

How Do Technological Capabilities Create The Service Innovation Of Service Sector In Sudan?

¹Mustafa Adam Mohammed, ²Siddig Balal Ibrahim, ³Adam Yagoub Abker,

⁴Kabashey Mohammed Hamed Nour Eldein

¹*Assistant Professor of Business Administration University of Kordofan-faculty of Economics & commercial studies*

²*Associate professor of marketing, Faculty of Business Studies- Arab Open University, Kingdom of Bahrain*

³*Assistant professor of Business Administration, Faculty of Economics & commercial studies – University of Kordofan, Elobeid, Sudan*

⁴*Assistant Professor of Business Administration Taif University -College of Management, Taif, Kingdom of Saudi Arabia*

**Corresponding Author: Adam Yagoub Abker*

ABSTRACT:- This study aimed to examine the relationship between technological capabilities and service innovation dimensions (incremental and radical) 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 response rate of 97%. The result of this study show that a positive relationship between technological capabilities and incremental innovation, the result also indicate that a positive relationship between technological capabilities and radical innovation. The study recommended that future research should test in other settings (e.g. manufacturing) could expand the scope of technological capabilities. The study also recommended 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 service innovation.

KEYWORDS: Technological Capabilities, Service Innovation, Incremental Innovation, Radical Innovation.

I. INTRODUCTION

Technological capabilities are a key elements in the use of knowledge and technology as requirements to achieve innovations within the firm (Business, 2014). The effect technological capabilities of innovation are important because the characteristics of this kind of capabilities (that promote improvement and innovation) can enhance the positive effect of the firm innovation. This study highlights the need for a complementary interaction between these technological capabilities and the service innovation firm (José and Ortega, 2010). 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 innovation, 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, Meixell, & Westfall, 2016).

A number of studies in the field of technological capabilities have only been carried out in small and medium size enterprises (SMEs) 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.

Most of the studies that addressed the technological capabilities, in general, focused on the manufacturing firms (Haeussler, Patzelt and Zahra, 2012; Srivastava, Gnyawali and Hat, 2015), 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 technological capabilities in service firms which the previous studies failed to deal with. Previous studies regarding technological and service innovation have focused mainly on a specific sector, such as banking, hotel, and insurance sectors (Cheng and Krumwiede 2012). 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. The objective of this study is to examine the relationship between technological capabilities and service innovation. In view of the previous argument, this research adds to the body of knowledge on technological capabilities and service innovation by addressing two research questions: What extends technological capabilities can contribute to incremental innovation? To what extent is the relationship between technological capabilities and radical innovation? The answer to these questions will contribute to supplement previous studies by explaining some mechanisms through which technological capabilities promotes service innovation.

Theoretical significance:

Theoretical significance of this study is trying to fill the gap through the relationship between theoretical significance and service innovation and then attempt to build a conceptual framework that will contribute to theories and practice in the field of strategic management also the study will provide scientific guidelines and advice through which the services firms operating in Sudan to achieve the efficiency and the effectiveness.

Practical significance:

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 service innovation and this study may encourage the managers to play a greater role in activities related to the development of service innovation.

In this article, we explore the relationship between technological capabilities and service innovation in the Sudanese service firms. This study started with the introduction of the term technological capabilities, and service innovation in the Sudanese service firms relying on the works of past researchers, followed by the research methodology, analyses of data and findings, discussion and conclusion.

II. LITERATURE REVIEW

2.2. Technological capabilities

Capabilities are defined as “a firm’s capacity to deploy resources, using organizational processes, to affect a desired end (Haeussler, Patzelt and Zahra, 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, Gnyawali and Hat, 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, Gnyawali and Hat, 2015).

2.2. Service innovation

Service innovation can be defined as making changes to something established by introducing something new (Lai, Yusof and Kamal, 2016). This definition does not suggest that ideas behind change need to be radical or that they need to happen exclusively to products. Ideas are often mundane and incremental and can affect products processes and services at every level within an organization. Service innovation is the successful implementation of creative ideas within the firms. It is a mechanism to adapt the company in a dynamic environment (Cheng & Krumwiede, 2012). Therefore the firms are required to create the assessment as well as new ideas and offer innovative services.

(Kingdom and Syafarudin, 2016) said that service innovation as the successful implementation of creative ideas within the company. It is a mechanism to adapt the company in a dynamic environment. Therefore the company is required to create the assessment as well as new ideas and offer innovative services. Innovation is a complex process related to changes in production functions and process whereby firms seek to

acquire and build upon their distinctive technological competence. Understood as the set of resources a firm possesses and the way in which these are transformed by innovative capabilities. Innovation at firm level refers to a firm's receptivity and propensity to adopt new ideas that leads to development and launch of new products (Perin, 2016). Service innovation can be defined as accepting a device, system, policy, program process, new product or service that can be created within the organization or be bought out and the new for organization, this definition of innovation is very comprehensive and can say that it includes many dimensions. Innovation through increased organizational flexibility, willingness to change and introduce new product and services and reduce waste organization positively affects the organization long-term success.

