INDUSTRIAL CLUSTERS AND INDUSTRIALISATION IN NIGERIA: A Micro-Assessment of the Nnewi Automotive Component Industrial Cluster, Anambra State[6]

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ABSTRACT

The Nigerian industrial sector performance has remained far from impressive despite efforts to advance it. Industrial clusters have however thrived in the face of deindustrialisation in the country. This study probes the link between cluster-based policy and industrialisation adopting Nnewi Automotive Component Industrial Cluster as the case study. A sample of 195 firms drawn from manufacturing, trade and services firms in the cluster were utilised. In addition to the descriptive analysis, micro-level cluster information identified from literature was estimated using binary and ordinal logistics regression techniques. Findings indentify significant determinants of internationalisation, collaboration and innovation in the cluster that have guaranteed its collective efficiency and sustenance. The study posits that the cluster concept is capable of transforming the fortunes of the sector if properly mainstreamed into industrial policy.

JEL classification: L14, L22, L60, O14

1. Introduction

THE relevance of industrialization is enormous for developed and developing countries alike. Industrialization generally raises productivity, creates employment, reduces exposure to risk, enhances income-generating assets of the poor and helps diversify exports (Iwuagwu, 2011). In Nigeria, the quest for industrialization to facilitate economic development has remained a focal issue of

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successive administrations in Nigeria since independence (Ekpo, 2004; Adamu and Iyoha, 2015). This is demonstrated by the multiplicity of industrial policies and strategies, initiated and implemented by the country over the period. Beyond this, successive governments (including the present) seem unable to exploit the critical role of industry in economic development. This is exemplified by the country's continuous reliance on petrodollar (now increasingly becoming unreliable) and the chequered industrial progress recorded overtime.

However, with the renewed interest to diversify and industrialise the economy, the cluster concept is one area that holds enticing potentials. Crucial elements of the industrial cluster model include the provision of a collaborative and competitive environment, an appropriate geographical location and proximity to resources, related and supporting firms, state regulations and strategic programmes that facilitate innovation and economic expansion (Romanelli and Khessina, 2005; Oosthuizen and Jura, 2014; Sosnovskikh, 2017). The cluster model of industrialisation has economic justification both in theory and in practice (Iammarino and McCann, 2006; Raimi, Shokunbi and Peluola, 2017), thus the relevance of the cluster strategy as an acceptable model of industrialization particularly for Nigeria is vital. This is because as other industrialisation efforts faltered, most clusters survived and thrived throughout the country (Oyelaran-Oyeyinka, 2004; Adebowale and Oyelaran-Oyeyinka, 2012).

It is noteworthy to add that the cluster policy adopted in 2007 is not entirely novel to Nigeria with the existence of macro level initiatives like free trade zones, industrial parks, industrial clusters, enterprise zones and incubators (Kalu, 2009, Iwuagwu, 2011). However, macroeconomic conditions are necessary but not sufficient for cluster development. Unlike macro-policy to boost clusters that is popular in literature, the microeconomics of clusters are often ignored or taken as given (Rosenfeld, 1997, Steinle and Schiele, 2002). The micro-level descriptors include the most obvious and quantifiable measures, such as number of related firms and specialized services, but also include those that are less obvious and that can only be evaluated through surveys, personal interviews or creative, unobtrusive means, such as collective vision and associative behaviour. Some of the less obvious measures include the mechanisms by which firms associate (social infrastructure), their entrepreneurial energy (innovation), their leadership abilities (vision), and their levels of collaborative business activity locally and internationally (networking) (Porter, 1990, 1998 and 2008; Schmitz, 1992; Rosenfeld, 1997).

Case studies are largely utilised in cluster literature to examine clusters and industrialisation. It is in this respect that the emergence of a vibrant automotive components cluster in Nnewi, Anambra state attracts the attention of this study. More importantly, this cluster has thrived in the face of deindustrialisation (similar with other clusters in Lagos (ICT), Aba (shoes), Onitsha (plastic), Kano (leather) etc), minimal incentives and infrastructure deficit; prompting factory owners to arrange for and utilise private options. Brautigam (1997) argues that the Nnewi cluster of capitalists internally substituted the state and successfully filled the gaps left by failures of both the market and the state. Success stories like Ibeto Group, Cutix Plc, Innoson Group, Chicason Group, Ogbwuawa Ltd, among others are testament to the progress and prospects of this cluster.

The literature on clusters is particularly vast. Cluster-specific economic research has made inroads to specifically analyse and establish the role of clusters as drivers of sector specialisation and innovation (McCormick, 1998; Raines, 2001; Enright and Roberts, 2001; Adeya, 2003; Helmsing, 2003; Feldman and Francis, 2005; Rogerson, 2008), clusters and access to skills, training and information (Foxcroft, Wood, Kew, Herrington and Segal, 2002; Richter, 2003), clusters and access to local and international markets (Nadvi, 1999; Rogerson, 2001; Brown and McNaughton, 2003; Helmsing, 2003; Oyelaran-Oyeyinka, 2005; Mudambi, Mudambi, Mukherjee and Scalera 2016), clusters and financing (Adegbite, 1997; Rosenfeld, 2002; Thomas, 2003; Phillips and Bhatia-Panthaki, 2007; Long and Zhang, 2011; Egbetokun, 2015; Nie and Sun, 2015), clusters and government policy (Rogerson, 2001; Raines, 2001; OECD, 2004; Oyelaran-Oyeyinka and Lal, 2006), clusters and inter-firm networking (Schmitz and Nadvi, 1999; Ostrom, 2000; Caniëls and Romijn, 2001; Enright and Roberts, 2001; Brautigam, 2003; Meagher, 2007), cluster creation, industrialisation and development (Fan and Scott, 2003; Zeng, Liu, Tam and Shao, 2008; Păuna, 2015; Glinskiy, Serga, Chemezova and Zaykov, 2016).

However, despite substantial research on clusters in general and developed countries in particular, literature for developing countries (especially Nigeria) has not attracted similar attention. Empirical literature on Nigeria (especially the Nnewi Automotive Component Industrial Cluster, Anambra State) remains relatively few. Existing studies on Nigerian clusters are mostly descriptive (Oyeyinka, 1997, Brautigam, 1997, Oyelaran-Oyeyinka, 2004, Oyelaran-Oyeyinka, 2006, Abiola, 2008), other studies descriptively compared features among clusters within and outside the Nigeria (Oyelaran-Oyeyinka, 2001, Brautigam, 2003, Yunnan, Irene Sun, Ukaejiofo, Xiaoyang, and Brautigam,

2016). Major studies on the Nnewi cluster area are Oyelaran-Oyeyinka (2004) and Adebowale and Oyelaran-Oyeyinka (2012) combine macro and micro-level descriptors. To enrich literature on this subject, this study incorporates solely micro-level information and estimates the link between sub-cluster data (manufacturing, trading and services) in promoting the sustenance and collective efficiency of the cluster.

