

The Technological impacts in Outsourcing Practices in Nigerian Oil and Gas Industry

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1. Introduction

Outsourcing is seen as an essential component of firm's competitiveness in new global business world (Broedner et al., 2009). Today companies compete not only on the basis of profit, product, service, and operational superiority, but also to enhanced management of their corporate memory and intellectual assets. Companies are beginning to realize their edge lies in how they manage the efficient flow and transfer of knowledge across the organisations. They see technology as a panacea for all knowledge management (Christy Silver, 2006).

A good example is the rise in 3D printing, also known as additive manufacturing technologies, which provides firms with opportunity of reconfiguring supply chains by bringing manufacturing closer to home and hence shortening or virtually eliminating lead times (Berman 2012; Mellor, et al., 2014; Weller et al., 2015).

Technology, according to Manufacturing and Logistics IT special report (June, 20015), now offers direct communication with suppliers via EDI and can align production/distribution schedules. The report also suggested that these solutions can enable Demand Sensing and Demand Shaping techniques that flow downstream from raw material intake through the production schedule and to distribution. "This means that, if supply chain is an oil pipeline, these demand techniques are the grease that keeps it from flowing." More so, integrated EDI appears to be a potential support and foundation for cost transparency along the supply chain (Yahaya and David, 1998).

Furthermore, breakthrough in technology increases the search and demand for liquid hydrocarbon especially in developing countries. The surge in consumption of liquid hydrocarbon in developing countries centres more in the transportation industry which is undergoing rapid growth and is also further encouraged by the industrial sector, in particular, the petrochemical industry (Lukoil, 2013). Thus, this will enhance the chain of activities in the extraction and transformation of crude oil into final petroleum products which also provides the avenues for endogenous technological acquisitions. More so, the use of technology to extracts the by-products of oil and gas resources in different activities reinforces the learning-by- doing and R&D Stimuli for generating endogenous economics growth (Musa Jega, 2000). In contrast, Nigeria is still at its rudimentary stage, both in economic and oil technological development.

After Nigeria's independence in 1960, the indigenous Government opened up the oil industry by giving exploratory rights in onshore and offshore areas of the Niger Delta to Mobil, Agip, Safrap (now Elf), Tenneco (now Texaco) and Amoseas (now Chevron). This act divested Shell of its monopoly status, though it was and still the largest international oil company operating in Nigeria. As more companies joined in the production, Nigeria's oil production rose to a peak of 2.4million barrel per day in 1970, thereby making Nigeria a major oil producing nation, and ranking 7th in the world. Crude Oil production for 2012 averaged 2.27million barrel per day (NEITI, 2012).

Even though, Nigeria is still ranked seventh among the oil and gas nations in the world and number one in Africa (see figure 1), oil and gas expert believed that Nigerian could even earn more from full utilization of gas resources with sound investment policy. Nigeria currently, has four refineries (Port Harcourt 1 and 11, Warri and Kaduna) with a total installed capacity of 450,000 barrels per day (bpd); Petrochemical industry at Eleme and the Nigerian Liquefied Natural Gas (NLNG) Project.

Therefore, this study has examined the current state of Nigerian oil and gas outsourcing practices and the impacts of technology within the industry. The following sections of this paper will also include the literature review, analysis and discussion. The paper ends with conclusions drawn from the study.

