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# Technology Transfer and Industrial Linkages for Entrepreneurial Development: A Study of the Federal Institute of Industrial Research Oshodi, Lagos Nigeria

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**ABSTRACT:** *This study examined the relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria. The study adopted a cross-sectional survey research design. Primary data was generated through structured questionnaire. The population for the study was fifty-three (53) employees in Technology Transfer Division and Industrial Linkages Division. The entire population was used as a sample size the population was small hence indicating a census. The reliability of the instrument was achieved by the use of the Cronbach Alpha coefficient with all the items scoring above 0.70. The hypothesis was tested using the Spearman's Rank Order Correlation Coefficient with the aid of Statistical Package for Social Sciences version 23.0. The test was carried out at a 95% confidence interval and a 0.05 level of significance. The finding revealed that there is a significant relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria. The study recommends that Research Institute-industry linkages are essential for stimulating technology transfer in Nigeria. Therefore, there is a need to improve the linkage between Research Institute-industry linkages in technology transfer.*

**KEYWORDS:** technology, technology transfer, industrial linkages

## INTRODUCTION

Globalization puts emerging nations under enormous pressure to rebuild themselves using technology in an attempt to keep up with global sustainability and economic trends (De Moortel and Crispeels, 2018). In order to compete effectively in the new global economy, knowledge generation and technological innovations are crucial, and African countries, through their Universities, are making rallying efforts in university–industry collaborations in order to be part of this new economic paradigm shift (Mazurelle and Ginies, 2010) and to contribute to better technological outputs.

Universities and Research Institutes play important roles in the transfer of technology. This is because the process of learning and acquisition of new knowledge has been the foundation for most ground-breaking inventions across all spheres of life (Giuri et al., 2019; De Moortel and Crispeels, 2018). Hence, universities are generally regarded as key agents of economic and social progress. Nevertheless, recent years have seen universities'/Research Institutions basic

roles evolve to now include collaborations with industry, to add to the traditional missions of teaching and research. This is further justified by Osabutey and Jin (2016), who explained that universities in contemporary times are required to play multi-faceted roles: teaching, research and entrepreneurial functions.

In emerging economies, universities are saddled with the responsibilities of creating new knowledge and working with indigenous industries in effective absorption and adaptation of internationally transferred technologies. Generally, role-playing by universities in emerging economies, especially in Africa, is faced with a number of challenges. According to research, African nations, with the exceptions of South Africa, Egypt, Mauritius, and Benin, are part of the so-called group of science laggards (Rand Corporation 2001). In addition, there seems to be a problem with African higher education systems, both in terms of university study schemes as well as institutional abilities. Individual academics are also affected, as morale to research and create positive output is generally low (Novickis et al. 2017). The availability of very little or no research and development funds (in some cases) also seems to worsen the situation (Oyedoyin, Ilori, Oyebisi, Oluwale & Jegede, 2013), resulting in extreme difficulty to initiate and maintain scientific research (Mohamedbhai 2008). The result of these challenges is the availability of mainly grey literature on university–industry collaborations (World Bank, 2008; World Bank, 2012). Individual researchers in Africa seem to have been particularly hit by restrictive working conditions, even though these difficulties are not peculiar to Africa (Sparks and Barnett 2010). Research resources are rarely available, especially in public higher institutions, leading to less motivation and innovation.

**Objective of the Study**

i. To examine the relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria.
ii. To examine the impact of the technology transfer-industrial linkages of the Federal Institute of Industrial Research Oshodi to entrepreneurial development in Nigeria.

**Research Hypotheses**

**$Ho_1$**: There is no significant relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria.
**$Ho_2$**: The technology transfer-industrial linkages of the Federal Institute of Industrial Research Oshodi does not significantly influence entrepreneurial development in Nigeria.

## LITERATURE REVIEW

### Technology Transfer

Technology transfer refers to deliberate, goal-oriented relationship between two or more persons, groups or organizations who exchange technological knowledge (Autio and Laamanen, 1995). Technology transfer refers to movement of ideas, inventions and prototypes within companies, from research producers to a wide group of users including government departments and non-profit agencies, such as industries and universities (Harman and Harman, 2004).

