

TECHNOLOGY AND DEVELOPMENT IN NIGERIA: A STUDY OF SELECTED MANUFACTURING COMPANIES IN SOUTH-EAST, NIGERIA

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ABSTRACT

This study investigated technology and development in Nigeria using selected manufacturing companies in South-East. Descriptive survey research design was used and questionnaire served as the instrument of data collection. Data collected were analyzed using percentages and mean statistic. The Pearson product moment correlation coefficient was used to test the hypotheses. The study revealed that there is significant relationship between development of indigenous technology and productivity of manufacturing firms, and technological transfer enhances productivity for manufacturing firms. The work concludes that the achievement of organizational goal in manufacturing firms depends on the extent of utilization of indigenous and transferred technologies. Based on the findings and conclusions of this study, it was recommended that manufacturing firms should effectively utilize indigenous technologies so as to reduce cost of production and achieve productivity. Again, manufacturing companies should go for technological transfer when necessary to improve their productivity and production efficiency/effectiveness and achieve their goal.

Key Words: Technology, Development, Indigenous Technology, Technological Transfer and Productivity.

Introduction

The contributions of technology to overall development of a nation cannot be neglected. Technology assists nations in communication, production, transportation, research medicine and all other aspects of development. However, developing nations like Nigeria are yet to achieve improved modern technologies; hence one of the challenges which hinder the development of developing nations is lack of technological foundation (Jones & George, 2019). For the fact that technology has improved the standard of lives of individuals, organizations and nations, there is need for Nigeria to embrace modern technology in its system. This is because technology has actually assisted humans in overcoming the critical challenges of manufacturing, trade barriers, costs of transportation and delays in the exchange of information, thus effecting positive changes in the market place.

Technology has facilitated collaboration of software experts in the exchange of ideas and to work over the network with firms worldwide (Lamba & Malhotra, 2019). Technology has assisted a lot in the creation and growth of global markets such as the manufacturing firms. The model of technology used is not specifically the same among nations. While developing countries (like Nigeria etc) tend to follow a model that produces technological products before research is embarked on them, advanced countries tend to embark on research first before developing the product (Ramanathan 2020). Whichever dimension technological transfer takes, its essence remains to make it available in areas where it is needed.

Khalil (2022) sees technology to be the result of man's learned and acquired knowledge or his technical skills regarding how to do things well. Technology is considered one of the world's fastest agents of change. On the other way, transfer is all about sending something somewhere else which is not its origin. The focal point of this work is on manufacturing firms. If modern technologies, through the development of indigenous technology, or technological transfer – is effectively used for manufacturing activities, manufacturing companies will achieve their goals and sustainability; hence impacting positively on the development of Nigeria.

Statement of the Problem

The Nigerian manufacturing industry over the past decades has undergone swift changes due to technology, globalization and trade liberalization. The entrance of more foreign companies into the manufacturing industry has brought about stiff competition. With this openness, come costs as it reduces the market strength of domestic firms and increases the rate of modern technological use. Most production firms use technology that were transferred from developed nations, because of lack of indigenous technology in Nigeria. According to Obi-Anike, Ofobruku and Okafor (2017), the controversial nature of technological transfer calls for its evaluation with respect to contribution to organizational expansion. While some countries rely on indigenous technology and transfers are purely domestic, others rely almost absolutely on foreign acquisition of technology product. Some argue that some of the acquired technologies can actually be produced locally by concerted effort; others maintain that transferred technology is cheaper in the comparative cost analysis. Based on the above, this work focused on technology and development in Nigeria using

selected manufacturing companies in South-East.

Objectives of the Study

The general objective of this study focused on technology and development in Nigeria using selected manufacturing companies in South-East. The specific objectives include to:

1. examine the relationship between development of indigenous technology and productivity of manufacturing firms.
2. assess the extent technological transfer enhances productivity of manufacturing firms.

Research Questions

Based on our objectives, the following research questions were formulated and used.

1. What is the relationship between development of indigenous technology and productivity of manufacturing firms?
2. To what extent does technological transfer enhance productivity of manufacturing firms?

1.5 Research Hypotheses

In line with our research objectives and questions, the following hypotheses are stated in a null form.

Ho1: There is no significant relationship between development of indigenous technology and productivity of manufacturing firms.

Ho2: Technological transfer does not enhance productivity of manufacturing firms.

Conceptual Review

Technology

Technology is the science which provides the knowledge, that is, it is the sum total of knowledge of ways of doing things. It includes inventions, techniques, and a store of organized knowledge about everything. Its main influence is on the ways of doing things, how we design, produce, distribute and sell goods as well as services (Koontz, Cyril & Heinz, 1980). Technology has been defined as a transformer, a tool, as knowledge and as a specialized knowledge. Technologies can drive significant structural changes and economic development. It includes a new development in products, processes and materials. The level of technology in a particular industry determines to a large extent what products and services will be produced, which equipment will be used, and how operations will be managed. According to Hammond (1984), technology is a system of physical operations on raw materials, essentials to the production of a given output.

To Carrick (1978), it is the theoretical knowledge and application of research, design, development and operation of goods and services and of the necessary materials, manufacturing, equipment, production and management techniques to permit the efficient production of the goods and services. Onu (1977) sees technology as that which involves the social and economic atmosphere within which the system application of scientific knowledge of practical tasks can take place. Arinze and Ofegbu (1997) defined technology as the systematic knowledge for the manufacture of a product or for rendering of services including any integrally associated managerial and marketing techniques.