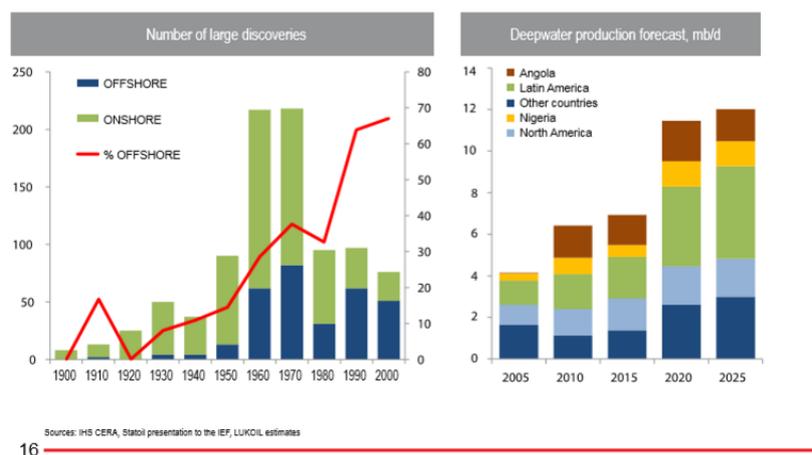


Figure 1.
Nigerian global
Deepwater forecast

2. Literature review

Outsourcing Practices

Although the concept of outsourcing was used by manufacturing executives in the late 1970s (Corbett, 2004), it was only a decade later that the term was officially introduced. Yet, another decade later it was already referred to by Harvard Business Review as one of the great management ideas of the past century (Sibbet, 1997).

Outsourcing practice has increasingly become an important strategy that can significantly assist organisations to leverage their skills and resources to achieve greater competitiveness (Quinn and Hilmer, 1994; Welson, 1996). Since the birth of the practice, several research streams have taken their interest in the phenomenon of outsourcing. Markell et al., (2005) have identified three streams in literature, which relate to the strategy of outsourcing. These three, however, have their own specific characteristics: strategic management literature, supply chain literature and international business (IB) literature.

Several researchers have also analysed the drivers of outsourcing, both from a theoretical perspective (Trunick, 1989; Quinn and Hilmer, 1994; Razzaque and Sheng, 1998; Lankford and Parsa, 1999; Kakabadse and Kakabadse, 2000; Jennings, 2002; Lynch, 2004) and from a practical point of view using case studies and surveys as empirical data. The authors based their analysis within the developed countries, such as US, UK, Australia, and New Zealand (Corbett, 1998; Fan, 2000; Bolumole, 2001; McIvor, 2003; Beaumont and Sohal, 2004). The results showed that many drivers are unique to specific geography and industries and explained some common factors that motivate organisational outsourcing practices such as cost structure, collaborative partnership, and market forces. The authors overlooked other major drivers of outsourcing, including technological capabilities as listed in figure 3, which perhaps is the key driver in outsourcing decisions. The researchers also excluded developing economies which is a major gap that this study investigated and validated in the discussion sections.

Outsourcing is viewed as the process of establishing and managing a contractual relationship with external supplier for the provision of capacity that has previously been provided in-house (Momme, 2002). Others viewed it a potential benefit of disadvantage and risk confronting with transaction cost (Lacity and Willcocks, 1995). Batoul Modarress, (2016), also claimed that all these perspectives focused on outsourcing process in discrete manufacturing and not in oil and gas oriented industries. This paper shared the author's argument but employed different approached as regards methodology and empirical data used in the analysis. For example, the author focused on collection of replies through interview and secondary data as empirical materials. But this paper used mixed method involving primary data from questionnaire and semi-structure interview as empirical data. More so, Modarress, (2016), addresses the driver of outsourcing from the shareholder's perspective of cost reductions, while this paper addressed it from the technology development perspective. Furthermore, the researcher adopted transactional cost theory while this research deployed the theory of resource base view (RBV) of comparative advantage.

2.1 Impacts of technology on oil and gas industry

Christy Silver (2000), has argued that because companies are facing similar challenges to retain knowledge, experience, and intuition of its top designers, knowledge management is quickly gaining recognition among executives as a key determinant of value in the market place, organisational success and competitive edge. The author emphasised that in response to this knowledge evolution, most companies look for quick solution and more often than not turn to technology. This study strongly supports this argument and explored it in the respondent's questionnaire and semi-structure interview.

