

## OPEN INNOVATION FOR AUTOMOBILE COMPONENT MANUFACTURING SMES IN NIGERIA

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### ABSTRACT

Some SMEs were involved in automobile component production in Nigeria but after the introduction of the Economic Structural Adjustment Programme of 1986, most of these firms (even those in the industrial cluster) could not match the steady increase in technological innovations, competitions in automobile sector and the constraints of the local business environment. This paper is proposing a model that will ensure the continuous participation of Nigerian automobile component manufacturing SMEs in the local and global automobile value chain.

This paper draws on literature survey coupled with semi-structured interview with managers in automobile assemble firms that work with some local automobile component part supply firms in Nigeria

Findings show progress made by SMEs in different sector through the process of Open innovation (OI), however there is still a divide on the use of open innovation in the automotive sector. One of the subsidiaries of a European multinational automobile companies surveyed in this study stated several local suppliers who could not fit in its supply chain when it introduced car models that were on different technology platforms. The fast integration & development of Mechatronics and material science in the automobile industry was disruptive for the Nigerian firms, even though some of these firms attempted to source for technology abroad to stay in business. There are question marks on the business strategies, absorptive capacities of these firms and also on the national support infrastructure. The model being proposed is suitable one for SMEs in the automobile component manufacturing in Nigeria. This paper concludes by stating that networking of SMEs into the global value chain remains an open innovation approach for SMEs in Nigeria and as a good learning mechanism, considering the structure of the innovation system found in most developing countries.

**Key words:** Open innovation, SMEs, automobile, automobile component manufacturing, learning, Nigeria

### BACKGROUND

According to the Nigerian National Automotive Council report (n.d), the Automotive Industry in Nigeria dates back to early 1960s when private companies like UAC, Leventis, SCOA, BEWAC and R.T. Briscoe pioneered the establishment of Auto Assembly Plants using Completely Knocked Down (CKD) or Semi-Knocked Down (SKD) parts. The report also noted that government got involved in the automobile sector between 1970-1980 when it concluded agreements with Europe based automobile Plants in Europe to set up two cars and 4 truck/light commercial vehicles assembly

plants using Completely Knocked Down (CKD) Parts. Peugeot Nigeria Ltd. (PAN), Kaduna, and Volkswagen of Nigeria Ltd. (VWON) Lagos were for the car assembly while the four truck plants were Anambra Motor Manufacturing Company (ANAMMCO), Enugu with technical partnership from Mercedes Benz, Styer had Styer Nigeria Ltd., Bauchi, an indigenous National Truck Manufacturers (NTM), Kano, and Leyland did set up the Leyland Nigeria Ltd., Ibadan. The NAC report has it that all these cars and truck/light commercial vehicle plants were all privatized by the end of 2007.

The thrust of the National Automotive Policy tilts towards the survival, growth and development of the Nigerian automotive industry using local human and material resources. The Nigerian automotive industry also envisages the production of components, and vehicle of international standard at competitive prices. Since 1960 till date, vehicle assembly in Nigeria started with a promising note but had gone down by 1986 when the Structural Adjustment Programme (SAP) proposed by the World Bank and IMF was introduced in Nigeria by the Nigerian military government. Smuggling of cheap goods affected manufacturing in Nigeria and most of the automobile manufacturing plants were producing below installed capacity and this affected the auto component suppliers. Some firms that existed as replacement suppliers to the open market could not compete with suppliers who were shipping parts from Asia to Nigeria. Those auto component suppliers that existed in industrial clusters were not immune to the vulnerabilities exposed to the independent automobile component firms in Nigeria. The case of the Nnewi Automotive component industrial cluster (as stated in Box 1) is notable in literature. The auto-component firms in the Nnewi clusters had their fortunes wobble over time despite efforts by the firms in the cluster to manage the cluster without any form of protection or support from the Nigerian state or the international development organizations.