Ile (2020) sees technology as a series of techniques which include methods used in marketed and non-marketed activities, nature and specification of the product produced and its techniques, it encompasses the organization of productive units in terms of scale and ownership, it extends to services, manufacturing and agricultural sectors. Vutsova (2013) in his words described technology as often identified with knowledge about improved machinery, product and process. Chen and Huang (2009) supported Jhingan (2013) when he defined technology as identified with the hardware production - knowledge about machines and process.

Development – This is the gradual growth of political and socio-economic conditions so that they become more advanced, stronger and effective.

Major Aspects of Technology for Development of Nigeria

Nigeria's development can be achieved when technologies are well used. This means that productive organizations can achieve their goals through the use of improved technologies. The basic aspects of technologies used in this study include indigenous technology and technological transfer. They are discussed thus:

Indigenous technology

Indigenous technology are technologies employed by the native inhabitants of a country and which constitute an important part of its cultural heritage and should therefore be protected against exploitation by industrialized countries (Chukwu & Enudu, 2021). Indigenous technology refers to the knowledge, techniques, tools, and practices that are developed and used by a particular group of people, typically indigenous or native

communities, to solve specific problems or meet their needs within their local environment ((Nnamani & Nwoha, 2019). This technology is often rooted in the traditions, culture, and natural resources of a specific community and has been passed down through generations. Indigenous technology can include a wide range of innovations and practices, such as traditional farming methods, artisanal crafts, herbal medicine, sustainable resource management techniques, and unique tools and implements tailored to local conditions. These technologies are often adapted to the specific ecosystems, climates, and cultural contexts in which they are developed, making them well-suited to the needs and challenges faced by the indigenous communities that create and use them (Sulek & Hensley, 2004).

Indigenous technology is important not only for its practical applications but also for its role in preserving cultural heritage, promoting community resilience, and fostering sustainable development. It represents a valuable source of knowledge that can offer insights into alternative ways of interacting with the environment and addressing contemporary issues such as climate change, biodiversity loss, and social inequality (Suth & Ginsberg, 2010). Indigenous technology is used by the native inhabitants of a country or region and it constitutes an important part of its cultural heritage. Characteristically, indigenous technologies: Are recognized as animate, imbued with the breath of life and they live in form and function.

Technological transfer

Technological transfer is a proactive form of advocacy for change through adoption of technology. Practitioners of

technology transfer are variously referred to as change agents, communicators, teachers, trainers, technology marketers, and by many other terms (Carayanis & Alexander, 1998). According to them, technology transfer “refers to all the activities leading to the appropriate adoption of a new product or procedure by any group of users. ‘New’ is used in a special sense as it means any improvement over existing technologies or processes, not necessarily a chronologically recent invention”. Technology transfer occurs at all stages of the technology innovation process, from initial idea to the final product.

These processes integrate multiple functions, including organized research and development, design, production, engineering, manufacturing, marketing, and other value-adding activities in a complex web containing multiple feedback loops (EC, 2007). In the broadest sense, technology transfer is a process of communication that results in putting research findings or new information into practice. Technology transfer is the process of deliberate and systematic acquisition, provision, sharing, licensing of equipment and machinery, technology, skills, knowledge, intellectual property rights, business and organizational processes, designs and facilities, for the manufacture of a product, for the application of a process or for the rendering of a service.

Concept of Productivity

Productivity is the ratio of what is produced to what is required to produce it; hence it measures the relationship between output and inputs. Also, productivity means how much and how well we produce from the resources used (Kuratko & Hornsby, 2014 cited in Njoku, 2016). Productivity growth constitutes an important element for modeling the productive

capacity utilization, which in turn allows one to gauge the position of economies in the business cycle and to forecast economic growth. In addition, production capacity is used to assess demand and inflationary pressures. According to Ibezim (2021), one of the major concerns of manufacturing companies is improving workers productivity.

Gerba and Viswanadham (2016) defined productivity as that which people can produce with the least effort. Because of its central importance to competitiveness and world prosperity, the topic of productivity has been a matter of interest since the beginning of industrialization. Productivity is perhaps one of the most important and influential basic variables governing economic production activities. While high productivity can be a significant source of competitive advantage for companies (Borman & Motowidlo, 2023; Ajagu, 2018); it also contributes to the general well - being of a society. Due to the size of the manufacturing industry, productivity trends in this industry have notable effects on national productivity and on the economy as a whole.

Almazmomi (2018) defined productivity as a measure of how successfully organizations are achieving their missions and advancing their visions through core strategies. García-Álvarez (2015) defines productivity as the ability of an organization or a business to achieve its objectives. García-Álvarez (2015) outlines that the achievement of organizational productivity requires some alignments – leadership alignment, strategic alignment, cultural alignment, performance alignment and customer focus alignment. To Gerba and Viswanadham (2016), organizational productivity is both a powerful and problematic term. The strength of it is that it may be used to critically evaluate and improve organizational activities.

