

# THE DARK AND LIGHT SIDES OF DYNAMIC CAPABILITIES IN THE SELECTED KNOWLEDGE-BASED FIRMS IN SOUTHWESTERN NIGERIA

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## Abstract

The study was carried out in three selected states in Southwestern Nigeria namely Lagos, Oyo and Ogun. Mixed Methods Research was used in the design, analysis and write up of the study. Structured questionnaire with some open-ended section was administered on one hundred knowledge-based firms across the four categories as identify by OECD such as [high tech (17), medium high-tech (17), medium low-tech (17) and low-tech firms (49)] in the three states. The prevalence of each category in the economy based on the information from Nigeria Stock exchange was the rationale for selecting the firms in that ratio. Dynamic capabilities of the firms were measured using three indigenous elements adapted from previous studies; strategic capability, internal capability and external capability. These variables were measured on a five point of scale, i.e. 1 to 5, in order to determine the extent of commitment of the selected firms to the stated indigenous operational routine. For instance, 1 was coded for 0-20%, 2 was coded for 21-40%....and 5 was coded for 81-100%. Technology upgrading variables were measured with product technology (technical specification, user friendliness and other functional characteristics of the firms) and process technology (improvement in the delivery techniques, software and equipment deployed by the firm). Technology upgrading was measured with improvement and no improvement. 1 was coded for no improvement while 2 was coded for improvement. Both descriptive and inferential statistics were deployed in the study with the aid of SPSS 20. The study shows that majority of the respondents from the selected firms are male, and most of the respondents have M.Sc./M.BA/M.Pharm and their farms are mostly situated in Lagos state. The products and activities of the selected firms varies based on their class of knowledge-based. The study shows that the selected firms are more committed in their strategic, internal and external operational routine except collaboration with government for either technical or financial support. Furthermore, most of the selected firms improve both their product and process technology. Furthermore, firms that have collaboration with University/research institute for technical support and acquire patent, licenses from other firms are more likely to upgrade their process technology. Also, firms that have collaboration with Government for financial support are more likely to upgrade their product technology. The study recommends that firms should collaborate with Government for inclusive industrial policy design. Not only that but collaborate with university/research institute for technical support and acquire patent and licenses from other firms.

**Keywords:** Dynamic Capabilities, Knowledge-based firms and Nigeria

## **I. Introduction**

Knowledge-based firms are innovative or science and technology-based firms that focus on the creation, transferring and application of knowledge and information for value addition to their economic activities. Although all firms are to some extent dependent on knowledge inputs, however, some firms rely more on knowledge than others (OECD, 1996). Moreover, the analysis of OECD is tending towards understanding the transfiguration of traditional economies to learning or knowledge economies because, internalizing the acquired skills and knowledge exhibits learning economy (OECD, 1996).

Nigeria economy is yet to be knowledge-based because agriculture sector dominates the largest contribution (43.71%) to the GDP in the fourth quarter of 2017 relatively to other sectors; manufacturing (14.82%), information and communications (18.76%), education (4.29%), mining and quarrying (12.23%) and other services activities (6.19%) (NBS, 2018). Therefore, operational routine of knowledge-based firms in the economy needs to be considered so as to know the reasons for their low contributions to the DGP.

Dynamic capabilities (DCs) explain the actual operational routine deployed/deploying for either sustainable competitive advantage, limited advantage, competitive parity, or business failure (Ambrosini and Bowman, 2009). There are two different school of thoughts as regard to the importance of DCs on the sustain competitive advantage of firms. These two schools of thought are mutually exclusive in coining dynamic capabilities which are based on different assumptions, theories, reasoning mechanism that ultimately lead to diverse conclusions (Peteraf, Stefano and Verona, 2013). The two schools of thought are the first mover of the constructs and implications of DCs with the aids of different lens. From the lens of “Teece et al., (1997), defined dynamic capabilities as the firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing business environment.” Teece group believed that DCs result to sustainable competitive advantage in a rapidly technological

change. Eisenhardt and Martin (2000) disputed the idea of Teece et. al., and reports that dynamic capabilities itself is not sustainable in a dynamic business condition. Then, the implication of dynamic capabilities as channel of sustainable competitive advantage is faulty rather for short period of time because of its substitutability. In addition to that, Eisenhardt and Martin defined dynamic capabilities to be the operational routine that enable firms to be creative, deploy and protect disembodied technologies that pave way to long run-business performance. Therefore, the definition connotes that DCs is not sufficient but necessary for firms to have a sustained business advantage rather resource configurations that they create (Eisenhardt and Martin, 2000).

Furthermore, Peteraf, Stefano and Verona (2013) shows that the cause of divergence in the context of constructs and implication of dynamic capabilities was based on “two separate arenas of knowledge” which can still be connected while conserving the assumptions that caused diverse conclusion about the constructs and implications of dynamic capabilities. The explanation of Peteraf et al., about the divergence conclusion is that Teece et al., viewed dynamic capabilities from the angle of “complex routines and organizational mechanisms while that of Eisenhardt and Martin’s view is from simple routines and managerial mechanism.” Peteraf et al., further notes that the two angles are simultaneously functional at firm level especially the knowledge-based firms. Therefore, dynamic capabilities need empirical triangulation view of the two school of thoughts for broader knowledge and for consensual agreement of the constructs and its implications in the Nigeria context. Based on that, dynamic capabilities (DCs) explains how firms manage constraints to technology upgrading via managing the internal, external and strategic capabilities that leads to new resource reconfiguration and thus sustainable competitive advantage in a dynamic business condition.