## **INTRODUCTION**

Peter Drucker famously called the automobile industry “the industry of industries” (MacDuffie and Fujimoto, 2010; Sako, 2002). Takeishi (1998) noted that a typical passenger car contains more than 30,000 parts, and this ranges from several mechanical to electrical parts. The assembling of cars involves levels of auto-component suppliers and provides employment for thousands of workers, contributing to sizeable per cent of national gross domestic product of most industrialized countries, and as well as has numerous forward and backward linkages with the rest of other industrial sectors. This makes Original Equipment Manufacturers (OEM) to engage several vehicle component/part suppliers (first & second tier levels of suppliers) in assemble of cars. How strategic an OEM manages its component suppliers determines the competitiveness of the OEM and the sustainability of its business.

Automobile manufacturing is capital intensive with very huge development costs, yet automobile assembling companies are bound to meet customers taste and demand, meet regulations on carbon emissions and car safety standards. These challenges have made most OEMs to shift some of these costs to the supplier base in the sector and they tend to tightly manage their supply chain. The huge development costs, long development cycles and fierce global competition, all make the automotive sector a traditionally closed industry as noted by Dodourova and Bevis (2012).

In some advanced countries the vehicle component suppliers are known to contribute up to fifty per cent of the Research & Development (R&D) funds in the automobile sector. These shared responsibilities passed from the OEM to the vehicle component suppliers do not end at R&D

spending but also on other corporate responsibilities; where these vehicle component suppliers are expected to also be environmentally responsible. The vehicle component suppliers are supposed to show evidence of efficiency in energy & material use, embrace low carbon emission standards and environmental benign waste management. Even though assembly firms such as General Motors (GM), Toyota and Volkswagen take responsibility for overall design, assembly, sales, and service (and usually produce a few key parts themselves), the bulk of value in a vehicle actually resides in the myriad of parts that go into it (Doner et al., 2006)

Apart from the shared responsibility given to the auto component suppliers, the Buyer-supplier relationships in the automobile sector is also changing with the automobile leading firms demanding that their largest suppliers have a global presence as a precondition to be considered for a new component supply contract (Sturgeon and Florida, 2004 as cited in Humphery and Memedovic, 2003). Multinational automobile firms' production now spans multiple regions since they use centrally designed vehicles and platforms to compete in these regions. According to Humphery and Memedovic (2003), Political pressure for local production has driven automakers to set up final assembly plants in many of the major established market areas and in the largest emerging market countries such as Brazil, India, and China with lower operating cost. The OEMs drag their global suppliers as they move to these emerging markets. Humphery and Memedovic (2003) were also quick to note that the geographical spread of vehicle output and sales in developing countries has not been accompanied by a spread of ownership in the assembly sector. The auto industry remains concentrated, with a small number of companies accounting for a significant share of production and sales. How then can auto component producers in developing countries (such as Nigeria and other African countries) be integrated in the global automobile value chain? It is already known that leading OEMs use Follow Supply Strategy. Some of these global suppliers are spinoff of the OEMs/multinational companies or sister companies from the same home countries as seen in the case of Peugeot and Valeo, and others as such. These global suppliers are often classified as first tier suppliers and they engage in modular production. They do not just supply one component but sub-compact systems of the automobile vehicles. This has placed a huge barrier for suppliers from developing countries who yet to have the technology expertise to produce some components talk less of sub-systems.

Some of the vehicle component suppliers in Nigeria and other developing countries are either micro, small and medium scale enterprises; and do not have the capabilities to compete with the global suppliers who are competing with them in the same local market. This paper will look at how automobile component suppliers in Nigeria can use the open innovation model to leverage on their internal competences to exploit the vista opportunities opened up by the new Nigerian automotive policy introduced in 2013/2014 and the Foreign Direct Investment that had followed the introduction of the new policy.

