MPRA

Munich Personal RePEc Archive

ICT sector, output and employment generation in Nigeria: Input-output approach

Aminu, Alarudeen and Raifu, Isiaka Akande

Department of Economics, Faculty of Economics, University of Ibadan, Ibadan, Oyo State, Nigeria

February 2019

ICT Sector, Output and Employment Generation in Nigeria: Input-Output Approach

By
Alarudeen Aminu (Ph.D),

Department of Economics
Faculty of Economics
University of Ibadan, Ibadan, Oyo State, Nigeria
alarudeen@yahoo.com
+2348034061234

and

Isiaka Akande Raifu

Department of Economics,
Faculty of Economics,
University of Ibadan, Ibadan, Oyo State, Nigeria
heritagetiamiyu@gmail.com
+2348069829396

Abstract

This study assesses the contributions of ICT sector to the Nigerian economy after the reform of the sector in 2001. Using the input-output table for 2001, 2006 and 2011, the study specifically examines the output and employment contributions of ICT sector to sectors of the economy including the ICT sector itself. The study computes the contributions along the lines of direct, indirect and induced output and employment effects of the ICT sector's activity. The study finds that ICT sector has contributed some output and employment the economy through its linkage with other sectors. Among the sectors, services sector seems to benefit much more from ICT sector reform than any other sector. While most of the benefits accrue to other sectors come from the induced effects of ICT reform, the benefits that accrue to ICT sector itself come mainly from the indirect effects that arise from the inter-sectoral linkages through the buying and selling of ICT sector products, services and contracts. Based on these findings, we propose that for the economy to continue to benefit from ICT sector growth and expansion, all stakeholders in the sector and the government through the Ministry of Communication and Nigerian Communication Commission should work out policies that would create enabling environment for the sector to thrive more efficiently and also to provide an effective framework that could further integrate the ICT sector with the rest of the sector in the economy.

1.0. Introduction

Since the first industrial revolution of the 18th century, the experts (academia, practitioners and policymakers) have recognised the importance of technology and by extension information and communication technology (ICT) as an engine of economic growth and development of countries across the world (Kuznets, 1965; Rosenberg, 1972; Rosenberg and Nathan, 1982; Romer, 1986, 1990; Jorgenson and Stiroh, 1999; Jorgenson, 2001; Dedrick, Gurbaxani and Kraemer, 2003). The proliferation of ICT, in this era, has made tremendous impact on all economic agents. To the firms, the acquisition of ICT has been said to have a reducing effect on the costs of business transactions (Norton, 1992; Roller and Waverman, 2001). Apart from increasing the spirit of competition among the firms, it also increases the productivity of labour and thereby increases firms' productivity (Gera, Gu and Lee, 1999; Khan and Santos, 2002; Otieno, 2010; Ceccobelli, Gitto and Mancuso, 2012; Arifin, 2012; Razavi, Ramezanpoor, Hajihoseini and Akbari, 2016; Mitra, Sharma and Véganzonès-Varoudakis, 2016). It has been reported that ICT reduces household poverty and improves their welfare through different channels (Otello, 2010; Tisdell, 2014; James, 2014; Lee, 2018). The business of governance is said to be better conducted with increasing use of ICT in government parastatals. Aside from generating additional revenue to the government, it also helps in ensuring transparency in government and in fighting against corruption through the medium of e-government (Bertot, Jaeger and Grimes, 2010; Nam, 2018).

Following the advent of democracy in 1999 in Nigeria, a new telecommunication policy was promulgated in 2001, leading to the liberalisation of the telecommunication sector which gives rise to the emergence of major private telecommunication firms such as ECONET (now AIRTEL), MTN, GLOBACOM, ETISALAT (now 9MOBILE) among others. Since the reform, the contribution of ICT sector to the Nigerian economy and the welfare of its people has increased tremendously. In terms of increment in access to the telecommunication facilities by Nigerians, the number of active voice call increased from about 400,000.00 before 2001 to about 162,522,772.00 in the second quarter of 2018. The teledensity also increased from around 0.4% before 2001 to about 120% in 2018. Similarly, the percentage of people using internet increased from 0.06% in 20001 to around 27.68% in 2017. As regards the generation of employment, ICT sector has been a mean of generating employment to the teeming population of the youth in Nigeria and thereby leading the improvement in the youth's welfare (Sofowora, 2009; Michael and Johnson, 2014). With regard to the overall economy, the contribution of ICT has increased since the reform in 2001. Its contribution to the Nigerian economy rises from meagre

contribution of about 0.16% in 1999 to about 8.40% in 2016 (CBN, 2017), making it the highest contributor to the economy among the information technology subsectors. Apart from this, it serves as a mean of generating additional revenue for the government through licensing and taxation. According to the Deloitte's report of 2015, about 6.97 trillion naira has been generated as revenue to the government, representing 8.69% of the overall Gross Domestic Product (GDP) (Deloitte, 2015).