Technology transfer is the process of taking an invention from its inception in a laboratory to a commercialized product. In the traditional view of universities, obvious commercialisation was antithetic to the pure goal of scientific inquiry. The modern view, however, assigns a critical role to research universities in technology transfer and commercialisation. This view has been further bolstered by legislative rulings on the disposition of the intellectual property rights (Bremer, 2003; Weber and Duderstadt, 2004). Technology transfer has also been defined as the translation across organisations of knowledge that can be embodied in a process or a product. The knowledge may be explicit; frequently it is tacit, often called know-how. Technology transfer includes any knowledge useful in the creation of new products and processes, and also the value of the technology and principles of operation, management, and utilisation (U.S. Department of Commerce, 2001). It also means a system under which various inter-related components of technology, namely, 'hardware', 'software' (techniques, know-how, information), 'humanware' (human ability), management aspects and the final product (including marketing) are rendered accessible to the end-users. The system also includes institutional capacity for technology adoption, adaptation or rejection. Technology transfer is the process by which research and other new technologies are transferred into useful processes, products, and programs (U.S. Department of Commerce, 2001). For the purpose of this study, technology transfer means formal transfer of rights to use and commercialise new discoveries and inventions resulting from scientific research to another party.

Technology 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 and 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 organised 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. Research is implemented as a result of technology transfer activities whether the process of technology transfer is formally engaged in or not. Also, implementation of research is more likely to occur, however, when technology transfer is practiced formally and purposefully. The main ingredients of technology transfer include fostering a mutual recognition of skills and abilities needed for the success of the technology transfer project and the technology transfer personnel should be willing to share organisational and technical know-how (Oyedoyin et al. 2013).

Technology transfer from a research university and other Research institutions is a process consisting of several steps. The first step in the process is invention disclosure, recognition of the information about a new technology developed by a faculty member or researcher, and linking the innovation to the office of technology licensing. The second step in the technology transfer process is patenting. Once a new technology is patented by a research institution, the

institution owns the intellectual property rights and can license the patented technology to another organisation. The next step in the process occurs when an individual or a commercial company secures a license from the research institution for the patented technology. After this, licensing agreement is executed, and the licensee is granted commercial use of the licenses. The research institution may then begin to earn income from the transferred technology. This technology transfer process requires several years after a technology is patented before the institution earns royalties from the licensed technology (Oyedoyin et al. 2013).

The number of start-up companies should be a measure of the effectiveness of technology transfer. In commercial context, a spin-off company is a new company that is formed by former employee(s) of a parent organisation and around a core technology that originated in, then was transferred to, the new company (Carayanis et al., 1998).

**Technology Transfer in Nigerian Universities**

Being one of Africa's largest economies, Nigeria has had its fair share of the challenges typical to African nations within the technology transfer domains. Nigeria's technological settings were mainly dominated by foreign firms until 1979, when the federal government set up the National Office for Technology Acquisition and Promotion (NOTAP) to help develop local technological expertise, as well as manage internationally transferred technology. In 2006, NOTAP found that research results in Nigeria ended on university and/or Research Institutions shelves and were not fully converted for industrial use. Although some Intellectual Property and Technology Transfer Offices (IPTTOs) were already in existence at the time, NOTAP again set up more IPTTOs in tertiary institutions as well as Research organizations and agencies across Nigeria (Aroture 2017).

NOTAP has effectively developed many more possibilities for Nigerian industries and entrepreneurs to develop their technological know-how through technology transfer agreements with universities (Aroture 2013). For instance, the rules of NOTAP stipulate that at least 40% of annual technical maintenance paid to foreign software-technology vendors should go to local affiliates to acquire abilities to implement, customize, integrate and support foreign innovation. This aims to ensure that local vendors are involved in maintaining such software in the country, thus reducing the cost of involving expatriates in local processes, and enhancing the capacity of nationals (Kruss et al. 2012). Many Nigerian software firms are now engaged in the execution of software projects, technology engineering and technical facilities that were once provided only by foreign firms. A major Nigerian software company, the Computer Warehouse Group (CWG), has discovered so much that it has grown into a tiny multinational company, operating in 18 of the 36 Nigerian states, with offices in other western African countries such as Ghana, Uganda, and Cameroon. Since 2006, more than 40 higher institutions in Nigeria have also facilitated the creation of more IPTTOs. Within the first six months of the introduction of NOTAP's system, many Nigerian universities that were without a single patent in their many years of existence can now boast 10 to 20 inventions (Aroture 2013; Aroture 2017).