In addition, technological development has helped oil drilling companies to exceed the depth of their offshore field to about 3,000m, despite the high cost of operation and operating risks (Lukoil, 2013). According to International Energy Agency's chief economist, Faith Birol, the global investment in upstream oil production in 2015 has decline by almost 20 percent to settle at \$100 billion. Some of the key challenges that industry face includes: the right equipment to be applied in a particular oil field/well discovery, appropriate production systems and structures, the availability of technological base to carry out the project economically. In some cases, new technologies needed to develop to extract the resources (Bruno Santos, 2009).

In June 2013, the UK Government commissioned a report, led by Aberdeen oil tycoon Sir Ian Wood. One of the key area identified by the wood report is technology development. He emphasised that commercial pressures dictate that industry wants quick, smarter and sustainable methods of getting fuel safely out of the ground. The researcher therefore, has explored this gap and used the above similar approach in the context of Nigerian situation and has made an interesting revelation as shown in the discussion sections (see figure 3 and 5)

Most studies have focused on technological development in oil and gas upstream and downstream supply chain management. Sea (1993) was probably the first to address the supply chain management in the context of an oil company. The author developed a linear programming network model for planning the logistics of a downstream oil company (Sergio et al., 2000). The main weakness of this theories was that it failed to address the activities within the offshore upstream planning of the oil fields. Nevertheless, Van den Heever, (2004) investigated this weakness and addressed the design and planning of offshore oilfield infrastructure focusing on business rules.

3. Conceptual model and theory

Conceptual model creates a balance between inductive and deductive reasoning and research (see figure 2). In this paper, we developed what Meredith (1993, p.7) cited in Craig, R et al., (2008), refers as a conceptual framework – “a collection of two or more interrelated propositions which explain and provide an understanding, or suggest testable hypothesis”. The researcher investigated and explained the relationship between the technology and outsourcing and their impact on performance.

The conceptual model explained the association between the technology and outsourcing and the impacts on performance. It has been established in literature that more efficient technological firms perform better than less technological firm and also more outsourcing firms out-performed the less outsourcing firms. For example, in a survey covering over 700 organisations of UK, USA, and continental Europe spanning diverse sectors like Financial service, Telecom, Pharmaceuticals, etc., it was found that cost was losing out to the other prominent drivers, like the desire to access new technology, capability and best practices (also see evidence in figure 6). Another example was the experience of Nike and Reebok, which focus on design and marketing of footwear, their core-competence, while outsourcing manufacturing activities (Sankalp Pratap, 2014). Therefore, what is new is the association between the technology and outsourcing in driving performance. The researcher investigated and explained the relationship between the technology and outsourcing and their impact on performance using two propositions to address this new concept and the research objectives of this study.

The theory used in this paper to examine the impacts of technology in Nigerian oil and gas industry is resource-based view (RBV) model of competitive advantage which suggest that competitive advantage may be sustained by harnessing resources that are available, rare, imperfectly limited, and valuable (Barney, 1991). Firms resources have been defined as all assets, capability, organisational processes, attributes, information, and knowledge controlled by enterprise that enable the firm to conceive and implement strategies with goal to improve its efficiency and effectiveness (competitiveness) (Barney, 199; Daft, 1983).

Conceptual framework

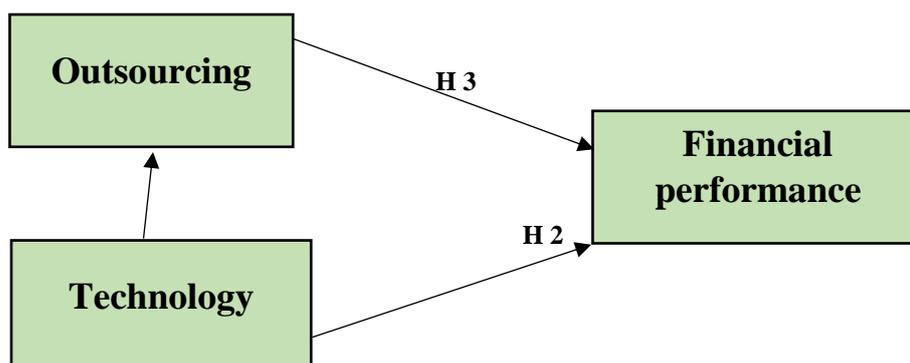


Fig. 2

This theory also identifies three basic distinctive technological capabilities – Corporate architecture, Innovation and Reputation. Corporate architecture explains the capability of organisation to promote organisational knowledge and achievement of a transparent and easy flow of information. Innovation explains the aspect of exploitation of new ideas by incorporating new technology and innovation through cooperation and collaboration with partner and reputation addresses the capacity to instil confidence and responsibility as an assets and knowledge (Lysons and Farrington, 2012).