The ninth item on the Sustainable Development Goals (SDGs) aims to build resilient infrastructure, promote sustainable industrialization and foster innovation globally (UNDP, 2015). This implies that in the absence of technology and innovation, industrialisation (and development) becomes difficult. Also, with the ever-changing nature of international competition fuelled by globalisation, nations and regions compete on becoming the most productive locations for business (Porter, 2008). With this in mind, the study aims to investigate how the Nnewi Automotive cluster has internally ensured sustenance and collective efficiency with respect to inter-firm collaboration, innovation and internationalisation. This is expected to elicit information that will guide cluster policy and legislation in the country, deepen the synergy and linkages in the Nnewi cluster in particular, and promote measures to better mainstream the cluster concept in the industrialisation policy of the country.

To effectively guide the study, it is organised into six sections. Following this introductory section, section two presents an overview of the Industrial Sector and Cluster Policy in Nigeria. The third section provides the literature review (conceptual, theoretical and empirical). Survey procedure and methodology is discussed in the fourth section, while section five presents the results of the study. Section six contains policy recommendations and concludes the study.

2. Industrial Sector and Cluster Policy in Nigeria

The role of industrialisation as a catalyst in the development of an economy cannot be overemphasised (Ekesiobi and Ibekilo, 2010). It took centre stage during the industrial revolution of the seventeenth century and kick-started a gyration process still evident till date. Anyanwu, Oyefusi, Oaikhenan and Dimowo (1997) described industrialisation as the process of building up a nation's capacity to convert raw materials and other inputs into finished goods and manufactured goods for other production or final consumption. According to Black (2003), industrialisation explains and represents the process of moving resources into the industrial sector and also establishing many industries in

different parts of a country to suit an already established policy objective. Tracing the development of industrialized nations like America, Britain, Germany, France and recent entrants China and Japan, industrial growth served as a propeller that fast-tracked their economic ascendancy (Todaro and Smith, 2006).

On the other hand, the tale of industrialisation in economies like Nigeria has been far from successful. To ginger the process, some specific industrial sector related policies initiated post-independence include the various development plans, Import substitution strategy, indigenization policy of 1972, economic stabilization programme in 1982, structural adjustment programme in 1986, privatisation programme in 1988, rolling plans of the 90's, guided deregulation/privatisation programme in 1993, vision 2010 in 1997, poverty reduction strategy paper in 2002, National Economic Empowerment and Development Strategy I (NEEDS I) in 2004, NEEDS II in 2006, seven point agenda in 2007, Vision 20:2020 in 2010, and the Transformation Agenda in 2012 (Ekesiobi and Ibekilo, 2010; Adamu and Iyoha, 2015). In spite of these efforts at industrialisation in the economy, the sector still remains a paradox (Ekpo, 2004) and table 1 shows the dismal performance of the country's manufacturing sector, especially manufacturing sector contribution to GDP which has remained below 10 percent on the average for the last 10 years.

Table 1: Selected manufacturing sector data for Nigeria

Years	Average Manuf. Capacity Utilisation(%)	Manuf. Output (N' Billion)	Manufacturing contribution to GDP (%)	Manuf. imports (% of merchand. imports)	Manuf. exports (% of merchand. exports)
1981-1985	53.58	30.27	18.33	75.22	0.05
1986-1990	41.14	60.51	18.10	81.37	0.23
1991-1995	35.40	250.82	17.48	66.84	0.70
1996-2000	33.19	636.94	12.98	73.74	1.55
2001-2005	52.92	1343.04	9.73	71.03	2.46
2006-2010	54.38	2798.94	7.06	80.30	3.86
2011-2015	—	7001.76	8.66	61.86	3.82

Sources: CBN, NBS and WDI (various years)

However, with present efforts to diversify the economy, the cluster concept is one area that presents a potential lifeline. As other industrialisation efforts faltered in the past, clusters survived and thrived throughout the country. It was against this background that the federal government, early in 2007 adopted the Cluster Concept as Nigeria's new Industrial Development Strategy set to operate on five planks namely, Free Trade Zones, Industrial Parks, Industrial Clusters,

Enterprise Zones and Incubators (Kalu, 2009). The cluster concept according to Iwuagwu (2011) is not entirely a change in policy as Nigeria had in the past promoted the setting up of industrial estates, but a refocusing of the country's implementation strategy to achieve rapid take-off and survival of industrial/productive enterprises.

Industrial policy is viewed as a set of actions implemented in order to influence the way factors of production are distributed across national industries. It is exemplified by a basic emphasis on achieving the required macro-economic environment for industrial development as well as attaining the planned economic performance for a country (Mailafia, 2016). The adoption of the cluster concept as one of the strategies for Nigeria's industrial development policy gained considerable attention in the seven point agenda, Vision 20:2020 and transformation agenda. Furthermore, in 2014 the Nigeria Industrial Revolution Plan (NIRP) was introduced to streamline and provide comprehensive, strategic and integrated roadmap to industrialization anchored (in part) on cluster development. This plan still serves as the benchmark for the current administration's industrial policy as revealed by the vice president, Prof Yemi Osibanjo during the inauguration of the Presidential Industrial Policy and Competitiveness Advisory Council. The NIRP aims to develop industrial cities, parks, and clusters while focusing on making hard infrastructure available within these industrial zones. Existing cluster locations in Nigeria include Nnewi (automotive), Otigba (technology), Onitsha (plastics), and Kano (leather) among others.

The Nnewi Automotive Industrial Cluster
Nnewi is a town with four villages (Otolo, Umudim, Uruagu and Nnewichi) in Nnewi North Local Government Area of Anambra State, (Mytelka and Fainelli, 2000) and a population of 155,443 (178,802 – 2011 projection) (NBS, 2012). It is a predominantly Christian community with trade and commerce as the major occupation of the citizens. Nnewi, the second largest city in Anambra State (southeast Nigeria), has positioned itself as the 'Japan of Africa'. It is home to many indigenous manufacturing companies, namely Ibeto Group, Cutix Plc, Uru Industries Ltd, Omata Holdings, Innoson Group, Tomy Tomy Group, Chicason Group, and lots more. It is a modern industrial hub that specialises in auto spare parts of motorcycles, vehicles, bicycles, iron and steel among others in the southeast (Oyelaran-Oyeyinka, 2004; Yunnan, Sun, Ukaejiofo, Xiaoyang and Brautigam, 2016).

There are varying accounts of the origin of the automotive Industrial cluster in Nnewi by commentators and researchers. Some accounts trace the origin to 1960s, and 1970s while others place the establishment of the industrial cluster between early 1940s and late 1980s. Moghalu (2016) argued that the industrial cluster in Nnewi started in 1950s with trading in auto spare parts. Uzor (2004) and Brautigam (1997) traced the origin of trade in Nnewi to the 19th century trade in palm oil and salt. Both studies narrate that the economic growth and development of the town grew in the 1960s but suffered setbacks due to the civil war. Abiola (2008) reports that the destruction of Onitsha during the Civil War enabled Nnewi to become the trading hub of the region, while Nkwo-Nnewi (the second largest market in the state after the Onitsha main market) became the centre of trade in various auto spare parts.