NOTAP works in a comparatively fragile scheme of information and in a nation where government agencies are often criticized for unnecessary bureaucracy, delays, bad expertise, and unmotivated workforce. Better equipping NOTAP to fulfill its obligation is another task.

Most recently, the organization explained the need for a large exhibition center, where entrepreneurs can come and see worldwide technology, domesticate these techniques and set up companies (Aroture 2013). NOTAP's project is also becoming a model for a number of African nations, collaborating with organizations in Ghana, Kenya, and Tanzania, among others, to set up science and technology museums and to improve the effective commercialization of intellectual properties.

Technology transfer from a research university and other institutions is a process consisting of several steps. The first step in the process is invention disclosure, recognition of the information about a new technology developed by a faculty member or researcher, and linking the innovation to the office of technology licensing. The second step in the technology transfer process is patenting. Once a new technology is patented by a research institution, the institution owns the intellectual property rights and can license the patented technology to another organisation. The next step in the process occurs when an individual or a commercial company secures a license from the research institution for the patented technology. After this, licensing agreement is executed, and the licensee is granted commercial use of the licenses. The research institution may then begin to earn income from the transferred technology. This technology transfer process requires several years after a technology is patented before the institution earns royalties from the licensed technology (Oyedoyin et al. 2013).

**Technology Transfer and Industrial Linkages**

Technology transfer requires research stations to disseminate information through extension agents and others to ensure that target audience receive the innovation through media and other means. Stock and Tatikonda (2000) described technology transfer as the act of conveying and utilizing technological innovation by the recipient to achieve set objectives, within cost and time targets. Technology transfer is, therefore, the movement of relevant specialized knowledge or innovations from research institutes to farmers for adoption with the help of extension agents and providing feedback to researchers in order to achieve the intended objectives

The objective of any technology process as indicated by Wang (2003) is the successful adoption of innovation or research findings by a significant majority of clients. Technology transfer is a critical process in transforming industrial research innovations into applications for end users. Technology transfer helps to improve economic growth, transform lives and boost outputs. The rate at which technology transfer is accepted for adoption depends on the effectiveness of the linkages.

Research Institute—industry collaboration refers to the interaction between any parts of the higher educational system and industry aiming mainly to encourage knowledge and technology exchange (Bekkers & Bodas Freitas, 2008; Siegel, Waldman, & Link, 2003).

Linkage implies the communication and working relationship established between two or more organizations pursuing common objectives in order to improve productivity. Linkage as a term indicates connection between systems so as to form a greater system (Havelock, 2006). The author further stated that if the barriers between two systems are permeable enough for messages and responses to flow out of each to the other, then, a link is created. It therefore,

means that research institutes and extension services are two systems connected by information flow and feedback (Agbamu, 2000). The poor coordination and linkage mechanisms in innovation and adoption have become a recurrent problem (Madukwe, 2008). So, effective interaction of research scientist, extension agents and farmers as key components of technology transfer must have a strong linkage to increase production and the standard of living.

Innovations are derived through careful experiments conducted by researchers domiciled in research institutes departments and universities across the country. Government established these agencies and institutions to generate and circulate innovations needed for increased production (Joans, 2013). Presently, there are twenty two (22) research institutes in Nigeria, each with specific mandate in crop, animal or other commodities and fields (Nigeria webmaster, 2017). Their research efforts give rise to a body of knowledge, technologies, practices and system which form the basis for agricultural innovations.

