

TECHNOLOGICAL CAPABILITIES AND PERFORMANCE OF CONSTRUCTION FIRMS IN KENYA

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ABSTRACT

Although the connection between technological capabilities and performance of firms is well documented in business economics literature, the link between technological capabilities and firm performance of late has attracted the interest of researchers in construction. construction as one of the most competitive and turbulent sectors in the world requires adoption of suitable and viable technological strategies to succeed. Therefore, dynamic capability theory that relates to technological capabilities and firm performance was incalculated to underpin technological capabilities' effect on firm performance. This study assessed the influence of technological capabilities on performance of construction firms in Kenya. The study used a descriptive research design and the target population was 357 firms registered with BORAQS and 30 Contractor best performing firms in Kenya. Stratified sampling technique with a sample size of 189 firms was used. The study depended on primary data sources based on self-administered questionnaire as a source of data and data collected were quantitative and qualitative. The collected data were then keyed into SPSS and analyzed using descriptive and inferential statistics. Multiple linear regression

revealed a significant statistical relationship between technological capabilities effect on performance, ($R^2 = 0.255$, $p < 0.001$), Correlation analysis revealed a strong positive significant linear between technological capabilities and performance ($r = 0.510$, $p < 0.001$). This was indicated by significant p-values less than 0.05 at 95% confidence level. The qualitative data revealed that technological capabilities had strong effect on performance ($M = 4.21$). Hypothesis testing results revealed that relationship between technological capabilities and performance of construction firms was strong and statistically significant and therefore null hypothesis was rejected. The conclusions drawn from the research study findings was that technological capabilities which is within the control of the firms was critical for achieving better performance of firms. The research study recommended that each firm needed to pay attention to technological advancement including conducting effective and efficient machine upgrade and protection, maintenance and placing priorities in innovation and novelties to spur performance.

Keywords: Technological Capability: Performance: Construction Industry.

INTRODUCTION

Currently, collective resources with regard to the information technology is regarded highly as a valuable resource of the firm. Information technology (IT) is considered as a key component that restructure all aspects of the firm with new scales in contemporary age of digital technology (Haseeb, Hussain, Kot, Androniceanu, & Jermisittiparsert, 2019). However, IT and HR are regarded as the key elements that results in the attainment of competitive advantage in

the dynamic, complex and globalised firm settings (Garg, 2014; Monday, 2015). With the transformation of society from industrial to information, technological advancement has eliminated the geographical barriers and the world has become a global village. In today hostile and competitive global business environment, dynamic challenges are complex and unpredictable and therefore require serious firms to acquire technological capabilities that ensure sustainable competitive advantage (SCA) over rivals firms in the market place and Hagoug and Abdalla (2021) asserted that for firms to have sustainable competitive advantage, such firms must capitalize and exploit their dynamic capabilities to transform raw materials into consumer desired finished products or services. Several scholars are in agreement that firm resources that are difficult to imitate, possess, value, scarce and irreplaceable supports the dynamic capability theory and that such resources generate SCA.

According to Pavlou & El Sawy (2011) argued that desired performance of a firm thrive on continuous dynamic approaches on firm operation capabilities. The researchers noted that resources must be reconfigured to effectively match and adhere to changing taste of consumers including meeting the environment fit changes. But Jemaiyo (2013) established that dynamic firm operation environment, were forcing firms to seek new management strategies that boosts the skills and technological strengths to achieve efficiency that focuses on profits margins and expenditures. Spanos & Lioukas, (2001) viewed technological capabilities of a firm as that skill of converting inputs into desired outputs while Lall (1992) and Teece (1989) studies both confirmed that technological capabilities that were difficult to acquire, demands more training sessions while Rothaermel (2008) later argued that technological innovations were the most vital drivers of SCA in a firm and attained only when firms mould their technological capabilities. Its is of great need to embrace modest strategies that necessitate and builds sufficient capacity in construction industry to undertake the projects that ensures better profit margin, good sales and customer expectations and satisfaction requirements.

Statement of the Problem

Despite the availability of various control techniques through technology and project control software and digitization, several construction projects still suffer from cost and time overruns (Oluwale & Sun, 2010). Most developing countries in the world continue to face acute perennial housing shortage over the years that have raised both national and international concerns in World Habitat circles. Although most research studies have evaluated the relationship between technological capabilities and performance, most of the studies are not in construction and mixed conclusions outcomes are still prevalent on this subject. Several studies have established diverse conclusions on the link between technological capabilities and performance in varied sectors. Construction firms compete globally to get better productivity, reduce wastage of resources and enhance performance and competitiveness (Tawil, 2013) to outperform competitors but despite a series of attempts, the desired results are still below industry expectation in Kenya and Client expectations desires has remain out of reach as Nyika (2012) found out that standard performance in Kenya construction sector was at a paltry rate of 20.8% on time and budget. Nyangilo (2012) also concurred with these low performance of construction projects that were substantively on the rise in Kenya due to inappropriate technology and ineffective leadership that resulted to performance shortfall on contract time

