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Investigation the Relationship between technological capabilities and operational performance in the Sudanese service firms

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المستخلص:

يتطلب البقاء في بيئة اليوم الديناميكية من المؤسسات أداءً متقوفاً مقارنة بالمنافسين. لذلك هدفت هذه الدراسة إلى التعرف على العلاقة بين القدرات التكنولوجية و الأداء التشغيلي بأبعاده (المرونة، الجودة و التكلفة) في القطاع الخدمي بالسودان. حيث تم استخدام المنهج الكمي و المدخل الإستقرائي وتم جمع البيانات عن طريق الاستبانة من عينة غير احتمالية مناسبة لعدد 161 من الشركات الخدمية السودانية العاملة بولاية الخرطوم، حيث بلغت نسبة الإسترداد 97% . و لأغراض التحليل تم استخدام التحليل العملي الإستكشافي و التوكيدي ، الإعتمادية ، تحليل الإرتباط بجانب تحليل المسار و نمذجة المعادلة البنائية باستخدام برنامج. و اشارت النتائج على أن هناك علاقة إيجابية بين القدرات التكنولوجية و أبعاد الأداء التشغيلي (المرونة ، الجودة و التكلفة). أوصت الدراسة بإجراء دراسات مستقبلية للقدرات التكنولوجية بأبعاد متعددة، كما أوصت الدراسة بتطبيق القدرات التكنولوجية و الأداء التشغيلي في قطاعات أخرى.

الكلمات المفتاحية: القدرات التكنولوجية ، الأداء التشغيلي ، المرونة ، الجودة ، التكلفة.

ABSTRACT:

Survival in today's dynamic environment requires organizations to have superior performance compared to competitors. In order to achieve this superior performance this study aimed examines the relationship between technological capabilities and operational performance (flexibility, quality and cost) in the service sector in Sudan. The study employed the quantitative method via convenience sampling; the population was the 161 managers of the service firm in Khartoum state response rate of 97%. The result of this study show that a significant positive relationship between technological capabilities and dimensions of operational performance (flexibility, quality and cost). This study focuses only on the service sector. Also, the data were only collected from single respondents in an organization. The study recommended that future research may examine multiple dimensions of technological capabilities; the study also recommended future research should endeavor to collect data from multiple members.

KEYWORDS: Technological Capabilities, Operational Performance, Flexibility, Quality, Cost.

INTRODUCTION:

The service sector in Sudan consists of health, education, freight, transport, roads and bridges, buildings and construction, communications, and other services. Business organizations in Sudan are faced with intensity competition thereby making their surviving and growth of any organization dependent on their ability to offer greater value to customers. Many authors have asseverated that competition is at the crux of the success or failure of firms, its decides the appositeness of a firm's activities that can contribute to its performance, competitive advantage grows basically out of value a firm is able to create for its buyers that exceed the firm's cost of creating it (Kenyon, et al, 2016).

A number of studies in the field of technological capabilities have only been carried out in small and medium size enterprises in emerging economies (Giuliani, *et al*, 2005; Romijn, 1999). In this sense there is a gap in the literature about the analysis of the technological capabilities in micro, large companies in developed countries (Ortega, 2009) or come from newly industrializing economies (Ernst & Kim, 2002; Hobday & Rush, 2007; Kim, *et al.*, 1987; Panda & Ramanathan, 1996). The concept of technological capabilities have been studied as a process with various foci, such as development, acquisition or building up of technological capabilities, and the technological capabilities impact has mainly investigated in relation to firms' performance (Acha, 2000; Eternad & Lee, 2001; Lee, *et al.*, 2001; Afuah, 2002; Schoenecker & Swanson, 2002; Vanhaverbeke, 2002; Tsai, 2004; Zahra, *et al.*, 2007). So far, however, there has been little discussion about how to improve technological capabilities at the firm level. Previous studies regarding strategic orientation, service innovation and operational performance have focused mainly on a specific sector, such as banking (Cheng and Krumwiede 2012, hotel (Zhou *et al.*, 2009), or insurance sectors (Lado and Olivares, 2001). This study covers multiple service sectors including hotel, post, banking, education, communication and insurance but the technological capabilities applied in two sectors communications and banking. Most of the studies that addressed the operational performance, in general, focused on the manufacturing firms (Bruque, *et al*, 2016). These studies neglected the service firms which represent a true foundation of the national economy which acts as the main player in the development of economic and social growth. Their roles also appeared through providing and diversifying services, achieving developmental goals and creating job opportunities. Therefore, this study focused on studying the operational performance in service firms which the previous studies failed to deal with.

The objective of this study is to examine the relationship between technological capabilities and operational performance

In view of the previous argument, this research adds to the body of knowledge on technological capabilities and operational performance by addressing three research questions:

- (1) What extend technological capabilities can contribute to operational flexibility?
- (2) What extend technological capabilities can contribute to operational quality?
- (3) To what extend technological capabilities can contribute on operational cost?