2.1.1. Incremental innovation

Incremental innovation is basically a modification in service which also called line extension or market pull innovation (Cheng & Krumwiede, 2012). Incremental innovation does not need to significantly diversify from current business. That is why this type of innovation enhances the skills and competencies of the organizational employees. Exploitative innovations are based on the existing companies' resources and are represented by small improvements in methods, technologies or products. This type feed on best practices and routines generated in the past. This type of innovation is called incremental innovation which is designed for existing customers or markets (Huhtala *et al.*, 2014).

Incremental innovation is related to customer-led strategies that focus on manifest needs (Cheng and Krumwiede, 2012).

Plessis (2007) explained that incremental innovation is basically a modification in product which also called line extension or market pull innovation. Incremental innovation does not need to significantly diversify from current business. That is why this type of innovation enhances the skills and competencies of the organizational employees. Incremental innovation is decisive for the organization because it helps the organization to increase their market to be remaining in industry for long time.

2.2.2. Radical innovation

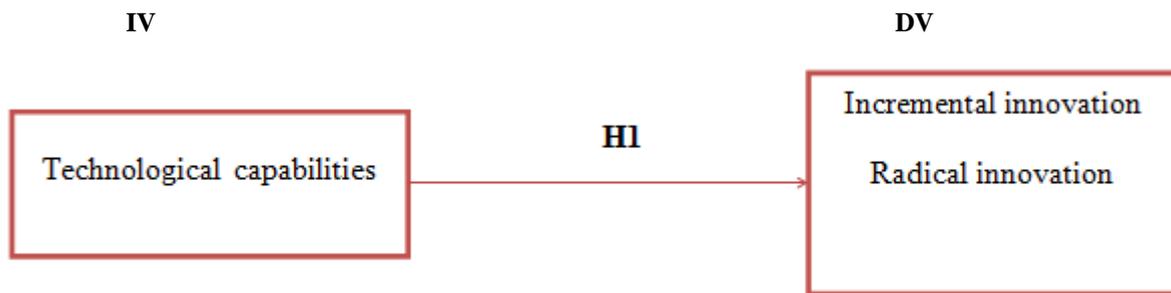
is a major change that represents a new technological paradigm (Engen and Holen, 2014). It implies that the codes developed to communicate changing technology will become inadequate. Radical change creates a high degree of uncertainty in organizations and service it also sweeps away significant parts of previous investments in technical skills and knowledge, designs, production techniques, plants and equipment the change is not necessary delimited by the supply side. It comes from a change on the demand side and in the organizational or institutional structure.

Radical innovation is a product, service and process with entirely unique or significant improvements in existing features which improve the cost and performance, radical innovation is a highly risky for the business because radical innovated products are more difficult to commercialize. But on the other hand, radical innovation in product, service or process is crucial for the business because it involves the development and application of new technology. Important aspect of radical innovation is that to what extent new technology is more sophisticated and advance as compared to current technology (Kashif *et al.*, 2010).

Radical innovation is expected to imply more fundamental changes for the company's activities, and it's often related to high risks during both the development and commercialization in comparison to incremental innovation. radical innovation as products that have a high impact on existing markets or create wholly new markets by offering totally new benefits, significant improvements in known benefits, or significant reduction in cost (Ulrika & Carolinne, 2016). Radical innovation also represents the development and implementation of new services or processes that lead to fundamental improvements in operational efficiencies, interactions with the market, and/or the fulfillment of new needs among stakeholders (Ringberg, Reihlen and Rydén, 2018). Radical innovation is defined as fundamental changes in new services that represent revolutionary changes in service benefits (Cheng and Krumwiede, 2012).

2.4. Resource Based View (RBV) Theory

The resource-based view provides the theoretical foundation for this study regarding the effect of strategic orientation on technological capabilities. The RBV suggests that firms deploy their physical, human, and organizational resources to gain an advantage in the marketplace. If these resources are valuable to customers, rare, and difficult to imitate, then these resources give rise to sustainable competitive advantage, enhancing firm performance, thus, the basic premise is that resources increase the efficiency and effectiveness of firms in general and the development of new services in particular in this context, (Cheng & Sheu, 2017). Based on the literature and (RBV) theory, the study framework is shown in figur. 1



Figur.1: the study conceptual framework

2.4. Hypotheses development

1. Technological capabilities and service innovation.

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). According to the theory of dynamic capabilities and results in the literature suggests that the technological capabilities is playing significant and positive relationship to service innovation. (Haeussler, Patzelt and Zahra, 2012) states that the a positive relationship between technological capabilities and product development, while (Ferna and Garcı, 2012) investigated a significant and positive relationship between technological capabilities and innovation while, . Therefore, based on the above discussions the following hypotheses are generated:

H.1. there is a positive relationship between technological capabilities and service innovation.