Dynamic business environment is a challenge to firms, specifically knowledge-based firms (KBF) in Nigeria. Virtually, KBF have gone-under such as Kaduna Textiles (KTL), Arewa Textiles PLC, Finetext PLC and United Nigeria Textiles (UNTL), Dunlop Nigeria changed from production of tires to marketing due to economic quagmire situation of Nigeria while some have moved out of Nigeria due to harsh operating business environment such as Michelin (Adebayo, 2017). The situation galvanized Nigeria unemployment rate to 14.2% in 2016 and consumer price index rose from 215.72 in January, 2017 to 248.35 in January 2018 (National Bureau of Statistics (NBS), 2018). Moreover, empirical studies on dynamic capabilities is limited with diverse findings (Wu, 2010), due to ambiguity in the nature of DCs construct and its implication on firm performance (Peteraf, Stefano and Verona, 2013). Also, scholars recommend studies on the implication of dynamic capabilities by focusing non-financial and financial firm performance (Grunbaum and Stenger, 2013; Giniuniene and Jurksiene, 2015; Breznik and Lahovnik, 2016). Therefore, there is need to know the implication of dynamic capabilities in the knowledge-based firms in Southwestern Nigeria, hence this study.

## **II Literature Review**

Knowledge-intensive firms were distinguished into two major types such as firms that are R&D based and professional service(s) based firms (Alvesson, 2004). The firms that focus on intangible products and often deal directly with clients are service(s) based while firms that produce tangible products with less contact between employees and the customers are R&D based firms. Increase in the number of knowledge-based firms will result to knowledge-based industries and ultimately leads to knowledge-based economy (Gera and Masse, 1996). The operational routines of firms depend on how they perceive their competitive status in the market, because their organizational routine will definitely affect the way they compete with either foreign or local competitors.

The business environment of knowledge-based firms is dynamic and requires constant sensing, seizing and exploitation windows of opportunities within and outside the business boundaries of the firms thus needs resource reconfiguration for sustained competitiveness (Breznik and Lahovnik, 2016). Dynamic capability creates and maintain competitive advantage of firms by “continuously integrating, building and reconfiguring internal and external competencies of firms to address rapidly changing business environments” (Teece *et al.*, 1997). The resource-base of dynamic capability can both be internal and external to the firms such as acquisition-based dynamic capability and alliance-based dynamic capability (Helfat, *et al.*, 2007).

Zaidi and Othman (2011) reviewed the concept of dynamic capabilities by showing how firms change their capabilities, based on the changes in their business environment. The study also revealed that DCs of firms is important in achieving innovative competitive advantage. This correspond to Teece (2007) that reports that firms have to be successfully commercializing their innovative product, based on the available opportunities. Zaidi and Othman (2011) further revealed that among the resources that have been used empirically for dynamic capabilities are alliance, technological, planning, human resources, capital, operational management capability and know-how. The study shows that DCs is an important resource that renew resources. Zaidi and Othman also show the two categories of firms’ resources. One, tangible resources like financial assets, two, intangible resources like intellectual property and capabilities. The main aim of DCs is to sustain competitive advantage of firms, and how DCs does that depends on its intangible resources meeting three criteria. One, it must be technically fit, two, it has to meet the need of change in the business environment, three, it must be scarce (Helfat, *et al.*, 2007). Zaidi and Othman (2011) reports that the use of dynamic capabilities depends on the context because of its typology. This is to either to maximize efficiency and effectiveness. Strategic capabilities emanate from the

resources acquired by the firms which does not really implies firm capability building due to its nature (Grobler, 2007). Dynamic Capabilities entails both external and internal resources to the firms such as alliance-based and acquisition-based which are knitted to relational capability (Helfat et al., 2007).

Breznik and Lahovnik (2016) deployed in-depth interview on six IT firms between 2011 and 2012. The study analyze capability from the perspective of dynamic capabilities and corroborated other studies (Teece, 2007 and 2009) by synthesizing dynamic capabilities into three categories; Sensing (opportunities identification), seizing (maximizing the opportunities) and reconfiguring capabilities (Commercializing the opportunities). The study revealed that firms that deploys dynamic capabilities sustained competitive advantage in a turbulent business environment. It also revealed that firms with a stronger commitment to using dynamic capabilities are more successful in their business activities. The study concluded that neglecting the deployment of a single dynamic capability can have negative effect on the effective deployment of other dynamic capabilities because of their correlation and interwoven attributes. Furthermore, firms' operational routine will lead to sustainable competitive advantage (Wang and Ahmed, 2007).

Grunbaum and Stenger (2013) deployed multi-case study design as research strategy, by interviewing seventeen (17) top management personnel in six case companies during a thirteen-month period. Six respondents out of seventeen interviewed were followed up as a double check, clarification etcetera on the responses of the respondents. Pattern matching logic was used for the data analysis. Findings from the study shows a positive relationship between dynamic capabilities and innovation performance of the selected firms. However, there was neither positive relationship between innovation performance and profitability, nor was there positive relationship between dynamic capabilities and profitability. This was attributed to the

existence of imbalanced supplier-customer relationship, few marketing-oriented speculations, assessment and feasibility calculation.