Abiola (2008) stated that Nnewi is an important town in Nigeria in terms of motor spare-part production, iron and steel trade and transport. According to Mytella and Fainnelli (2000), Nnewi has the capacity to adopt technological transfer and new designs. Annually, the Nnewi automotive industrial cluster produces over 102,000 cars, 55,000 commercial vehicles, 500,000 motorcycles and 650,000 bicycles (Mytella and Fainnelli, 2000 and Abiola, 2008). Nnewi was a typical informal cluster with zero infrastructures on ground but has recorded giant industrial progression overtime (UNCTAD, 1998, Mytella and Fainnelli, 2000, Chete, Adeoti, Adeyinla and Ogundele, 2014). Some of the enabling factors for the industrialization of Nnewi were acquisition of skills and innovation from Taiwan and China, globalization, multi-nationalism, membership of private industry associations, such as the Nnewi Chamber of Commerce, Industry, Mines and Agriculture and the Nigerian Association of Small-scale Industries (Oyelaran-Oyeyinka, 1997 and 2006). Brautigam (1997), Oyelaran-Oyeyinka (1997), Uzor (2004) and Nzewi (2016) identified trading, private savings, private investments, informal educational endowment of talent and traditions as factors underpinning the success story of the independent Nnewi automotive industrial cluster.

Although most firms in the Nnewi cluster are small, some have grown to medium size and their competence levels have improved through training and apprenticeship (Oyelaran-Oyeyinka, 1997 and 2006). In terms of technological capability, the cluster has also upgraded, though a lot are still far from the frontier (Brautigam 1997 and 2003). The Nnewi cluster of automobile parts manufacturers in Nigeria has also exhibited the capacity to undertake technology adaptations, to design new products and processes and to bring them quickly to

market. Most of them have the design capability to modify products and adapt the production process to the local market (Nzewi, 2016). They are a typical example of how firms located in an informal cluster with virtually no infrastructure have been able to grow, to export informally and upgrade; grouping together and setting up common utilities. While there is no official data on the number of micro and small industries involved in the production of automotive and motorcycle spare parts, a cursory tour around Nnewi shows a large number of them in operation.

A study by Yunnan, Sun, Ukaejiofo, Xiaoyang, and Brautigam (2016) expressed that the success of the Nnewi industrial cluster was underpinned by Nigeria's automotive import substitution in 2010. They argued that high tax on imported cars and tax holidays on local firms encouraged local producers in the cluster. The policy was underpinned by the need for small scale entrepreneurs to produce and assemble automotives in Nigeria. Moghalu (2016) argued that economic diversification and restructuring of the Nigerian economy can only be achieved through manufacturing, citing the case of the Nnewi automotive industrial cluster. This industrial cluster now exports automotive parts to countries in the West African subregion as well as other international destinations, making it a remarkable industrial reference point in Nigeria.

3. Literature Review

The birth of a cluster begins with the creation of firms and an industry. These firms are fashioned to explore and exploit competitive advantage in an area or locality, paving the way for the formation of an industry and an industrial cluster (Pisa, 2014). The word 'cluster' is paradoxical given its popularity and controversial record in economic literature. The popularity stems from the numerous direct and indirect benefits accruable to cluster development, while the latter is linked to the difficulty in deriving a universal definition for such a multidisciplinary and multidimensional concept. Hence, the cluster concept means different things to non-economists and within economic literature, varying explanations can be found in sub-fields like industrial, spatial, institutional, transportation, development, environmental, regional and urban economics.

However, there is an agreement in literature that the cluster concept was introduced by Marshall (1920), which articulates a cluster as concentration of specialised industries operating in districts or localities for mutually beneficial economic interests, or agglomeration economies. He added that reduced transportation costs, attraction of skilled labour and knowledge spillovers were

key reasons why firms locate in close proximity to each other. This formed the foundation of cluster discourse till the emergence of Micheal Porter who polished and popularised the cluster concept in modern economic literature (Raimi, Shokunbi and Peluola, 2017). Porter (1990, 1998 and 2008) defines a cluster as a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities and based on competitive advantages or agglomeration economies. Following Porter, several other scholars (Schmitz 1992; Ceglie and Dini, 1999; Elsner, 2000; Morosini, 2004; Oyelaran-Oyeyinka, 2004 and 2006; Rosenfeld, 2005; Christensen, Lämmer-Gamp, and Köcker, 2012) have put forward various and similar attempts to describe the cluster concept which possess key features like geographical concentration, presence of actors (manufacturers, suppliers, users, researchers, policymakers and traders), collaboration, competition and susceptibility to general cluster internal and external economies and diseconomies.

Clusters can be regional thereby representing a set of enterprises, concentrated and localized in one area with interrelated economic and production processes (Glinskiy, Serga, Chemezova and Zaykov, 2016). UNCTAD (1998) identifies clusters that originate naturally as spontaneous clusters while those induced by public policies are constructed (or artificial) clusters. Spontaneous clusters can be sub-categorised as informal (micro and small firms whose technology level is low relative to the industry frontier with owner-operators and weak management capabilities), organized (characterized by a process of collective activity, mainly oriented towards the provision of infrastructure and services) and innovative (high skill level, technological advancement and innovation) (UNCTAD, 1998). According to Chisenga (2012), artificial clusters can be flexible or rigid. The flexible ones are not confined by strict rules while the rigid clusters follow a specific operating framework. Porter (1990) and Elsner (2000) demarcated clusters vertically (industries that are linked through buyer-seller relationships) and horizontally (industries which might share a common market for the products, use a common technology, labour force skills and similar resources). Lastly, Rosenfeld (1997) delineate clusters in to three categories namely, potential cluster (cluster with good opportunities and some key elements are already in place), latent cluster (cluster with a high number of firms but with a low level of interaction due to the lack of trust, low cooperation and high transaction costs) and working cluster (a well-developed industrial district with

clusters able to realize their full potential and produce more than the sum of their parts).

Theoretical discourse on clusters begins with the Marshallian Theory. In his *Principles of Economics*, Marshall (1920) introduced 'industrial districts' as a cluster framework, showing why and how clustering could help firms (especially small ones) to compete. In reference to the localized concentrations of economic activity using the concept of external economies of scale, the theory (also known as agglomeration theory) posits that agglomeration advantages arise from three sets of localization economies, namely a pooled market for workers with specialized skills, the availability of specialized inputs and services, and technological spillovers (Schmitz and Nadvi, 1999, Fan and Scott, 2003). Such external economies (positive and/or negative) aid the explanation of the growth of contemporary industrial clusters and Marshall's century-old work is a standard reference in this new literature. It is also agreed, however, that Marshallian external economies are not sufficient to explain cluster development (Bergman and Feser, 1999, Kirankabeş and Arik, 2014). However, these economies are external to the firm but internal to the geographic area, and increase the efficiency of each individual firm. Rocha (2004) draws four main conclusions relating to the forms of economies from Marshall's work, economies of specialisation (inter-firm division of labour in complementary activities), economies of labour supply (local pool of specialised labour), economies of information and communication (joint production of no-standardised commodities and the presence of local subsidiary trades) and the economies of innovation (acquisition of specialised skills and the promotion of innovation and innovation diffusions).