Again, Research Institutes can contribute to technological innovation in several ways. These include conducting research in technological fields relevant to industry, providing technical assistance to local firms, educating well-trained professionals, and supporting faculty to engage in consulting and commercialization activities (Geiger & Sa, 2015). In the corporate sector, there is a trend in high technology industries towards better and closer linkages with university research. Firms' readiness to seek out multiple sources of knowledge is viewed as critical for their success in fiercely competitive markets (Chesbrough, 2013). This drives large companies to establish more partnerships with research institutes, where knowledge is generated and advanced.

Furthermore, Research Institutes' research productivity is crucial in determining the level of linkages with industry. In terms of factors that facilitate university industry-government partnerships, the organizational structure of universities has been identified as an important dimension in their technology transfer performance (Bercovitz et al., 2014). Also, the role played by geographical proximity in the development of partnerships between university and industry is very important. Although geographical proximity can have a motivating factor, the quality of higher education institutions is the most important determinant factor for industries to engage with universities in their region (Vedovello, 2017; Laursen & Salter, 2011).

The limited research capacity of universities and Research Institutes in developing countries, including in the African continent (Altbach, 2012, 2016) has been described as a major hindrance in forging partnership with the industry. At the institutional level, universities in Africa have long been facing funding difficulties due to limited state resources. Universities face constraints in building research programmes in relevant fields of science and technology that would be of interest to industry. Generally, weak research capacity and insufficient R&D funding inhibit a more sustained research role (Atuahene, 2017). These structural issues prevent Research Institutes from training a larger number of scientists and retain productive researchers. With limited funding and support to their research mission, Research Institutions are usually hard-pressed to initiate and sustain programmes of research (Mohamedbhai, 2018; Mouton et al., 2018).

For industry, pressures have included rapid technological change, shorter product life cycles and intense global competition that have radically transformed the current competitive environment for most firms (Wright, Clarysseb, Lockett & Knockaertd, 2008). With regards to Universities/Research Institutes, pressures have included the growth in new knowledge and the challenge of rising costs and funding problems, which have exerted enormous resource burdens on universities to seek relationships with firms to enable them to remain at the leading edge in all subject areas (Hagen, 2002). In addition, there is a mounting societal pressure on universities for them to be seen as engines for economic growth and less as fulfilling the broader social remit (i.e. education and generating knowledge) they have had in the past (Blumenthal, 2003; Philbin, 2008). These pressures on both parties have led to an increasing stimulus for developing industrial linkages that aim to enhance innovation and economic competitiveness at institutional levels (e.g. countries and sectors) through knowledge exchange between academic and commercial domains (Perkmann et al., 2013). Moreover, industrial linkage has been widely perceived as a promising tool for enhancing organizational capacity in open innovation — where an organization employs external networks in developing innovation and knowledge (Dess & Shaw, 2001), as a complementary option to traditional internal R&D (Harvey & Tether, 2003).

**Technology Transfer, Industrial Linkages and Entrepreneurial Development**

Entrepreneurship can be described as the cornerstone of the free enterprise economy (Popoola, 2014). Entrepreneurship can be described as including activities such as discovery, innovating, and exploitation of opportunities in other to overcome challenges, introduce new goods and services, develop better, efficient and effective ways of managing resources.

Technology transfer from a research institution contributes to creating new commercial companies, jobs and economic growth. Researchers are the driving force behind technology transfer, and they constitute an important resource in moving technology from bench top to the marketplace. To be most successful, technology transfer must engage all those involved in the research and implementation process. Technology transfer should not only be a consideration upon the conclusion of research, it is a process that must be effectively integrated throughout the entire research effort, resulting in greater benefit from the research results (Oyedoyin et al. 2013). There are various activities involved in the transfer of R&D results from the research institutes to the end users (firms). These activities include identification of process equipment; raw materials studies to establish their sources and costs; establishment of costs of other inputs; operating and maintenance costs and investment analysis (Oyedoyin et al. 2013).