Protogerou, Caloghirou and Lioukas (2007) studied the direct and indirect relationship among dynamic capabilities, functional competences and the firm performance in the study area. Multidimensional factors were used to capture dynamic capabilities such as coordination, learning and strategic competitive response. The study considered knowledge-based industries. Data were collected by interviewing 280 chief executive officer (CEO) of the selected firms by using structured questionnaire. The study reduced the possible dimension error that may emanate from a single source of information by identifying and making several phone contacts with the most knowledgeable informants (experienced managers). The study used subjective performance measures in line with Tippins and Sohi, (2003) because of financial statement that were not accessible or not available (Protogerou, Caloghirou and Lioukas, 2007). Subjective performance measures ease firms' comparisons across different industries (Song *et al.*, 2005). Outcome from the study shows that dynamic capabilities do not have a direct significant effect on firm performance. While DCs have indirect effect on performance via mediating factor; functional competence. By implication, the direct effect of DCs on the performance of firms are disputed but rather mediated and such correspond to other studies (Eisenhardt and Martin, 2000 and Zott, 2003). Therefore, mediated relationship of DCs and performance of firm indicates that DCs is not sufficient for sustainable competitive advantage but rather pave way to achieving improve firm performance through combining and renewing functional competences of the firms.

Other studies have shown that DCs significantly affect the performance of firms directly. The firm's ability to integrate external knowledge is positively related to its productivity (*number of patent*) (Henderson and Cockburn, 1994). Also, in the post-acquisition

integration processes, study showed that firms that invested more effort in codifying their integration processes are the market winner in the banking industry (Zollo and Singh, 1998).

Janssen, Castaldi and Alexiev (2015) study from Netherland use five constructs for dynamic capabilities such as sensing user needs, sensing technological options, conceptualizing, coproducing and orchestrating, and scaling and stretching. Questionnaire was administered on managers of 391 Dutch firms. SEM deployed for its analysis. Findings from the study shows that the measured capabilities positively correlated with performance measures.

Based on the empirical studies reviewed, there have been contradicting issues about how dynamic capabilities influence the performance of firms. This contradiction from the scholars might be as a result of how dynamic capabilities was operationalized and the methodology adopted for the study. Teece *et al.* (1997) sees DCs from the perspective of internal and external capabilities of firms while Eisenhardt and Martin (2000) sees it from the operational strategy deployed by firms. Therefore, this study will adopt the perception of the two scholars that developed the concept of dynamic capabilities largely.

### **III Methodology**

The study was carried out in three selected states in Southwestern Nigeria namely Lagos, Oyo and Ogun. The knowledge-based firms were divided into four broad groups using OECD 1996 classification viz: high-tech firms such as information and communications technology and pharmaceutical firms, medium high-tech firms such as chemical, medium low-tech firms such as fabricated metals, rubber and plastic and low-tech firms such as food and beverages, paper and printing. Mixed Methods Research was used in the design, analysis and write up of the study. Structured questionnaire with some open-ended section was administered on one hundred knowledge-based firms across the four classes [high tech (17), medium high-



tech (17), medium low-tech (17) and low-tech firms (49)] in the three states. The prevalence of each category in the economy based on the information from Nigeria Stock exchange was the rationale for selecting the firms in that ratio.

The level of dynamic capabilities of the firms were measured using three indigenous elements adapted from previous studies; strategic capability, internal capability and external capability (Narver and Slater, 1990; Kohli, Jaworski and Kumar, 1993; Sinkula, Baker and Noordewier, 1997; Mavondo and Farrel, 2000; Subramaniam and Youndt, 2005; Akman and Yilmaz, 2008; Hakala and Kohtamaki, 2011). Strategic capability is the ability geared towards achieving aims and objectives by scanning business environment, identifying new opportunities, assessing its competitive position and quickly responding to its competitors' strategic move (Protogerou, Caloghirou and Lioukas, 2007). Internal capability deals with managing the disembodied and embodied technology so as to enhance the organisation's innovative capabilities. It contributes to dynamic capabilities by managing the constraints to innovation capability of an organization. External capability of a firm entails the capacity needed to manage external resources such as forming alliances with competitors, customers, research institutes, and governments among others.

Strategic capability was captured with technology orientation (how committed are the firms in adopting or adapting/developing new technology), learning orientation (how committed are the firms: in making provision for yearly budget for training of employee; in encouraging advice or suggestion from employees, customers, suppliers of raw materials; in encouraging policy for teamwork and information sharing), market orientation (how committed are the firms in ensuring that: their strategies are driven by the need to create customer value; their need to meet higher customer satisfaction; they regularly conduct SWOT analysis on their competitors; they responds rapidly to competitor's move; they try as much as

possible to retain their best staff/personnel (trade secret); and they seek to anticipate future customer needs).

Internal capability was captured with disembodied and embodied technology. For disembodied technology (how committed are the firms in ensuring that: they employed highly skilled personnel, number of employees with M.Sc. in 2016 increase; they ensure regular training of staff to improve their knowledge; they preserve knowledge through patents and other Intellectual Property Right (IPR); and they adopted knowledge management techniques for effective talent) and embodied technology (number of turnkey technologies procured in 2016 was high relatively to previous years).