Given the importance of ICT as an engine of growth and development, several studies have been carried out to qualitatively and quantitatively assessing the contributions of ICT to the Nigerian economy and the welfare of its population. To the best of our knowledge, the scope of extant studies so far, particularly in Nigeria, ranges from an examination of evolution of telecommunication industry in Nigeria to other issues such as the evaluation of the effect or contribution of ICT to the economy, employment generation, empowerment and poverty using either qualitative, quantitative or other simple econometric techniques (Ogunsola and Aboyade, 2005; Ndukwe, 2011; Olumide, 2011; Awoleye et al. 2012; Asogwa, Ohaleme and Ugwuanyi, 2013; Azubuike and Obiefuna, 2014; Akanbi, Adebayo and Olomola, 2015; Ogunsola, Salman and Popoola, 2015; Adi, 2015; Adebayo and Ekejiuba, 2016; Oladimeji and Afolayan, 2018). One drawback of all these studies is that it is practically impossible to draw up policy for the economic agenda on growth and employment creation. In our study, we aim at examining the output and employment contributions of ICT in Nigeria using input-output approach in order to determine the distributional effect of ICT on its own sector as well as the other sectors of the economy. The employment of input-output approach is justified on the following ground. Since the work of Wassily Leontief in 1936, the use of I-O method has been the workhorse in policy arena. It is possible to quantitatively assess the socioeconomic impact of government policy or economic activity in one sector on other sectors of the economy as well as economic agents with the aim to develop a comprehensive economic planning that would result in economic growth and development of a country (Raa, 2006 and Miller and Blair, 2009).

In the context of this, we contribute to extant studies by focussing on the post reform era of ICT sector in Nigeria. Specifically, the study utilises Nigerian input-out table covering the periods of 2001, 2006 and 2011. The goal is to examine the output and employment contributions of ICT to its own sector and other sectors of the economy overtime. Considering different periods will enable us to know whether the evolvement of ICT and its development has resulted in increment in growth and employment generation during the periods under consideration. Besides, three categories of effects of ICT are considered, namely: direct effect, indirect effect and induced effect. Elaborately, direct effects are the

effects produced by ICT on its own sector in terms of output and employment. Indirect effects are the effects generated in the sectors that are producing input for ICT sector and the sectors supplying the ICT products while the induced effects are the effects of income on household expenditure on the output and employability of other sectors (Schuschny, 2005). Such a comprehensive consideration of the effects of ICT activities on its own sector and other sectors of the economy will enable the policymakers to know whether further investment in ICT facilities will spur economic growth and employment generation in the future.

Following the introduction, the rest of the study is structured as follows: sector 2 provides analysis on the development in ICT before and after reform. In section 3, the review of extant studies is provided while section 4 presents methodological approach. Section 5 presents the main findings and section 6 concludes with policy implications.

2.0. Stylised Facts of Evolution of ICT in Nigeria

This section deals with the provision of some stylised facts of the information and communication technology in Nigeria. Several studies have provided information on the historical evolution and the development on ICT in Nigeria, which is dated to the era of colonial master (see Ndukwe, 2011; Ijewere and Gbandi 2012; Nigerian Communication Commission, 2014; Adebayo and Ekejiuba 2016; Raji, Jedin and Subhan, 2017). The pictorial diagram that shows the evolvement of telecommunication in Nigeria is presented and briefly discussed here.[1] The Figure 1 shows the historical evolution of Telecommunication sector in Nigeria. Historically, the advent of Telecommunication began in 1886 when the colonial administrator laid the first telegram submarine cable to connect the Lagos and some West African countries with the colonial office in London. However, despite the long historical presence of telecom service in Nigeria, significant improvement was not recorded in the sector. The sector was poorly developed and offered limited access to telephone services to the growing population of the country. This is due to the challenges that bedevilled the sector. NCC (2014) ascribes these challenges to insufficient number of lines and trunks, low-revenue generation capacity, poor facility maintenance, slow response to advances in technology and underfunding.

Before 1980, the telecommunication sector was dominated by two government owned parastatals and they are Department of Posts and Telecommunication and Nigerian External Telecommunication. By 1980, the two parastatals were merged together to form Nigerian Telecommunications Limited

---

[1] *The diagram is culled from the publication of Nigerian Communication Commission of 2014.*

(NITEL), a limited liability company which has monopoly to control the telecommunication services in Nigeria, either internally or externally. Despite the establishment of NITEL, the organisation failed to meet the demand of the growing populace because the number of lines made available by it did not match the demand of growing population. The operations of organisation were also characterised by the aforementioned challenges facing the industry, particularly poor management and corruption. To make the telecommunication industry more efficient and to deregulate its operations, the Military Government of Ibrahim Babangida promulgated a decree in 1992 that led to the establishment of Nigerian Communication Commission and the commencement of its operation in 1993. The NCC is saddled with the responsibility of seeing to the advancement of telecommunication services in Nigeria in terms of licencing telecommunication operations. It is also established to see to the consumers' welfare. The decree that established NITEL was repelled in 2003 and replaced with the NCC Act of 2003 which gives the NCC more autonomy and widens the scope of its operations.

The advent of democracy in 1999 brought revolution into the telecommunication industry in Nigeria. This revolution entails the deregulation and liberalisation of the industry that eventually resulted in the privatisation of the NITEL and emergence of telecom operators such as ECONET, MTN, GLO, ETISALAT and others. Since the advent of the licenced telecom operators and the development brings about by increasing competition among the operators, there have been increased in the number of people that have access to the telecommunication services and internet facilities in the country. Figure 2 shows the trend of fixed-telephone subscription from 2000 or 2017. From the figure, it can be observed that as from 2000, the number of fixed telephone subscriptions increases until around 2006 before it declines over the subsequent years. Similarly, the percentage of people that have access to internet has also increased tremendously. As shown by Figure 3, the percentage of people having access to the internet increases from 0.06% in 2000 to about 27% in 2018. This is made possible by the cheap internet provided by the aforementioned telecom services providers. Competition among the telecom services providers has led to a reduction in the price of not only the buying of the credit but also of the subscription for the internet data. In the same figure, the teledensity, measured as the number of telephone connections for every hundred of individuals living in a given area, has also increased from 8.50% in 2004 to around 123.40% as at the end of 2018. With regard to the employment generation, the proliferation of telecom services providers has led to the generation of a lot of employment through establishment small scale business such as call services, phone repairing business and sales of phone accessories. Thousands of unemployment youths are now engaged in some of these small scale business

which comes into existence as a result of ICT. The licenced telecom services operators have also employed a considerable number of people working in their main offices and their power stations across the country.