## **THE CONCEPT OF OPEN INNOVATION/LITERATURE REVIEW**

Open Innovation (OI) is defined as 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation' (Chesbrough et al., 2006, Chesbrough and Crowther, 2006). OI is seen as utilization of inbound and outbound knowledge flows converting to economic values, and acceleration of product development and marketing accumulated ideas leading to added value chain (De Jong,

Vanhaverbeke, Kalvet & Chesbrough, 2008). According to Ozman (2011), Chesbrough broadly defined Open Innovation (OI) as business strategy which refers to the creation, development and maintenance of channels through which firms access external sources of knowledge and reduce the barriers of access to their own knowledge bases. He went further to state that Open innovation emphasizes the “collective” nature of the innovation process, which has been the central premise of the innovation literature since the 1980s. New ideas in forms of products or services have to find their way to the market. According to Edquist (1997), Firms rarely learn or innovate in isolation but in networks of production. Most innovative activities involve multiple actors and stems from combining complementary and specialized competencies and knowledge of various actors. The synergy that arises from the combination of complementary knowledge of dissimilar firms and knowledge organizations and the need for firms to cope with the increasing dependency upon their environment are the driving force for the emergence of innovative collaborative agreements and other forms of business models (virtual manufacturing) seen today.

According to Alfredo et al., (2012), OI is in contrast with the traditional innovation model, where innovation is internally generated and marketed. The closed innovation strategy supports companies to generate their own innovation ideas and then develop, build, market, distribute, service, finance and support them on their own. Open innovation deals instead with relying on a firm’s capability to carry out internally and externally technology management tasks along the innovation process. The interaction and collaboration with external environment leads to external technology acquisition and exploitation as a company shares its core competencies with others. The boundary between a company and its environment becomes porous allowing the flow of knowledge from customers, suppliers and competitors. Technological knowledge should be considered as an economic good itself

Doudourova and Bevis (2012) stated that the basic assumption behind the OI model is that even large enterprises can no longer possess all the capabilities and resources to generate innovation by themselves and need to capitalize on external knowledge. Outbound knowledge flows are defined as unused technologies that can be sold or licensed to organizations with better suited for their commercialization business models (Chesbrough and Crowther, 2006).

OI strategy is now favoured in many industries (such as computers, semiconductors, telecommunications equipment and, pharmaceuticals, biotechnology), when compared with the closed innovation approach and this is currently reported in the literature (Chesbrough, 2003, Chesbrough *et al.*, 2006; Diaz-Diaz *et al.*, 2006, West and Gallagher, 2006, Gardet and Fraiha, 2012). Ibarra *et al.*, (2015) noted the three challenges which were previously identified by Chesbrough and Brunswicker (2013) to affect a firm’s disposition to OI. They are the internal organizational change management, external relationships management with sources of innovation and marketing effectiveness in the protection of intellectual property.

### **Open innovation in the automotive industry**

There are few studies in literature that have studied open innovation in the automobile sector. Alfredo *et al.*, (2012) noted that the question on the appropriateness of the application of OI for a better R&D performance in the automobile industry has not being completely answered. Mature industries display very different characteristics in terms of types of innovation, handling of

intellectual property rights (IP), patterns of innovation diffusion, risk management as well as strategies for exploiting innovation (Dodourova and Bevis, 2012)

The huge development costs, long development cycles and fierce global competition in the car industry have made the industry traditionally closed industry. Increasing cost of R&D and Innovation are not proportionate to customers' willingness to pay for extra cost despite customers' constant demand for innovations. Despite the high cost challenge, automobile firms will still have to commit resources on lowering carbon emissions, the development of environmentally benign and high safety standards for vehicle

Alfredo et al., (2012) stated two most important drivers of innovation in the automobile sector and they are two customers demand and globalization. Globally the customers demand more and more from the cars manufacturers for the same old price. In a bid to meet local demands in some other emerging markets, OEMs tend to adapt vehicles for local use. Some OEMS have to tropicalise cars to produced and used in South America and Africa countries.

Both Gassmann (2006) and Ili *et al.* (2010) are two studies that have looked at the appropriateness of OI in the automotive Sector. OI could be applied in the sector based on its global coverage, technology intensity, high levels of technology fusion and adaptability to new business models in different locations. OI should be given an opportunity in the automotive industry due to continuous demand for innovation by customers and short cycles of technological innovations, cost pressure, globalization, technology intensity and fusion. The automotive industry may have to also look outside its own boundaries to achieve this. The cross industry innovation (CII) is the deliberate combination of the potentials of companies operating in different industries (Gassmann *et al.*, 2004).