External capability was captured by collaboration with firms; government and research institutes/universities. For collaboration with firms (how committed are the firms in: outsourcing R &D to other firms, acquiring patent, licenses from other firms and participate in open collaborative innovation with other firms), collaboration with government (How committed are the firms in ensuring that: Government provide financial support to the firm (Loan, tax rebates, and subsidies), and Government provide technical support to our firm (Advice, training and infrastructure)), and collaboration with university/research institute(s) (how committed are the firms to ensuring that collaboration with university/research institute will grant technical supports i.e advice, training and R&D).

The dynamic capabilities variables were measured on a five point of scale, i.e. 1 to 5, in order to determine the extent of commitment of the selected firms to the stated indigenous operational routine. For instance, 1 was coded for 0-20%, 2 was coded for 21-40%....and 5 was coded for 81-100%. Technology upgrading variables were measured with product technology (technical specification, user friendliness and other functional characteristics of the firms) and process technology (improvement in the delivery techniques, software and equipment deployed by the firm). Technology upgrading was measured with improvement and no improvement. 1

was coded for no improvement while 2 was coded for improvement. Both descriptive and inferential statistics were deployed in the study with the aid of SPSS 20.

#### **IV Results and Discussion**

Table 1 explain the socio demographic characteristics of respondents from the selected knowledge-based firms in Southwestern Nigeria. The Table shows that 19.4% of the respondents are from high technology-based firms, 11.1% are from medium high technology-based firms, 18.1% are from medium low technology-based firms while 51.4% of the responses are from low technology-based firm in Southwestern Nigeria. In addition, the Table shows that about 63.9% of the respondents are male while 36.1% of the remaining respondent are female. The Table further shows the highest degree of the respondent in the firm. This shows that majority (58.3%) of the respondents have M.Sc./MBA/M.Pharm, follow by the respondents with B.Sc./HND (37.5%), while only 4.2% of the remaining respondents have Ph.D as their highest degree certificate. As regard the location of the selected knowledge-based firms, majority (73.6%) of the respondents are from Lagos state, 22.2% are from Oyo while only 4.2% are from Ogun State. This was due to the localization of the firms and the return rate of the questionnaire administered.

The respondents of the selected firms report the business activities/products of their firms qualitatively. The business activities of the selected knowledge-based firms (KBF) in Nigeria is based on their classes such as high technology-based, medium high technology-based, medium low technology-based and low technology-based firms.

**Table 1** **Socio-Demographic Characteristics of the Respondents**

Gender of the respondents	Class of the Knowledge-based Firm				Total
	Low Tech	Medium Low Tech	Medium High Tech	High Tech	
Male	20(27.8%)	12(16.7%)	7(9.7%)	7(9.7%)	46(63.9%)
Female	17(23.6%)	1(1.4%)	1(1.4%)	7(9.7%)	26(36.1%)
<b>Total</b>	<b>37(51.4%)</b>	<b>13(18.1%)</b>	<b>8(11.1%)</b>	<b>14(19.4%)</b>	<b>72(100.0%)</b>
<b>Highest qualification of the respondents</b>					
B.Sc./HND	11(15.3%)	9(12.5%)	3(4.2%)	4(5.6%)	27(37.5%)
M.Sc./MBA/M.Pharm	24(33.3%)	4(5.6%)	5(6.9%)	9(12.5%)	42(58.3%)
Ph.D.	2(2.8%)	-	-	1(1.4%)	3(4.2%)
<b>Total</b>	<b>37(51.4%)</b>	<b>13(18.1%)</b>	<b>8(11.1%)</b>	<b>14(19.4%)</b>	<b>72(100.0%)</b>
<b>Location of the respondents' firms</b>					Total
Lagos state	26(36.1%)	6(8.3%)	7(9.7%)	14(19.4%)	53(73.6%)
Ogun state	3(4.2%)	-	-	-	3(4.2%)
Oyo state	8(11.1%)	7(9.7%)	1(1.4%)	-	16(22.2%)
<b>Total</b>	<b>37(51.4%)</b>	<b>13(18.1%)</b>	<b>8(11.1%)</b>	<b>14(19.4%)</b>	<b>72(100.0%)</b>

The products and activities of the high technology-based firms selected are (i) pharmaceutical firms that produces analgesics, capsules, tablets, intravenous fluid, haematinic, liquid and cream Ointments, antiretrovirals, dry powder to mitigate diseases (cardiovascular disease, malaria, diabetes), psychiatry, chemotherapy, nutraceuticals, allergies, oncology and immune inflammation and Vaccines products, multivitamin and Anxiolytics products, cough and cold Syrup, Supermag, suspension, Neofylin, throtal, Micpol Suspension, antacid and ulcer care. (ii) The products and activities of information and communications technology (ICT) includes web design/development, database management, provision of internet services for voice over internet protocol (VoIP), broadband internet access, web and email hosting, video conferencing and surveillance solution, colocation services, data exchange activities, provision

of the state of the art broadband technology etc. The business activities and the products of chemicals as medium-high technology-based firms includes among others are paint products such as decorative and non-decorative paints, automotive, wood products, industrial and marine paints. These paints include Gloss, Emulsion, Texcote, weathershield, masonry paint, metal care, pro-Deco, wood finish, Enamels. For household chemical such as bar and toilet soap, detergent, Carex Cussons baby, imperial leather, premier, Robb, Canoe soap, morning fresh, ZIP, germicide bleach, air-fresher. For industrial chemicals such as metal and iron pretreatment, textile, auxiliaries and boiler treatment, adhesive and bond products. The activities and products of fabricating iron and steel, rubber and plastic as medium low technology-based firms include carport, canopy, metal and iron steel fabrication, Aluminum Roof and agriculture equipment fabrication, plastic production, production of ceiling and floor flex rubber tiles, fabrication of overhead and under head, water facility construction, fabrication of office cabinet. The products and business activities of the food and beverages, book printing press, branding, packaging, and farming (poultry, fish etc) as low technology-based firms among others include, beverages, drinks, fertilizer, pastas, sugar, flour, granular, branding, graphic design and salt.