and cost to an extent that 70% of the construction works initiated had time overrun above 50% and 50% of such works had 20% cost overrun. Kibuchi and Muchungu (2012) also concluded that client expectations on quality, budget and time in construction projects remains out of reach despite stringent laws put in place by construction players as measures. While studies revealed mixed statistical link between technological capabilities and firm performance, several were not in construction industry volatile market particularly in developing economies as Kenya that are marked by rapid infrastructural developments but, these attempts have not abated grim results in this sector. Construction firms are reportedly adopting strategic technologies efforts to remain competitive on fast advancing construction technologies, rising costs of raw materials and shifting consumer demands. In Kenya however, the construction sector has been dragging in performance despite the substantial growth in construction projects. KNBS(2025) noted a decline in construction performance in government affordable housing units that dropped from 3,357 units in 2023 to 1,655 units in 2024 and annual inflation in the construction sector that rose from 2.3% in 2023 to 2.83% in 2024. This is proof that the technological capabilities and performance of these firms has not been replicating the growth in the sector in terms of performance, thus raising the need for study on whether the technological capabilities adopted by the construction firms have been strategic enough to influence the performance of firm in the sector.

Research Objectives

The general objective of this study was to assess the influence of technological capabilities on performance of construction firms in Kenya.

Research Hypothesis

H₀₁; Technological capabilities has no significant statistical influence on performance of construction firms in Kenya.

LITERATURE REVIEW

Heckscher-Ohlin Theory revealed that trade arise and gains on technologies and resource disparity across countries while dynamic capability theory (DCT) was formulated by Teece, Pisano & Shuen (1997) noted efforts of the firm strive to renew competencies to meet novelty in a dynamic business environment and that the theory allows firms to adapt, integrate, reconfigure both internal and external firm skills, resources and basic functional competencies and was later advanced by Schumpeters' innovation-based competition with Pavlou & El Sawy (2011) argued that resources must be reconfigured to effectively match and adhere to changing taste of consumers including meeting the environment fit changes.

DCT must respond to rapid technological changes (Teece, 2007) and cascades value on resourced based theory by transforming what is taken as a static view into a theory that embrace dynamism and flexibility (Barney, 2001a, b). Winter (2003) suggested that firms must embrace two types of capabilities namely ordinary capabilities which allows firms to operate its strategic business units efficiently and effectively while dynamic capabilities (DCs) upgrades ordinary capabilities by moulding capabilities to match novelty. DCT is aligned to this study to assess how technological capability derives from a firm dynamic resources and moulds novelty

competence that lift performance growth of the firm. DCT explains firm capacity and embraces novelty and previous studies found DCs is strongly related to firm external factors such as taste and preference of consumers, laws and policies, politics and competitors hence the need to adopt the six dynamic capabilities functions of Helfat & Peteraf (2003).

Technological Capabilities and Performance.

Ferreira *et al*, (2020) noted that dynamic, creativity and innovation capabilities had a positive significance influence on performance on the Portuguese Big Multinational. Tundui (2020) found positive significant relationship between technological capability and performance in learning Institutions in Tanzania. Further, Cano & Baena, (2015) revealed building IT capabilities using technological and firm resources significantly affected firm performance though, Fink (2011) study had earlier noted a contrary finding that IT infrastructure capability's effect on firm performance was inconclusive.

Ndegwa (2017) value additions of technology to the SMEs in Kenya hinged on evaluating the increase in revenues as a result of access to mobile payment platforms such as Mpesa and the availability of easy-to-use accounting software packages noted that the internet had changed SMEs market access considerations across the continent but more intensely in Kenya, where 13% of trade was done online via e-Commerce platforms (Kivuva, 2021) and considering that in 2020 worldwide e-commerce revenues amounted to \$4.28 trillion; Kenyan SMEs positioned themselves aggressively to take advantage of this global shift (Key enablers to E-commerce in Kenya, 2020). A key determinant to the software application upgrade of technology uptake was the leaders' knowledge inadequacy in technology and its perceived advantages (Mungai, 2014) and the results on SMEs linked economic growth, in Sub-Saharan Africa that 60% of business firm performance drove 41% of annual economy growth on software application upgrade (Douglas, Douglas, Muturi & Ochieng, 2017) and added that regimes should seek to promote the technological applications offered by SMEs by purchasing from them and making it easier to carry out business between the two variables.