Closely following the Marshallian theory is the industrial location theory of Weber (1929). The theory posits an alternative explanation of agglomeration economies, describing it as cost savings firms enjoy as a result of increased spatial concentration (Bergman and Feser, 1999). Also, unlike Marshall (1920), Weber is not predominantly bothered with the reason for the rise of agglomeration economies; rather the theory chooses to mention the varieties of economies of scale. Specifically, the main objective of the theory was to model how such economies might lead to agglomeration and not explaining the economies themselves. Bergsman, Greenston and Healy (1975), Feser (1998) and Bergman and Feser (1999) agreed that the location theory was indeed a theoretical approach with a bias for methodological emphasis. Both theories by Marshall (1920) and Weber (1929) held sway till the 1980s when Pyke, Becattini

and Syngberger (1990) introduced the flexible specialization theory. The theory recognises the emergence of flexible production systems exhibited by small-localized economic firms. These systems perform crucial roles in social and cultural networks by offering competitive advantage to small and medium-sized firms (Malmberg and Maskell 2002). Krugman (1991) advanced a theory based on regional specialisation of industrial activities, hinged on the advantage of specialised labour pools and intermediate goods, and the presence of knowledge externalities.

The diamond model by Michael Porter is however the most relevant and adopted model in industrial cluster literature. According to Porter (1990 and 1998), the competitiveness of nations and firms depend on the existence of a mix of clusters in industries that are connected by vertical and horizontal linkages. Cluster formation in this theory is dependent on supporting factors that endow firms in that country with a competitive advantage (Pisa, 2014). Four key inter-related factors that determine national competitive advantage in any industry are highlighted to include: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry (Fesser, 1998, Bergman and Feser, 1999). These elements however form the basis for criticisms of the model, due to the vagueness in clarifying regional competitiveness and specialization, geographical and industrial ambiguity, and an unfounded universalism (Kirankabeş and Arik, 2014). Despite the shortcomings of the theory, it nonetheless symbolises the most convenient beginning for modern economic discourse on industrial clusters and industrialisation.

3.1 Empirical review

Economic research on clusters as a distinct subject area is touted to stem from the insightful studies by Porter (1990, 1998 and 2000). Following this, cluster –based literature has made inroads to specifically analyse and establish the role of clusters as drivers of sector specialisation and innovation (McCormick, 1998; Raines, 2001; Enright and Roberts, 2001; Adeya, 2003; Helmsing, 2003; Feldman and Francis, 2005; Rogerson, 2008), clusters and access to skills, training and information (Foxcroft, Wood, Kew, Herrington and Segal, 2002; Richter, 2003), clusters and access to local and international markets (Nadvi, 1999; Rogerson, 2001; Brown and McNaughton, 2003; Helmsing, 2003; Oyelaran-Oyeyinka, 2005; Mudambi, Mudambi, Mukherjee and Scalera 2016), clusters and financing (Adegbite, 1997; Rosenfeld, 2002; Thomas, 2003; Phillips and Bhatia-Panthaki, 2007; Long and Zhang, 2011; Egbetokun, 2015; Nie and Sun, 2015), clusters and

government policy (Rogerson, 2001; Raines, 2001; OECD, 2004; Oyelaran-Oyeyinka and Lal, 2006), clusters and inter-firm networking (Schmitz and Nadvi, 1999; Ostrom, 2000; Caniëls and Romijn, 2001; Enright and Roberts, 2001; Brautigam, 2003; Meagher, 2007), cluster creation, industrialisation and development (Fan and Scott, 2003; Zeng, Liu, Tam and Shao, 2008; Păuna, 2015; Glinskiy, Serga, Chemezova and Zaykov, 2016).

Overtime the evaluation of clusters, cluster policy and programmes have witnessed increased research attention. This review is however devoted to a thematic presentation of cluster development in relation to innovation, collaboration and internationalisation, which form the major objectives of the study. Beginning with cluster and innovation, Baptista and Swann (1998) in a bid to discover if firms in a cluster innovate more, studied 248 manufacturing firms in the United Kingdom. The OLS results revealed that a firm is considerably more likely to innovate if own-sector employment in its home region is strong and innovation, entry and growth tend to be stronger in clusters. Using descriptive techniques, Adeya (2003) showed that most owners, owner managers and employees acquire skills within ICT clusters in Ghana and Kenya, leading to more innovation. However, Oyelaran-Oyeyinka (2004) utilised a combination of correlation, descriptive and non-parametric techniques to examine the effect of interaction between clusters and local knowledge institutions. The study found interaction with 'knowledge creators' such as universities as insignificant. Employing the difference-in-difference-in-differences (DDD) estimator methodology on cluster in Bavaria, Germany, Falck, Heblich and Kipar (2010) submitted that clustering increased the likelihood of innovation by a firm in the target industry from 4.6 percent to 5.7 percent. In a similar study, but applying the OLS and total-output production function, Fleisher, Hu, Mcguire and Zhang (2010) posited that in the initial stages of cluster formation, because of low capital and technology barriers to entry, innovation may be minimal.

Adegbite (2011) investigated the factors influencing technology innovations in indigenous small-scale textile weaving firms in south-western Nigeria. The study descriptively exposed lack of knowledge and skills, shortage of skilled personnel, high costs of production and financial constraints, economic and market uncertainty, lack of basic infrastructure and government regulations as key obstacles to innovation in the cluster. In a study of the patterns of China's industrialization in the face of concentration, specialization and clustering, Long and Zhang (2012) used firm-level data to reveal that China's industrialization has

been accompanied by greater spatial concentration, increasing regional specialization and cluster-based innovation.

Oigiagbe, Olusoji and Owoyemi (2012) theoretically appraised technological innovation diffusion in the Nigerian automobile industry and put forward that industrial cluster development will increase the engineering, technological and innovation capability within the Nigerian automobile industry. In line with this, Oluwale, Ilori and Oyebisi (2013) employed analysis of variance (ANOVA) to determine effect of clustering on innovation in the auto-mechanic industry in south-western Nigeria. The study involved 13 auto-mechanic villages (clusters) comprising of 237 master mechanics located within Lagos and Ogun states and 145 master mechanics in Osun State stand-alone mechanic workshops. From the findings, cluster mechanics recorded higher frequencies of modifications and improved working techniques than the stand-alone mechanic workshops. Also, there were significant differences between the standalone and clustered firms in terms of innovations during the study period.