Theoretical Framework

The use of theories in social science and business research cannot be neglected. This is because theories help researchers to understand existing ideas, concepts and constructs and use such to address or provide solution to current research work. The theory used in this work is competitive advantage theory,

Competitive Advantage Theory

This work is anchored on Competitive Advantage Theory by Micheal Porter in 1980. The term competitive advantage refers to the ability gained through attributes and resources to perform at a higher level than others in the same industry or market (Christensen & Fahey, 1984; Kay, 1994; Porter, 1980 cited in Chacarbaghi, 1999). A firm is said to have a competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential player (Barney, 1991 cited in Clulow, Val, Gerstman, Julie, Barry & Carol, 2003). Competitive advantage is seen as the strategic advantage one paint manufacturing business entity has over its rival entities within its competitive industry. It is a business concept describing attributes that allow an organization to outperform its competitors. Achieving competitive advantage strengthens and positions a business better within the business environment. Successfully implemented strategies will lift a firm to superior performance by facilitating the firm with competitive advantage to outperform current or potential players.

To gain competitive advantage, a business strategy of a paint manufacturing firm manipulates the various resources over which it has direct control and these resources have the ability to generate competitive advantage. The attributes that could

provide competitive advantage for a firm may include access to natural resources, such as high grade ores or inexpensive power, highly skilled personnel, geographic location, high entry barriers. Competitive advantage makes sure customers remain loyal through offering superior products and services. It enhances effectiveness, efficiency, patronage, and customer retention Value proposition which is important when understanding competitive advantage. This theory was used because a manufacturing firm that has advantage on technology will achieve its goals and organizational growth through improve efficiency, effectiveness, patronage, and retention of customers.

Empirical Review

In this section, the researcher espoused some past findings related to the research work.

Atongdem and James (2023) evaluated factors that influence technology transfer in the upper east region: a case study of Bolgatanga Municipality, Ghana. Twelve prominent firms in the study area were selected. The population covered 300. Purposive sampling technique was used to select twelve management staff and simple random sampling technique was used in selecting two hundred (200) non-management staff from the various firms in the Bolgatanga municipality. The researchers adopted stratified sampling technique for the study which had a sample size of two hundred and twelve (212) respondents. Questionnaire was the only instrument used for the data collection. The questionnaire was administered by the researchers directly to the respondents. Data collected were analyzed using tables with frequencies and percentages. The results indicate that the need for improved market performance,

profit increase, and organization growth are the needs for technology transfer.

Hussain, Ali, Ibrahim, Noreen and Ahmad (2023) worked on impact of technology use on consumer perception and purchase intention in Pakistan. The study used 20 staff and 20 design marketing staff, and 200 regular customers in two selected firms. The work used interview method through survey. Data were analyzed using mean and standard deviation. It was revealed that technology use to have good perception and intention.

Osuoha, Ekeruo, Obinna and Nnamdi (2023) examined technological transfer and performance of manufacturing firms in Lagos. A sample of two hundred and fifteen (215) was randomly drawn from six judgmentally selected organizations in Lagos, using questionnaire. The resulting primary data were analyzed for correlations and multiple regressions using the version 20 of the Statistical Package for Social Sciences (SPSS). The results were that vertical technology transfer had positive effects on the manufacturing firms' profitability ($r = 0.816$) and productivity ($r = 0.625$). Horizontal transfer had similar significant positive effects with $r = 0.741$ for productivity and $r = 0.566$ for profitability. All beta coefficients from the regression result were positive and statistically significant. The coefficient of multiple determination from the model summary was $R^2 = 0.321$, with an adjusted value of 0.294, showing that vertical and horizontal transfers would have a joint effect of 29.4% increase in profitability and productivity. These findings led to the conclusion that technology transfer has a positive effect on a firm's performance and to the recommendation that managers of manufacturing firms should adopt technology transfer as a

strategy towards higher profitability and productivity, among others.

Udegbe (2023) examined the effect of technological development process and its impact on business performance in Awka, Anambra State, Nigeria. The researcher adopted the survey research design. The research sample consists of 180 Nigerian manufacturing industries. The sample in the study was designed using convenience sampling method. Two copies of the questionnaire were administered to each of the 180 manufacturing firms that served as sample. Out of the total employee sample of 360, 330 useable questionnaire copies were returned representing a response rate of 63.89%. Data were analyzed with the use of statistical methods such as factor analysis, correlation analysis and reliability analysis. Validity and reliability test indicated that the research instrument was valid and reliable. Based on the data analysis, the findings were that although some of the results corresponded to the previous findings, it was however found that new and modern technology affected both the new product development business plan and business performance (growth).

Agbim (2021) determined the relationship between technology network and technology transfer and technology transfer performance among indigenous family-owned manufacturing entrepreneurship in the town Aba, Abia State. Survey design and simple random sampling technique were adopted. Questionnaire was employed to generate the study data. The chi-square analysis of the data shows that technology transfer and technology transfer performance significantly depend on technology network. The study concludes that through cooperation with-in a technology network, actors can acquire, apply and put a transferred technology to commercial

ends based on their absorptive capabilities. In addition to increased investment in education and other infra-structures, the study recommends taking advantage of the Nigerian market power to create various technology networks of owners and users of similar technologies. Further research themes are provided.

Akbar (2021) determines the effect of technological change on management accounting change in Iran manufacturing firms. The study used descriptive survey design. T test, Friedman test and Kruskal test were used for the hypothesis. Both the primary and secondary data were used for the study and the industries used were randomly selected. 150 questionnaires were given out while 112 were answered. The result was that technological change has effect on management accounting change. The study recommends that firms must replace traditional and individualized method of working in order to increase the quality and reduce the cost price.