This entailed moderating the tendering process for procurement and buying directly from them instead of importing from foreign firms (Ogaya & Ngatia, 2021). Research by Maisiri & Van Dyk (2021) on the cost of technology in relation to the current one-dimensional view that target a re-look and a new approach on technology cost also noted perceived losses in such spheres as job losses and loss of control but other divergent views emerged and stated that firms that continue to use old software application without upgrading or failed to adopt new software application upgrade lagged behind and were unable to compete at a global stage in their performance (Carzo, 2020) and the cost implication was adopted by Vyborov (2021), when he claimed that the cost of replacing existing technology, cost of software application upgrade and new software application upgrade, connectivity and technology infrastructure support remained a bottle neck in the software application upgrade by SMEs though there were serious efforts in place on the African continent, especially with examples such as Kenya, where more than \$339 million is invested in internet backbone connectivity powered by Fiber (Ngila, 2022). Namusonge (2016) revealed that ICT infrastructure played critical role in enhancing firm performance and added that the use of ICT infrastructure reduces administrative overheads,

enhances efficiency in the procurement processes and that it improved the speed of delivery of goods to purchasers and noted that ICT infrastructure support enhanced the procurement function. The research also established that the use of ICT infrastructure enhanced information sharing among supply chain partners enabling them to maintain long term relationships that bring forth improved trust and delivery of high-quality inputs and that ICT infrastructure could improve firm performance. Kinuthia & Rotich (2015) argued application is counterproductive when employees' competencies are not aligned with the ICT infrastructure and added that high cost of some aspects of ICT infrastructure undermined the impact of ICT on firm performance leading to weak performance.

Wilson *et al.* (2015) detected that use of information technology within the procurement process logistics firms in Nairobi County improved firm performance and added that ICT infrastructure reduces transaction costs by replacing paper work with electronic processes and led to improvement in coordination between members of the supply chain network. This reduced unnecessary costly errors like the supply of unordered goods or erroneous products and reduced transaction costs and eliminated avoidable errors including ICT infrastructure that significantly improved performance of firms in their procurement functions.

Khaled (2013) found out that, the utilization of a new technology Libyan Banks became widespread in both developed and developing economies especially in the banking sector in recent years. However, Libya was still using traditional methods in commercial banking systems. The results of the study confirmed the level of using ICT was still low in Libyan commercial banks and further analysis noted that there was poor state infrastructure, especially within the fields of telecommunications and electricity leading to low performance within Libyan commercial banking operation though government intervention was blamed as responsible for low ICT uptake.

Kim, Shin, Kim & Lee (2011) reported that IT infrastructure positively affected performance. Tallon & Pinsonneault (2011) surveyed the "effect of alignment of firm agility strategy and IT infrastructure on firm performance" data analyzed using SEM methodology findings concluded that IT infrastructure capability moderated the relationship between alignment and agility while Lee *et al.*, (2012) study detected that business development improved by resources such as IT infrastructure, human resource and institutions. Quality of IT infrastructure capability signified the nature of hardware and software components and that human capital signified well-educated and trained firm employees, while the value of the institution guaranteed a managerial system where people and firms collaborated to improve their economic value.

Contrary study by Chen *et al.*, (2015) noted that IT infrastructure and IT personnel failed to note how IT influenced performance in China and concluded that multidimensional view of IT capability and its influence on performance was necessary and that IT infrastructure significantly predicted firm performance. One limitation of the studies was that IT infrastructure capability was a predictor in some and moderator in others. Hermelo & Vassolo (2007) earlier findings noted, financial resources, technological advancement, diversification strategies on regional markets as the main key constructs responsible for the firm's growth of Small and Medium size firm's (SME's) in Tuc'uman in Argentina conducted through a survey

design involving 87 questionnaires sent to firms where only 34 were received back was later merged with the National Economic Census of 1993-1994 and later subjected to regression analysis for data analysis.

Maletic, Maletic, Al-Najjar & Gomiscek (2014) in Slovenia revealed that nearly 3% of additional profit are generated if unplanned stoppages and loss of quality due to weak productivity is deterred and the findings registered the firm economic results of an effective maintenance due to its effects on productivity and profitability of a manufacturing process. Khalaji (2014) found all factors advancing better productivity, technological development contributed to the most critical role in implementation and absorption of technology had least score of 39.69% comparatively to technology strategy that scored 52.71% in agricultural industry in India and was considered successful because it adopted a survey design with a target population comprising 32 senior experts with averages of six years job experience on technology business units in Salman Farsi firm.

While a comparative Study by Bulita, Obonyo, & Ojera (2014) in Kenya results found were impressive such that it obtained four and above out of the best five was done on the Medium and Large manufacturing firms, through a census survey on firms that were involved in production and marketing of edible oils, soaps & detergents and beverages registered by Kenya Association of Manufacturers (KAM) where the data was collected through self – administered questionnaire sent to 68 firms and where only 50 responded.

Bushuru, Namusonge, Oteki, & Wandera (2014) on the effect of technology adoption, early supplier involvement, low-cost sourcing and backward integration on supply chain performance in the agricultural sector through purposive sampling detected technology adoption as a critical component improving efficiency and effectiveness of the supply chain and early suppliers’ involvement and results noted a positive correlation between supply chain and firms’ performance. It was therefore critical to test whether the application of technological capabilities had link with performance of construction firms in a different sector.