The answer to these questions will contribute to supplement previous studies by explaining some mechanisms through which strategic orientation promotes operational performance.

Therefore, the theoretical significance of this study is trying to fill the gap through the relationship between technological capabilities and operational performance and then attempt to build a conceptual framework that will contribute to theories and practice in the field of technological capabilities also the study will provide scientific guidelines and advice through which the services firms operating in Sudan to achieve the efficiency and the effectiveness. While the practical significance of this study; will make the managers aware about the change

and complexity of the business environment, managers can emphasize the importance of intangible resources in enhancing operational performance and this study may encourage the managers to play a greater role in activities related to the development of operational performance. In this article, we explore the relationship between technological capabilities and operational performance in the Sudanese service firms.

This study organization started with the introduction of the term technological capabilities and operational performance in the Sudanese service firms relying on the works of past researchers. This was then followed by the research methodology, data analyses, hypotheses testing, discussion, and implication of study, limitation and conclusion.

LITERATURE REVIEW:

Technological capabilities

Teece *et al.* (1997) define dynamic capabilities as the processes and routines used to adapt, alter, deploy and protect the firm's resources so to maintain them as a source of competitive advantage. Helfat (2007) simplifies this definition as, the capacity of an organization to purposefully create, extend, or modify the resource base. Dynamic capabilities distinguish themselves from operational processes in that the dynamic capability of a firm influences the change and reconfiguring of existing operational processes (Ali, et al, 2012; Helfat & Peteraf, 2003; winter, 2003). Capabilities are defined as “a firm’s capacity to deploy resources, using organizational processes, to affect a desired end (Haeussler, et al, 2012). From this perspective, capabilities can be understood as a firm’s orientation to integrate and reconfigure its resources and processes and, even more importantly, transform its processes in response to foreign environments to achieve competitive advantage (Wang and Ahmed, 2007).

Technological capabilities is the ability to perform any relevant technical function or volume activity within the firm including the ability to develop new products and processes and to operate facilities effectively, (Authors 2017). Technological capability is the ability to make effective use of technological knowledge in production, engineering and innovation (Srivastava, et al, 2015). It has the capacity to enable a firm in creating new technologies and to develop new products and processes in response to their changing economic environment. The various activities undertaken to acquire intangible assets for technological learning are a major process for building and accumulating these capabilities. Technological capability extends beyond having advanced technology and incorporates intangible asset of the firm in the form of knowledge about that technology (Srivastava, et al, 2015).

Operational performance: is a strategic objective of firms which is difficult to achieve due to the competitive challenges in the knowledge economy. Operational performance helps in achieving the added value of the organization and also is guarantees its survival and sustainability. Some characteristics that include uncommonness, invaluable and indispensable human resources, cordial customer relationships and system, are what give organization competitive advantage that result in sustainable competitive position (Chavez *et al.*, 2015).

Flexibility is important operational flexibility measure, which is described as the ability of the company to adapt and respond to diversity or change, to give customers individual treatment, or to introduce new products/services flexible is systems can respond to special service requirements, product innovativeness and product variety, and thus achieve a variety of operating attributes (Chavez *et al.*, 2015). William, (2007) points that flexibility is the ability of the organization to respond quickly to changes on the characteristics of the products design or changes related to the size of customers’ orders and the multiplicity of their desires.

Quality: Paladini (2011) understands that the fact that the term quality is commonly used may result from the considerable efforts made in the recent past to popularize the term. In his understanding, this cannot be said to be a bad thing. The problem lies in the frequent use of incorrect concepts. This is because something that is already widely known cannot be intuitively redefined; nor can the term be restricted to specific situations, as it is in the public domain. Service quality management involved highly subjective assessment processes. The appreciation of variables in service provision requires measurement scales and tools capable of measuring perceptions and expectations with a reasonable degree of objectivity. An accurate evaluation of an external service aids companies to reposition themselves in the market and redirect their resources to achieve service quality levels compatible with customers' needs (Fabiano *et al.*, 2016).

Quality defined as the degree to which products and services meet service specifications (Chavez *et al.*, 2015). the ability to offer products and services at the lowest cost and free of defects, and to ensure the achievement of discrimination to the organization under the existing competition in the market and represent the overall attributes and characteristics of the product and the service that meets the needs of customers (Gupta, et al, 2014) quality is known as one of the most important factors for the survival and growth of the organization and to maintain its competitiveness.

Quality was the outcome of the evaluation process where the perceived service and the expected service were compared. Service quality has also been described as a form of attitude, as it is a global judgement on the superiority of the service provided by an organization. Service quality has been the focus of numerous studies since its early conceptualizations, as delivering positive levels of service quality creates a competitive advantage for an organization (Authors, 2017).

