0.788
Technical factors	0.942	0.078	0.735	12.109	**0.000**
Dependent Variable: Government regulation					

Table 4: Mediating effect of Government regulation on the relationship between Technical factors and In-house SQA (Third Step)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.717	0.144		11.923	0.000
Government Regulation	0.579	0.038	0.804	15.137	**0.000**
Dependent Variable: In-house SQA					

Table 5: Mediating effect of Government regulation on the relationship between Technical factors and In-house SQA (Fourth Step)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.431	0.186		7.686	0.000
Technical factors	0.168	0.071	0.182	2.363	0.020
Government regulation	0.483	0.055	0.671	8.719	**0.000**
Dependent Variable: In-house SQA					

variable should be insignificant in the presence of the mediating variable (table 5).

The mediation test failed the fourth conditions that should be met for a full mediation relationship to be considered and therefore it can be concluded that government regulation partially mediate the influence of Technical factors on In-house SQA.

DISCUSSION

This study aimed at establishing the influence of Technical factors on In-house SQA in SSCs in Kenya. A hypothesis was generated from this objective which stated that "There is no significant relationship between Technical factors and In-house SQA in SSCs." Ordinary least squares regression was carried out to determine the relationship between Technical factors and In-house SQA in SSCs. The R value of was found to be 0.675 showing that there was a positive linear relationship between Technical factors and In-house SQA SSCs. The R^2 value indicated that the explanatory power of Technical factors was 0.455. This means that 45.5% of the variation in In-house SQA in SSCs was explained by Technical factors. The results of coefficients estimates were significant at the 0.05 level of significance. The significance was 0.000, which was less than 0.05. The p-value was 0.000<0.05. This indicated that the null hypothesis was rejected hence there is a significant relationship between Technical factors and In-house SQA in SSCs.

The study further investigated the intervening effect of Government regulation on the relationship between Technical factors and In-house SQA in SSCs. The introduction of the mediator Government regulation significantly influenced the relationship between Technical factors and In-house SQA in SSCs. The results provided evidence to support the partial mediation of Government regulation on the relationship between Technical factors and In-house SQA in SSCs.

CONCLUSIONS

The study found that there was a relationship between Technical factors and In-house SQA in SSCs in Kenya. The results also provided sufficient statistically significant evidence to signify a partial mediation of Government regulation on the relationship between Technical factors and In-house SQA in SSCs in Kenya. From the forgoing, it can be concluded that an improvement in Technical factors such as enforcement of software development methodologies and processes, competences in software

development languages and tools, availability of good and update hardware, software and supporting infrastructure among other technical requirements that support in-house software development will greatly lead to an improvement in In-house SQA which will by extension lead to in-house development of quality software.

Recommendations

In-house software development provides a unique opportunity to SSCs in Kenya to support their crucial functions as they discharge their mandate to the Government and the people of Kenya. In addition, it provides a rare opportunity to create jobs to thousands of young ICT graduates. The incorporation of TQM approach in the whole software development approach will ensure ownership by the entire organization. To consolidate all this, an In-house SQA framework is needed to guide policy makers, top management in SSCs, software developers and entire organization in the production of quality In-house software.

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