Table 2 explain the descriptive statistics of dynamic capabilities across its three surrogate variables such as strategic capability, internal capability and external capability. By implication, the selected firms note the extents of their operational routine commitment from the range of 1 to 5 which implies 0-20% and 81 to 100% of implementing/committed to dynamic capabilities variables respectively. On the average, the Table 2 shows the mean value 4.52 for rapid adoption of new technology. By implication, the operational routine of the selected firms is highly dynamic because of their 80-100% commitment to rapidly adopting new technologies. Likewise developing new technologies (4.06), encouraging suggestion from employees, customers etc (4.66), encouraging policy for team work (4.73), by ensuring that

strategies are driven by the need to create customer value (4.82) and satisfaction (4.69), firm rapidly respond to the competitors' move (4.38), they retain the best staff (trade secret) (4.65) as far as possible, they anticipate future customer needs (4.70), and employ highly skilled personnel (4.47), the number of employees with M.Sc. in 2016 was increase relatively to previous year (s) (4.29), they regularly train their staff to improve their knowledge (4.59), they preserve knowledge through patent and other intellectual property right (4.55), the firms outsourced R&D to other firms (4.21), acquire patent, licenses from other firms (4.22), and they participate in the open collaboration with other firm (4.27).

The mean value of the respondents of the selected firms that had 60-80% commitment in their operational routines are the firms that have yearly budget for training of personnel (3.60), they conduct SWOT analysis of their competitors (3.74), there was increase in the number of turnkey technologies procured in 2016 relative to previous year(s) (3.89), there was increase in the number of intellectual property right applied for in 2016 relative to previous year(s) (3.41), collaborate with university and research institute for advice, training and R&D (3.22) and they deploy effective knowledge management techniques for effective talent (3.57), Some of the knowledge management techniques includes "knowledge base (knowledge base can contain text, multimedia materials, video tutorials, links to relevant third party resources, and more ), communities of practice (these are professional communities where members are united by a common activity or goal), knowledge map ( it entails the lists of experts within the organization, their respective areas of expertise, and means of contacting them), and bank of ideas (it entails the collection of ideas, best practices in the organization)". The mean value of the respondents of the selected firms with 0-20% commitment in the operational routines are collaboration with government for technical support (1.74) and financial support (1.58). The implication of Table 2 above is that the operational routine of the selected firm in terms of their strategic capabilities and internal capabilities is in the range of 81-100% commitment to their

strategic and internal capabilities, while for their external capabilities is in the range of 0-20% which means that the firm has limited or no linkage (s) with the government either for technical advice or financial support.

Table 3 shows the process and product upgrading in the selected firms. Form improvement in product technology such as technical specification, user friendliness and other functional characteristics. About 66.2% of the respondents reports that that there was an improvement in their product technology while only 33.8% of the remaining firms reports of no improvement. Out of the selected firms that have product technology improvement, 14.7% are high tech, 10.3% are medium high tech, 11.8% are medium low tech, and 29.4% are low tech. In addition, about 83.8% of the selected firms reports an improvement in the process technology such as delivery techniques, software and equipment deployed. While only 16.2% of the remaining firms shows no improvement in their process technology.

Therefore, there was an improvement in the majority of products and process technology of the selected firms. This improvement might be customer driven, competitors' driven or speculation driven.

**Table 2 Descriptive Statistics of Dynamic Capabilities Variables**

	N	Min	Max	Mean
<b>A. <u>Strategic Capability</u></b>				
<b>(i.) Technology Orientation</b>				
Our firm adopt new technology rapidly (how fast do they acquire new technology- adopting what is in the market)	71	3	5	4.52
Our firm is active in developing new technologies (how fast do they develop new technology)	69	2	5	4.06
<b>(ii.) Learning Orientation</b>				
Our firm has yearly budget for training of employee	72	2	5	3.60
Our firm encourages advice or suggestion from employees, customers, suppliers of raw materials	71	4	5	4.66
Our firm encourages policy for teamwork and information sharing	71	4	5	4.73
<b>(iii.) Market orientation</b>				
Our firm strategies are driven by the need to create customer value.	71	4	5	4.82
The objectives of our firm are driven by the need to achieve higher customer satisfaction	71	3	5	4.69
We regularly conduct SWOT analysis on our competitors	69	2	5	3.74
Our firm responds rapidly to competitor's move.	69	4	5	4.38
Our firm try as much as possible to retain her best staff/personnel (trade secret)	72	3	5	4.65
Our firm seek to anticipate future customer needs.	69	2	5	4.70
<b>(B) <u>Internal Capability</u></b>				
<b>(i.) Disembodied technologies</b>				
Our firm employed highly skilled personnel	72	3	5	4.47
Total number of employees with M.Sc. in 2016 is high	69	3	5	4.29