Finally, the ICT sector has been one of the key contributory sectors to the Nigerian economy since its deregulation and liberalisation in 2001. In recent time, services sector is the uppermost driver of the Nigerian economy in which ICT is one of the subsectors driven the sector. Figure shows the contribution of ICT sector to the Nigerian economy since 1980 (average over five year intervals). From the figure, it is possible to see that the contribution of ICT sector to the Nigerian economy has increased tremendously. For instance, between 1981 and 1985, the ICT sector contributes about 0.77% to the Nigerian economy. However, the contribution of the sector to GDP deteriorated abysmally throughout the rest of 1980s and 1990s. As it can be observed from the figure, the contribution of ICT which stood at 0.77% between 1981 and 1985 declined greatly to 0.16% between 1996 and 2000. The decline in the contribution of ICT sector to the economy cannot but be attributed to the inefficient, mismanagement and corruption that characterised the sector during those years. With deregulation and liberalisation that brought about the operations of licenced telecom operators in Nigeria, the contribution of the sector to the Nigerian economy has increased tremendously. For instance, between 2001 and 2005, the contribution of ICT sector to the economy increased to 2.03% from the 0.16% it was in the previous five years. As at 2016, ICT sector's contribution to the economy has increased to 8.40%, representing a massive contribution overtime.
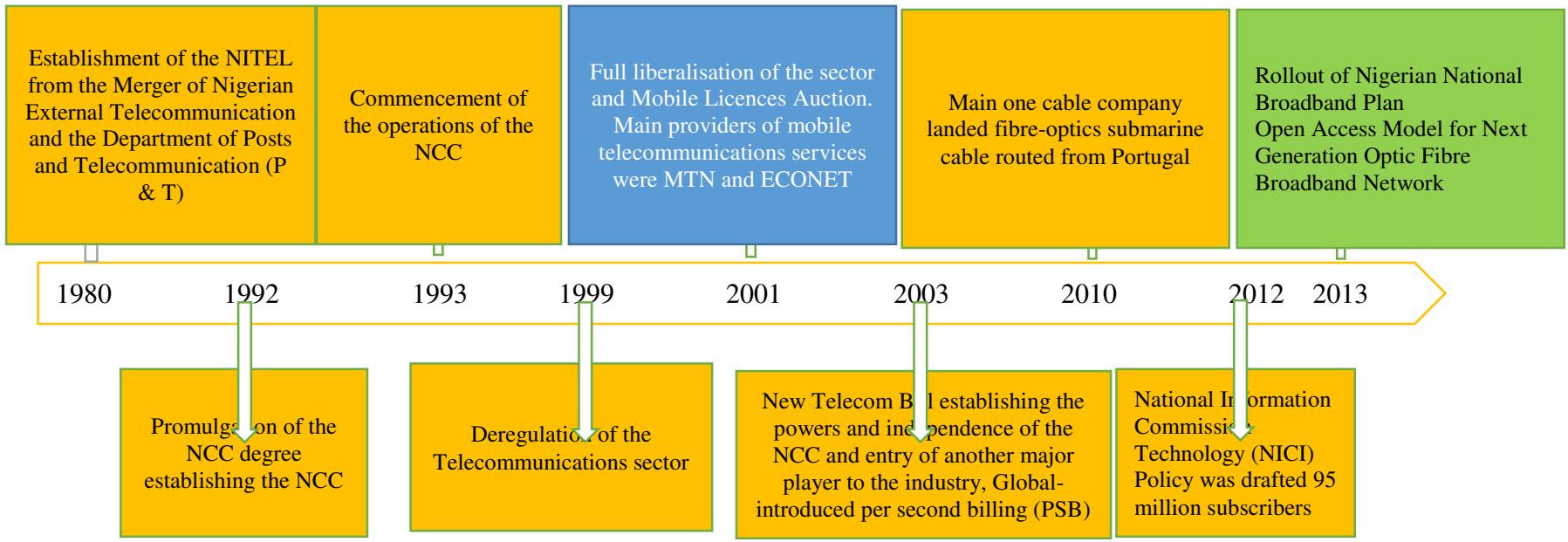
Establishment of the NITEL from the Merger of Nigerian External Telecommunication and the Department of Posts and Telecommunication (P & T)	Commencement of the operations of the NCC	Full liberalisation of the sector and Mobile Licences Auction. Main providers of mobile telecommunications services were MTN and ECONET	Main one cable company landed fibre-optics submarine cable routed from Portugal	Rollout of Nigerian National Broadband Plan Open Access Model for Next Generation Optic Fibre Broadband Network

1980   1992   1993   1999   2001   2003   2010   2012   2013

Promulgation of the NCC degree establishing the NCC

Deregulation of the Telecommunications sector

New Telecom Bill establishing the powers and independence of the NCC and entry of another major player to the industry, Global-introduced per second billing (PSB)

National Information Commission Technology (NICI) Policy was drafted 95 million subscribers