According to Dodourova and Bevis (2012) the automotive industry in the 1980s witnessed a move from the prevalent central-R&D-lab model towards a more distributed R&D model through supplier involvement in new product development. However, this is doubted to be OI since the suppliers worked under strict guidelines and specifications provided by OEMs. These OEMs still maintained powerful central laboratories while experimenting with ways of coordinating R&D at different levels (Tidd *et al.*, 2005 as cited by Dodourova and Bevis, 2012).

Automobile component suppliers in developing countries are to learn from the spill over effects of producing components for leading automobile firms; which offer them contracts to supply components that meet approved designs. These local firms are allowed to engage in reverse engineering and in some cases acquire license from other global suppliers known to their buyers (the OEM). Doner *et al.* (2006) also suggested contract supplying, acquisition of license as a learning pathway for local auto-component suppliers in developing countries

### **Open Innovation for SMEs in the automotive industry**

OI in itself is not an easy ride for any category of firm. Alfredo *et al.*, (2012) also shared this view and cited studies in literature that share this same view. They stated that the implementation of OI may be quite difficult, the prevailing objectives of the firms notwithstanding. However, no firm has all the resources to engage in all business opportunities that comes its way. It is possible to see several patents in the shelf of some big companies without being exploited. It is even a more difficult task for SMEs to engage in OI if such a firm does not have a good knowledge or technology based. Most SMEs are constrained by resources to carry out R&D and to venture into new technological

enterprise. If this is a general case for SMEs in several sectors, then it should be tight rope to climb for SMEs in the automotive sector.

Lichtenthaler, 2008, Langlois, 2003 and Christensen, 2006, all support that SMEs can reap greater benefits from OI. SMEs can offset the limitations of internal resources and competencies through external collaboration with other SMEs, large firms, other intermediaries or support institutions. They can build a strong technology knowledge base; which is not generally found among the large players and commercialize those technologies (O'Connor, 2006). They can also achieve this through purchase of patents to obtain technologies which could be used to service other firms. These new technological innovations developed or acquired through the patents could be exchanged with big firms for integration into their product architecture in exchange for complementary assets that are not possessed by the SMEs.

SMEs engagement in OI can result in division of labour where SMEs concentrate on exploration and perhaps some experimentation, while large incumbents step into the final stage and take over experimentation and exploitation, instituting repeatable processes such as manufacturing, delivery and customer contact and support.

Dodourova and Bevis (2012) noted that OI model is highly dependent upon intermediate markets where entrepreneurs supply new discoveries and highly specialised technological capabilities, possibly in collaboration with research institutions, to large companies, like OEMs, who in turn provide integrative capabilities and complementary assets for large scale commercialisation of innovation, and transform technologies into application-specific use. These intermediate or support institutions could be business associations, universities, research centres, government and regional institutions.

### **Methodology:**

This paper draws on literature survey (external publications, internal company documents and other online publications), but some of the data used in this paper were extracted from semi-structured interviews with managers in subsidiaries of Peugeot and Mercedes in Nigeria. Ten management cadre personnel were chosen to attend to the semi-structured interviews, with the duration of each interview session lasting about one hour to one and half. Six were chosen from Peugeot subsidiary and four from that of Mercedes-Daimler. The number of persons interviewed enabled the researchers to obtain additional information and check for consistency of the views being sampled. There were later discussions with some of the managers interviewed to verify data obtained for better clarity

Most of the component manufacturing firm were out of business and the ones still operating were sustaining themselves with other businesses waiting for the full implementation of the national automotive plan. Majority of them were not available for interview and we had to engage the two Multinational subsidiaries interviewed in this study; who had buyer-supplier relationship with them. Data obtained on the Nnewi automobile component cluster (which now manufacture and supply most of the after sales automobile in Nigeria) were from secondary sources.