Focus of Tests	Cronbach's Alpha	Number of Items
Demographic data	.656	3
Technology deployed	.799	5
Performance Measurement	.613	4
Outsourcing Drivers	.683	4
Outsourcing challenges	.648	4
Collaboration and Relationship	.631	5

Table 1.
Reliability
Cronbach's Alpha
coefficient

Table 2. Two – wave Analysis of External Validity

	First 50% (mean score)	Last 50% (mean score)	Two-tail Significant
Turnover	3.220	3.290	0.931 0.931
Major line of products and activities	5.561	3.570	0.229 0.229
Number of employees	2.617	2.710	0.865 0.865
Types of companies	3.090	2.610	0.989 0.989

4. Methodology
Problem statement
and data collection

Table 3. Response Rates across Business Sector

Business sector/Major product line	Sample	Rate %	Response	Rate %
Exploration and production	33	33.0	28	23.3
Base logistics	19	19.0	15	12.5
Geographical services	3	3.0	3	2.5
Oil services and operations	2	2.0	2	1.6
Engineering service	5	5.0	4	3.3
Maritime, Transport and allied services	2	2.0	2	1.6
Electrical and Electronic Equipment	6	6.0	5	4.2
Offshore construction and Maintenance	7	7.0	6	5.0
Transport, storage and communication	16	16.0	13	10.8
Construction, operation and landing services	3	3.0	2	1.7
Procurement and Equipment	4	4.0	3	2.5
Others (invalid samples)	20	-	-	-
Total	120	100	83	69.1

To examine the impacts of technology in outsourcing practice in Nigerian oil and gas industry, the researcher adopted a mixed method research, a combination of questionnaire and semi-structure interview. The data collected provides cross-sectional study of 200 oil and gas companies with operations managers, senior managers and supply chain experts as the respondents. We have asked the respondents to provide their perceptions on how technological capabilities have impacted and drive their organisational outsourcing practices and performance. Part of these questionnaire questions were advance from the literature and conceptual framework. The researcher collected 120 samples and valid 100 samples were analysed using SPSS Version 21 for window, showing a 60% response rate (See table 3). The sampled companies are a combinations of small, medium and large enterprises and the respondents selected for interviews include senior level managers. Subsequently, the survey questionnaire

results will enable the researcher in developing a framework for selecting specific companies and the interview questions that would be used for the interview in the second phase of the research. This second phase will be used to complement the survey by questionnaire; the study will also serve in exploring and validating the survey results which to a greater extent will solve the methodological issues which mix-method research seeks to address. Interview with managers will be performed by following a set of semi-structured questions. The answers will be recoded, transcribed, validated with the respondents and consequently analysed.

Measurement model fit

Empirically, the soundness of the model was first ensured by construct validity which consisted of checking for convergent and discriminant validity as well as by reliability for internal consistency. The reliability test was conducted focusing on major constructs and Cronbach's Alpha ranges = 0.613 to 0.799 (see Table 1). The results of the wave analysis to test external validity of the questionnaire are shown in Table 2. In order to obtain these results, a date was noted against every complete questionnaire returned. The first 50 per cent was then compared to the last half using company size, measured by both the number of employees and sales annual turnover, the company's types, and the major line of products/activities. The null hypothesis is that there is no difference between the mean values of the two groups, while the alternate hypothesis states that there is difference between the two groups. The tail significance is greater than 0.1 for all the measures considered. It can be seen from table 2 that the null hypothesis – there is no difference between the mean values of the two groups – cannot be rejected.