H.1.1. there is a positive relationship between market technological capabilities and incremental innovation.

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

III. METHODOLOGY

3.1. 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 and different dimensions of service innovation.

3.2. 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 percent. The questionnaire for this study consisted of three main sections, firstly, the profile of the company secondly, specific questions designed to measure the technological capabilities thirdly, specific questions designed to measure the service innovation, eleven questions were used to measure the model variables were subjected to exploratory factor analysis using principal component, technological capabilities as one dimensions the items of technological capabilities was measured using six measurements adopted from (Jantunen et, al. 2011). While, the service innovation was measured using tow dimension (incremental and radical) the items is measured using six items were adopted from (Cheng ja Krumwiede ,2012) We used a five-point scale as a unit of measurement ranging from "strongly disagree" to

IV. DATA ANALYSIS AND FINDINGS

4.1. 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.

4.2. 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 0.45. Fifthly, the minimum requirement of factor loading 0.50. 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 eighteen items, which were used to measure study variables. Table 1 showed the summary of results of exploratory factor analysis on study variables.

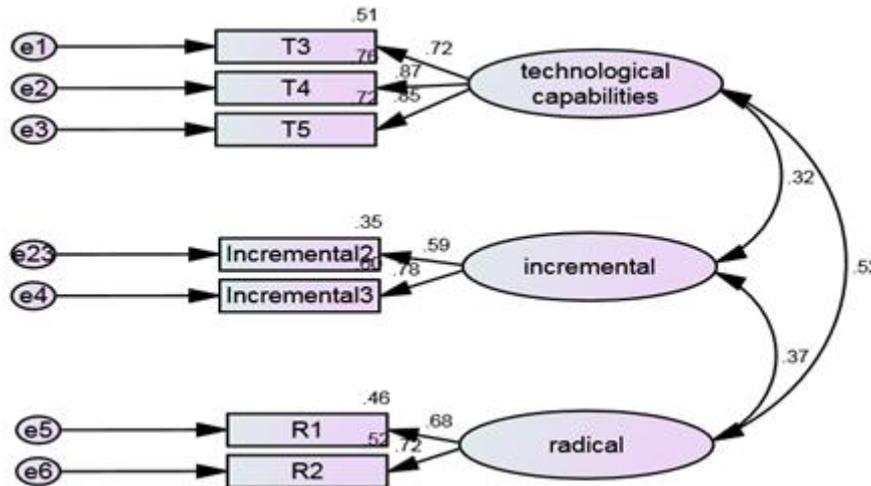
Table: 1 Factorial loads of observed variables - Promax Rotation.

<i>Observable variables</i>	<i>Factorial load</i>	<i>Code</i>
The firm has strong internal technology operations capabilities.	.619	T1
The firm has the technological infrastructure and competencies to engage in e-commerce initiatives.	.779	T2
Our technological capabilities are top class.	.785	T3
The success of our research and development activities is based on long-term know-how.	.699	T4
We have invested heavily in certain research and development projects.	.678	T5
KMO, .782; Bartlett's Test of Sphericity, 322.887; Total Variance Explained, 51.100.		
The services were modification of an existing company service	.457	Incremental1
The services were revision of an existing company service.	.844	Incremental2
The services were repositioning of an existing company service.	.553	Incremental3
The services were totally new to the market.	.954	R1
The services offered new features versus competitive services.	.508	R2
KMO, .674; Bartlett's Test of Sphericity, 154.091; Total Variance Explained, 50.854.		

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

4.3. 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. Figur.2: below show the Confirmatory Factor Analysis for study variables.



Figur.2: Confirmatory Factor Analysis for study variables

Confirmatory factor analysis fit indices show that the measurements model fits the data well: Chi-square/degree of freedom (cmin/df) = 14.680; incremental fit index (IFI) = .734; comparative fit index (CFI) = .732; goodness of fit index (GFI) = .845; adjusted goodness of fit index (AGFI) .707; root mean of residual (RMR) =.072; root mean square error of approximation (RMSEA) = .292; and P Close = .000. All items loaded on their respective constructs, and each had large coefficients and significance at the 0.001 level.