Akpan (2021) conducted a study on nation's economic development through adequate technology in industrialization in Nigeria. The study which is empirically inclined examined the relationship between industrialization and economic development with focus on some states in Nigeria. The Ordinary Least Square (OLS) technique was adopted in line with diagnostic test for the model. It found that technology is an avenue for industrialization.

Cheng and Gan (2021) looked into the stimulatory impact of trade competitiveness on technology transactions as a result of Regional Management Board RMB appreciation in China. The researchers analyzed Chinese regional data over the period from 1998 to 2015 to estimate the stimulatory impact of

RMB appreciation on technical transactions via trade competitiveness using the General Management Method (GMM) approach. Their findings suggested that a strengthening of the RMB could encourage companies to utilize local technology market capabilities for innovation. Increased imports resulting from RMB appreciation can result in technological spillovers and greatly boost technology commerce. The study also found that the increased export rivalry brought on by RMB appreciation could push international and local enterprises to improve their export competitiveness through improved technology transactions.

Chukwu and Enudu (2021) investigated the impact of technology transfer on consumer buying behavior using cosmetic firms in Lagos State, Nigeria. Technology transfer can dissuade consumers from buying products. In addition, a poorly technology transfer poses serious problem to salesmen, since it will require enough explanations to persuade customers to buy the products. Customers dislike shabbily packaged products. Good and attractive technology transfer influence consumers buying behavior by making them to buy products and always patronize products. A survey was used for this purpose. The data collected from the questionnaire instrument were analyzed using percentages and multiple regression. The research findings show that a significant and positive relationship lies between the independent variable, technology transfer, value and quality of packaging, impulse purchasing and the dependent variable consumer buying behavior.

Ibezim (2021) investigated the effect of product quality on corporate growth in Starline, Abia State. Survey research design was used and interview system served as the instrument of data collection. The population of the study is made up of the

entire 180 permanent staff of the firm, which also served as sample. The collected data were analyzed using simple percentage and the hypotheses tested using Pearson product coefficient correlation. The findings revealed that product quality, and good price enhance customer satisfaction and customer patronage.

Nwankwo (2021) focused on the effect of technology on new product development of soft drink industry using Seven Up Bottling Company Aba, Abia State as the focal point. Three research objectives, three research questions and three hypotheses guided the study. Survey research design was used and questionnaire served as the major instrument of data collection. The population of the study is made up of the entire staff of seven up in Aba, Abia State from were 133 were sampled. Out of the 133 copies of questionnaire distributed, only 120 were properly filled, returned and used. The data collected were analyzed using simple percentage and Pearson product moment correlation coefficient. Based on the data analysis, it was discovered that there is significant effect of technology on the profitability of seven up Aba, Abia State.

Okoli (2021) investigated effect of employee's ICT skills on the performance of manufacturing firms in southeast Nigeria. One hundred and nine employees from different departments in various manufacturing firms responded to the research instrument designed to measure ICT competence and two performance domains. A simple linear regression was conducted on the data, and the result indicated a statistically significant association between employees' ICT skills and increased performance of the firms.

Oruma and Amah (2021) examined the impact of

globalization on technology in Nigeria. They used mean for data analysis because the work was a survey study. The study found that technological globalization leads to expeditious economic growth in Nigeria, and it has been of immense benefits to both the public and private sectors of the Nigerian economy.

Skare and Soriano (2021) looked at how globalization affects digital technology adoption in Algeria. The enhanced panel data model was used to apply country level data from the digital adoption index, KOF globalization index, total factor productivity and global competitive index to 183 nations. Globalization has a major impact on technological transfers, digital technology uptake, and spillovers in all nations, according to the research. This implies that convergence of digital technological adoption is always experienced by countries that undergo significant technological changes.

Palmberg, Pajerien and Tumo (2017) studied transferring science based technology for the period 2000 to 2016 in Makurdi. The results showed that transfers are beneficial to both the transferer and the transferee and can affect a 26.2% increase in GPD of both parties.

Ukpabio, Siyanbola and Oyeibisi (2017) investigated the impact of technological innovation on the performance of manufacturing firms in Ogun State, Nigeria. The sample for this study was drawn from 305 SMEs in the textile/leather/apparel and footwear subsector; wood/furniture and woodworks subsector; and domestic/industrial plastic and rubber subsector. Data collected was analyzed using correlation analysis and hierarchical regression analysis. The correlation result shows that product innovation and process innovation had significant positive relationship with firm performance. However, the

regression result confirmed that product and process innovations have positive impact on the performance of firms. Additionally, process innovation maintained a significant impact on firm performance with the inclusion of control variables whereas product innovation had significant impact on innovation with the exclusion of the control variables from the model.

Carl (2016) tracked the importance of technology on the growth of the economy and its competitiveness in China in a quantitative and qualitative analysis, and described the tactics of the fastest rising economies over the past 50 years from the standpoint of their technology strategic orientation. He also outlined some of the important global dynamics that are making it more difficult for developing countries to replicate the rapid growth of the mentioned countries, as well as the impact of China's growth on developing countries. The study's main findings are that technology is becoming a more critical component of globalization and determination, and that the rapid pace of technological change and the preconditions required to effectively partake in globalization are making it even more complicated for many developing countries to compete. To succeed in the ever-demanding and twisted global economy, he suggested that emerging countries develop additional technology capabilities and greater flexibility. Furthermore, globalization and increased global competition should be fought, as they lead to powerful protectionist absence in both emerging and rich countries. If rich countries focus on increasing their flexibility in adapting to the growing comparative advantage resulting from rapid technological development, and developing nations focus on extending their technological capabilities, infrastructures, and education, the world will be a better place. However, there are significant imbalances in the globalized world, necessitating

significant efforts to provide some transfer mechanisms and world balancing.