## RESULTS AND DISCUSSION

### The Case Of Nnewi Automotive Component Manufacturing Cluster In Nigeria

#### *Historical Background*

According to Brautigam (1997), Nnewi is a town in the old eastern part of Nigeria, and was home to one of the major privately owned transport company. They were known to be involved in the market and transport of palm oil products with the European traders. This later led to automobile component business in town after the Nigerian-Biafran war. The automobile cluster at Nnewi town is made up of four villages (Otolo, Umudim, Uruagu and Nnewichi). According to a World Bank report (2008) each of the villages hosts a number of automotive spare parts manufacturing firms. Large and medium firms generally are located away from residential areas while small enterprises are located within homes, apartment buildings, backyards, market stalls and the Federal Government owned Technology Incubation Centre. The cluster have a high number of entrepreneurs who have built large as well and small and medium-scale factories at Nnewi especially in auto spare parts manufacturing. Based on the number of employees, the firms were classified into large scale (over 50 employees), medium (10-49), small (2-9) and micro-enterprises.

According to Oyelaran-Oyeyinka, 1997 (as cited by Chete *et al.*, 2013), the Nnewi Automotive Parts Industrial Cluster is a huge success story in Nigeria, when one looks at how an informal cluster can survive and succeed without government support in terms of provision of essential public utilities. This industrial cluster exports automotive parts to countries in the West African sub-region as well as other international destinations. Its key critical success factors include active participation of private industry associations such as Nnewi Chamber of Commerce, Industry, Mines and Agriculture and the Nigerian Association of Small Scale Industries, a social – cultural milieu characterized by competitiveness, high entrepreneurial spirit as well as investment in training and capacity to imitate and assimilate foreign technology. Above all, the Nnewi cluster made an independent effort to provide the necessary infrastructural support when the state failed to do so.

#### *Infrastructure*

Firms in Nnewi grew despite major infrastructural and credit constraints. Electricity, for example, was only supplied through private generators, water was provided through the company's boreholes, telephone service was poor and tariffs high, land was expensive and scarce, and banks were reluctant to extend the level of credit offered to companies with high inventory costs. Despite all these limitations, Nnewi firms succeeded in innovating, growing and exporting to neighbouring countries while other firms in Nigeria were failing.

#### *Product from the Cluster*

Since the mid-1970s, local traders in Nnewi have transformed themselves into manufacturers of automobile parts through close linkages to technology suppliers in Taiwan Province of China. Seventeen firms, ranging in size from enterprises with 40 employees to those with 250, supply Nigeria and other West African markets with switch gears, cables and hoses, roller chains for engines, auto tubes, batteries, engine seats, shock absorbers, foot mats and gaskets for motorcycles, as well as other parts. Most of these firms have the design capability to modify products and adapt the production process to the local market.

### *Institutional Support*

The Aluminium Smelting Company of Nigeria (ALUSCOM), Delta Steel and Ajaokuta Steel Company could not really provide raw materials, furnaces, crucibles pots and moulds to the firms that were engaged in manufacturing in the cluster. The firms resorted to importing these items from Taiwan and later Mexico. The Nigerian Industrial Development Bank assisted the company in bringing in eight grinding machines from their trading partner in Taiwan. The Taiwanese partner trained six Nigerian employees in their own plant and sent three Taiwanese nationals to transfer the technology. The technology transfer had been mainly through apprenticeship, training in the plants and learning by doing.

### *The linkages, network, learning in the cluster*

The acquisition of skills by workers in the cluster is mainly through learning by-doing, especially during equipment installation and test run, and through inter-firm linkages with foreign technology suppliers, notably those from Taiwan. Typically of other self managed clusters in developing countries, the cluster was vulnerable, especially because firms were not well organized within the cluster to support a continuous process of improvement. Policy inconsistency, lack of support structures (notably credit facilities), and weak local capital goods capability continued to slow down a full acquisition of major innovation capability of firms within the cluster.

However, according to the survey conducted by World Bank (2008) the firms within the cluster exhibit different modes of inter firm linking. The nature and intensity of such networking vary according to the context and variety of firms in the cluster. There is a strong accent on kinship among the firms. This strategy is to keep the skills and experiences gained within the family while reducing the risk of losing a valuable worker. Maintaining trust between employers and employees is critical for success. Employing relatives into the trading and manufacturing network reduces the risk of sabotage and ensures some measure of loyalty.