Cost: is one of the important variables in achieving competitive advantage by reducing the cost of production in a percentage that achieves the desires of a wide range of customers by reducing the total cost of service products, with the need to realize that the strategic goal of reducing cost is not absolute, but according to the governed conditions and regulations (Abdulraheem, 2016). Therefore, the organization that adopts the least cost should focus on the production process, starting from the supplier and the ending with the arrival of the product to customers and control overall products and costs associated with production and provide new value-inexpensive services.

(Chavez *et al.*, 2015) defined cost doing things cheaply producing goods at a cost that enables them to be priced appropriately for the market while still allowing a return to the organization.

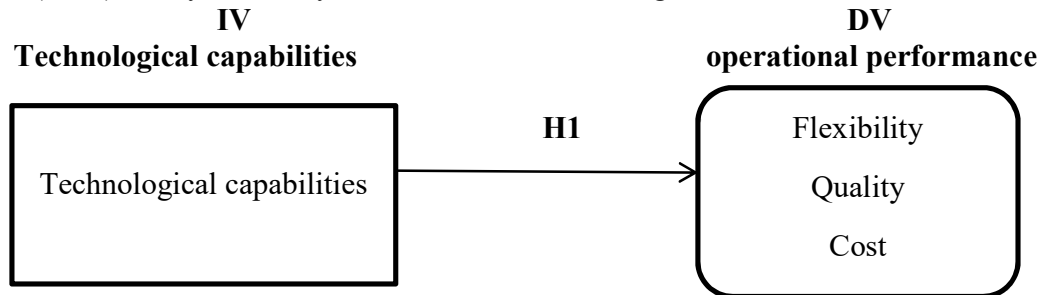
Cost is one of the most basic dimensions for competition and that many organization tried to rely on reducing their product cost to achieve competitive advantage, which means that the organization carry on the product and marketing of products at the lowest possible cost compared to its competitors enabling it to sell at a lower price (Chavez *et al.*, 2015).

Dynamic capabilities theory (DCT)

The dynamic capabilities theory (DCT) explained that to sustain their competitive advantage firms need to renew their stock of valuable resources as their external environment changes. The (DCT) provides the theoretical foundation for this study regarding the effect of technological capabilities on operational performance. This means that if a firm possesses Valuable, Rare, Inimitable and Non-substitutable resources but does not use any dynamic capabilities, its superior returns cannot be sustained without dynamic capabilities and a firm's returns may be short lived if the environment exhibits any significant (Barney, 1991; Helfat, *et al.*, 2007). Dynamic capabilities are derived from the resource-based view of the firm, which suggests

that resources are developed through specialized routines that create distinct competencies (Teece *et al.*, 1997).

These further encourage the renewal and development of technological capabilities to better match the demands of the market environment (Day, 2011; Hou, 2008). Based on the literature and (DCT) theory, the study framework is shown in figur.1



Figur.1: the study conceptual framework

Hypotheses development:

Technological capabilities and operational performance

Firms with superior technological competencies tend to be more innovative and thus perform at high levels. Those firms with superior technological capability can secure greater efficiency gains by pioneering process innovations and can achieve higher differentiation by innovating products in response to the changing market environment, (José and Ortega, 2010).

the theory of dynamic capabilities and results in the literature suggested that the technological capabilities is playing significant and positive effect to performance, (Wu, 2014) investigated that a significant and positive relationship between technological capabilities and product innovation, (Haeussler, et al, 2012) states that the technological capabilities influence effectively on relationship between Strategic alliances and product development, while (Ferna and Garcı, 2012) investigated a positive effect of technological capabilities on firms performance. And (José and Ortega, 2010) confirmed that a significant and positive effect of technological capabilities on the relationship between Competitive strategies and firm performance. Based on the above discussions the following hypotheses are generated:

H.1. there is a positive relationship between technological capabilities and operational performance.

H.1.1. there is a positive relationship between technological capabilities and flexibility.

H.1.2. there is a positive relationship between technological capabilities and quality.

H.1.3. there is a positive relationship between technological capabilities and cost.

METHODOLOGY:

Sample and Data Collection:

Consistent with the purpose of this study, the study relied on the Positivism philosophy, deduction approach to theory development, mono-method quantitative methodological choice, survey strategy and cross-sectional Time horizon. The data were collected through questionnaires sent to the service firm's managers in 161 large service firms among Sudanese listed and registered corporations, and using personal administered questionnaire. A cross-sectional description survey research design was adopted for the purpose of this study. Cross-sectional is cost and time effective because data can be gathered just once perhaps over a period of days or weeks or months, in order to answer research questions (Sekaran, 2003). This design is enabling to describe the technological capabilities that affect the operational performance components.