Figure   1: Historical Evolution of Nigeria's Telecom Sector (Culled from NCC, 2014-2018)
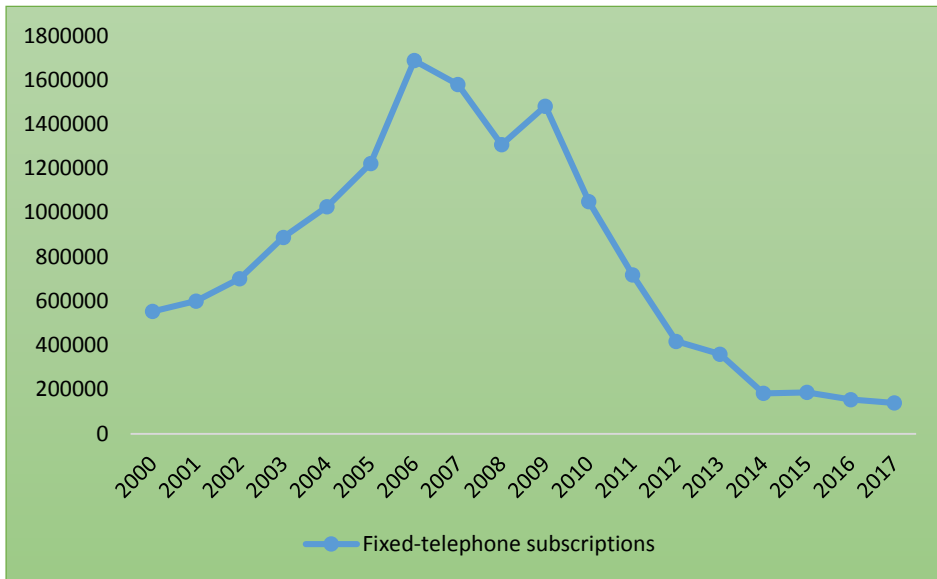
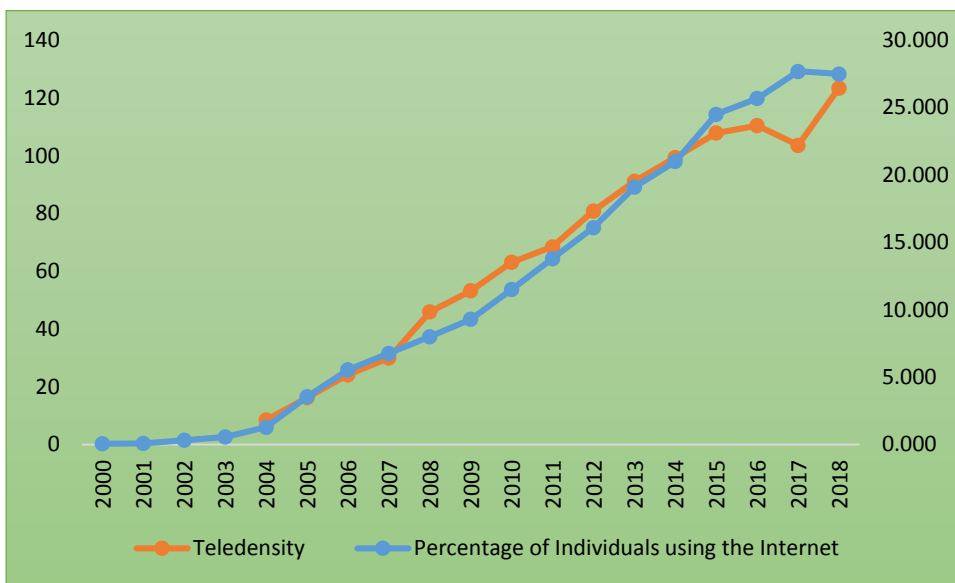**Figure 2: Fixed-Telephone Subscriptions**

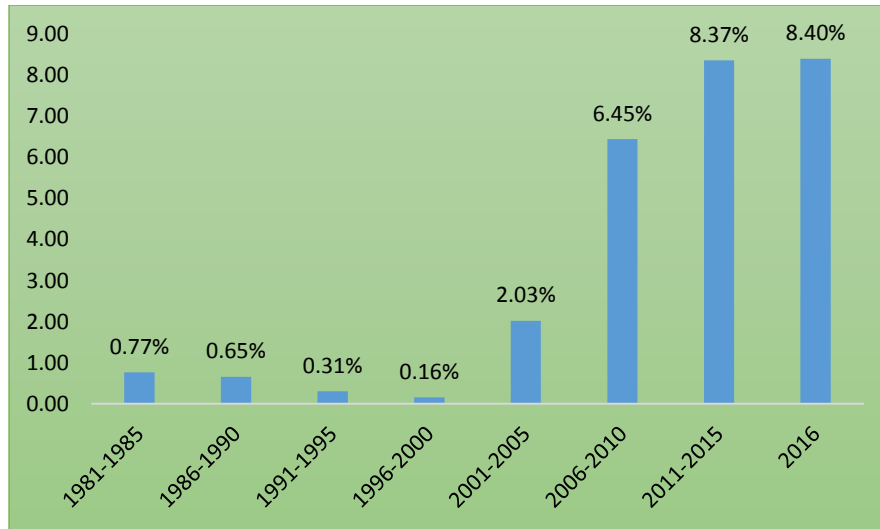**Figure 3: Percentage of Individual Using the Internet and Teledensity**

Figure 4: ICT Contribution to Gross Domestic Product (1981-2016)

3.0. Review of Literature

Since the introduction of input-output method by Wassily Leontief in 1936, considerable efforts have made by the academia, practitioners and policymakers to use input-output method to conduct research that would lead to policy formation and implementation for planning and development agenda. The method has been put to use to analyse quantitatively the multiplier effects of economic activities in one sector of the economy on its own sector and other sectors in terms of value-added and employment generation (see Pietroforte and Gregori, 2003; Kofoworola and Gbowala, 2008; Surugiu, 2009; Lindberg and Hansson 2009; Ivanova and Rolfe, 2010; Danielis and Gregori, 2012; Kim and Kim, 2015; Silveira et al., 2015; Yamada and Imanaka, 2015; Williams, 2016). It has also been used to examine and analyse the effects of change in government policies such as change in tariffs, taxes, exchange rate and others on the economy as whole and the welfare of its citizenry (See Borges and Montibeler, 2014; Cui, Peng and Zhu, 2015; Hoang, 2017; Yih, Hsu and Li, 2018; Aydoğuş et al., 2018).