Gap in Literature

In line with our empirical studies, it could be seen that many related works have been done. However, the exact subject matter was not covered. We are grouping the gap in categories, thus:

- a. Gap in topic:** As we can see from the related empirical work, none of the past studies covered the topic. Only related works were covered. No work was done on both independent and dependent variables.
- b. Gap in the area of the study:** This work covered manufacturing firms (paint industries in south east) Nigeria. However, most of the empirical studies used other places in Nigerian and some were even done outside Nigeria.
- c. Gap in the indices in objectives of the study:** The indices in our objectives of study were not exactly covered by past researches.

S/N	STATES AND COMPANY			POPULATION
1	IMO STATE	Dulux color centre Owerri CAP PLC (Rc: 4551)	106 Okigwe Road, Owerri	14
		Zicli Synergy (Paint) Ltd (Rc: 1226001)	No.1 Zicli Road off Okporo Road, Orlu	17
		Nnenco Paints Nig. Ltd (Rc: 38697)	102 Okigwe-Owerri Road, Okigwe	18 Total = 49
2	ABIA STATE	Saclux Paint Ind. Nig. Ltd (Rc: 79691)	No.3 Club Road, Umuahia	16
		De Samtex Painting & Production Services Nig. (REG. Business Name. Rc: 4217160)	Uhideogwe-Azumini Ndoki, Abia	22
		Clover Paint Co. Nig. (Rc: 80548)	No.5 Amaifeke Road, Aba	28 Total = 66
3	ENUGU STATE	Nalin Paints Ltd (Rc: 176692)	No.3 Isuochi Street Uwani Enugu	8
		Intercolor Paint Ind. Ltd (Rc: 991393)	Plot CR6/8 standard layout Emene Industrial Area by Old Airport Road, Enugu	10
		Ebonyi Paint Nig. (Rc: 10799)	No.48 Zik Avenue Uwani Enugu	13 Total = 31
4	EBONYI STATE	Ebonyi-Salt Paint & Allied Products (Reg. Business Name Rc: 3694959)	No.9 Amasiri Street, New Haven Abakiliki	18
		Sunpac Chemical Ind. Ltd (Rc: 634386)	No.26 Afikpo Road Abakiliki	16
		Roxin Resources and General Contract Ltd (Rc: 1756642)	No.1 Gabriel Street Abakiliki Ebonyi State; Mr. Dominic Onele Compound Igwe Okpu Phase 2 Abakiliki	22 Total = 56

5	ANAMBRA STATE	Portland Paint & Product Nig. Ltd (Rc: 76075)	91 Limca Road Nkpor Onitsha	9
		Silk Coat Global Effect Paint Ltd (Rc: 1355002)	36 Limca Road Nkpor Onitsha	10
		Vinotex Paint Industry (Reg. Business Name: Rc: 2494036)	Onye kwere Compound Umugama Village, Anambra	12
		Paradise Paint & Chem. Ind. Nig. Ltd (Rc: 707483)	No.33 St. John Street Odoakpu, Onitsha	17
		Ebulux Paints Nig. Ltd (Rc: 1721487)	No.10 Abagana Street New Layout Road Onitsha	8
		Sharon Paints & Chemical Co. Ltd (Rc: 61855)	No.8 Obosi Road Onitsha North L.G.A.	15 Total = 71
	GRAND TOTAL			478

Based on the foregoing, it's a fact that little or nothing has been covered on technology and development in Nigeria using selected manufacturing companies in South-East. For that, research gap exist and there is need for this study.

Methodology

In this study, survey research design was used. Survey research design is an aspect of quantitative research design which provides a numeric description of trends, attitudes and opinions of a population by studying a sample of the population (Asika, 2008). The population of this study is 273. It comprises of the entire management staff and employees in production

department of the selected Paint manufacturing firms in South East Nigeria (**Source:** Personnel Units of the Paint Manufacturing Companies Under Study, 2024, see *table 3.1 for details on the companies*). The Paint manufacturing firms were used because they use both transferred technology and indigenous technology for their production process. The management staff and employees in production department of the selected Paint manufacturing firms were used to provide information for the study because they are in position to provide information on technology and development in Nigeria using selected manufacturing companies in South-East.

Table 1: Study population.