**Table 2 Descriptive Statistics of Dynamic Capabilities Variables (Cont.d)**

	N	Min	Max	Mean
<b>B. <u>Internal Capability</u></b>				
Our firm ensure regular training of staff to improve their knowledge	70	3	5	4.59
We train our technical staff in 2016	68	4	5	4.76
Our firm preserves knowledge through patents and other Intellectual Property Right (IPR).	66	2	5	4.55
The number of Intellectual Property Right (IPR) applied for or registered in 2016 was high	70	1	5	3.41
Our firm adopted knowledge management techniques for effective talent	69	3	5	3.57
The number of knowledge management techniques use in 2016 was high	68	2	5	3.01
<b>(ii) Embodied technologies</b>				
Numbers of turnkey technologies procured in 2016 was high	70	2	5	3.89
<b>(C) <u>External Capability</u></b>				
<b>(i.) Collaboration with other firms</b>				
Our firm outsource R &D to other firms	71	1	5	4.21
Our firm acquire patent, licenses from other firms	68	2	5	4.22
Our firm participate in open collaborative innovation with other firms.	66	2	5	4.27
<b>(ii.) Collaboration with government</b>				
Government provide financial support to our firm (Loan, tax rebates, and subsidies)	69	1	5	1.58
Government provide technical support to our firm (Advice, training and infrastructure)	68	1	5	1.74
<b>(iii.) Collaboration with Research institute/University</b>				
University/research institute provide technical support to our firm (Advice, training and R&D)	68	1	5	3.22
Valid N (listwise)	39			

**Legend: Min = Minimum, Max = Maximum; Scale: Minimum = 1 and Maximum = 5**

**Table 3 From 2014 to 2016, did you notice any improvement in your Product and Process Technology**

Improvement in Product technology (Technical specification, user friendliness and other functional characteristics our firm)	Class of the Knowledge-based Firm				Total
	Low Tech	Medium Low Tech	Medium High Tech	High Tech	
No improvement	14(20.6%)	4(5.9%)	1(1.5%)	4(5.9%)	23(33.8%)
There was an improvement	20(29.4%)	8(11.8%)	7(10.3%)	10(14.7%)	45(66.2%)
<b>Total</b>	<b>34(50.0%)</b>	<b>12(17.6%)</b>	<b>8(11.8%)</b>	<b>14(20.6%)</b>	<b>68(100.0%)</b>
Improvement in Process technology (delivery techniques, software and equipment deployed)					
No improvement	3(4.4%)	2(2.9%)	-	6(8.8%)	11(16.2%)
There was an improvement	31(45.6%)	10(14.7%)	8(11.8%)	8(11.8%)	57(83.8%)
<b>Total</b>	<b>34(50.0%)</b>	<b>12(17.6%)</b>	<b>8(11.8%)</b>	<b>14(20.6%)</b>	<b>68(100.0%)</b>

**Determine the effects of dynamic capabilities on technology upgrading in the firms**

Table 4 shows that nine (9) variables extracted with the aid of factor analysis shows 77.283% cumulative factor loading of the extracted variables. Therefore, 77.3% variation in the dynamic capabilities variables was explained by the extracted variables.

**Table 4 Total variance explained in the Dynamic capabilities****Factor Analysis**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.194	18.550	18.550	5.194	18.550	18.550	3.151	11.253	11.253
2	3.559	12.709	31.260	3.559	12.709	31.260	2.989	10.675	21.927
3	2.736	9.772	41.032	2.736	9.772	41.032	2.740	9.784	31.711
4	2.372	8.471	49.503	2.372	8.471	49.503	2.662	9.507	41.219
5	2.091	7.468	56.971	2.091	7.468	56.971	2.454	8.766	49.984
6	1.743	6.226	63.197	1.743	6.226	63.197	2.204	7.870	57.854
7	1.566	5.594	68.791	1.566	5.594	68.791	1.958	6.993	64.847
8	1.237	4.416	73.207	1.237	4.416	73.207	1.816	6.486	71.333
9	1.141	4.076	77.283	1.141	4.076	77.283	1.666	5.950	77.283
10	.901	3.219	80.503						
11	.859	3.068	83.571						
12	.743	2.654	86.225						
13	.684	2.443	88.668						
14	.630	2.251	90.919						
15	.529	1.890	92.809						
16	.394	1.408	94.217						
17	.356	1.272	95.489						
18	.299	1.069	96.558						
19	.239	.853	97.411						
20	.189	.674	98.085						
21	.148	.528	98.614						
22	.124	.445	99.058						
23	.103	.367	99.425						
24	.082	.292	99.717						
25	.048	.172	99.888						
26	.020	.073	99.961						
27	.008	.029	99.990						
28	.003	.010	100.000						

Extraction Method: Principal Component Analysis.