Conceptual Framework.

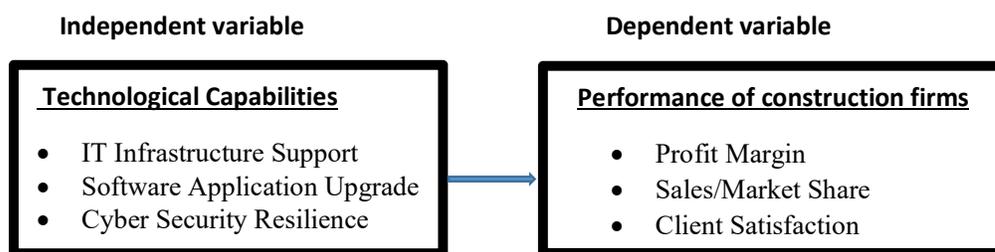


Figure 1: Conceptual Framework

If a firm employs adequate IT Infrastructure Support coupled with timely software application upgrade and cyber security resilience safeguards technological capabilities.

Performance in construction contract depends mainly on three measurement parameters namely profit margin, sales/market share and client satisfaction and if achieved then desired performance target are met.

RESEARCH METHODOLOGY

The study used a descriptive research design and the target population in this study was 357 firms which included; 196 selected architectural firms, 131 Quantity Surveying firms all registered with Board of Registration of Architects and Quantity Surveyors (BORAQS) and 30 Contractor best performing firms in the construction industry in Kenya. Stratified sampling technique was adopted with a sample size of 189 firms which included; 104 selected architectural firms, 69 Quantity surveying firms and 16 Contractors. The study fundamentally depended on primary data sources based on self-administered questionnaire and data collected were both qualitative and quantitative. The collected data were fed into SPSS and analyzed using descriptive and inferential statistics. The study adopted descriptive, correlation research designs and inferential statistics to analyze the obtained data. This study considered stratified random sampling with proportional allocation. The sample size (n) for the study was calculated using the Serekan (2006) and Yamane (1967) formulae, at 95% confidence level and precision level, $e = \pm 5\%$ was taken for the equation. Multiple linear regression analysis was used to assess the nature and magnitude of the relationship between variables; and to test hypothesized relationships.

The coefficient r revealed the strength and magnitude of linear relationship between variables of study and correlation noted as strong when $r = 0.5$ and above, moderately strong when r is between 0.3 to 0.49, weak when r is below 0.29, and 0 indicates no relationship. The value of the coefficient of determination R^2 revealed the degree of variation in the dependent variable(s) attributed to the predictor variable(s). The Beta values revealed the amount of change in the dependent variable attributable to the amount of change in the predictor variable, and the F ratio measured the model fit with observed data. The statistical significance of hypothesized relationship was interpreted based on the F and t values. The multiple regression model used was represented as below: $Y_i = \beta_0 + \beta_1 X_1 + \epsilon_i$, Where, Technological Capabilities = X_1 , ϵ_i is the error term. Performance of Construction Firms = Y_1 .

ANOVA statistic was also used for hypothesis testing to determine the relationships and predictions between the independent and dependent variables. The hypothesis was tested within 95 per cent level of confidence interval or 5 per cent level of significance. Multiple linear regression analysis was used to predict the effects of the independent variable on criterion variable.

Test of Hypothesis

Table 1 gives a summary of the objective and Null Hypothesis of the study, the type of data analysis and interpretation of the results.

Table 1 Test of Hypothesis.

Objective	Null Hypothesis	Type of Analysis and Interpretation of results
To assess the influence of technological capabilities on performance of construction firms in Kenya.	H₀₁ ; Technological Capabilities has no significant statistical influence on performance of construction firms in Kenya.	Multiple linear regression analysis. If P value $\leq \alpha/2$, we reject the null hypothesis, and conclude that Technological Capabilities significantly influences performance at the given level of significance, α .

DATA ANALYSIS AND DISCUSSION

The study targeted 189 firms in the construction industry in Kenya. Questionnaires were administered to each of the firms and the overall response rate of 77% was achieved which concurred with earlier researchers like Bula (2012) and Zoubi (2012) that such response rates were admissible and fitted well with Mugenda & Mugenda (2003) response benchmark ratings that 70% response rate as excellent. In summary, the overall response rate of 77% was excellent and therefore good thresholds for the research study to proceed to the data analysis, presentation, and interpretation including discussion stages.

The reliability variables were all reliable since their Cronbach alpha values were greater than 0.7, that was, technological capabilities had 0.834 and Firm Performance had 0.791. The research instrument was reliable and required no amendments. A CVI of 0.947 was obtained and this was acceptable as a valid instrument because it met the standard measure of Oso & Onen (2009) study that noted a validity coefficient of at least 0.70 acceptable as a valid research instrument for any empirical research study.