Source: Personnel Units of the Paint Manufacturing Companies Under Study, 2024

To determine the sample size, the formula of Taro Yamane was used. The formula is given as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where

n = the sample size

N = population. An estimated population of 300 is used.

e² = square of maximum allowance for sampling error at 5% level of significance.

$$n = \frac{273}{1 + 273(0.05)^2}$$

$$n = \frac{2.73}{1 + 273(0.0025)}$$

$$n = \frac{273}{1+0.6825}$$

$$n = \frac{273}{1.6825}$$

$$n = 162.3$$

The sample size (n) = 162

More so, to get the specific sample size from each of the companies, the researcher used proportionate approach so as to select an appropriate sample size from each of the companies. The proportionate method is applied thus:

$$\frac{W_1}{N} \times n$$

Where K = sample size proportion

W₁ = no of employees for individual firm

N = population size

n = sample size

Imo State

Dulux Color Centre

$$n_1 = \frac{14}{273} \times \frac{162}{1}$$

$$n_1 = \frac{2,268}{273}$$

$$= 8.3$$

$$= 8$$

Zicli Synergy Paints

$$n_2 = \frac{17}{273} \times \frac{162}{1}$$

$$n_2 = \frac{2,754}{273}$$

$$= 10.1$$

$$= 10$$

Nnenco Paints Nigeria Limited

$$n_3 = \frac{18}{273} \times \frac{162}{1}$$

$$n_3 = \frac{2,916}{273}$$

$$= 10.7$$

$$= 11$$

Abia State

Saclux Paint Industries Ltd

$$n_4 = \frac{16}{273} \times \frac{162}{1}$$

$$n_4 = \frac{2,592}{273}$$

$$= 9.5$$

$$= 10$$

De Samtex Painting & Production Services Nig

$$n_5 = \frac{22}{273} \times \frac{162}{1}$$

$$n_5 = \frac{3,564}{273}$$

$$= 13.1$$

$$= 13$$

Clover Paint Co. Nig. Ltd

$$n_6 = \frac{28}{273} \times \frac{162}{1}$$

$$n_6 = \frac{4,536}{273}$$

$$= 16.6$$

$$= 17$$

Enugu State

Nalin Paints Ltd

$$n_7 = \frac{8}{273} \times \frac{162}{1}$$

$$n_7 = \frac{1,296}{273}$$

$$= 4.7$$

$$= 5$$

Intercolor Paint Ind. Ltd

$$n_8 = \frac{10}{273} \times \frac{162}{1}$$

$$n_8 = \frac{1,620}{273}$$

$$= 5.9$$

$$= 6$$

Ebonyi Paints (Nigeria) Limited

$$n_9 = \frac{13}{273} \times \frac{162}{1}$$

$$n_9 = \frac{2,106}{273}$$

$$= 7.7$$

$$= 8$$

Ebonyi State

Ebonyi-Salt Paint & Allied Products

$$n_{10} = \frac{18}{273} \times \frac{162}{1}$$

$$n_{10} = \frac{2,916}{273}$$

$$= 10.7$$

$$= 11$$

Sunpac Chemical Ind. Ltd

$$n_{11} = \frac{16}{273} \times \frac{162}{1}$$

$$n_{11} = \frac{2,592}{273}$$

$$= 9.5$$

$$= 10$$

Roxin Resources and General Contract Ltd

$$n_{12} = \frac{22}{273} \times \frac{162}{1}$$

$$n_{12} = \frac{3,564}{273}$$

$$= 13.1$$

$$= 13$$

Anambra State

Portland Paint & Product Nig. Ltd

$$n_{13} = \frac{9}{273} \times \frac{162}{1}$$

$$n_{13} = \frac{1,458}{273}$$

$$= 5.3$$

$$= 5$$

Silk Coat Global Effect Paint Ltd

$$n_{14} = \frac{10}{273} \times \frac{162}{1}$$

$$n_{14} = \frac{1,620}{273}$$

$$= 5.4$$

$$= 5$$

Vinotex Paint Industry

$$n_{15} = \frac{12}{273} \times \frac{162}{1}$$

$$n_{15} = \frac{1,944}{273}$$

$$= 7.1$$

$$= 7$$

Paradise Paint & Chem. Ind. Nig. Ltd

$$n_{16} = \frac{17}{273} \times \frac{162}{1}$$

$$n_{16} = \frac{2,754}{273}$$

$$= 10.1$$

$$= 10$$

Ebulux Paints Nig. Ltd

$$n_{17} = \frac{8}{273} \times \frac{162}{1}$$

$$\begin{aligned}
 n_{17} &= \frac{273}{1} \\
 &= 4.7 \\
 &= 5
 \end{aligned}$$

Sharon Paints & Chemical Co. Ltd

$$\begin{aligned}
 n_{18} &= \frac{15}{273} \times \frac{162}{1} \\
 n_{18} &= \frac{2,430}{273} \\
 &= 8.0 \\
 &= 8
 \end{aligned}$$

$$\begin{aligned}
 &n_1(8) + n_2(10) + n_3(11) + n_4(10) + n_5(13) + n_6(17) \\
 &+ n_7(5) + n_8(6) + n_9(8) + n_{10}(11) + n_{11}(10) + \\
 &n_{12}(13) + n_{13}(5) + n_{14}(5) + n_{15}(7) + n_{16}(10) + \\
 &n_{17}(5) + n_{18}(8) + = 162
 \end{aligned}$$

The researcher applied purposive sampling technique so as to select respondents who were available/accessible and who effectively respond to the questionnaire. The reason for using purposive sampling technique is to enable the researcher to personally use his own judgement in selecting people who were in the position to provide answers to the questionnaire. In this study, the questionnaire was the major instrument of primary data. The questionnaire was framed in likert format of strongly agreed, agreed, disagreed and strongly disagreed.