With regard to the impact analysis of ICT on its own sector and other sectors of the economy, several empirical studies have been conducted both in advanced and developing economies. Beginning from industrialised countries, Mattioli and Lamonica, (2013) examine the role of ICT in the world economy using the world input-output table constructed by Dietzenbacher et al., (2013) for the period from 1995 to 2009. Making use of the productive sectors of the 27 European countries and 13 industrialised countries, the authors examine the effects of ICT sector on the other productive sectors in those countries. Their method of analysis is the Rasmussen forward and backward linkage indices. They find that ICT contributes significantly to the economies considered, albeit more to the supply side than

the demand side of the economies. Previously, Rohman and Bohlin (2010) had examined the contributions of ICT sectors to the European economies using the Input-Output method for two periods, namely: 1995-2000 and 2000-2010. Carrying out a decomposition analysis, they conclude that ICT sector contributes to the European countries' economies marginally with the contribution waned down overtime. In fact, the authors attributed the decline in the contribution of ICT to disconnection between ICT and other sectors of the economy. Their final result shows that ICT sector has lost its export prowess and technological effect on the other sectors. Similar results are documented by Rohman (2013). Apart from focusing on the role ICT in the regional economies, some studies have focused on some specific country of Europe extraction (Javala and Pohjola, 2007; Di Carlos and Santarelli, 2010; Keček, Hrustek and Dušak, 2016). Javala and Pohjola, (2007) analyse the effects of ICT on the output and productivity growth in Finland during the period of 1995-2005. Using the growth accounting method, it is found that ICT accounts for about 1.87% increase in labour productivity and about 0.46% to capital deepening or intensity in the country. Di Carlos and Santarelli, (2010) focus on the contribution of ICT to Italian economy covering the period of 1995, 2000 and 2005). Using the input-output method, they find that ICT contributes to more to the productive sectors of the Italian economy than the non-ICT sectors. In other words, ICT has a profound multiplying effect on the productivity than the non-ICT sectors. Carrying a study on the analysis of the multiplier effects of ICT sectors in Croatia using Input-Output table of 2004 and 2010 respectively, Keček, Hrustek and Dušak, (2016) conclude that there is no significant difference between the ICT multiplier and the multipliers of other sectors. Among the sectors considered, it is observed that ICT service sector has the highest multiplier effect compared with other components of ICT sector, albeit the multiplier effect declines overtime.

Aside the countries of European countries reviewed above, some studies on the contribution of ICT sector have also been carried out in some Asian countries such as Japan, Indonesia, Malaysia, Thailand, Iran as well as Vietnam. Starting from the study carried out by Kuriyama and Oniki, (1992) in which the contribution of new ICT in Japanese economy is analysed between 1974 and 1985. Based on I-O table of the aforementioned years and using productivity and biplot analyses, they document that about 10 to 20 % of growth experienced in Japanese economy is attributed to the new ICT during the period under consideration. Zubdi, Mori and Kamegai (2012) aim at analysing the role of ICT sector to the structural change of the national economies of Japan and Indonesia for different periods (Japan-1995-2005, Indonesia-1990-2005). Employing decomposition method, their findings indicate that Japan economy benefited more from the advent of ICT than in Indonesia. In other words, ICT plays an

important role in the structural changes witnessed in the Japanese economy but no significant effect on the structural change in Indonesian economy. Focusing on the Iranian economy for the period of 2001, Bazzazan (2009) shows that of all the sector considered, ICT ranked fourth in terms of its contribution to the Iranian economy, accounting for about 8.6% and 9.5% from the demand side and supply side respectively. Similar positive findings were also documented by the study conducted by Duc and Linh (2018) in which they analyse the contribution of ICT to the Vietnamese economy using I-O table of 2007 and 2012. Specifically, their results show that ICT manufacturing, ICT services and ICT media have strong impacts on the economy of Vietnam with backward linkages stronger than the forward linkages. This implies that ICT sector generates more impact on the sectors which provide it inputs rather than on the sectors that use its products and services. In fact, the degree with which ICT impacts the economy has been attributed to factors such as intensity of the usage of ICT, the size and the structure of ICT sector and the level of development of the economy. Irawan (2013) conducts a research on the importance of ICT to the economic development of four Asian countries, namely: Indonesia, Singapore, Malaysia and Thailand. The author conclude that developed countries do not actually benefit more than less developed countries from the ICT.