Technological Capabilities and Performance

The researcher placed the respondents to indicate their level of agreement on the influence of technological capabilities on performance in their firm. The statements were measured on a five-point Likert scale with 5 indicating strongly agree and 1 indicating strongly disagree. The results are presented in Table 2.

Table 2: Descriptive Analysis of Technological Capability

							Std.
	SD	D	N	A	SA	Mean	Dev
	%	%	%	%	%		
Software application upgrade improves your firm technological capability.	0.0	0.0	4.8	15.2	80.0	4.75	.534
Software application upgrade escalates technology cost.	2.1	4.1	2.8	62.1	29.0	4.12	.812
Software application upgrade improves work quality.	0.0	1.4		57.9	40.7	4.38	.566
IT integration link other functional firm production processes.	0.0	0.7	1.4	46.9	51.0	4.48	.566
Software application upgrade improves competitive firm technology capability in your firm.	2.1	0.0	1.4	40.7	55.9	4.48	.727
Software application upgrade in your firm is a response to government regulations and policies.	2.1	15.9	2.8	42.8	36.6	3.96	1.105
Your firm allocates enough resources towards IT Infrastructure support in your firm.	0.0	4.8	6.9	51.0	37.2	4.21	.772
Your firm has policies that support software storage services and data bases.	0.0	2.1	4.1	54.5	39.3	4.31	.651
Your firm has a comprehensive framework for filtering and implementing viable innovations	0.0	1.4	15.9	40.0	42.8	4.24	.766
Your firm has some mentor ship program for innovators that enhance technological capability	1.4	1.4	4.8	58.6	33.8	4.22	.721
Your top management is committed towards network security regular monitoring and constant review of security measures.	0.0	1.4	1.4	58.6	38.6	4.34	.582
Your firm allocates enough resources towards cyber security awareness, risk prevention and data management.	2.1	0.7	9.0	49.7	38.6	4.22	.803
Your firm practice waste reduction through use of technology during productivity and maintenance process.	0.0	0.7	1.4	44.1	53.8	4.51	.567
Your firm is engaged in strategic maintenance methods for timely replacement of obsolete technology	0.7	1.4	7.6	38.6	51.7	4.39	.748
Your firm benchmarks for best maintenance practices for its operational benefit.	0.0	8.3	2.8	37.2	51.7	4.32	.881
Your firm adopts best maintenance practices to optimize plant and office machinery usage.	0.0	0.0	7.6	37.2	55.2	4.48	.636

The respondents were requested to respond to 16 aspects of technological capabilities in relation to its influence on performance of construction firms in Kenya. The first item sought whether software application upgrade improved the firm’s technological capabilities (M = 4.75, SD = 0.534) with (95.2%) of the respondents affirming. The second item sought to find if software application upgrade escalated technology cost in which majority accepted (91.0%) (M = 4.12, SD = 0.812) while (6.2%) disputed. From the results, the respondents indicated that

IT integration link other functional firm production processes ($M = 4.48$, $SD = 0.566$) of which most of them agreed (97.9%). The results again established that software application upgrade improved competitive firm technology capabilities in the firm ($M = 4.48$, $SD = 0.727$) most of the respondents accepted (96.6%) and 2.1% dissented. The results established that software application upgrade in a respondent's firm was a response to government regulations and policies. This was indicated by ($M = 3.96$, $SD = 1.105$) where majority agreed (79.4%) and those who disagreed were 18.0%. The results implied that firms in the construction industry allocated enough resources towards IT Infrastructure support in their firms ($M = 4.21$, $SD = 0.772$). Majority of the respondents (88.2%) affirmed while (6.9%) remained neutral and 4.8% dissented.

From the results it was again established that firms in the construction industry in Kenya had policies that supported software storage services and data bases ($M = 4.31$, $SD = 0.651$). From the results most of the respondents indicated that their firms had comprehensive framework for filtering and implementing viable innovations ($M = 4.24$, $SD = 0.766$) with majority of the respondents agreeing and the least disagreeing and remaining neutral (15.9%). They also indicated that their firms had some mentor ship programs for innovators that enhanced technological capabilities ($M = 4.22$, $SD = 0.721$) and that firm top management were committed towards network security regular monitoring and constant review of security measures ($M = 4.34$, $SD = 0.582$). The respondents accepted that their firms allocated enough resources towards cyber security awareness, risk prevention and data management ($M = 4.22$, $SD = 0.803$) and that their firms practiced waste reduction through technology usage during productivity and maintenance processes ($M = 4.51$, $SD = 0.567$).