The data collected in this study were analyzed using simple percentage, mean statistics and Pearson Product Moment Correlation Coefficient (PPMCC) at 0.05 level of significance through Statistical Package for Social Sciences (SPSS version 21.0). Simple percentage and bar chart were used to analyze the percentage responses of the respondents on bio-data, and first section of the thematic issue. Mean statistic was used to determine the level of agreement and disagreement of the respondents in each questionnaire item for construct variables (the subject matter in the objectives). More so, Pearson Product Moment Correlation Coefficient (PPMCC) at 0.05 level of significance through Statistical Package for Social Sciences (SPSS version 21.0) was used to test the hypotheses. For the formulars, see *Appendix I, II & III*.

Data Analysis and Interpretation

It should be noted that out of 162 copies of the questionnaire distributed, only 152 copies were returned and used.

Section A: The Biographic Data of the Respondents

Table 2: Gender distribution of the respondents.

Question	Response	Respondents	
		No	%
Sex	Male	97	63.8
	Female	55	36.2

Total		152	100
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Source: field survey, 2024

From the table above, it can be seen that 97 or (63.8%) of the respondents are male while 55 or (36.2%) of the respondents are female.

Table 3: Distribution of respondents by academic qualification.

Question	Response	Respondents	
		No	%
Academic qualification possessed by respondents	FLSC	7	4.6
	O' level	21	13.8
	OND or its equivalent	33	21.7
	BSC/HND	64	42.1
	Post graduate qualifications	17	11.2
	Others	10	6.6
Total		152	100

Source: field survey, 2024

The table above shows that 7 or (4.61%) of the respondents hold a first school leaving certificate, 21 or (13.82%) has O' level certificate, 33 or (21.71%) holds either OND or its equivalent, 64 or (42.10%) holds either BSC or HND certificate, 17 or

(11.2%) hold post graduate qualifications while 10 or (6.6%) of the respondents have other certificates.

Table 4: Distribution of respondents by age.

Question	Response	Respondents	
		No	%
Age range of respondents	18-25	21	4.6
	26-33	35	23.0
	34-41	66	43.4
	42 years and above	30	19.7
Total		152	100

Source: field survey, 2024

It can be seen from the table above that 21 or (4.61%) of the respondents fall within the ages bracket of 18-25years, 35 or (23.0%) are within the ages of 26-33years, 66 or (43.4%) are within the ages of 34-41 years while the number of respondents within 42 years and above is 30 or (19.7%)

Table 5: Distribution of the respondents by marital status.

Question	Response	Respondents	
		No	%

Marital status	Married	99	65.1
	Single	53	34.9
Total		152	100

Source: field survey, 2024

It can be seen from the table above that 99 or (65.1%) are married while 53 or (34.9%) of the respondents are single.

Table 6: Distribution of respondents by duration of service in the organization.

Question	Response	Respondents	
		No	%
Length of service	1-4	40	26.3
	5-8	59	38.8
	9-15	44	28.9
	16 years and above	9	5.9
Total		152	100

Source: field survey, 2024

The table above shows that 40 or (26.3%) of the respondents have worked in their respective organizations between 1-4years, 59 or (38.8%) worked between 5-8years, 44 or (28.9%) 9-15years, while 9(5.9%) of the respondents have worked for between 16years and above.

Section B: The Subject Matter

Research question one: What is the relationship between development of indigenous technology and productivity of manufacturing firms?

S/ N	Questionnaire Items	S A	A	D	S D	N	Σ X	X	Dec .
1	My company sometimes go for technology transfer to achieve productivity	77	50	15	10	152	498	3.3	Accept
2	technology add value to our output maximization	55	59	26	12	152	461	3.0	Accept
3	Our company is developing based on modern technology in use	101	33	11	7	152	532	3.5	Accept

4	Technology transfer through imitation is a road map to improve productivity	102	29	13	8	152	529	3.5	Accept
5	The achievement of more productivity depends on technology used	57	89	4	2	152	505	3.3	Accept
	Grand mean							3.3	

Table 7: The relationship between development of indigenous technology and productivity of manufacturing firms.

Source: field survey, 2024

It was discovered in table 7 that all the items were accepted. This is because item 1 has a mean of 3.3, item 2 has a mean of 3.0, item 3 has a mean of 3.5, item 4 has a mean of 3.5 and item 5 has a mean of 3.3; hence all the items have mean scores more than 2.5 and above. It is therefore concluded that there is significant relationship between development of indigenous technology and productivity of manufacturing firms.

Research question two: To what extent does technological transfer enhance productivity of manufacturing firms?

Table 8: Technological transfer enhances productivity of manufacturing firms.

S/ N	Questionnaire Items	SA	A	D	SD	N	ΣX	X	Dec.
1	Use of indigenous Technology will be beneficial to my company if well implemented	79	61	8	4	152	519	3.4	Accept
2	Our company sometimes use indigenous technology for production	57	59	20	16	152	461	3.0	Accept
3	Indigenous will help to develop the nation's economy	57	88	2	5	152	501	3.3	Accept
4	Our company most times do not go for indigenous if we have modern transferred technology	68	69	5	10	152	499	3.3	Accept

5	Indigenous technology will help use to produce and sales our products on a lower cost	102	33	10	7	152	534	3.5	Accept
	Grand mean							3.	

Source: field survey, 2024

It was discovered in table 8 that all the items were accepted. This is because item 1 has a mean of 3.4, item 2 has a mean of 3.0, item 3 has a mean of 3.3, item 4 has a mean of 3.3 and item 5 has a mean of 3.5; hence all the items have mean scores more than 2.5 and above. It is therefore concluded that technological transfer enhances productivity of manufacturing firms.