In today's era of globalization, technology transfer is an operational vehicle for closing the gap in knowledge, ideas and innovations from one part of the world to the other, especially from developed to developing economies. Okeke and Ayonmike (2015) submitted that indigenous oil and gas firms must establish significant partnerships with international supply and service companies, with whom the international oil companies mostly do business, in order to provide goods and services with appropriate quality, pricing and reliability. Momoh (2013) submitted that the necessary human resource capital required to achieve the 70% target of the Nigerian Content Government Policy, as at 2010, must include: stimulation of technology transfer, training in skills, mentoring and apprenticeship and upgrade of existing organizational and

educational facilities. However, despite the passage of the Local Content bill into law in 2010, there exist some challenges in implementation.

Oyeku, Adesanya, Elemo, Unuigbe, Bello, Adekoya, Suaibu, Isong and Oduyoye (2016) noted that The Federal Institute of Industrial Research, Oshodi (FIIRO) in fulfilling its mandate has developed over 250 technologies since inception and has completely packaged 100 of them ready for immediate commercialization. Some of these technologies have been transferred to indigenous entrepreneurs and many have set up profitable businesses based on the acquired technologies. The Institute since full inception of its technology transfer training programme in 1986, has trained over 500,000 techno-entrepreneurs through its various technology transfer and entrepreneurship development programmes. The Institute prides itself as technology providers to the micro, small and medium enterprises in Nigeria. Recent survey of enterprises in the South West geo-political zone indicated that the institute is technology provider to over 65% of enterprises operating in the zone most especially those in the food sector.

Oyeku, et. al. (2016) further argued that the technology transfer efforts of the Federal Institute of Industrial Research, Oshodi has stimulated entrepreneurial development by stating some of the Institute's achievements as enumerated below:

i. The pioneering activities of FIIRO in soaps and cosmetics R&D led to proliferation of micro, small and medium soaps and cosmetics industries in Nigeria thus reduced the domination of the multinationals in the industry as was the case in the '70 and '80s.
ii. The Institute's R&D into Sorghum malt production led to the ban on Barley malt importation in 1986 and since then Sorghum malt has replaced Barley malt in the brewing industry in Nigeria for production of beer and malt drinks thus saving the country huge foreign exchange. The government gets billions of naira yearly as direct company taxes, withholding taxes from declared dividends from the brewing industry. It has also created an expansion in the use of sorghum and created employments. The multiplier effects on the domestic economy are better imagined. This innovation has since been adopted by other nations as the United Nations Industrial Development Organization has been conducting training courses on beer brewing from sorghum.
iii. Weaning food: The Institute's research breakthrough in the infants formula Soy-ogi has been adopted by many firms to produce various brands of infant formulae in the market. This innovation brought down the cost of infant formulae and made them affordable. The manufacturers of this brands pay company taxes to government as most of them are publicly quoted on the Nigerian Stock Exchange. The innovation has created high demand for cereals and created employments.
iv. The Institute pioneered research on the mechanization of the production of Gari. The first of such plant designed by the Institute was manufactured in the UK by the Engineering firm Newell Dunford and sold around the world for which the Federal Government earned royalties. The Institute research in cassava brought cassava to the golden crop it is today. R&D in cassava flour inclusion in wheat flour for bread and confectioneries baking is the genesis of the policy on 20% cassava flour inclusion in wheat flour in Nigeria.
v. High Quality Cassava Flour inclusion in wheat flour has the capacity for foreign exchange savings of N127Billion at 20% inclusion. It is also estimated that the cassava value chain can generate over 3million jobs.

vi. Proliferation of Instant Pounded Yam Flour (IPYF) production companies in Nigeria today is through the pioneering activities of the Institute in IPYF R&D. Based on our current survey of over 45 IPYF companies in Nigeria, over 2,500 jobs were created directly by the IPYF companies and it is estimated that over 12,000jobs were created indirectly. Foreign exchange is earned through export of IPYF.

vii. The Institute R&D in pulp and paper led to the identification of tropical hardwoods for the production of pulp for the paper production. This led to the establishment of the Paper Mills at Jebba and Iwopin and later at Oku Iboku.