Obembe, Ojo and Ilori (2014) reported a positive impact of technological capabilities, innovations, and clustering on the performance of the firms in the furniture making industry in South-western Nigeria. In a Turkish study, Yildiz and Aykanat (2015) examined clustering and innovation concepts in techno-parks and results showed that clustering-effect is significant and an important model for innovative development in Turkey. Zhang (2015) studied the effect of agglomeration economies on firm-level product innovation (new products), using Chinese firm-level data from 1998 to 2007. Findings from the binary-choice non-structural analysis suggest that in China, urbanization economies play an important role in fostering product innovation by urban size and diversity.

Looking at studies on cluster and inter/intra-firm collaboration, Oyelaran-Oyeyinka (2004) investigated networks and linkages in African manufacturing clusters, with special focus on industrial clusters in Lagos and Nnewi, Nigeria. The study examined characteristics of clustering in the forms and intensity of inter-firm linkages, including the formation of trade networks, and the role of business associations. The findings from this comparative study indicate a significant level of collaboration among firms in sharing utilities and modest forms of subcontracting non-core activities among Lagos firms, but this is less so at Nnewi. Dahl and Pedersen (2004) studied the role of informal contacts among a sample of 80 engineers in a regional cluster of wireless communication firms in Northern Denmark. Descriptive and chi-square results show that informal contacts represent an important channel of knowledge diffusion and collaboration

among firms in a cluster. Giuliani and Bell (2005) applied social network and principal component analysis to identify the different roles played by intra-cluster knowledge system and cluster interconnection in Chile. The empirical outcome shows that knowledge and collaboration were not diffused evenly in the clusters, but within a core group of firms.

Oyelaran-Oyeyinka (2005) appraised the dynamics of inter-firm collaboration of two footwear clusters (Aba and Onitsha) in South-eastern Nigeria in response to local and global competition. The study found that collaboration among enterprises grew over time, induced largely by competitive forces. The findings bear some resemblance with Adebowale and Oyelaran-Oyeyinka (2012) who studied the determinants of productivity and inter-firm collaboration in Nigerian clusters, but separately identified education of owners, skill of workers and past productivity records as key determinants of firm-level productivity and collaboration. Delgado, Porter and Stern (2012) evaluated the role of regional cluster composition in the economic performance of industries, clusters and regions in America. The multivariate analysis shows a strong evidence for cluster-driven agglomeration and industries participating in a cluster register higher employment growth, as well as higher growth of wages, number of establishments, and patenting.

In a survey of Nigerian 170 manufacturing firms, Egbetokun (2015) measured the relationship between interactive learning, capabilities and collaboration among firms using multivariate probit estimations. Formal and informal modes of interactive learning were found to be positively associated with firm-level collaboration and capabilities but informal interactions dominate. Sarach (2015) sought to establish an empirical understanding of the cooperative relationship between different members of clusters in Russia. Game theoretic modelling results show that education and business systems in clusters gain advantages from the collaboration process. Branco and Lopes (2016) using labour productivity data for Portugal, examined the relative collaboration and performance of clustered and non-clustered companies during the different phases of the cluster lifecycle. The main findings substantially support the theoretical predictions of collaboration and performance in literature for clustered and non-clustered firms.

With increased globalisation, empirical studies on cluster development with emphasis on internationalisation have emanated. The consistent export success of Pakistan's Sialkot stainless steel surgical instrument cluster prompted Nadvi (1999) to explore the collective efficiency argument of clusters, by exploring how

clustered producers respond to exogenous shocks. Evidence from the simultaneous multiple regression analysis suggests that joint action within the cluster increased in the face of external competition. Employing UNIDO survey data of the Kano industrial cluster, Amakom (2006) investigated among others, if foreign owned firms more likely to export and what link exists between a firm's age and export? Probit regression findings showed that the indigenous firms in the clusters where worse-off than their foreign counterparts while the age of the firm had a positive influence on export. Kirankabeş and Arik (2014) probed the extent to which cluster formation is related to economic openness in Turkey. The cluster density index for the manufacturing sector in Turkey and the relationship between the cluster density index and openness were analysed using a combination of non-parametric methods and Spearman's rank correlation. Regional economic clustering was revealed to have a close relationship with international openness of the region. Mudambi, Mudambi, Mukherjee and Scalera (2016) explored both local linkages and distant global ties of the Akron industrial cluster in northeast Ohio, America. Multivariate analysis results of a comprehensive 30-year dataset (1975– 2005) revealed that global knowledge and connections enhanced the evolution of the Akron industry cluster from tires to polymers.

As observed from the above discussions, despite the growing popularity and importance of the study focus, empirical literature on Nigeria (especially the Nnewi Automotive Component Industrial Cluster, Anambra State) remains relatively few. Existing studies on clusters in Nigeria are mostly descriptive (Oyeyinka, 1997; Brautigam, 1997; Oyelaran-Oyeyinka, 2004; Oyelaran-Oyeyinka, 2006; Abiola, 2008); other studies descriptively compared features among clusters within and outside Nigeria (Oyelaran-Oyeyinka, 2001; Brautigam, 2003; Yunnan, Irene Sun, Ukaejiofo, Xiaoyang, and Brautigam, 2016). Major studies on the Nnewi cluster area (Oyelaran-Oyeyinka, 2004; Adebowale and Oyelaran-Oyeyinka, 2012) combined macro and micro-level descriptors. The current study incorporates solely micro-level information and estimates the link between sub-cluster data (manufacturing, trading and services) in promoting the sustenance and collective efficiency of the cluster.

4. Methodology

This investigation is a case study using Nnewi North Local Government Area of Anambra State as the study area. Data for the 2006 census state that Nnewi North Local Government has a population of 155,443 persons (77,517 male and 77,926

female) (NPC, 2010). The local government is a one-town local government with four villages, namely Otolo, Umudim, Uruagu and Nnewichi. It is a predominantly Christian community with trade and commerce as the major occupation of the citizens.

This research is quantitative in nature, using data obtained from primary sources. The research approach will be deductive, while the time horizon will be cross sectional. The research instrument adopted is the questionnaire which was self-administered to 195 firms sampled using a blend of systematic random sampling and cluster sampling. The respondents were guaranteed anonymity and provided with the option of opting out of the survey if they wish to. Also, participants were assured their responses would be treated with utmost confidentiality and used solely for research purposes. To improve the effectiveness of the survey, ten research assistants were engaged and trained on the vital details and usage of the questionnaire. Guided procedures (translation and interpretation) were employed for semi illiterate and illiterate respondents by the trained research assistants who comprehend the native language (Igbo) to minimize errors. The enumerators (in pairs of a male and female) were assigned to cover the firms in the local government, pre-grouped into manufacturing, trading and services to adequately capture the required data without compromising the spread.

The data used in the study were obtained through field survey carried out between June and July 2017. The visits were conducted in the evening during works hours and at weekends in other to increase the chances being attended to and not interfering with the routine business activities of the firms. Number of questionnaires distributed in each subgroup was based on the proportion of the number firms in the subgroup. The questionnaire, titled 'Industrial Clusters and Industrialisation in Nigeria: A Micro-assessment of the Nnewi Automotive Component Industrial Cluster, Anambra State' was divided into four sections: Section A involves basic personal and firm-structure information; sections B, C and D were designed to provide information on the core interests of the study, namely, internationalisation, collaboration and innovation.