Test of Hypotheses

H01: There is no significant relationship between development of indigenous technology and productivity of manufacturing firms.

Fig. 1: To test hypothesis one, data in table 7 was used.

Hi1	There is significant relationship between development of indigenous technology and productivity of	Pearson Correlation = 0.89 Sig = 0.05 N = 152	VALID
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	manufacturing firms	Grand mean = 3.3	
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The analysis has a grand mean of 3.3. The table above shows that the Pearson product moment correlation is 0.89 which indicates that there is significant relationship between development of indigenous technology and productivity of manufacturing firms. Hence, the null hypothesis is hereby rejected.

Ho2: Technological transfer does not enhance productivity of manufacturing firms.

Fig. 2: To test hypothesis two, data in table 8 was used.

Hi2	Technological transfer enhances productivity of manufacturing firms	Pearson Correlation = 0.84 Sig = 0.05 N = 152 Grand mean = 3.3	VALID
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The analysis has a grand mean of 3.3. The above table indicates that the Pearson product moment correlation is also 0.84 which reveals that technological transfer enhances productivity of manufacturing firms. Hence, the null hypothesis is rejected.

Fig. 3: General table results for the hypotheses.

S/N	Hypotheses	Software results	Result
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Hi1	There is significant relationship between development of indigenous technology and productivity of manufacturing firms	Pearson Correlation = 0.89 Sig = 0.05 N = 152 Grand mean = 3.3	VALID
Hi2	Technological transfer enhances productivity of manufacturing firms	Pearson Correlation = 0.84 Sig = 0.05 N = 152 Grand mean = 3.3	VALID

4.3 Discussions of Findings

H01: There is no significant relationship between development of indigenous technology and productivity of manufacturing firms.

For hypotheses one, it was found that there is significant relationship between development of indigenous technology and productivity of manufacturing firms. According to Yauri (2016), many manufacturing companies have ventured into technological transfer to improve their production and achieve market growth. Productivity can be achieved in business when the right modern equipments are used (Sartipi, 2020).

Ho2: Technological transfer does not enhance productivity of manufacturing firms.

It was found in hypothesis two that technological transfer enhances productivity of manufacturing firms. In the view of Adeola (2020), indigenous technology is a strategy of technological use which manufacturing firms adopt to achieve production, reduce cost and improve performance.. There is need for government to improve the indigenous technological system to assist firms to improve transformation (Dauda, 2019).

Conclusion

Production organizations need the collaboration, cooperation and support themselves through the use of both transferred and indigenous technologies. The above issues necessitate the emphasis on technology used in manufacturing firms. This work concludes that the achievement of organizational goal in manufacturing firms depends on the extent of utilization of indigenous and transferred technologies.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made:

1. Manufacturing firms should effectively utilize indigenous technologies so as to reduce cost of production and achieve productivity.
2. Manufacturing companies should go for technological transfer when necessary to improve their productivity and production efficiency/effectiveness and achievement of their goals.
3. Government should make funds available to investors for technology transfer and manufacturing effectiveness.

4. Economic, management, public administration student are expected to benefit from this study in their future studies.

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APPENDIX I SIMPLE PERCENTAGE FORMULA

Simple percentage formula is given as follows:

$$\frac{X}{N} \times \frac{100}{1}$$

Also,

$$\frac{\sum X}{\sum F}$$

Where,

X = True outcome

N = Total number of possible outcomes.

$\sum X$ = calculation of total number of observation in the X variable

$\sum F$ = calculation of total number of observation in the F variable

APPENDIX II FORMULA FOR MEAN STATISTICS

Mean statistics is determined by applying the following formular:

$$\bar{X} = \sum fx/N$$

Where $\bar{X}$ = mean

f = frequency

x = scale point

N = number of respondents

e.g.

Standard mean = $\frac{\text{total scale points}}{\text{No. of classes of respondents}}$

Standard mean = $\frac{4}{10}$

Standard mean = 2.5

The points are assigned in the following manner:

- i. A respondent that strongly agreed to the point (SA) scored 4 points
- ii. A respondent that agreed (A) scored 3 points
- iii. A respondent that disagreed (D) scored 2 points
- iv. A respondent that strongly disagreed (SD) scored 1 point

Decision Rule

The researcher therefore adopts a cutoff point of 2.50 mean score. Thus, any response/attribute with a mean score up to 2.50 and above is accepted and below 2.50 is therefore rejected.

APPENDIX III

THE FORMULA FOR PEARSON

The formula for Pearson R is stated thus:

$$r = \frac{NXY - (\sum X)(\sum Y)}{\sqrt{\left[\sum NX^2 - (\sum X)^2 \right] \left[\sum NY^2 - (\sum Y)^2 \right]}}$$

Where

N	=	number of pairs of scores
$\sum xy$	=	Sum of the product of paired scores
$\sum x$	=	Sum of x scores
$\sum y$	=	Sum of y scores
$\sum x^2$	=	Sum of squared x scores
$\sum y^2$	=	Sum of squared scores.

Source: www.statisticsonlation.com, 2023

Decision Rule: The decision rule is to reject H_0 if p-value (Asymp sig) < 0.05, otherwise we accept H_0 .