## METHODOLOGY

The study adopted a cross-sectional survey research design. Primary data was generated through structured questionnaire. The population for the study was fifty-three (53) employees in Technology Transfer Division and Industrial Linkages Division. The entire population was used as a sample size the population was small hence indicating a census. The reliability of the instrument was achieved by the use of the Cronbach Alpha coefficient with all the items scoring above 0.70. The hypothesis was tested using the Spearman's Rank Order Correlation Coefficient with the aid of Statistical Package for Social Sciences version 23.0. The test was carried out at a 95% confidence interval and a 0.05 level of significance.

## DATA ANALYSIS AND RESULTS

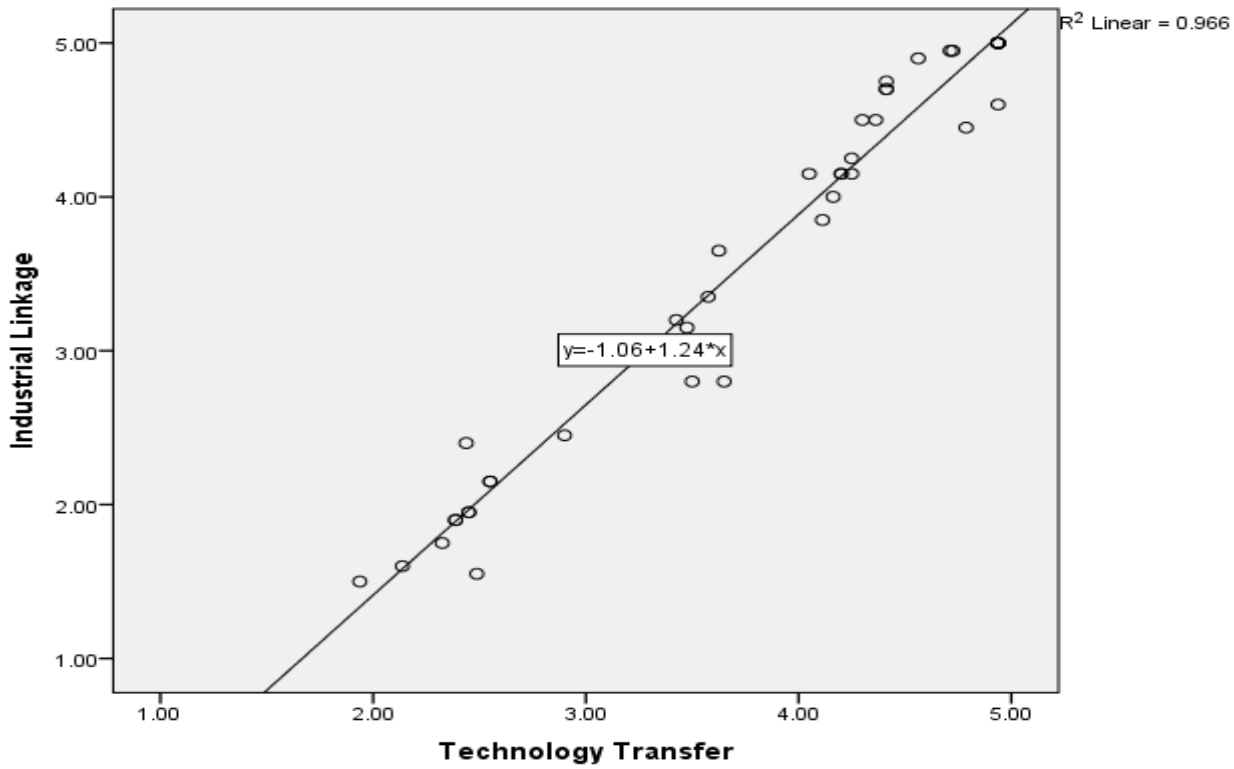


***Figure 1: Scatter plot show showing the direction of the technology transfer and industrial linkage***

Figure 1 shows a very strong relationship between technology transfer (independent variable) and industrial linkage (dependent variable). The scatter plot graph shows that the linear value of (0.966) depicting a very strong viable and positive relationship between the two constructs. The implication is that an increase in technology transfer simultaneously brings about an increase in the level of industrial linkage. The scatter diagram has provided vivid evaluation of the closeness of the relationship among the pairs of variable through the nature of their concentration.