This study collected data from 195 firms which were subjected to simple statistical processing using the statistical package for social science (SPSS) for coding and STATA for analysis. The questions were also structured to elicit quantitative information from the respondents to aid the analysis. Validity and reliability tests of all factors were performed and Cronbach alpha values for all factors were found to be very meaningful. The study used both descriptive

statistics and inferential statistics. Frequencies and percentages are the descriptive techniques adopted. Following the works of Oyelaran-Oyeyinka (2005), Amakom (2006), Long and Zhang (2012), Adebowale and Oyelaran-Oyeyinka (2012), Delgado, Porter and Stern (2012), Yildiz and Aykanat (2015), Zhang (2015), Egbetokun (2015b), Glinskiy, Serga, Chemezova and Zaykov (2016) and Mudambi, Mudambi, Mukherjee and Scalera (2016), binary and ordinal logistics regression models are the inferential techniques used in this study due to the nature of the response variables analysed, which are qualitative (see Wooldridge, 2000, 2002; Gujarati, 2006).

The theoretical foundation of the work is based on the diamond model by Porter (1990 and 1998) which is the most relevant and adopted model in industrial cluster literature. Cluster formation in this theory is dependent on four key inter-related factors that determine national competitive advantage in any industry namely factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry. These elements are in sync with the objectives of this study, warranting the adoption of the theory.

4.1 Model specification

Model One

To ascertain the drivers of internationalisation in a cluster we investigate whether a firm exports its product or not, the study adopts a probability regression model (binary logistics regression model). The binary logistics regression model in this study reflects the dichotomous of a firm being engaged in exportation or not and it is stated as follows:

$$Logitp_x = log[\frac{P(Y=1)}{1-P(Y=1)}] = \sum_{k=1}^{k} \alpha_k X_k \qquad\qquad 1$$

Equation 1 shows that there is a linear relationship between the $logitp_x$ and the vectors of explanatory variables X. Therefore, the study can state the probability of a firm engaging in exportation as thus:

$$Pr(Y=1) = \frac{\sum_{e^{k=1}}^{k} \alpha_k X_k}{\sum_{e^{k=1}}^{k} \alpha_k X_k} \qquad\qquad 2$$

Whereas the probability of not engaging in export (which is 1 minus the probability of being an exporting firm) is specified thus:

$$Pr(Y=0) = \frac{1}{\sum_{e^{k=1}}^{k} \alpha_k X_k} \qquad\qquad 3$$

Equation 3 shows the binary nature of the dependent variable, with being an exporting firm categorized as 1 and not being an exporting firm categorized as 0. The final model for the effect of internationalisation of cluster on the probability of a firm engaging in exportation or not is stated as equation 4:

$$Logit(P) \;=\; ln[\tfrac{P}{1-p}] \;=\; \propto_0 + \; size\_of\_employee\beta_1 + mgt\_qua\beta_2 + tradefair\beta_3 + internet\beta_4 +$$
$$patner\beta_5 + age\beta_6 + credit\_access\beta_7 + years\_R\&D\beta_8 + capital\_base_9 + \varepsilon \qquad 4$$

Model Two
To identify the determinants of the probability of firms engaging in inter-firm collaboration, the study equally employed binary logistics regression. This was because of the binary nature of the dependent variable with 1 representing firms that collaborate and 0 for those that do not collaborate. The binary logistics regression model for the determinants of inter-firm collaboration is stated as equation 5:

$$Logit(P) = ln[\tfrac{P}{1-p}] = \propto_0 + size\_of\_employee\beta_1 + mgt\_qua\beta_2 + capital\_base\beta_3 + industry\beta_4 + age\beta_5 + \varepsilon$$
$$5$$

Model Three
To identify the factors that determine how innovative a firm is, the study first classified the innovative level of the firms into very poorly innovative (1), poorly innovative (2), innovative (3) and very innovative (4). Considering the ordinal nature of categorizing the dependent variable for this objective, the study adopts the ordinal logistics regression model. The ordinal logistics regression model for the determinants of level of innovation of firms is stated as equation 6:

$$WP_i = \Sigma W_{ij} P_{ij} = \propto_0 + training\beta_1 + mgt\_qua\beta_2 + size\beta_3 + age\beta_4 + Internet\beta_5 + expenditure\beta_6 +$$
$$fcollaboration\beta_7 + export\beta_8 + capital\_base\beta_9 + years\_R\&D\beta_{10} + tech\beta_{11} + +\varepsilon.$$
$$6$$

Where WP_i = weighted position for firm i becoming innovative

Table 2: Core variables and their measurement

Variable	Description	Measurement
Employee size	Size of employee	Above 50 = 1, otherwise = 0
Qualification of the manager	Mgt qua	Managers with university degree and above = 1, otherwise = 0
Participation of firms in trade fairs and exhibitions	Trade fair	Participation = 1, otherwise = 0
Internet presence	Internet	Presence = 1, otherwise = 0
partnership with foreign firms	Partner	Partnership = 1, otherwise = 0
Number of years in existence	Age	In Complete years
Firm access credit assistance within cluster	Credit access	Access = 1, otherwise = 0
Years the firm has been into research and development	Years R&D	In complete years
capital base of the firm	Capital base	In naira
firm engaged in training	Training	1 if they are engaging and 0 otherwise,
Industry category of the firm	Industry	Manufacturing = 1, trading = 2 and services = 3

Source: Author's compilation

Presentation of Results

Descriptive analysis

The descriptive statistics result on table 4 showed that out of the 195 validly sampled firms in Nnewi business area of Anambra state Nigeria, 33.3% of the firms were majorly involved in manufacturing while 44.6% and 22.1% were involved majorly in trading/selling and services respectively. This shows that almost half of the sampled firms engage majorly in trading. Also, 67.7% of the firms have 50 employees and below while the remaining 32.3% of the firms have above 50 employees. More so, for the sex of the firms' manager, 65.6% of them were male while the remaining 34.4% of them were female. Furthermore, for the highest education attainment of the firms manager, 41.5% of them have less than university degree while as many as 58.5% of the mangers have university degree or above. For the capital base of the firms, 17.4% of them have below ₦5 million 40% whereas 40% of the firms have ₦5 to ₦10 million and the remaining 42.6% have capital base of above ₦10. This implies that only few firms have capital base of less than ₦ 5 million. On the other hand, 34.9%of the firms have engaged in exportation while as many as 65.1% of the firms have not engaged in exportation. This shows that most of the firms have not engaged in exportation. Similarly, for whether firms engage in research and development, the study discovered that only 37.4% of the firms engage in research and development. This means that most of the validly sampled firms (62.6%) do not engage in research and development.