Variables	Types of companies				
	Sole proprietorsh	Partnershin	Public limited	Private company	Unlimited company
Technology for ordering and procurement	3	1	1	5	1
Technology used in information sharing	0	7	4	0	0
Technology that impacted in design changes and maintenance	2	2	8	8	2
Production process innovation technology	1	5	10	6	1
Logistics operations technology	11	6	6	7	3

Table 4.
Technology deployed:
Types of companies

Table 5. Cross – tabulation of deployed technology by outsourcing operations

Variables	Outsourcing Drivers							
	Cost reduction	Core competence	Increase flexibility	Organisational	Market shares	Information sharing	Technology development	Risk sharing
Technology for ordering and procurement	1	1	0	0	1	3	3	2
Technology for information sharing	0	1	0	1	2	0	7	0
Technology for design changes and maintenance	9	0	1	1	0	1	7	3
Production process innovation technology	1	2	2	3	4	1	10	0
Logistics operations technology	7	3	1	5	4	6	5	2

Two questions were advanced from the literature and conceptual model, with special emphasis on the Nigerian oil and gas industry clusters. Table 6 showed the demographic characteristics and business activities of the companies sampled. Q1. To what extent does technological adaptation the major drivers of outsourcing practice and performance in your company? Q2. Do you agree that technological capabilities influence your organisation's outsourcing decision?

	Percentage
Sales turnover	
Less than 50M	28.00
51M – 100M	10.00
101M – 250M	19.00
251M – 500M	13.00
500M – 1B	22.00
Above 1B	8.00
Number of employer	27.00
Up to 50	26.00
51 – 250	19.00
251 - 550	17.00
551 - 2500	11.00
Above 3000	
Major Line of products and activities	33.00
Exploration and production	19.00
Base Logistics	3.00
Geographic services	2.00
Oil services and operation	5.00
Engineering service	2.00
Maritime, transport and allied services	6.00
Electrical and Electronics equipment	7.00
Offshore construction and maintenance	16.00
Transport, storage and communication	3.00
Construction, operations and landing facilities	4.00
Procurement and equipment supplier	

Table 6.
Demographic
characteristic data

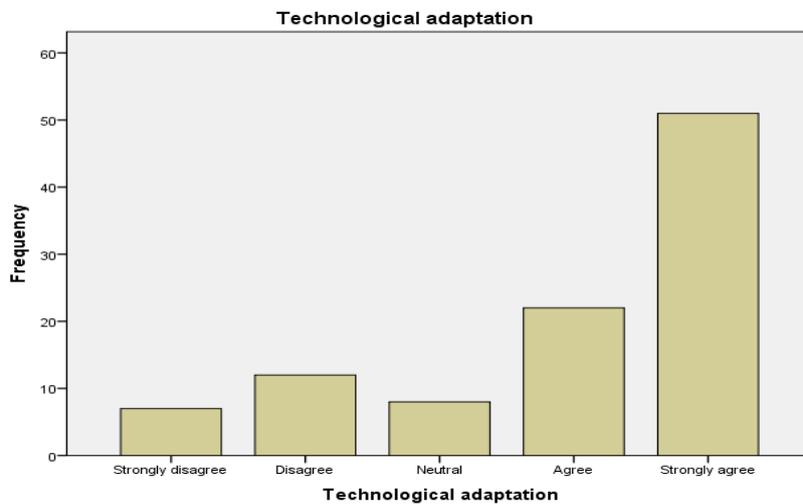


Fig 3.

Table 7. Measure of financial performance and level of technology deployed.