As firms interact in the cluster, they learnt from one another. Internal and external economies of scale also affect their function, as do both vertical and horizontal links (World Bank, 2008). The World Bank (2008) survey by Boladale Abayomi found out as the horizontal cooperation among firms in the Nnewi cluster was low especially in joint marketing as compared with information exchange and joint training which maintained slight increase between 1999 and 2004. Generally, cooperation among firms has remained at consistent levels in most areas. There were backward linkages with sub-contractors and input suppliers with measurable exchange of information and quality improvement. Cooperation levels with subcontractors have largely remained the same. The survey also reveal that forward linkages with both domestic and foreign buyers especially in some cooperation in information exchange, areas of quality improvement and joint marketing were significant among the firms in the cluster.

### *Link to Global value chains*

The firms in Nnewi cluster export their products to the West African market, and they also had a links to Taiwan for machinery, equipment and skills. The Technological capability to actively engage in the automobile industry is lacking in Africa. There is yet to be an indigenous automobile firm in

Nigeria that has introduced its own brand of vehicle. Innoson Vehicle Manufacturing (IVM) is now located in Newi but most of all the components are made and imported from Chinese firms. The African automobile market is dominated by Multinationals from Europe and Asia. Few indigenous firms are into assembly of motor vehicles and they still import most of their components from outside Africa. There is a bountiful opportunity for African clusters which lies in the manufacturing of auto parts lead to entire motor vehicle manufacturing. The industrialization of Newi auto cluster is notable because it had relied on local initiatives; it has been a localized learning effort with considerable knowledge from long distance in Taiwan and other places. The process involved wholesale importation of production technologies from erstwhile product suppliers in Taiwan and the training of Nigerian technicians, in-plant and/or in Taiwan to man the plants (World Bank, 2008). Among the small entrepreneurs, it was common to start with manual or semi-automated tools and later on introduced advanced machinery.

### **The case of automobile components/parts to Automobile Multinational companies in Nigeria**

Peugeot Automobile Nigeria (PAN) is one of the subsidiaries of a European leading firms-Peugeot Citroen Automobile group (PSA) of French extraction. Peugeot at the peak of automobile manufacturing in Nigeria in the 1980s had over 35 of local automotive component manufacturing firms; who were also servicing the replacement/spares part for Peugeot cars all over Nigeria. The Table in the appendix below shows the list of the firms (suppliers) and the components supplied to PAN. The fact remains that most of these firms went out of auto-component manufacturing after Peugeot faced out Peugeot 504 and 505 platforms and introduced others with different designs and platforms. The story of these automobile component firms were not different from the rest who were supplying components to ANAMMCO; a subsidiary of Mercedes-Daimler, Germany. The new auto policy in Nigeria aims at bringing back assembly of automobiles in Nigeria. Reports state that the OEMs such as the Nissan-Renault group, Toyota, and others are negotiating to start up assembly in Nigeria but they are also planning to come along with their Mega global suppliers.

### **DISCUSSION**

The case of the automobile component manufacturers in Newi cluster depicts the pathetic condition of most SMEs in some developing countries such as Nigeria. Beyond the lack of internal resources to engage in upgrade of technologies or build other capacities, these firms are constrained with basic infrastructure such as electricity supply, access road, water supply, work space, e.t.c. Attempts to provide the basic infrastructure ties down capital that would have being invested in machinery and acquisition of new technological capabilities. The clustering of the firms in Newi is unique in the sense that it does not necessary translate to sharing of facilities. The social network is built along family line and capital is also raised along that same line too. Most of the firms are not owned by highly educated persons and ownership of the firms in the cluster by persons from Newi community seem to limit the boundaries of the firms in the cluster.

Despite the mutual benefits enjoyed initially enjoyed by the Newi cluster, there seems to be the lock-in crisis which is typical of industrial clusters. The firms upgrade their technological capabilities through self effort and sufficiency of their Greenfield factories as observed by Oyelaran-Oyeyinka, B., (2004). It was no surprise that the firms could not continuously upgrade their technologies from Taiwan to catch up with the technological trend in the automobile industry. The qualities of some of

the parts supplied to the local market in Nigeria are poor and these days; one sees more of the used components/parts for repair and maintenance than the locally manufactured ones. More so, one cannot find the firms in Nnewi as the suppliers of two of the subsidiaries of the multinational companies (MNCs) surveyed in this study. The list of suppliers to one of the Peugeot subsidiaries is in the appendix. Unlike the firms in Nnewi cluster became less competitive over time, most of the automobile manufacturing firms supplying to PAN were out of business when PAN changed its vehicle platforms.