Table 3: Enumerated respondent/firm characteristics

Characteristic	Frequency	Percentage
Industry		
Manufacturing	65	33.3
Trading	87	44.6
Services	43	22.1
Size of the firm		
50 and below employees	132	67.7
Above 50 employees	63	32.3
Sex of manager		
Male	128	65.6
Female	67	34.4
Highest education of the firms manager		
Less than university degree	81	41.5
University degree or above	114	58.5
Capital base of the firm		
Below 5 million	34	17.4
5 to 10 million	78	40.0
Above 10 million	83	42.6
Firm has exported		
Yes	68	34.9
No	127	65.1
Firm engage in Research and Development		
Yes	73	37.4
No	122	62.6
Firm engage in training		
Yes	89	45.6
No	106	54.4
Age		
Less than 5 years	48	24.6
5 to 10 years	73	37.4
Above 10 years	74	37.9
Firm have internet facility		
Yes	165	84.6
No	30	15.4
Firm engage in foreign collaboration		
Yes	72	36.9
No	123	63.1
Firm access credit		
Yes	148	75.9
No	47	24.1
Firm adopt modern technology		
Yes	143	73.3
No	52	26.7

Source: Authors' Analysis, 2017

Going further, 45.6% of the sampled firms engage in staff training while the remaining 54.4% of the firms do not engage in staff training. For the years of existence (age) of firms, the study discovered that 24.6% of the firms have existed for less than 5 years while 37.4% and 37.9% have existed for between 5 to 10 years, and above 10 years respectively. Also, 84.6% of the firms have internet facility, while the remaining 15.4% do not have internet facility. This shows that most of the sampled firms use internet facility in their business. Again, only 36.9% of the sampled firms engage in foreign collaborations while as many as 63.1% of the firms do not engage in foreign collaboration. This indicates that most of the sampled firms do not engage in foreign collaboration. Only 24.1% of the sampled firms do not access credit while as many as 75.9% of the firms access credit. What this means is that most of the firms access credit and assistance. For technology adoption, 73.3% of the sampled firms adopt modern technology while only 26.7% of the firms do not.

5.2 Binary logistics regression results for internationalisation of cluster (whether a firm exports or not)

Logit regression is aimed at examining the effect of internationalisation of a cluster. The result on whether a firm exports its product or not is presented in table 4. The Prob> chi^2 highlights the probability that the null hypothesis is true and from table 1, the Prob> chi^2 of 0.00 shows that the null hypothesis should be rejected as there is no statistical probability that the null hypothesis occurred. This therefore means that the model is statistically significant. For the effect of internationalisation of clusters on the probability of a firm exporting or not, the study discovered that a being a big firm significantly (0.03) increases the probability of a firm engaging in export by 1.73. This means that firms who have large number of employees have greater probability to export than firm with small number of employees. Also, firms whose managers have university degree and above when compared to firms whose managers do not have up to university degree significantly (0.00) have higher probability (1.73) of engaging in exportation. This shows that the more educated the manager of a firm is, the greater the chances of the firm engaging in exportation. More so, a firm participating in exhibitions such trade fairs insignificantly (0.28) increases the probability of the firm engaging in exportation by 1.67. What this means is that firms who participate in exhibitions have greater probability to export than firms who do not participate, however their participation in the exhibition is not significant.

Table 4: Logit regression for the effect of internationalisation of cluster

Export	Odds Ratio	Std. Err.	Z	P>|z|
Employee size	1.73	.42	2.22*	0.03
Management qualification	1.02	.01	4.23*	0.00
Trade fair	1.67	.79	1.08	0.28
Internet	2.03	.75	1.93	0.54
Partnership with foreign firm	.31	.40	-0.91	0.36
Age	3.09	.78	4.48*	0.00
Credit access	.88	.13	-0.83	0.41
Years spent on R&D	2.53	.66	3.56*	0.00
Capital base of firm	1.39	.15	2.95*	0.00
Cons	1.65	.73	0.48	0.63
Probability chi-square	0.00			

Coefficients with * denote significance at 95% confidence interval.

In the same way, ownership of a website (or have internet presence) insignificantly (0.05) increases the probability of a firm exporting by 2.03 over those who do not own a website. This means that by owning a website, firms have higher chances of engaging in exportation over those who do not own a website. Engaging in collaboration in the form of foreign partnership insignificantly (0.36) decreases the probability of a firm engaging in exportation by 0.31. This implies that cluster firms collaborating with foreign firms have not increased their chances of going into exportation but has decreased it. Furthermore, the age of the firm significantly (0.00) increases the probability of a firm engaging in exportation by 3.09. What this means is that the older a firm becomes, the more the probability of the firm to engage in export. Firms which access credit (or assistance within the cluster) insignificantly (0.41) reduces the probability of a firm engaging in export by 0.88. This means that accessing credit by a firm does not promote their chances of firm engaging in export over firms who do not.

On the other hand, the years a firm spent in research and development significantly (0.00) increase the probability of them engaging in export by 2.53. This indicates that the more firms engage in research and development, the more their chances of engaging in export. The capital base of firms significantly (0.00) increases their chances of engaging in export by 1.39. This means that firms with high capital base have higher chances of engaging in exportation over those with low capital base.

5.3 Binary logistics regression results for the determinants of inter-firm collaboration

The logit regression result that is aimed at identifying the determinants of inter firm collaboration is presented in table 5.

Table 5: Logit regression for the determinants of inter firm collaboration

Inter-firm collaboration	Odds Ratio	Std. Err.	Z	P>|z|
Size of employee	.91	.27	-0.33	0.74
Management qualification	1.04	.02	2.17*	0.03
Capital base of firm	1.04	.03	1.50	0.13
Industry (sales)	1.03	.01	3.78*	0.00
Industry (services)	.55	.30	-1.12	0.26
Age	1.07	.03	2.29*	0.02
Cons	.77	1.46	-0.14	0.89
Probability chi-square	0.00			

Coefficients with * denote significance at 95% confidence interval.

The result in table 2 shows that Prob> chi^2 is 0.00. This indicates that the null hypothesis is rejected, as there is no statistical probability that the null hypothesis occurred, implying therefore that the model is statistically significant. For the factors that determine inter-firm collaboration, the result shows that the size of a firm insignificantly (0.74) decreases the probability of a firm engaging in inter-firm collaboration by 0.91. This implies that the number of employees a firm has does not determine whether the firm engage in inter-firm collaboration or not. Also, firm managers with minimum of university degree significantly (0.03) increases the probability of a firm engaging in inter-firm collaboration by 1.04. This implies that highest education degree attainment of managers determines whether firms engage in inter-firm collaboration. Furthermore, the capital base of a firm insignificantly (0.13) increases the probability of a firm engaging in inter-firm collaboration by 1.04. This implies that the capital base of a firm does not determine whether or not the firm goes into inter-firm collaboration.