There are also some studies on the evolution of ICT in Nigeria. Several authors have devoted a lot of efforts to analyse the revolution of ICT in the country and its potential in generating employment, improving welfare and reducing poverty. Recent among these studies include Awoleye et al. (2012), Asogwa, Ohaleme and Ugwuanyi, (2013), Azubuike and Obiefuna, (2014) and Akanbi, Adebayo and Olomola, (2015). None of these studies, however, has quantitatively estimated the distributional effects of ICT sector on the economy in Nigeria in terms of output and employment. Most of studies are based on simple descriptive analysis and on some econometric analyses such as Ordinary Least Squares and Vector Autoregressive methods. For instance, study by Awoleye, et al. (2012) use descriptive and OLS method to examine the socio-economic effect of telecommunication on economic growth in Nigeria shows that investment in telecommunication positively affects the economic growth. The same positive results are reported by Asogwa, Ohaleme and Ugwuanyi, (2013), Azubuike and Obiefuna, (2014) and Akanbi, Adebayo and Olomolain (2015), Using VAR, Akanbi et al. (2015), however, conclude that the positive impact of ICT on the economy is noted after the 6 years of ICT reform. One major problem that could emanate from these studies is that the outcomes of such studies may not be suitable for policy formation, implementation and economic planning. In the light of this, this study fills this gap by aiming

at investigating the output and employment contribution of ICT to the Nigerian economy using I-O table covering the periods after ICT sector reform that is 2001, 2006 and 2011.

4.0. Methodological Approach

This study employs input-output approach developed by Wassily Leontief (1936, 1967) and extended by Ghosh (1958) to examine the contribution of ICT sector to sectors of the Nigerian economy. The input-output model presented in this study follows Miller and Blair (2009), Keček, Žajdela Hrustek and Dušak (2016), Garza-Gil, Suris-Regueiro and Varela-Lafuente, (2017). Suppose Nigerian economy consists of several sectors denoted as n sectors. The total value of domestic output of a sector i, say ICT, is denoted as x_i. The equation that shows how the output of the sector i is distributed as sales to other sectors as an intermediate input and to final demand denoted as f_i is shown as:

$$x_i = z_{i1} + z_{i2} + ... + z_{ij} + ... + z_{in} + f_i = \sum_{j=1}^{n} z_{ij} + f_i \qquad (1)$$

Where $1 \le i; j \le n$, that is, $i, j = 1, ..., n$. The equation can be compactly written as follows:

$$X = Zi + f \qquad (2)$$

Using matrix algebra equation 1 and 2 can be expressed as:

$$(I - A)x = f \qquad (3)$$

Where f denotes matrix column for final demand for the product of sector i, x represents the matrix column of total output of sector i, I is a diagonal unit matrix with n by n, A is the matrix of the technical coefficient denoted as $a_{ij} = \dfrac{z_{ij}}{X_j}$. From the equation 3, the Leontief demand model can be derived as:

$$x = (I - A)^{-1} f \qquad (4)$$

Where $(I - A)^{-1}$ is the Leontief's inverse matrix. The inverse matrix is the total value of the input from sector i required, directly and indirectly, by sector j to produce a unit of its product needed to satisfy the final demand in the economy. Put differently, inverse matrix is also known as the multiplier matrix which measures how the total output in the economy changes as a result of a unit change in the final demand. The output multiplier effect, which shows the amount of production needed from all economic sectors to generate a unit increase in the final demand of products generated by sector j, can be computed by summing up the element in the column j of the Leontief's inverse matrix and it is given as:

$$m(0)_j = \sum_{i=1}^{n} \alpha_{ij} \qquad\qquad\qquad (5)$$

The equation 5 is otherwise known as simple multiplier and it represents both the direct and indirect effects of variation in the final demand of ICT sector on the overall output of other sectors in the economy.

To compute the induced effects, the input-output model is often extended by endogenising the household expenditure and estimate its effect on final consumption. Assume that the input-output model is a closed one with respect to households, then the model can be extended to $n+1$ by $n+1$ form. The extended matrix of technical coefficient and that of extended Leontief's matrix inverse can be denoted as $(\overline{A})$ and $(\overline{I-A})^{-1}$ respectively. The elements of the inverse matrix (α_{ij}) consists of direct, indirect and induced effects. When the first n element of each column in the new inverse matrix are summed up, they represent the total multiplier effects for the output from each of the n sector denoted as:

$$m(ot)_j = \sum_{i=1}^{n} \gamma_{ij} \qquad\qquad\qquad (6)$$

Finally, the employment required by the economic activity which permits the computation of employment multipliers for both simple and total effects can be represented as follows:

$$m(e)_j = \sum_{i=1}^{n} e_{oi} \alpha_{ij} \qquad\qquad\qquad (7)$$

$$m(et)_j = \sum_{i=1}^{n} e_{oi} \gamma_{ij} \qquad\qquad\qquad (8)$$

Where e_{oi} is the employment technical coefficient, representing the number of sector i, employees required to produce a unit of output in the sector ($e_{oi} = \dfrac{e}{x_i}$). The sum of all the employment needed is then shows the total amount of employment generated in the economy owing to increase in production of goods and services in sector j.