The respondents indicated that their firms were engaged in strategic maintenance methods for timely replacement of obsolete technology ($M = 4.39$, $SD = 0.748$) most of them agreed (90.3%). The respondents affirmed that their firm's bench-marked for best maintenance practices for their operational benefits ($M = 4.32$, $SD = 0.881$) which (88.9%) accepted while (2.8%) remained neutral. Lastly, the respondents agreed that their firms adopted best maintenance practices to optimize plant and office machinery usages ($M = 4.48$, $SD = 0.636$) and the respondents agreed (92.4%) while 7.6% remained indifferent. This study findings supported earlier studies by Ferreira et al., (2020), Tundui (2020), Cano & Baena (2015), Ndegwa (2017), Kivuva (2021), Mungai (2014), Namusonge (2016) and Lee (2012) that found technological capabilities to influence firm performance.

Descriptive Analysis of Performance of Construction Firms

Performance of construction firms was the dependent variable in this study. The data collected from primary and secondary sources and Performance of construction firms—Primary Data Sources - The researcher asked the respondents to indicate their level of agreement to statements on performance of firms in construction industry.

The statements were measured on a five-point Likert scale with 5 indicating strongly agree and 1 indicating strongly disagree. The results were presented in Table 3.

Table 3: Descriptive Analysis of Performance of Construction Firms

	SD	D	N	A	SA	Mean	Std.Dev
	%	%	%	%	%		
Our firm profit Margin performance is always above expectation.	0.0	0.0	1.4	44.8	53.8	4.52	.528
Our firm Profit Margin performance is always within expectation	0.0	0.0	.7	38.6	60.7	4.60	.506
Our firm profit Margin performance is always below expectation	49.0	49.7	1.4	0.0	0.0	1.52	.528
Our firm Sales Performance is always above expectation.	0.7	2.1	2.8	54.9	39.6	4.31	.692
Our firm Sales Performance is always within expectation.	0.0	0.0	0.0	30.3	69.7	4.70	.461
Our firm Sales Performance is always below expectation.	42.8	55.2	0.0	1.4	.7	1.62	.635
Our firm Client Satisfaction is always above expectation.	0.0	0.0	0.7	53.1	46.2	4.46	.513
Our firm Client Satisfaction is always within expectation.	0.0	0.7	0.7	29.0	69.7	4.68	.525
Our firm performance on Client Satisfaction is always below expectation	49.0	49.0	0.7	1.4	1.4	1.57	.675

The respondents were requested to respond to 9 aspects of performance of construction firms in Kenya. The first item sought whether the firms’ performance profit margin was always above expectation and most of the responded affirmed (98.6%). They agreed on average as indicated by a mean value of 4.52 and a standard deviation of 0.528. The second item sought to find out if the firms’ performance profit margin was always within expectation which majority agreed (99.3%) with only 0.7% being neutral. The third item was on whether the respondents’ firm performance on profit margin was always below expectation. From the results, the respondents disagreed on average (M = 1.52, SD = 0.528). Most of them disagreed (98.6%). The results again established that firm sales performance was always above expectation (M= 4.31, SD = 0.692) and within expectation (M = 4.70, SD = 0.461). Therefore, the respondents disagreed that their firm sales performance was below expectation (M = 1.62, SD =0.635). On client satisfaction, the respondents indicated that their firm performance was always within expectations (M = 4.68, SD = 0.525) and (M = 4.46, SD = 0.513) above expectation. Therefore, the respondents dissented that their firm client satisfaction performance was always below expectation (M = 1.57, SD = 0.643).

Comparison of Study Variables across Firm Categories

This section sought to compare technological capabilities and performance of construction firms across firm categories (architectural firms, quantity surveying firms and contractor firms). To achieve this, the researcher compared their mean differences using a one-way analysis of variance (ANOVA) with Tukey post hoc test at 5% significance level ($\alpha = 0.05$). The results are considered to be significant whenever the probability value is less than 0.05 ($p < 0.05$). The results were then presented in Table 4.

Table 4: Comparison of Study variables across Firm Categories

Variable	Architectural firm	Quantity surveying firm	Contractor firm	F(2,142)	P-value
Technological capabilities	4.36±0.324ab	4.24±0.500a	4.51±0.314b	3.115	0.047*
Firm performance	3.54±0.247a	3.51±0.212a	3.71±0.275b	3.661	0.028*

Notes: The means, followed by the same letter in a row are not statistically different at (P<0.05) using one way ANOVA with Tukey test on post-hoc t-tests. * Indicates significance (p<0.05).

Technological capability was found to be significantly higher in contractor firms (M= 4.51, SD = 0.314) compared to that of architectural firms (M = 4.24, SD = 0.500) which was not the case for quantity surveying firms (M = 4.36, SD = 0.324) though different, was insignificant, F (2,142) = 3.115, p = 0.047. This was further illustrated in Figure 2.