There could be other factors which formed barriers to innovation for these automobile component manufacturing firms but I think that lack of internal organizational change management, and poor external relationships management with sources of innovation were serious issues that made most of them not to embrace OI. OI can be easily facilitated when there is an organizational culture of learning and a learning orientation that embraces change. Changes in market environment, customer demands, regulations, technological change, and climatic change all demand that firms constantly change their business models, production processes and products.

Where the Nigerian automobile component manufacturing firms cannot internally develop their own knowledge, they should be apt to absorb and acquire technologies in forms of licenses, technical partnerships and patents from foreign firms to develop their own capabilities. There is a need for support institutions to provide business information and other support services to these firms. Apart from crafting good national automobile policies, the public institutions saddled with responsibilities of managing the automobile sector has to ensure that firms upgrade their capabilities, have access to a supply of skilled persons (in automobile engineering, Mechatronics, foundry, e.t.c), maintain linkages with R&D or knowledge support institutions and also interact within the automobile sectoral system.

As the new entrants (MNCs) into the automobile industry are coming into the Nigerian market due to the recent Automobile Liberalization plan of the government, it is expected that the National Automobile Council match make the local auto-component manufacturers with mega global automobile suppliers who will be following the MNCs. This will create a learning platform for these local automobile firms in Nigeria. According to Doner *et al* (2006), working closely with global first tier suppliers and entering into joint ventures and licensing arrangements are critical channels for accessing such new technologies and competences in the automobile business. Indian automobile industry took that path after the initial period of protectionism and now has only Indian indigenous auto-component firms in its automotive sector. This is explained in Box 1. The automobile industry in Central Europe region had that benefit of hindsight and grew with a mixture of follow sourcing strategy and upgrading of existing local suppliers.

**Box 1. The follow Design and follow supply strategy in the automobile industry**

When auto assemblers began to set up production operations in Argentina and Brazil in the 1950s and 1960s, they created new supplier networks in the host country. Within the context of import-substitution industrialization, auto assemblers were obliged to source a large part of their inputs from within the domestic economy. They were able to do this because they were used to providing sub-contractors with designs for simple, easy-to-make parts (as illustrated by the example of the seats presented above). For simple components, the local component manufacturer could work from an assembler's drawings and meet its requirements. In the case of more technically demanding components, the local suppliers might require links with a developed country component manufacturer in order to acquire process technology.

**CONCLUSION**

Open innovation is possible for firms that have the knowledge and capability to manage internal organizational change management, external relationships management with sources of innovation and marketing effectiveness in the protection of intellectual property. The essence of clustering, creation of inter-firm linkages and matching making of SMEs is to enhance knowledge flow between the boundaries of these firms. Clusters that do not encourage skilled labour mobility and inter-firm linkages are not likely to enhance OI.

The position of second and third tiers for suppliers within the supply chain in the automobile industry gives room for knowledge flow and inter-firm learning. This should be effectively utilised by automobile component manufacturing SMES in Nigeria to learn and innovate. The automobile component manufacturing firms should be match with the mega suppliers entering into the automobile sector in Nigeria

It is observed that not all MNCs are embedded into the innovation systems of their local market, therefore the public support institutions in the automobile sector in Nigeria should scout for the right automobile MNCs. A good example of technology transfer by an automobile MNC to developing countries in the literature can be found in the study by Ivarsson and Alvstram (2005) as cited by Gastrow (2012). They noted an internalized innovation networks and technology transfer by AB Volvo to local suppliers in developing countries (Brazil, India, china and Mexico). Volvo provided its domestic suppliers with technological assistance, enhanced supplier capabilities to improve their operations.

The match making of the local auto-component suppliers with other global auto-component supplier enhances learning and acquisition of other capabilities by the local suppliers. More so the match making of local auto-component suppliers with leading OEM and other global first tiers suppliers will lead to technological upgrading, competence building, export business opportunities and foster more openness.