**Table 1: Correlations for technology transfer and industrial linkages**

| | | | Technology Transfer | Industrial Linkage |
|---|---|---|---|---|
| Spearman's rho | Technology Transfer | Correlation Coefficient | 1.000 | .974** |
| | | Sig. (2-tailed) | . | .000 |
| | | N | 42 | 42 |
| | Industrial Linkage | Correlation Coefficient | .974** | 1.000 |
| | | Sig. (2-tailed) | .000 | . |
| | | N | 42 | 42 |

**. Correlation is significant at the 0.01 level (2-tailed).
**Source:** SPSS Output

**Ho$_1$**: There is no significant relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria.
The result in table 1 shows the correlation for technology transfer and industrial linkage (r = 0.974). This represents a high correlation indicating a strong substantial relationship. By interpretation, there is a strong positive relationship between technology transfer and industrial linkage. Implying that industrial linkages is dependent on technology transfer. Similarly displayed in table 1 is the statistical test of significance (p - value), which makes possible the generalization of our findings to the study population. From the result obtained the probability value is (0.021) < (0.05) level of significance; hence the study rejects the null hypothesis and concludes that there is a significant relationship between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria.

**Ho$_2$**: The technology transfer-industrial linkages of the Federal Institute of Industrial Research Oshodi does not significantly influence entrepreneurial development in Nigeria.

**Table 2: Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .737[a] | .543 | .501 | .22777 |

a. Predictors: (Constant), Industrial Linkage, Technology Transfer
**Source:** SPSS Output

The co-efficient of determination ($R^2$) showed relatively the highest number of significant variables in conformity with a priori expectation. Table 2 depicts a linear regression analysis and it was found that the R value is (0.737), R square (0.5463), adjusted R (0.501) and the standard error of the estimate value is (0.22777). The high R value revealed that technology transfer and industrial linkage jointly accounted for (73.7%) change in entrepreneurial development while the remaining 26.3 % is explained by other factors outside the model.

**Table 3: ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.355 | 2 | .677 | 13.055 | .000[b] |
| | Residual | 1.141 | 22 | .052 | | |
| | Total | 2.496 | 24 | | | |

a. Dependent Variable: Entrepreneurial Development
b. Predictors: (Constant), Industrial Linkage, Technology Transfer
**Source:** SPSS Output

Furthermore, in table 3, the analysis of variance (Anova) showed a regression sum of square value of (1.355) which is higher than the residual sum of squares value of (1.141). This implies that the model involving technology transfer and industrial linkage accounted for most of the variations in the criterion variable entrepreneurial development.

The F calculated value of (13.055) depicts the significance and reliability of the model developed through the regression analysis results. In addition the significant P-value of (0.000) is smaller than (0.05) which implies that jointly, the independent variables namely: technology transfer and industrial linkage to a large extent explained the variations in the dependent variable entrepreneurial development.

**Table 4:Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.337 | .490 | | 2.729 | .012 |
| | Technology Transfer | .340 | .040 | .507 | 3.511 | .002 |
| | Industrial Linkage | .531 | .123 | .504 | 3.490 | .002 |

a. Dependent Variable: Entrepreneurial Development
**Source:** SPSS Output

The result obtained in our multiple regression analysis as depicted in Table 4 showed that all two (2) independent variables had significant influence on entrepreneurial development. A critical examination of the Beta Coefficients showed on revealed industrial linkage made relatively highest contributions (0.531) to entrepreneurial development compared to technology transfer with a value of 0.340.

From Table 4, it shows that technology transfer has a calculated t-value of 3.511 and a corresponding sig. value/probability value (PV) of 0.000. From the decision rule, since t-calculated = 3.511 is greater than t-tabulated $_{(0.05,\ 258)}$ =1.96; the null hypothesis is hereby rejected. Also, from Table 4, it shows that industrial linkage has a calculated t-value of 3.490 and a corresponding sig. value/probability value (PV) of 0.000. From the decision rule, since t-calculated = 3.490 is greater than t-tabulated $_{(0.05,\ 258)}$ =1.96; the null hypothesis is hereby rejected. The hypothesis is thus restated that technology transfer-industrial linkages of the Federal Institute of Industrial Research Oshodi significantly influence entrepreneurial development in Nigeria.