5.0. Empirical Results and Discussion

5.1. Introduction

In this section, the results of input-output analysis of the impact of Information and Communication Technology (ICT) sector on the Nigerian economy are presented for the years 2001, 2006 and 2011. Specifically, apart from assessing the impact of ICT sector on itself in terms of output and employment,

its effects on other eight sectors of the economy are also examined and analysed. These sectors include *AGRICULTURAL SECTOR, MINING AND QUARRING SECTOR, MANUCATURING SECTOR, UTILITIES SECTOR, BUILDING AND CONSTRUCTION SECTOR, TRANSPORT SECTOR, FINANCE AND INSURANCE SECTOR and SERVICES SECTOR*. Aside this, the distributional effects of ICT sector on the economy as a whole and other sectors are presented for each year considered. The main findings are presented as follows:

5.2. Output and Employment Generated by ICT Sector in 2001

Table 1 presents the output contributions of ICT sector to the Nigerian economy in 2001. The ICT output contributions are examined in terms of direct, indirect and induced effects on the whole economy and other aforementioned sectors of the economy. According to Kim and Kim, (2005), direct impact is the initial impact that comes from the purchases made by firms and consumers within a sector while induced effect is an ancillary effect that arises from other firms or sectors affected by the purchases made by the producers and consumers. Induced impact, on the other hand, is an economic impact made by households spending owing to increment in their wages and salaries. Thus, as shown in the Table 1, ICT sector generates a total direct, indirect and induced effects on the economy amounting to ₦237.37 million, ₦24,627.02 million and ₦3,835.27 million respectively. The total amount of output generated by ICT sector in all the sectors is ₦28,699.66 million after the reform of the sector in 2001. Sectorally, services sector appears to benefit more from ICT sector than the other sectors in terms of output contributions, enjoying direct, indirect and induced output effects of about ₦177.37 million, ₦4,470.81 million and ₦1,363.28 million respectively. The services sector was followed by manufacturing sector benefiting a total output contribution of about ₦1,878.98 million, disaggregated into direct, indirect and induced output effects of about ₦15.78 million, ₦1,020.99 million and ₦842.21 million respectively. Financial and Insurance sector takes the third position in terms of output benefit from ICT sector. The direct, indirect and induced output effects benefited by finance and insurance from ICT sector are ₦0.28 million, ₦769.35 million and ₦270.66 million respectively, amounting to a total output effect of ₦1,040.29 million. The sector that benefited the least from ICT sector is the mining and quarrying sector with output contribution of about ₦72.30 million decomposed into direct effect, indirect and induced output of ₦0.00million, ₦30.18 million and ₦42.13 million respectively. Sectors such as services, manufacturing, finance and insurance, utilities and transport benefit substantially from indirect output effect while only the agricultural sector benefit more than any other sector from induced output effect.
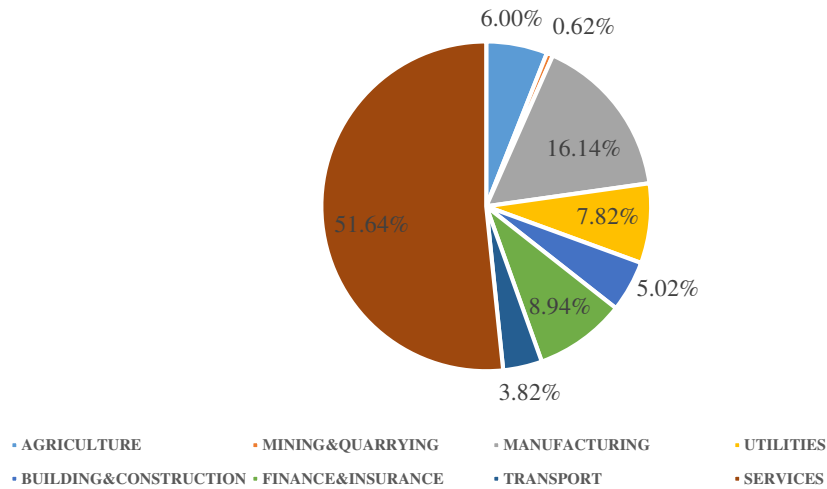
In short, as shown in Figure 1. The percentage contributions of ICT sector to the sectors are displayed in Figure 1.

The foregoing findings seem plausible if one considers the structure of the ICT industry and that of the Nigerian economy. For instance, services sector that benefits more from the ICT sector consists of numerous ancillary small scale firms offering several ITC-related services such as phone servicing, data computation and analysis, business centres providing services such as photocopying, typing and printing of documents among others. The banking and insurance industries, which are incorporated in the finance and insurance sector also make use of ICT-related products for their operations. Most firms in the manufacturing sector of the economy are being automated and their operations are driven by ICT output in recent time. That agricultural sector benefits more from induced output effects can be plausibly explained on the strength of the fact that most of the household members employed in the ICT sector and other sectors linked to ICT sector expended their income on agricultural-related products for their daily sustenance. Lastly the percentage contribution of ICT sector to output produced in other sectors and in the economy as a whole is 0.17% and 0.42% respectively.

Table 1: Contribution of ICT Sector to Output produced in the Economy in 2001				
SECTOR	DIRECT (₦million)	INDIRECT (₦million)	INDUCED (₦million)	TOTAL (₦million)
AGRICULTURE	0.00	159.74	538.65	698.39
MINING&QUARRYING	0.00	30.18	42.13	72.30
MANUFACTURING	15.78	1020.99	842.21	1878.98
UTILITIES	22.04	700.68	187.82	910.53
BUILDING&CONSTRUCTION	2.87	139.54	441.44	583.85
ICT	5.96	17004.75	48.15	17058.86
FINANCE&INSURANCE	0.28	769.35	270.66	1040.29
TRANSPORT	13.13	330.99	100.93	445.04
SERVICES	177.32	4470.81	1363.28	6011.42
TOTAL	237.37	24627.02	3835.27	28699.66
Value of Output produced in the Economy				6877187.58
Percentage Contribution of ICT Sector to Output produced in the Economy (%)				0.417%
Percentage Contribution of ICT Sector to Output produced in other Sectors (%)				0.169%