4.4. 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 service innovation 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
1 technological capabilities	.835	4.0709	.90360	1		
2 incremental innovation	.659	2.6259	.43749	.270**	1	
3 radical innovation	.647	3.0916	.57081	.578**	.394**	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 gives 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

4.5. Hypotheses Testing

After the preliminary analyses, 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 service innovation dimensions (incremental and radical) through the structural equation modeling (SEM) that grows out of and serves purposes similar to multiple regression, but in 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 a positive relationship to

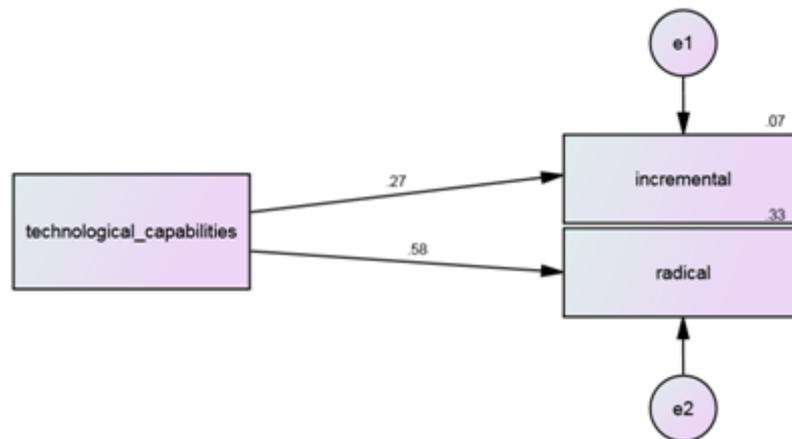
service innovation components (incremental and radical) as shown in figur.3 and table3 below. Based on the below figure tow hypotheses were developed to be tested. Therefore, to test these hypotheses, a similar process of path analysis using (AMOS) was conducted to predict the impacts of technological capabilities on service innovation. The results of the study indicate that a positive relationship between technological capabilities and incremental innovation, with values (estimates=.365, $p < 0.01$) In addition to that the results indicate a positive relationship between technological capabilities and radical innovation (estimates=.131, $p < 0.01$) .These results give support to hypotheses H1.1 (technological capabilities and incremental innovation) support to hypotheses H1.2 (technological capabilities and radical innovation) Table 3 show path analysis for direct effects of study variables.

Table 3 Path analysis for direct effects

Relationships			Estimate	S.E.	C.R.	p-value
radical	<---	technological capabilities	.365	.041	8.950	***
incremental	<---	technological capabilities	.131	.037	3.551	***

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

Figur.3: the relationship between strategic orientation and service innovation



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

The results of path analysis showing Model fit parameters consistent with recommendation as follow, CMIN= 15.423, DF= 1, CMIN/DF= 15.423, RMSEA. .300, GFI=.942, AGFI= .654, RMR= .024, NFI=.842, CFI=.839, and PCLOSE=.000.

V. DISCUSSION

This paper investigates the factors that contribute to the improvement of technological capabilities in service firms in Sudan. A firm’s competitiveness depends on how well the company responds to market needs. Technological capabilities are a fundamental concept for micro and service firms which have to respond to market pressures. The hypothesis that this paper tested was a direct model itself. The findings of this study show that a significant and positive relationship between technological capabilities and service innovation dimensions (incremental and radical innovations), Murovec and Prodan, (2009) confirmed the importance of absorptive capacity for innovation and for the competitiveness and growth of firms. (Business, 2014), indicated that a positive relationship between technological capabilities and firms performance, (Jantunen *et al.*, 2011) which argue, that indicate not positive relationship between technological capabilities and performance it differs between it and current study in cultural and environmental factors. While, some prior studies emphasized that technological capabilities have a positive influence with innovation and firm’s performance (Haeussler, Patzelt and Zahra, 2012; Wang and Ahmed, 2007; srivastava, gnyawali and hat, 2015).

VI. CONCLUSION AND IMPLICATIONS OF THE STUDY

This study has provided empirical justification for a framework that identifies technological capabilities on service innovation constructs (incremental and radical) within the context of service sector in the Sudan. This study contributes to the competitive strategy literature by corroborating the positive influence of technological capabilities and service innovation.

Previous studies supporting the importance of technological capabilities mostly used and relate technological capabilities to organizational innovation, the major contribution of this study is the development of technological capabilities 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 philosophy and deduction approach in the extant literatures. As whole, technological capabilities have important implications for service innovation. This study offers a number of managerial implications. *First*, this study will help decision makers in firms to know the importance of technological capabilities and how technological capabilities influence the service innovation. Therefore, decision makers should focus on improve their technological capabilities. *Second*, the study highlights the importance of managerial emphasis on the creation of a strategic oriented business environment and encouragement of innovative activities. Given that technological capabilities helps managers to be more connected to the business environment to play an important role in allowing service firms to devise innovative solutions to business problems.

This study is subject to several limitations and leaves some areas in need of further research. *First*, this study tests the role of technological capabilities in service context. Research in other settings (e.g. manufacturing) could expand the scope of technological capabilities. *Second*, 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 service innovation.

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*Corresponding Author: Adam Yagoub Abker

²Assistant professor of Business Administration, Faculty of Economics & commercial studies...