Response rate, measurement and questionnaire development:

This subsection presents the response rate and the measures of questionnaires employed in the study, was used to distribute 170 questionnaires to the manager of service firms. The total numbers of questionnaires received back from respondents were 161 questionnaires with a response rate of 94%. The questionnaire for this study consisted of three main sections firstly, the profile of the company secondly, specific questions designed to measure technological capabilities thirdly, the specific questions designed to measure the operational performance, nineteen questions were used to measure the model variables were subjected to exploratory factor analysis using principal component, technological capabilities was measured as one dimension the items is measured using five measurement were adopted from (Jantunen *et al.* 2011). While, operational performance were measured by using three dimensions the flexibility is measured using five items were adopted from (Bruque- *et al.*, 2016). Quality is measured using five items were adopted from (Modgil, 2016) And cost is measured using four items were adopted from (Chavez *et al.* 2015) we use a five –point scale as a unit of measurement ranging from “strongly disagree” to “strongly agree and worse to better for (quality and cost).

DATA ANALYSIS:

Respondents characteristics:

Based on the descriptive statistics using the frequency analysis this part investigates the profiles of firms that participated in the survey on the light of five characteristics, these are the property of firm, experience of firm, number of labourers, natural of work, and number of competitors. Table 5.3 show respondent's characteristics, in the property of firm, rate (90.1%) respondents were national, followed by (6.8%) respondent were foreign, while (3.1%) respondent were intermixed that represent the lower ratios. Furthermore, the respondent's experience of firm, 20 and more are representing a rate (26.1%), from 11 to 15 representing a rate (25.5%), From 5 to 10 representing a rate (14.9%) while to less than 5 years representing a rate (21.7%) last in this group from 16 to 20 years are few number 19 frequencies and represented in (11.8%). The respondents number of labourers, that fill up the questionnaires, majority of them were 200 and more are representing a rate (49.1 %) followed by from 101 to 150 and from 151 to 200 are representing a rate (13.7%), to less than 50 labourers are representing a rate (12.4%) and from 50 to 100 were representing a rate (11.2%) as lower ratios. Concerning the respondents natural of work majority of them were education which represent (44.1%), followed by banker were representing a rate (22.4%), then followed by hostelry were representing a rate (16.8%), insurance were representing a rate (8.7%) , mailers (5.6%) and communication were (2.5%) represent the lower ratios. Regarding the number of competitors, the majority of the respondents 20 and more (82.0%) followed by from 11 to 15 were rate (8.7%), to less than 5 competitor were rate (5.0%) and from 5 to 10 were rate (2.5%) represent the lower ratios.

Exploratory factor analysis

The exploratory factor analysis has been performed to extract the loadings of factors with promax rotation. In conducting factor analysis, this study followed assumptions that recommended by (Hair, Anderson, Black, 2010). Firstly, there must be a sufficient number of statistically significant correlations in the matrix. Secondly, Kaiser-Meyer-Olkin measure of sampling adequacy should be at least 0.6. Thirdly, Bartlett's test of sphericity should be significant at 0.05. Fourthly, communalities of items should be greater than 0.50 fifthly, the minimum requirement of factor loading 0.45. Also to provide a simple structure column for interpretation, the factors were subjected to promax rotation. Finally, eigenvalues should be more

than 1 for factor analysis extraction. Factor analysis was done on the nineteen items, which were used to measure study variables. Table 1 showed the summary of results of exploratory factor analysis on study variables.

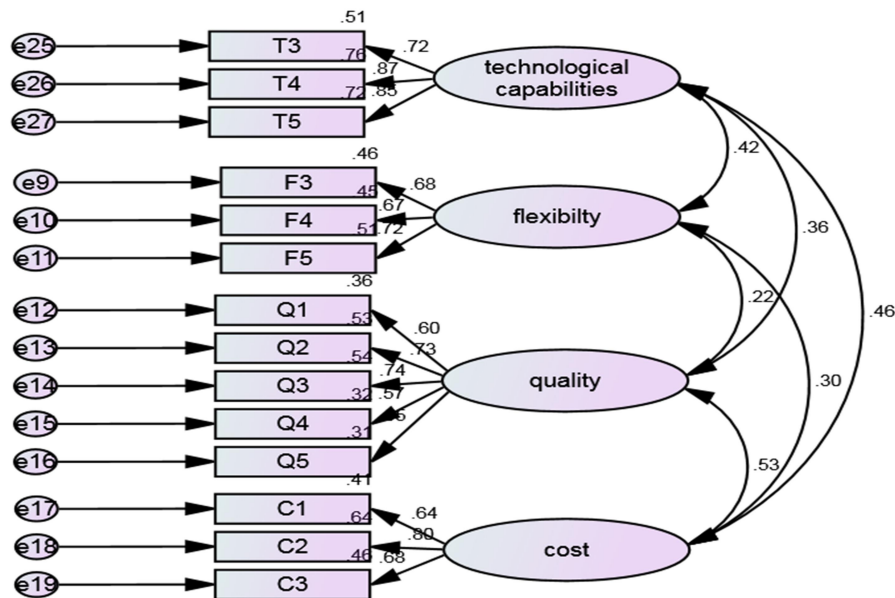
Table(1) Factorial loads of observed variables - Promax Rotation.