On the other hand, firms whose major area is sales, rather than manufacturing, significantly (0.00) increases the probability of the firm engaging in inter-firm collaboration by 1.03. However, firms whose major area is services when compared to those in manufacturing insignificantly (0.26) decreases the probability of the firm engaging in inter-firm collaboration by 0.55. This means that the subgroup a firm belongs to determines whether the firm engages in inter-firm collaboration or not. Also, age of a firm significantly (0.02) increases the probability of it engaging in inter-firm collaboration by 1.07. This means that the

years of existence of a firm determine whether it will engage in inter-firm collaboration or not.

5.4 Ordinal logistics regression results for the determinants of innovative level of firms

The ordinal logit regression result that is aimed at identifying the determinants of innovative level of a firm is presented in table 6.

Table 6: Logit regression for the determinants of innovative level of firms

Innovative level	Odds Ratio	Std. Err.	Z	P>|z|
Training	1.76	.43	2.35*	0.02
Management qualification	1.37	.14	2.99*	0.00
Size	1.23	.09	2.93*	0.00
Age	1.48	.52	1.12	0.26
Internet	.69	.39	-0.66	0.51
Expenditure	1.01	.52	1.17	0.87
Foreign collaboration	.88	.13	-0.83	0.41
Export	.81	.06	-3.08*	0.00
Capital base	1.32	.54	0.70	0.48
Years spent on R&D	1.70	.30	2.98*	0.00
Technology	1.03	.09	0.32	0.75
Probability chi-square	0.00			

Coefficients with * denote significance at 95% confidence interval.

The Prob> chi^2 of 0.00 in table 3 indicates that the null hypothesis is rejected, as there is no statistical probability that the hypothesis occurred. This means that the model is statistically significant. For the determinants of innovative level of firms, the result suggests that training by firms, with a value of 0.02, was a significant determinant of level of innovativeness of firms—as the value was less than the 0.05 minimum value of significance; hence, it was significant. In the same way, highest education attainment of firm managers, size of the firm, export status of firm and the years firms spent on research and development with significant value of 0.00 each were significant. On the other hand, age of the firm with significant value of 0.26 was not significant as its probability value was greater than the maximum 0.05 value for significant hence insignificant. Also, use of internet by firms, expenditure of firms, whether firm collaborate with foreign firms, capital base of firms and technology adoption by firms, just like age of the firm, were insignificant, with the values of 0.51, 0.87, 0.41, 0.48 and 0.75 respectively, which were higher than the maximum probability values of significance.

The foregoing suggests that for the innovative level of firms to increase, policy efforts need to be channelled towards staff training by firms, firm's managers' education, expansion of the firm and recruitment of people, and activities in exports and research and development. However, it is important to note that the predicting nature of export status of a firm was negative, indicating that it reduces the probability of the firm becoming highly innovative; whereas, years of existence (age), expenditure, capital base and technology adoption, though insignificant, increased the probability of a firm becoming innovative.

6. Conclusion and Recommendations

The findings of this study have useful policy implications. Firms and cluster leaders should strengthen collaborative avenues, which promote mutual efforts in innovation. Innovation itself is both endogenous and exogenous, shaped through interaction between firms within and outside cluster environments. Internally, firms in a cluster should collaborate more with universities and research institutions; such collaboration is presently low. This will facilitate the training of mostly semi-skilled employees in the cluster and empower them with requisite skills to blossom. Also, research institutes and universities (both public and private) have to be more responsive to industry requirements. They can reach out to firms to offer technology assistance and technical support in the form of contracted services and joint research, among others.

Externally, strategic alliances beyond trade, import and local assembly should be improved by firms in the cluster to seek partnerships on training and knowledge transfer. This engenders technological innovation diffusion and encourages global players to participate actively in the infrastructure investments in the cluster. In a digital age, it is expected that firms in clusters key into online platforms to promote visibility, improve information and global appeal. The findings of the study suggest that firms in the cluster need to improve in this regard. The will to undertake micro-level reforms are necessary to enable individual firms to reposition themselves to meet up with a changing environment. For firms in the cluster to be stronger collaborators and boost inter-firm cooperation, there is a need to upgrade their activities relating to cost-efficiency, quality, variety/diversification, responsiveness, acceptance of entrepreneurial risks, and a positive attitude towards change and innovation. These factors alone do not give a competitive advantage, but represent prerequisites for surviving in a globalized market.

The internationalization of clusters, which is part of the Nnewi cluster strategy, needs to be enhanced, to boost the number of manufacturing firms in the cluster and consolidate the gains achieved by current exporters within the cluster. Also, policy at the cluster level should emphasise data gathering and management to adequately capture all firms in the clusters (especially the obscure one) and facilitate their integration. Government also has to play a crucial part in compiling statistics about cluster composition, membership, employment, and performance (cluster mapping is a good take-off point). Such records will better inform public policies for smoother alignment with industry needs, based on the cluster characteristics in various localities. Cluster information also promotes efficiency of private sector investment to cultivate fresh ideas to exploit the presence and capabilities of clusters.

Cluster development is a collaborative process requiring government at multiple levels, cluster firms, companies, teaching and research institutions and international partners to join efforts. In line with global best practice, cluster evaluation, benchmarking, monitoring and impact analyses should be internalised at the cluster and national levels. Internalising the following evaluation needs of clusters, cluster managers and policymakers are paramount: benchmarking and performance statistics of cluster organisations (key performance indicators focus typically on input and output), cluster programme evaluation and performance statistics of cluster actors (key performance indicators focus typically on outcome), impact assessment and analysis of cluster policies (key performance indicators focus on impact). This shares the burden of cluster development evenly and guarantees a win-win situation for all actors.

Cluster (and, by extension, industrial) policy is within the realm of macroeconomic policy; thus, sound macroeconomic management is essential to cater for exchange rate fluctuation, price level uncertainty, policy inconsistencies, employment generation and income generation. These measures might seem ambitious, but for a nation yearning for rapid industrialisation, they will certainly help it in the future to avoid the pitfalls it had stumbled into in the past. Ideally, this will rekindle already dimming hopes and bring about the much touted 'change'. This way the industrial sector can at last open up to solutions not yet considered and limitless opportunities still begging to be exploited.

After undergoing phases of industrial revolutions, the global industry is repositioning dramatically in the face of the fourth industrial revolution. A host of economies that were just finding their industrial feet on the global stage now have economic power to spare. From the beginning industrialisation in Nigeria, a lot

has transpired over the last five decades with regard to launching the industrial sector. Present realities, however, suggest that despite the humble achievements recorded thus far, the sector still has uncovered grounds. Consequently, the cluster strategy push advocated by this study underscores the below-par performance of sector. It showcases the capability of clusters to propel Nigeria's industrial take-off, given its ability to thrive in the midst of deindustrialisation. In the light of this, the study concludes that boosting industrial productivity in the country requires, to a large extent, positive and committed synergy of the cluster policy and industrialisation to advance a healthy, robust and rewarding industrial sector. When properly executed, this will certainly gladden the hearts of entrepreneurs, firms and clusters, as well as the nation, thus ensuring the possibility of making the nation an industrial giant by 2020.

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