Variables	Financial performance			
	Annual turnover	Market shares	Return on investment	Corporate social responsibility
Technology for ordering and procurement	3	6	0	2
Technology used in information sharing	7	0	1	3
Technology that impacts in design changes and maintenance	8	7	2	5
Production process innovation technology	9	7	1	6
Logistics operations technology	8	7	8	10

5. RESULTS AND ANALYSIS

Hundred questionnaires (100) were analysed out of 120 questionnaires collected, showing 60% response rate. The Participants were asked to rank all the outsourcing drivers in terms of strongly agree, agree, neutral, disagree and strongly disagreed as outline in figure 3. In answering question Q1; An overwhelming majority of the respondents (51%) strongly agreed (see figure 3) that technology adaptation drives their outsourcing practices. Also when compared statistical median results of all the drivers, technological adaptation has the highest median value of 5.00. More importantly, when compare technological adaptation with its rival - cost reduction, technological adaptation has a median value of 5.00 while cost reduction has median value of 2.00. Table 4, 5, 7, 8, and 9 explained in detail the statistical and descriptive analysis of the relationship between different variables. The Null hypothesis was carried out to determine the relationship between the level of technology deployed and outsourcing drivers (see table 5). The result showed a significant difference between the variables since the p-value is < 0.05 . However, the researcher went further to determine the regression causal relationship of the constructs - and obtained R square value of .032. But when other variables were included, the R square value increased to .055. Also table 5, shows a chi -square test result of .037, demonstrating a significant positive association of deployed technology and outsourcing drivers of operations. Table 7 measured the association of technology deployed and financial performance with R Square value of .026. The chi-square test shows significant of 0.044, showing a positive relationship between the financial performance and the level of technology deployed.

Table 8. Outsourcing challenges by performance measurement

Variables	Financial performance			
	Annual turnover	Market shares	Return on investment	Corporate social responsibility
Inappropriate Infrastructure	8	5	2	11
Lack of expertise/unskilled employees	3	4	7	6
Local Contents issues	9	9	2	3
Quality issues	6	2	0	6

The researcher also went further to determine the significant level of association of technology deployed and companies size. The two constructs show a positive association at chi- square significant level of 0.004 (see table 4). In table 7, the study explains the measure of association between outsourcing challenges and financial performance. The chi -square test results shows a significant value of 0.002, indicating positive relationship between the two constructs. The analysis results include a positive association of outsourcing drivers and the financial performance of the organisation (see table 9). Table 10 results demonstrate the significant relationship between variables of outsourcing operations and annual turnover of the organisation (see table 9).

Table 9. Outsourcing Drivers by Company's Performance

	Financial performance			
	Annual return	Market shares	Return on investment	Corporate social responsibility
Cost reduction	5	4	3	6
Core competence	3	1	1	2
Increase flexibility	2	1	1	0
Organisational performance	0	4	2	0
Market shares	7	2	2	0
Information sharing	5	4	0	2
Technological development	10	9	2	11
Risk sharing	3	2	1	1

Table 10. Drivers of outsourcing by Company Size

Variables	Annual turnover					
	Less than 50m	51m – 100m	101m – 250m	251m -500m	501m-1b	Above -1b
Cost reduction	6	1	3	1	5	2
Core competence	1	1	2	1	2	0
Increase flexibility	0	1	2	0	1	0
Organisational performance	2	2	3	0	3	0
Market shares	3	1	1	2	3	1
Information sharing	6	1	0	2	2	0
Technological adaptation	7	3	8	3	6	5
Risk sharing	3	0	0	4	0	0

6. Discussion and conclusion

The analysed results showed that small enterprise in terms of employee numbers and sales turnover have the highest (27.1% and 28% respectively). In major line of activities, the exploration and production, base logistics and transport took the lead (see table 6). The results show that there are more small and medium enterprise within the Nigerian oil and gas clusters, both in Upstream and downstream sector. The discussion also follows a major agreement among the senior level manager from small, medium and large enterprise that in their outsourcing operations, technology plays a key role which enhances performance (see figure 3). The study also shows that there are evidences of relationship and association between outsourcing and technology, technology and performance, outsourcing and performance, technology deployed and types of companies, outsourcing challenges and financial performance (table 4, 5, 7, 8, 9 and 10). These demonstration of evidence also validated the conceptual model proposition that technology could play the role of an enabler in driving outsourcing to better organisation performance and effectiveness. This awareness is key now that there is a strong demand from the industry for improving its performance towards a path to reaching an even higher success rate (Sara Haji-Kazemi, 2013). Managers can use this technology-based tools to understand the critical issues and importance of TM and SAP. Most researchers like, Prunedu and Bagchi (2016), have argued that next-generation technology, leading-edge technology, and new practice technology are helping firms to achieve financial gains and improve financial performance. This study has further validated this claim by demonstrating an empirical strong link and relationship within the financial measurement construct, technology construct and outsourcing variables (see figure 4).