Code	Observable variables	Factorial load
	Technological capabilities	
T1	The firm has strong internal technology operations capabilities.	.619
T2	The firm has the technological infrastructure and competencies to engage in e-commerce initiatives.	.779
T3	Our technological capabilities are top class.	.785
T4	The success of our research and development activities is based on long-term know-how.	.699
T5	We have invested heavily in certain research and development projects.	.678
	KMO, .782; Bartlett's Test of Sphericity, 322.887; Total Variance Explained, 51.100.	
	Flexibility	
F3	Our company can quickly introduce new products onto the market.	.686
F4	Our company can quickly respond to changes in market demand.	.691
F5	Our company can quickly respond to changes in competitors.	.686
	Quality	
Q1	Improved service quality.	.516
Q2	Reduced costs of defects and rework.	.727
Q3	Reduced delivery lead time of finished products/services to customers.	.803
Q4	Reduced customer complaints.	.558
Q5	A decline in the number of warranty claims.	.525
	Cost	
C1	Labour productivity	.608
C2	Production cost.	.843
C3	Improved capacity utilization.	.641
	KMO, .761; Bartlett's Test of Sphericity, 479.731; Total Variance Explained, 56.173.	

Source: prepared by the researchers from data (2019).

Confirmatory factor analysis:

The statistical analysis software package was used AMOS (Analysis of Moments of Structure) to perform the process of confirmatory factor analysis for the model, as this package is used to test the hypotheses relating to the existence or non-existence of a relationship between the variables and underlying factors. The confirmatory factor analysis is also used to assess the ability of the factor model to change from the actual dataset and also to compare several models of factors in this area. Fig.2: below show the Confirmatory Factor Analysis for study variables.



figur.2: Confirmatory Factor Analysisfor study variables

Confirmatory factor analysis fit indices show that the measurements model fits the data well: Chi-square/degree of freedom ($cmin/df$) = 4.961; incremental fit index (IFI) = .760; comparative fit index (CFI) = .756; goodness of fit index (GFI) = .841; adjusted goodness of fit index (AGFI) = .778; root mean of residual (RMR) = .055; root mean square error of approximation (RMSEA) = .157; and P Close = .000. All items loaded on their respective constructs, and each had large coefficients and significance at the 0.001 level.

Descriptive, Reliability and Correlation Analysis:

The correlation analysis was used between the study variables with aim of identifying the correlative relationship between the independent and dependent variables; the correlation was conducted for all dimensions of the constructs operationalized in this study using bivariate correlations. These bivariate correlations allow for preliminary inspection of hypothesized relationships. Thus whenever the closer the degree of correlation to the integer one, the stronger

the correlation between the two variables, whenever the less the degree of correlation than the integer one, the weaker the relationship between the two variables, and the relationship may be direct or inverse. In general, the relationship is weak if the value of the correlation coefficient is less than (0.30), and it can be considered medium if the correlation coefficient value ranges between (0.30-0.70), yet if the value of the correlation is more than (0.70) the relationship is considered strong between variables, and the correlation is considered positive if its value is negative. The standard deviation, mean and Cronbach's alpha along with person correlation, for technological capabilities and operational performance constructs, has been shown in Table 2.

Table (2) Descriptive, Reliability and Correlation Analysis for study variables

Variables	Cronbach's alpha	mean	Standard Deviation	1	2	3	4
1. technological capabilities	.835	4.0709	.90360	1			
2. flexibility	.730	3.3976	.56938	.464**	1		
3. quality	.768	3.4582	.48186	.399**	.278**	1	
4. cost	.744	3.2335	.52335	.489**	.361**	.622**	1

Source: prepared by the researchers from data (2019).

As shown in the table, 2 above the correlation analysis provides medium indicators of associations, thus for more examination of the proposed relationships path analysis through structural equation model (SEM) was conducted to give the best predictive model of the relationship present among the variables. In the following are hypotheses testing the last part of the data analysis and results.

Hypotheses testing and findings:

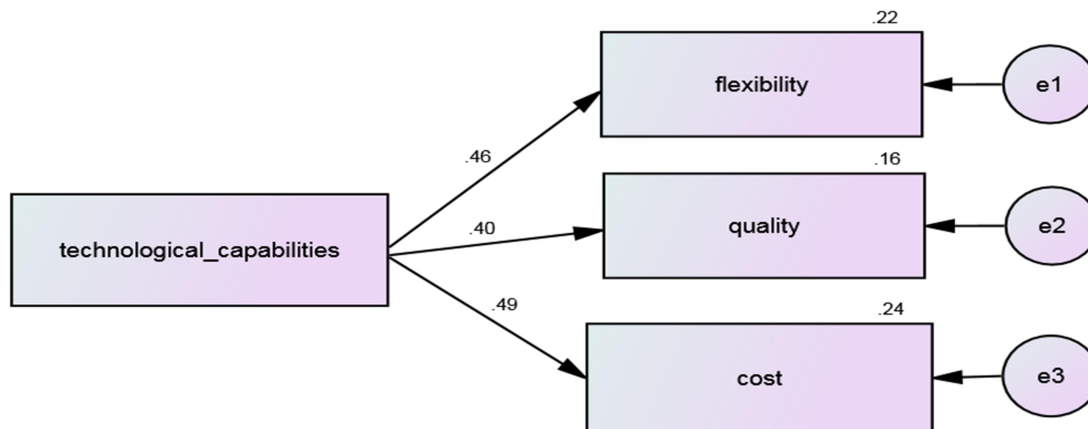
This part discusses the hypotheses testing and findings of the study. The hypotheses were tested with the path analysis that discloses the effect of independent variables technological capabilities on dependent variables operational performance dimensions through the structural equation modeling (SEM) that grows out of and serves purposes similar to multiple regression, but in a more powerful way which takes in account the modeling of interactions between variables, nonlinearities, correlated independents, measurement error, correlated error terms, multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators (Gaskin, 2016). In this study which assumes that the technological capabilities have a significant and positive relationship with the operational performance components (flexibility, quality and cost) as shown in fig.3 and table3 below. Based on the below figure three hypotheses were developed to be tested. Therefore, to test these hypotheses, a similar process of path analysis using (AMOS) was conducted to predict the impacts of technological capabilities on operational performance. The results of the study indicate that a positive relationship between technological capabilities and flexibility, with values (estimates=.293, $p < 0.01$). A positive relationship between technological capabilities and quality, with values (estimates=.213, $p < 0.01$). In addition to that the results show a positive relationship between technological capabilities and cost (estimates=.283, $p < 0.01$). These results give support to hypotheses H1.1 (technological capabilities and flexibility) support to hypotheses H1.2 (technological capabilities and quality) and support to hypotheses H1.3 (technological capabilities and cost) Table 3 show path analysis for direct effects of study variables.

Table (3) Path analysis for direct effects

	Relationships	Estimate	S.E.	C.R.	<i>p-value</i>
flexibility	<--- technological capabilities	.293	.044	6.629	***
quality	<--- technological capabilities	.213	.039	5.500	***
cost	<--- technological capabilities	.283	.040	7.092	***

Source: prepared by the researchers from data (2019).

Figur.3: the relationship between service innovation and operational performance.



Source: prepared by the researchers from data (2019).

The results of path analysis showing Model fit parameters consistent with recommendation as follow, CMIN=58.653, DF= 3, CMIN/DF= 19.551, RMSEA.341, GFI=.859, AGFI= .530, RMR=.037, NFI=.665, CFI=.658, and PCLOSE=.000.

DISCUSSION AND CONCLUSION:

This study pointed out that a significant and positive relationship between technological capabilities and three components of operational performance (flexibility, quality and cost) these results are coinciding with a number of previous studies (Business, 2014; Wang and Ahmed, 2007), indicated that a positive relationship between technological capabilities and firms performance, (Haeussler, et al, 2012) states that the technological capabilities positive influence on product development, (José and Ortega, 2010) confirmed that a significant and positive effect of technological capabilities on the relationship between competitive strategies and firm performance, and . (srivastava, et al, 2015) investigated that technological capabilities have a positive influence to firms performance. While, some prior studies emphasized that technological capabilities have a not positive influence with and firm's performance (Jantunen *et al.*, 2011) which indicate that not positive relationship between technological capabilities and performance it differs between it and current study in cultural and environmental factors.

Theoretical implication:

The first theoretical contribution of this study is the development of technological capabilities and dimension of operational performance constructs through comprehensive combination perspective; based on a survey data of 161 service firms, this study carries more weight especially for generalization purpose due to the limited quantitative approach in the extant literatures. As a whole, technological capabilities have important implications for operational performance.

The second theoretical contribution, it an attempt to viaduct that knowledge gap by addressing the value of technological capabilities as drive of such operational performance like flexibility, quality and cost, the result consists with the findings in literature that technological capabilities were posited to have significant and positive relationship with operational performance.

study offers a number of managerial implications. First, this study will help decision-makers in of service companies to know the importance of technological capabilities and how technological capabilities influence the operational performance with defiance dimensions (flexibility, quality and cost); therefore, decision-makers should focus on improving their technological capabilities. Second, the study highlights the importance of managerial emphasis on the creation of a technological capabilities business environment and encouragement of innovative activities. Given that technological capabilities helps managers to be more connected to the business environment and play an important role in allowing service firms to devise innovative solutions to business problems.

Limitation and suggestions for future research:

This study is subject to several limitations and leaves some areas in need of further research. *First, this study* investigated technological capabilities as one dimension; Future research may examine multiple dimensions of technological capabilities. *Second, this study* tests the role of technological capabilities in a service context. Research in other settings (e.g. manufacturing) could expand the scope of technological capabilities. *Third, this study* use of only one respondent per company, which might be a cause of possible response bias. Thus, caution should be taken in results interpreting. Future research should endeavor to collect data from multiple members. *Finally, this study* focuses on service firms in Sudan. Future research may include firms from other industries or regions to generalize the findings. It would provide valuable information for managers regarding the mapping of technological capabilities with operational performance flexibility.