## DISCUSSION OF FINDINGS

The study finding revealed that there is very strong positive and significant correlation between technology transfer and industrial linkages in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria. The findings also revealed that technology transfer-industrial linkages of the Federal Institute of Industrial Research Oshodi significantly influence entrepreneurial development in Nigeria. These findings agree with earlier study of Malairaja and Zawdie (2008) which showed that companies that collaborate with universities typically have higher productivity rates than companies that do not have such collaboration. Companies that collaborate also enjoy greater benefits in terms of research and development (R&D) and are able to produce quality products at a competitive cost. Recognizing that the R&D activities conducted in universities have a significant function in driving firm-level innovations, the Malaysian government has implemented explicit policies since the early 1990s to stimulate R&D collaboration between universities and industry. Following the action plan for Industrial Technology Development in 1990, the government launched the Malaysian Technology Development Corporation, the Government High Technology, the Intensification of Research in Priority Areas Grant, and a number of other organizations to support university industry partnerships among other things (Rasiah & Govindaraju, 2009). The interaction between research institutions and the industry has been considered a strategic instrument for national and regional innovation, competitiveness, and economic growth. Government research policies have strongly emphasized cooperation between universities and businesses as a key public policy in fostering innovation across the country (Rast, Khabiri & Senin, 2012).

There is a growing worldwide trend of linkages between university/research institutes and industry to promote wealth creation, national competitiveness and economic development of a nation (Barnes, Pashby & Gibbons, 2002; Hamdan et al., 2011; Muscio, 2013). However, the outcome of this relationship can get strengthen by adopting favourable policies beneficial for both parties (Plewa et al., 2013; Zane, 2011).

Universities and research institutes are more inclined towards industrial linkages to avail the benefit of improving academic capabilities, intellectual property and revenue generation (Patarapong & Schiller, 2009; Santoro & Bierly, 2006). On the other hand, industries gain the knowledge, innovative ideas, skills, and new technologies by digging into the links with universities (Patarapong & Schiller, 2009; Tijssen, 2012). In another finding of a study, (Lööf & Broström, 2008) suggest that linkages with university facilitate the firms in increasing their innovative output. Further, higher productivity rates are found of companies having links with

universities and research institutes as compared to others having no such linkages (Malairaja & Zawdie, 2008).

Some other researchers have considered it necessary for the universities and research institutes to collaborate with the business community for promoting the research activities, product development and further commercializing those products from university to industry (Hamdan et al., 2011; McAdam, Miller, McAdam & Teague, 2012; Muscio, 2013). Plewa et al. (2013) extend the literature on the intellectual property of universities' research by qualitatively exploring it in the context of industrial linkages. The guidance to managers of intellectual property activities is provided with a better understanding to develop productive relationships. During the analysis, they also focused on the industrial linkages evolvement and respective success factors.

## CONCLUSION AND RECOMMENDATIONS

Research Institutes are centers for technology transfers and having a strong theoretical as well as applied knowledge which are attractive to the industries and as such there is need for a variable industrial linkage. Research Institutes-industrial linkages logically promote the development and maintenance of a positive relationship which facilitates the transfer of technology as well as making it possible for the commercialization of research and development breakthroughs especially in the Federal Institute of Industrial Research Oshodi, Lagos Nigeria.

The study recommends that Research Institute-industry linkages are essential for stimulating technology transfer in Nigeria. Therefore, there is a need to improve the linkage between Research Institute-industry linkages in technology transfer. It is also recommended that Research Institutes can share knowledge and new insights that are beneficial for industries to move forward. This study further recommends that future studies could be targeted at the actual field study of the various entrepreneurial development in terms of the businesses set up owing to the Research – Industry linkages.

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