Fig. 4

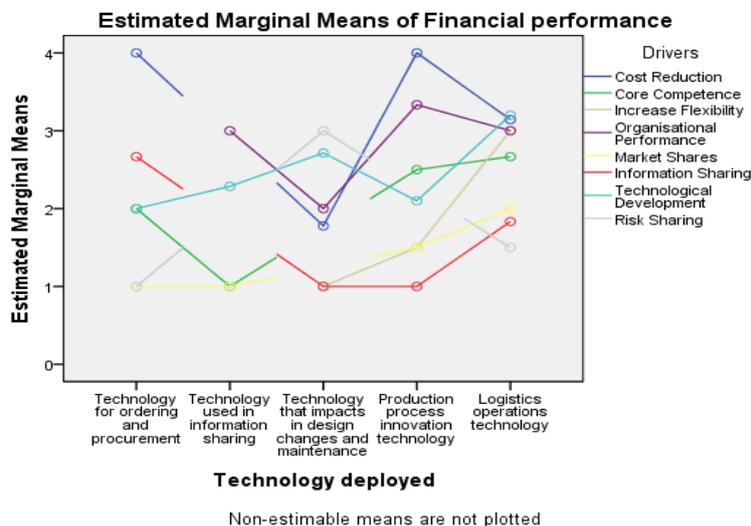
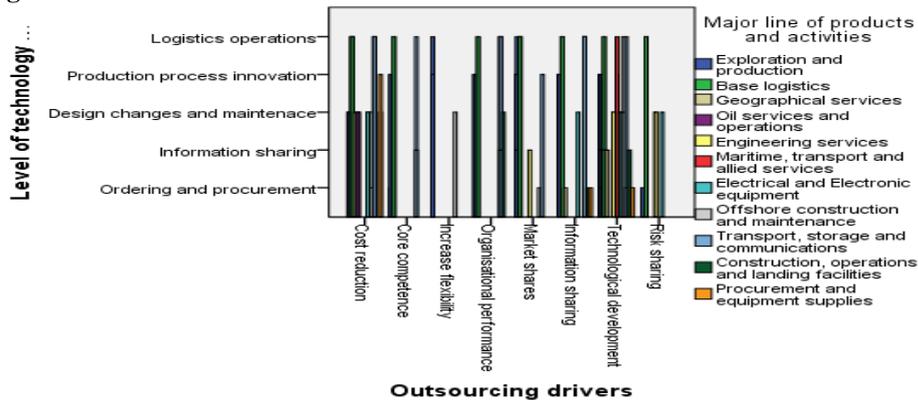


Fig. 5



Therefore, oil and gas industry needs to find a way to share expertise so that the important core knowledge is not lost but fostered internally and externally and adapted to embrace new evolving industry challenges across supply chain. What this finding also means is that companies within the oil and gas clusters can form outsourcing collaboration or alliance with the larger firms and this will offer the smaller companies the opportunity to adapt and imitate the technological capabilities of the multinationals. Indigenous firms that acquired these technological capabilities or home-grown innovation can also leverage them in attracting contracts through outsourcing operations. Clearly, offshore outsourcing presents many opportunities that are not available domestically in most developing oil and gas economies. It could create both new opportunities and often mitigate the nature of risks and hazards, which may limit a firm's prospects (Lisa Ellram et al., 2008).

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