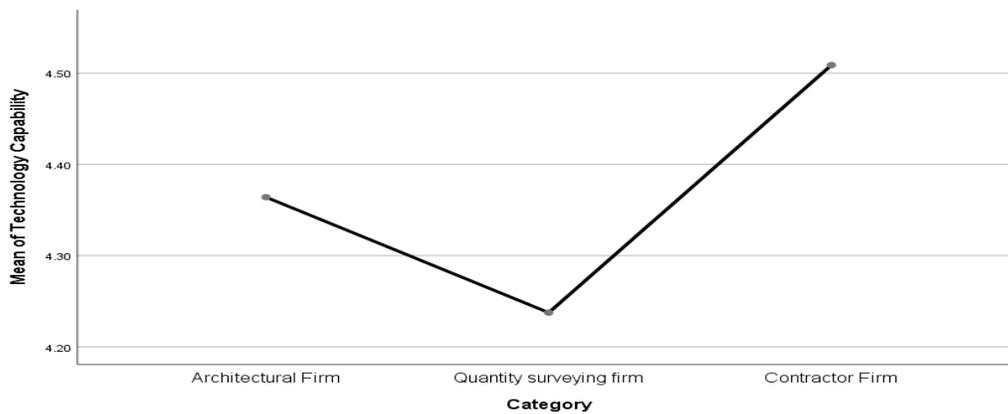


Figure 2: Comparison of Technology Capabilities across Firm Categories

Lastly, contractor firms (M= 3.71, SD = 0.275) performed better compared to architectural firms (M = 3.54, SD = 0.247) and quantity surveying firms (M = 3.51, SD = 0.212), F (2,142) = 3.661, p = 0.028. This was further illustrated in Figure 3.

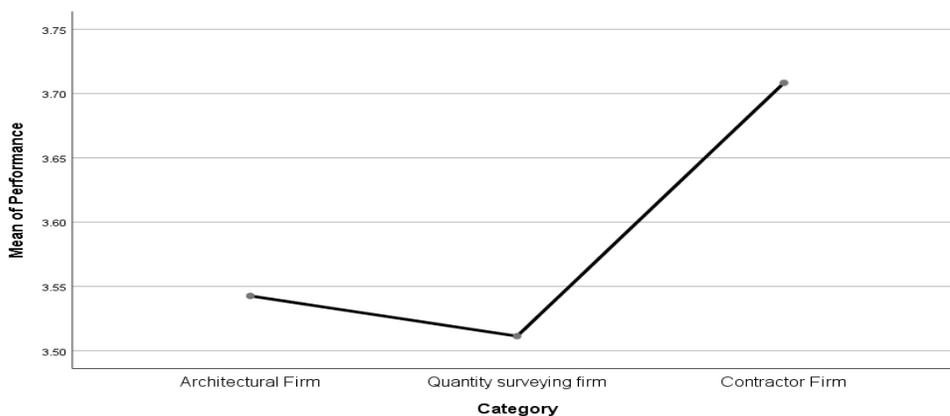


Figure 3: Comparison of firm Performance across Firm Categories.

Inferential Analysis of Technological Capabilities.

In this study, inferential analysis was used to test the study hypothesis. This study embraced the parametric tests which entailed Pearson’s correlation and linear regression analysis. This section tested assumptions made by regression and Pearson’s correlation first, performs the Pearson’s correlation and finally performed the linear regression which aided the researchers to solve the study objectives.

Table 5: Correlation Analysis

			4.2 Perf ormance	4.3 Tech nological Capability
4.1				
4.4 Perfo rmance	4.5 P earson Correl ation	4.6 1		4.7
	4.8 S ig. (2- tailed)	4.9		4.10
	4.11 N	4.12 144		4.13
4.14 Tech nological Capability	4.15 P earson Correl ation	4.16 .51 0**		4.17 1
	4.18 S ig. (2- tailed)	4.19 .00 0		4.20
	4.21 N	4.22 144		4.23 145

From the results in table 5, the results indicated a strong linear relationship between performance of firms in the construction industry and technological capabilities, $r = 0.510$, $p = <0.001$. These were indicated by significant p-values less than 0.05 at 95% confidence level.

Hypothesis Testing

The study hypothesis sought stated that technological capabilities had no significant statistical effect on performance of construction firms in Kenya. A simple linear regression was adopted and performed with performance of construction firms as the dependent variable and technological capabilities as the independent variable. The results were presented in three tables as shown in Table 6, 7 and 8

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.510 ^a	0.260	0.255	0.21087

a. Predictors: (Constant), Technological capabilities

The findings revealed that the coefficient of determination (R square) for the regression model was 0.255 which meant that technological capabilities explained 25.5% of any variation or change occurring in the performance of construction firms in Kenya.

Table 7: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.219	1	2.219	49.905	.000 ^b
Residual	6.314	142	.044		
Total	8.534	143			

Table 7 showed the ANOVA results where F-calculated was 49.905 and the p-value was <0.001 inferring that this relationship was significant at 95% significance level since F-calculated was greater than F-critical (3.89). This showed that the model could significantly predict the response variable (performance of construction firms in Kenya).