References:

1. Abdulraheem Ali Alghamdi (2016) Market Knowledge, Blue Ocean Strategy, and Competitive Advantage (Direct and Indirect Relationships and Impact) , Universal Journal of Management 4(4): 141-160.
2. Acha, V. (2000). The role of technological capabilities in determining performance: the case of the upstream petroleum industry. *The DRUID conference of industrial dynamics*. Hillerod.
3. Afuah, A. (2002). Mapping technological capabilities into product markets and competitive advantage: the case of cholesterol drugs. *Strategic Management Journal*, 23, 171-179.
4. Ali, S., Peters, L. D., & Lettice, F. (2012). An organizational learning perspective on conceptualizing dynamic and substantive capabilities. *Journal of Strategic Marketing*, 20(7) , 589-607.
5. Authors, F. (2017c) ‘Research framework for the impact of total quality management on competitive advantage’. doi: 10.1108/RIBS-02-2017-0016.
6. Authors, F. (2017d) ‘SME international performance in Latin America The role of entrepreneurial and’. doi: 10.1108/JSBED-09-2016-0142.
7. Barnney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of management*, 17(1), 99-120.
8. Bruque-Cámara, S., Moyano-Fuentes, J. and Maqueira-Marín, J. M. (2016) ‘Supply chain integration through community cloud: Effects on operational performance’, *Journal of Purchasing and Supply Management*. Elsevier, 22(2), pp. 141–153. doi: 10.1016/j.pursup.2016.04.003.
9. Business, S. (2014) ‘Entrepreneurial orientation and its impact on the improvement of technological capability in Colombia Yonni Angel Cuero Acosta *, Noor Un Nabi and Utz Dornberger’, 21(2), pp. 231–245.
10. Chavez, R. *et al.* (2015) ‘Customer integration and operational performance: The mediating role of information quality’, *Decision Support Systems*. Elsevier B.V., 80, pp. 83–95. doi: 10.1016/j.dss.2015.10.001.
11. Cheng, C. C. and Krumwiede, D. (2012) ‘The role of service innovation in the market orientation - New service performance linkage’, *Technovation*. Elsevier, 32(7–8), pp. 487–497. doi: 10.1016/j.technovation.2012.03.006.
12. Day, G. S. (2011). Closing the Marketing Capabilities Gap. *Journal of Marketing*, 75(4), pp. 183-195.
12. Ernst, D. & Kim, L. (2002). Global Production Networks Knowledge Diffusion and Local Capability Formation. *Research Policy*, 31, 1417 - 1429.
13. Etemad, H. & Lee, Y. (2001). Technological capabilities and industrial concentration NICS and industrialized countries: Taiwanese SMEs versus Southern Korean chaebols. *International Journal of Entrepreneurship and Innovation Management*, 1, (3), 329-55.
14. Fabiano, A. *et al.* (2016) ‘Evaluating credit union members ’ perception of service quality through service innovation’, *RAI Revista de Administração e Inovação*. Departamento de Administração, Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo - FEA/USP, 13(4), pp. 242–250. doi: 10.1016/j.rai.2016.06.007.
15. Ferna, E. and Garci, F. (2012) ‘Learning from exporting: The moderating effect of technological capabilities’, 21, pp. 1099–1111. doi: N10.1016/j.ibusrev.2011.12.001.
16. Gaskin, J. (2016, January 1). *Gaskin's Stat Wiki*. Retrieved October 5, 2016, from Stat Wiki: <http://statwiki.kolobkroot.com>