APPENDIX

Table: List of auto-component suppliers and parts supplied to Peugeot Automobile Nigeria

Name of company and location	Parts /components produced
<ol style="list-style-type: none"> <li>1. Auto Components Industries-Kaduna</li> <li>2. Nasco Fibre Factory-Jos</li> <li>3. Polyplast Ltd-Kano</li> <li>4. Norcon Ltd-Kano</li> <li>5. Kumoh Ltd-Kaduna</li> <li>6. Unisteel Ltd-Kaduna</li> <li>7. Shempate Ltd-Kaduna,</li> <li>8. Maizuma Ltd-Kaduna</li> <li>9. Chuks Metal Ltd-Kaduna</li> <li>10. Intensive Arts Ltd-Kaduna</li> <li>11. NOCACO-Kaduna</li> <li>12. Union Adhesive &amp;Co Ltd-Kaduna</li> <li>13. Emcon Ltd-Zaria</li> <li>14. MSP-Kano</li> <li>15. Alpha Chemicon-Kaduna</li> </ol>	<ol style="list-style-type: none"> <li>1. Seat Foams</li> <li>2. Carpets</li> <li>3. Seat Covers</li> <li>4. Sound proof Materials</li> <li>5. Polythene Protector</li> <li>6. Metal Parts</li> <li>7. Seat Frames, Exhaust, Ambulance Stretcher,</li> <li>8. Bonnet Strut</li> <li>9. Engine Protector</li> <li>10. Stickers</li> <li>11. Harnesses</li> <li>12. Foam Paddings</li> <li>13. Protective Coating</li> <li>14. Steel Brackets</li> <li>15. Radiator Coolant</li> </ol>
<ol style="list-style-type: none"> <li>1. Safety Products Ltd-Lagos</li> <li>2. Norman Industries-Lagos</li> <li>3. Monaplex-Lagos</li> <li>4. Universal Rubber Ltd-Ibadan</li> <li>5. August Moon Ltd-Ibadan</li> <li>6. Auto Components Lagos –</li> <li>7. DVC Ltd Lagos -</li> <li>8. Isoglass Ltd Ibadan -</li> <li>9. TSG Ibadan -</li> <li>10. Penters Ltd Lagos –</li> <li>11. Moudaco Ltd Lagos –</li> <li>12. Canplas Ltd Lagos –</li> <li>13. Berger Paints Lagos –</li> <li>14. CAPL Plc Lagos –</li> <li>15. Kay Plastics Ilorin –</li> </ol>	<ol style="list-style-type: none"> <li>1. Wiper Reservoir</li> <li>2. Condensers</li> <li>3. Fuel filter ,Window winder, RR Light cover</li> <li>4. Pedal rubber &amp; other rubber parts</li> <li>5. Wiper water hose etc</li> <li>6. Engine Mounting &amp; Seat slides</li> <li>7. Sealants</li> <li>8. Glasses</li> <li>9. Glasses</li> <li>10. Derusting Chemicals</li> <li>11. Bumpers, Plastic Linings</li> <li>12. Flywheel Casts</li> <li>13. Auto Paints</li> <li>14. Auto Paints</li> <li>15. Boot trimmings</li> </ol>
<ol style="list-style-type: none"> <li>1. Pan Brasfibre Enugu</li> <li>2. Chieme Industries Aba –</li> <li>3. Udofe Ind. Ltd Igarra</li> <li>4. Onwuka Hi-Tek Aba</li> </ol>	<ol style="list-style-type: none"> <li>1. Boxer Roof Linning</li> <li>2. Monogram, Frt. Grill, Wheel Cover etc</li> <li>3. Stamped Metal Parts</li> <li>4. Shock Absorber Plate</li> </ol>
<ol style="list-style-type: none"> <li>1. Nig. Engr Works Port Harcourt-</li> <li>2. Quality Radiators Port Harcourt</li> <li>3. Car components Industries Asaba</li> <li>4. Michelin-Port Harcourt</li> </ol>	<ol style="list-style-type: none"> <li>1. Engine Protector, Cross members Evaporator,</li> <li>2. Radiator</li> <li>3. Seat Belts</li> <li>4. Tyres</li> </ol>

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