**Table 5 The variables extracted for Dynamic Capabilities**

	Rotated Component Matrix <sup>a</sup>								
	Component								
	1	2	3	4	5	6	7	8	9
Our firm adopt new technology rapidly (how fast do they acquire new technology- adopting what is in the market)	.153	.167	.300	.247	-.549	-.240	.011	.113	-.037
Our firm is active in developing new technologies (how fast do they develop new technology)	.203	.041	-.184	.184	-.247	-.527	.146	.048	.471
Our firm has yearly budget for training of employee	.032	.820	.061	-.014	-.190	-.051	.002	-.068	-.008
Our firm encourages advice or suggestion from employees, customers, suppliers of raw materials	.814	.150	-.265	-.039	.125	.105	-.072	-.062	-.083
Our firm encourages policy for teamwork and information sharing	.194	.042	.546	.222	-.235	.433	-.459	-.072	.041
Our firm strategies are driven by the need to create customer value.	.013	-.028	.834	-.020	-.084	.019	-.027	-.320	-.039
The objectives of our firm are driven by the need to achieve higher customer satisfaction	.843	-.013	.082	.004	-.099	-.140	-.032	.108	-.085
We regularly conduct SWOT analysis on our competitors	.662	-.193	-.278	-.160	.007	.088	-.106	.045	.418
Our firm responds rapidly to competitor's move.	.038	.714	-.038	.173	.063	-.121	.094	.246	.342
Our firm try as much as possible to retain her best staff/personnel (trade secret)	.608	-.268	.328	.102	.059	.187	-.085	-.405	-.167
Our firm seek to anticipate future customer needs.	.200	-.100	-.029	-.013	-.086	-.110	-.173	-.026	-.849
Our firm employed highly skilled personnel	-.431	.587	.290	.327	.194	.084	-.033	-.227	-.024
Total number of employees with M.Sc. in 2016 is high	.108	.517	-.464	.309	.428	-.063	-.008	.077	-.224
Percentage/ratio of technical staff relative to total workforce is high	-.186	.317	.653	-.345	.142	.259	.155	.120	-.064
Our firm ensure regular training of staff to improve their knowledge	-.283	-.095	.709	-.303	.137	-.038	-.223	.324	.059
We train our technical staff in 2016	.092	.006	.009	-.011	.024	.187	-.847	.076	-.158
Our firm preserves knowledge through patents and other Intellectual Property Right (IPR).	-.118	-.043	-.085	.882	.142	.086	.059	.189	.009
The number of Intellectual Property Right (IPR) applied for or registered in 2016 was high	-.131	.435	-.056	.193	.413	-.679	-.070	.009	-.063
Our firm adopted knowledge management techniques for effective talent	-.266	-.027	-.208	.519	-.437	-.311	.092	-.210	.153
The number of knowledge management techniques use in 2016 was high	-.095	.025	.028	-.223	.025	-.073	.024	-.765	-.055
Our firm procure turnkey technologies (machineries and equipment that is ready for use)	-.333	.041	-.087	.275	.311	.237	.457	.421	.088
Numbers of turnkey technologies procured in 2016 was high	.049	.270	-.096	.801	.093	.054	.009	.071	.040
Our firm outsource R &D to other firms	-.457	.519	-.037	.025	.118	.366	.373	.151	.119
Our firm acquire patent, licenses from other firms	-.198	.445	-.060	-.229	.093	-.036	.292	.531	-.094
Our firm participate in open collaborative innovation with other firms.	.017	.390	-.110	.132	.224	.174	.571	.313	.003
Government provide financial support to our firm (Loan, tax rebates, and subsidies)	.171	.148	.181	.168	.645	-.011	-.116	.035	.475
Government provide technical support to our firm (Advice, training and infrastructure)	-.033	-.012	.016	.202	.826	.002	.270	.060	-.032
University/research institute provide technical support to our firm (Advice, training and R&D)	.008	.057	.055	.212	.189	.817	-.080	.098	.107

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 13 iterations.

Table 5 shows the component factor loading of the extracted variables. For instance, firm has yearly budget for training of employee (820), firm strategies are driven by the need to create customer value (834), objectives of our firm are driven by the need to achieve higher customer satisfaction (843), firm preserves knowledge through patents and other Intellectual Property Right (IPR) (882), firm acquire patent, licenses from other firms (531), firm participate in open collaborative innovation with other firms (571), Government provide financial support to our firm (Loan, tax rebates, and subsidies (475), Government provide technical support to our firm (Advice, training and infrastructure) (826), and University/research institute provide technical support to our firm (Advice, training and R&D) (817).

Table 6 shows that between 28.4 and 48.2% of the variation in the process technology upgrading can be explained by the model in block 1 (see Omnibus Tests of Model Coefficients). Furthermore, the correct classification rate has reduced by 9.8% to 87.8%. From the table of variables in the Equation, coefficients of ECCURI (1.370), ECCfirms2 (1.326) and the Exp(B) of the selected variables implies that firms with ECCURI (have collaboration with university/research institute for support such as advice, training and R&D) are 3.935 more likely to upgrade their process technology. Also, firms with ECCfirms2 (that acquire patent, licenses from other firms) are 3.765 more likely to upgrade their process technology.

Table 7 shows that between 10 and 13.6% of the variation in the product technology upgrading can be explained by the model in block 1 (see Omnibus Tests of Model Coefficients). Furthermore, the correct classification rate has reduced by 23.4% to 58.7%. From the table of variables in the Equation, coefficients of ECCGov1 (1.314) and the Exp(B) of the selected variables implies that firms with ECCGov1 (have collaboration with Government for financial support such as loan, tax rebates and subsidies) are 1.314 more likely to upgrade their product technology.