Table 8: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.169	.196		11.053	.000
Technological Capabilities	.318	.045	.510	7.064	.000

a. Dependent Variable: Performance of construction firms in Kenya

The regression equation obtained from this finding was: -

Y= 2.169 +0.318*X₁..... Equation (1)

Where Y = Performance of construction firms Kenya and X₁= Technological Capabilities

Table 8 illustrated the findings where the coefficient for Technological capabilities was 0.318 which was statistically significant since p= < 0.001 and was less than 0.05 level of significance, meaning that when technological capabilities changed by one unit, it led to 0.318 units change in the performance of construction firms in Kenya. Also, if technological capabilities were to be held constant at zero, then the performance of construction firms in Kenya would be 2.169 units. Therefore, the null hypothesis, which stated that technological capabilities had no significant statistical influence on performance of construction firms in Kenya, was rejected. This suggested that there existed a significant positive linear relationship between technological capabilities and performance of construction firms in Kenya.

This supported earlier studies like that of Ferreira *et al*, (2020),Tundui(2020),Cano& Baena,(2015),Ndegwa(2017),Kivuva(2021), Namusonge (2016) study on the impact of ICT infrastructure in procurement on firm performance that revealed that ICT infrastructure plays a very critical role in enhancing firm performance and that revealed that the use of ICT infrastructure reduces administrative overheads, enhances efficiency in procurement processes

and that ICT infrastructure support enhanced procurement function. These finding underpins earlier studies like that of Wilson *et al.* (2015), Kim, Shin, Kim & Lee (2011) including Maletic, Maletic, Al-Najjar & Gomiscek (2014). It also converges with Khalaji (2014), Bulita, Obonyo, & Ojera (2014), impressive Bushuru, Namusonge, Oteki, & Wandera (2014) findings on the effect of technology adoption, Carzo (2020) study that noted firms using old software application as opposed to adopting new software application upgrade were unable to compete at a global stage with competitors so encounter negative impact in their performance and Vyborov (2021).

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The coefficient for technological capabilities was 0.318 which was statistically significant since $p < 0.001$ and was less than 0.05 level of significance, meaning that when technological capabilities changed by one unit, it led to 0.318 units change in the performance of construction firms in Kenya. Also, if technological capabilities were to be held constant at zero, then the performance of construction firms in Kenya would be 2.169 units. Therefore, the null hypothesis, which stated that technological capabilities had no significant statistical effect on the performance of construction firms in Kenya, was rejected. This suggested that there existed a significant positive linear relationship between technological capabilities and performance of construction firms in Kenya. The findings revealed that the coefficient of determination (R square) for the regression model was 0.255 which meant that technological capabilities explained 25.5% of any variation or change occurring in the performance of construction firms Kenya. The research study found out that the industry had invested moderately in IT infrastructure support. Although, the industry had not invested much in software application upgrade; there was a general feeling by the respondents that software application upgrade seemed to have played a critical role in the firm' in attaining their objectives and target goals.

Performance of cyber security resilience was moderate. The technological capabilities of the industry were also moderate which indicated a time lag in replacement of obsolete technology, low investment in technology innovation and less effective maintenance strategies. The outcome of multiple linear regression analysis revealed a strong positive significant statistical relationship between technological capabilities and performance of construction firms. Correlation analysis noted that there was a strong significant statistical positive linear relationship between technological capabilities and performance of construction firms ($r=0.510$, $p<0.001$). Hypothesis testing revealed that there was a statistically significant relationship between technological capability and performance of construction firms in Kenya that led to the rejection of the null hypothesis. This meant that if technological capability was enhanced then performance of construction firms would also improve significantly.

Conclusions

The conclusion observed from the research findings was that technological capabilities positively influenced performance of construction firms in Kenya as shown from the multiple linear regression, correlation analyses results and hypothesis testing results. This led to a logical conclusion that technological capabilities influenced performance of construction firms. The

multiple linear regression, correlation and hypothesis results revealed that investment in newer technology, successful innovation process and prompt cyber security resilience or facilities led to better performance of firms in the construction industry. The study supported dynamic capabilities theory because it aids dynamics interplay and interactions between firms' capability IT building blocks and environment, and sustain competitive performance needs through novelty.

Recommendations

The recommendations was that technological capabilities had significant statistical influence on performance of construction firms and therefore required industry players to be more vigilant by creating an enabling environment for technology acquisition, technology innovation and sound novelties including constantly evaluating the prompt modest maintenance strategies that boosted efficiency and timely effective operation of the construction industry in Kenya in order to enjoy better performance, turn-around time and sustained competitive advantage (SCA) in such firms. The construction firms under the research study were seriously under performing and therefore the industry players were encouraged to pursue policies that would enhance positive influence on technological capabilities.

Areas for further study

The study recommends further research that similar studies be done in other counties to confirm the results including further studies to identify and expose other variables that could be explaining the 74.5% change on performance.

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