17. Giuliania, E., Pietrobelli, C. & Rabelotti, R. (2005). Upgrading in Global Value Chains; Lessons from Latin American Clusters. *World Development*, 33, (4), 549-573.
18. Hair, J. F., Black, B., Babin, B., Anderson, R. E., & Tath, R. L. (2010). *Multivariate data analysis*. Prentice Hall. Inc. Upper Saddle River, NJ, USA
19. Haeussler, C., Patzelt, H. and Zahra, S. A. (2012) 'Journal of Business Venturing Strategic alliances and product development in high technology new firms: The moderating effect of technological capabilities', *Journal of Business Venturing*. Elsevier Inc., 27(2), pp. 217–233. doi: 10.1016/j.jbusvent.2010.10.002.
20. Helfat, C. E., & Peteraf, M. A. (2003). The dynamic resource-based view: capability lifecycles. *Strategic management journal*, 24(10), 997-1010.
21. Helfat, C. E. (2007). Stylized facts, empirical research and theory development in management. *Strategic organization*, 5 (2), 185-192.
22. Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., et al. (2007). *Dynamic Capabilities: Understanding Strategic Change in organizations*. London: Blackwell.
23. Hobday, M. & Rush, H. (2007). Upgrading the Technological Capabilities of Foreign Transnational Subsidiaries in Developing Countries: The Case of Electronics in Thailand. *Research Policy*, 36, 1335-1356.
24. Hou, J.-J. (2008). Toward A research Model of Market Orientation and Dynamic Capabilities. *Social Behavior and Personality: an international journal*, 36(9), 1251-1268.
25. Jantunen, A. et al. (2011) 'Innovation and internationalization as growth strategies: The role of technological capabilities and appropriability', 20, pp. 508–520. doi: 10.1016/j.ibusrev.2010.09.004.
26. José, M. and Ortega, R. (2010) 'Competitive strategies and firm performance: Technological capabilities as moderating roles', *Journal of Business Research*. Elsevier Inc., 63(12), pp. 1273–1281. doi: 10.1016/j.jbusres.2009.09.007.
27. Kenyon, G. N., Meixell, M. J. and Westfall, P. H. (2016) 'Production outsourcing and operational performance: An empirical study using secondary data', *International Journal of Production Economics*. Elsevier, 171, pp. 336–349. doi: 10.1016/j.ijpe.2015.09.017.
28. Kim, L., Lee, J. & Lee, J. (1987). Korea's Entry into the Computer Industry and its Acquisition of Technological Capability. *Technovation*, 6, (4), 277-93.
29. Lado, N., Maydeu-Olivares, A., 2001. Exploring the link between market orientation and innovation in the European and US insurance markets. *International Marketing Review* 18 (2), 130–144.
30. Lee, C., Lee, K. & Pennings, J. (2001). Internal capabilities, external networks, and performance: a study on technology-based ventures. *Strategic Management Journal*, 22, 615-40.
31. Modgil, S. and Sharma, S. (2016) 'Total productive maintenance, total quality management and operational performance An empirical study of Indian pharmaceutical industry', *Journal of Quality in Maintenance Engineering*, 22(4), pp. 353–377. doi: 10.1108/JQME-10-2015-0048.
32. Murovec, N. & Prodan, I. (2009). Absorptive capacity, its determinants, and influence on innovation output: cross-cultural validation of the structural model. *Technovation*, 29, 859-872.

33. Ortega, M. (2009). Competitive strategies and firm performance: technological capabilities' moderating roles. *Journal of Business Research*, 63, (12), 1273-1281.
34. Paladini, E. P. (2011). *Gestão da Qualidade: teoria e prática* (2th ed.). São Paulo: Atlas.
35. Panda, H. & Ramanathan, R. (1996). Technological Capability Assessment of a Firm in the Electricity Sector. *Technovation*, 16, (10), 561-588.
36. Romijn, H. (1999). *Acquisition of Technological Capability in Small Firms in Developing Countries*. New York, USA, St. Martin's Press.
37. Sekeran .2003, research method for business, A Skill-Building Approach Fourth Edition, ISBN 0-471-20366-1 -ISBN 0-471-38448-8 (WIE)
38. Srivastava, M. K., Gnyawali, D. R. and Hat, D. E. (2015) 'Technological Forecasting & Social Change Behavioral implications of absorptive capacity : The role of technological effort and technological capability in leveraging alliance network technological resources', 92, pp. 346–358. doi: 10.1016/j.techfore.2015.01.010.
29. Schoenecker, T. & Swanson, L. (2002). Indicators of firm technological capability: validity and performance implications. *IEEE Trans Eng Manage*, 49, (1), 36-44.
40. Teece, D.J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.
41. Vanhaverbeke, W., Cuysters, G. & Beerkens, B. (2002). Technological capability building through networking strategies within high-tech industries. Eindhoven Center for Innovation Studies (ECIS) working paper series 01.15, *Eindhoven Center for Innovation Studies (ECIS)*.
42. Wang, C.L. and Ahmed, P.K. (2007), "Dynamic capabilities: a review and research agenda", *International Journal of Management Reviews*, Vol. 9 No. 1, pp. 31-51.
43. William, Hubbard (2007). The competitive advantage of weak patent. *Boston Collage Law Review*, (54), 1909- 1965
44. Winter, S.G. (2003), "Understanding dynamic capabilities", *Strategic Management Journal*, Vol. 24 No. 10, pp. 991-995
45. Wu, J. (2014) 'Industrial Marketing Management Cooperation with competitors and product innovation : Moderating effects of technological capability and alliances with universities', *Industrial Marketing Management*. Elsevier Inc., 43(2), pp. 199–209. doi: 10.1016/j.indmarman.2013.11.002.
46. Zahra, S.A., Neubaum, D.O. & Larrañeta, B. (2007). Knowledge sharing and technological capabilities: the moderating role of family involvement. *Journal of Business Research*, 60, (10), 1070-9.
47. Zhou, K., Brown, J., Dev, C., 2009. Marketing orientation, competitive advantage, and performance: a demand-based perspective. *Journal of Business Research* 62, 1063–1070