**Table 6** **Binary Logistic Regression for Dynamic Capabilities and Process Technology Upgrading**

Omnibus Tests of Model Coefficients				Model Summary				
		Chi-square	df	Sig.	Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
Step 1	Step	16.392	9	.059	1	27.222 <sup>a</sup>	.284	.482
	Block	16.392	9	.059				
	Model	16.392	9	.059				

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Classification Table <sup>a</sup>					
	Observed	Predicted			Percentage Correct
		From 2014 to 2016, did you notice any improvement in your Process technology (improvement in the delivery techniques, software and equipment deployed by our firm)			
		No improvement	There was an improvement		
Step 1	From 2014 to 2016, did you notice any improvement in your Process technology (improvement in the delivery techniques, software and equipment deployed by our firm)	No improvement	3	5	37.5
	There was an improvement	1	40	97.6	
Overall Percentage					87.8

a. The cut value is .500

Variables in the Equation							
	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 1 <sup>a</sup>	SCLO1	.728	.574	1.605	1	.205	2.071
	SCMO1customer1	-20.501	17782.923	.000	1	.999	.000
	SCMO2customer2	-.511	1.246	.168	1	.682	.600
	ICFC1	-1.390	1.238	1.260	1	.262	.249
	ECCfirms2	1.326	.764	3.009	1	.083	3.765
	ECCfirms3	-.393	.858	.210	1	.647	.675
	ECCGov1	-.681	1.347	.255	1	.613	.506
	ECCGov2	-.808	1.113	.528	1	.468	.446
	ECCURI	1.370	.674	4.131	1	.042	3.935
	Constant	104.801	88914.615	.000	1	.999	3.268E+045

a. Variable(s) entered on step 1: SCLO1, SCMO1customer1, SCMO2customer2, ICFC1, ECCfirms2, ECCfirms3, ECCGov1, ECCGov2, ECCURI.

### LEGEND

**SCLO1**, = Yearly budget for employee training

**SCMO1customer1**, = firm strategies are driven by the need to create customer value

**SCMO2customer2**, = objectives of firm are driven by the need to achieve higher customer satisfaction

**ICFC1**, = firm preserves knowledge through patents and other Intellectual Property Right (IPR)

**ECCfirms2**, = firm acquire patent, licenses from other firms

**ECCfirms3**, = firm participate in open collaborative innovation with other firms

**ECCGov1**, = Government provide financial support to our firm (Loan, tax rebates, and subsidies)

**ECCGov2**, = Government provide technical support to our firm (Advice, training and infrastructure)

**ECCURI** = University/research institute provide technical support to our firm (Advice, training and R&D)

**Table 7** **Binary Logistic Regression for Dynamic Capabilities and Product Technology Upgrading**

	Chi-square	df	Sig.
Step	4.847	9	.847
Step 1 Block	4.847	9	.847
Model	4.847	9	.847

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	56.731 <sup>a</sup>	.100	.136

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

	Observed	Predicted			
		From 2014 to 2016, did you notice any improvement in your Product technology (Technical specification, user friendliness and other functional characteristics our firm)		Percentage Correct	
		No improvement	There was an improvement		
Step 1	From 2014 to 2016, did you notice any improvement in your Product technology (Technical specification, user friendliness and other functional characteristics our firm)	No improvement	4	14	22.2
		There was an improvement	5	23	82.1
	Overall Percentage				58.7

a. The cut value is .500

	B	S.E.	Wald	df	Sig.	Exp(B)
SCLO1	.141	.329	.184	1	.668	1.152

**LEGEND:**

**SCLO1**, = Yearly budget for employee training

**SCMO1customer1**, = firm strategies are driven by the need to create customer value

**SCMO2customer2**, = objectives of firm are driven by the need to achieve higher customer satisfaction

**ICFC1**, = firm preserves knowledge through patents and other Intellectual Property Right (IPR)

**ECCfirms2**, = firm acquire patent, licenses from other firms

**ECCfirms3**, = firm participate in open collaborative innovation with other firms

**ECCGov1**, = Government provide financial support to our firm (Loan, tax rebates, and subsidies)

**ECCGov2**, = Government provide technical support to our firm (Advice, training and infrastructure)

**ECCURI** = University/research institute provide technical support to our firm (Advice, training and R&D)

## **V. Summary and Conclusion**

The study shows that majority of the respondents from the selected firms are male, and most of the respondents have M.Sc./M.BA/M.Pharm and their firms are mostly situated in Lagos state. The products and activities of the selected firms varies based on their class of knowledge-based such as high tech, medium high-tech, medium low-tech and low-tech firms. The study shows that the selected firms are more committed in their strategic, internal and external operational routine except collaboration with government for either technical or financial support. This shows that they are not inclusive in industrial policy design by Government. Furthermore, most of the selected firms improve both their product and process technology upgrading. Furthermore, firms that have collaboration with University/research institute for technical support (advice, training and R&D) and acquire patent, licenses from other firms are more likely to upgrade their process technology. Also, firms that have collaboration with Government for financial support (Loan, tax rebates, and subsidies) are more likely to upgrade their product technology.

## **VI Recommendation**

The study recommends that firms should collaborate with Government for inclusive industrial policy design. Not only that but also collaborate with university/research institute for technical support and acquire patent and licenses from other firms.

## **VII Further studies**

- (a) Number of firms selected is small, further studies should consider larger sample size



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Dine tankevækkende kommentarer kan gøre dette arbejdsdokument bedre. Tak skal du have.

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