Source: Computed by Authors from Nigerian Input-Output Data for 2001

Figure 1: Distribution of Total Output Generated by ICT in Other Sectors in 2001

6.00%   0.62%
16.14%
7.82%
51.64%
5.02%
8.94%
3.82%

- AGRICULTURE   - MINING&QUARRYING   - MANUFACTURING   - UTILITIES
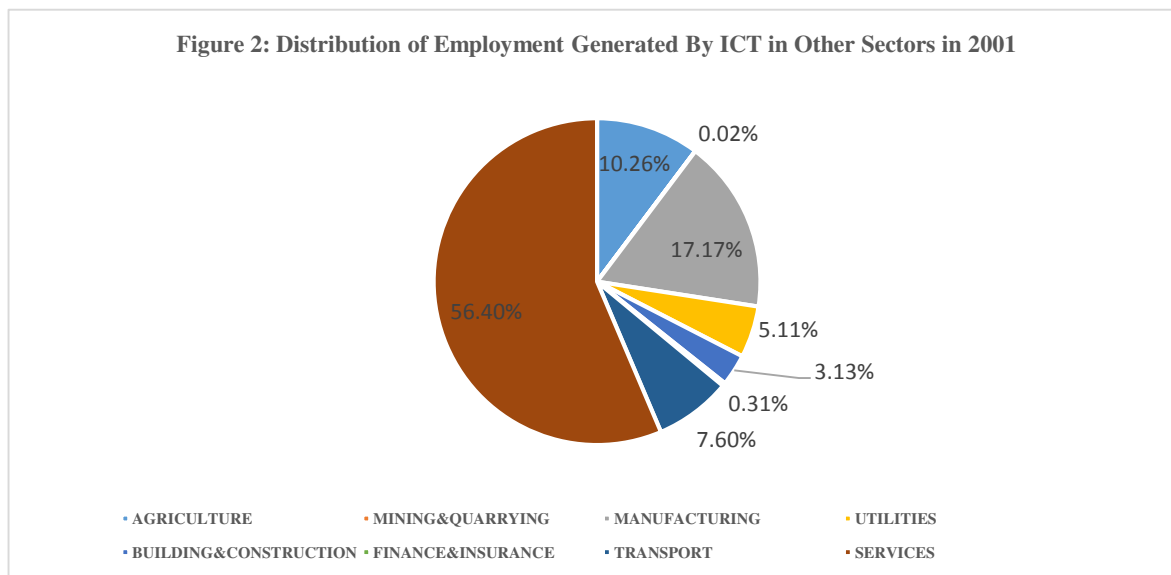- BUILDING&CONSTRUCTION - FINANCE&INSURANCE   - TRANSPORT   - SERVICES

With regard to the employment contributions of ICT sector to other sectors and the whole economy, Table 2 shows that services sector benefits the most in terms of jobs creation, enjoying about 45,542 jobs, which is made up of 35,214 indirect jobs and 10,328 induced jobs. The total jobs generated in the manufacturing sector as a result of ICT activity is 13,862 while jobs generated through ICT sector activity in agricultural sector is 8,285 jobs. In transport sector, 6,137 jobs are created on account of ICT sector's activity. On the whole, the employment generated across sectors by ICT sector's activity is 124,617, decomposed into direct, indirect and induced jobs of 43,316, 54,015 and 27,286 respectively. From the results, it can be observed that apart from the services sector, agricultural sector benefits more from induced job effect generated by ICT. This is reasonable considering the fact that the agricultural sector benefited more from induced output effect. This implies that the induced output effect on agricultural sector enables the sector to generate more jobs for the people. However, it can be noted that other sector such as manufacturing sector, utilities sector, transport sector and finance and insurance sector benefit more from indirect effect of ICT sector. The employment contribution of ICT sector on other sectors and the economy are 0.19% and 0.29% respectively (see Figure 2) The total employment contributions of ICT to its own sector during the year under consideration is 43,864 decomposed into direct, indirect and induced jobs in the neighbourhoods of 43,316; 424 and 124 respectively. Also, the value of output of ICT as shown in Table 1, is ₦17, 058.86 million. This is decomposed into direct, indirect and induced effects of about ₦237.37 million, ₦24,627.02 million and ₦3,835.27 million respectively. The main observation from these findings is that while the ICT sector creates the highest

employment within itself through its direct effect, it creates the highest output within the same sector through its indirect effect.

Table 2: Contribution of ICT to Employment in the Economy in 2001				
SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
AGRICULTURE	0	1895	6390	8285
MINING&QUARRYING	0	6	9	15
MANUFACTURING	0	7649	6213	13862
UTILITIES	0	3277	852	4128
BUILDING&CONSTRUCTION	0	617	1913	2530
ICT	43316	424	124	43864
FINANCE&INSURANCE	0	188	66	254
TRANSPORT	0	4745	1392	6137
SERVICES	0	35214	10328	45542
TOTAL	43316	54015	27286	124617
Total Employment in the Economy				43591862
Percentage Contribution of ICT Sector to Employment in the Employment in the Economy (%)				0.286%
Percentage Contribution of ICT Sector to Employment in other Sectors of the Economy (%)				0.185%

Source: Computed by Authors from Nigerian Input-Output Data for 2001

Figure 2: Distribution of Employment Generated By ICT in Other Sectors in 2001

- AGRICULTURE　　- MINING&QUARRYING　　- MANUFACTURING　　- UTILITIES
- BUILDING&CONSTRUCTION　- FINANCE&INSURANCE　- TRANSPORT　　- SERVICES

5.3. Output and Employment Generated by ICT Sector in 2006

Table 3 reports the results of input-output analysis of ICT contributions to the Nigerian economy in terms of output and employment in 2006. The results show that, among the sectors, the total output
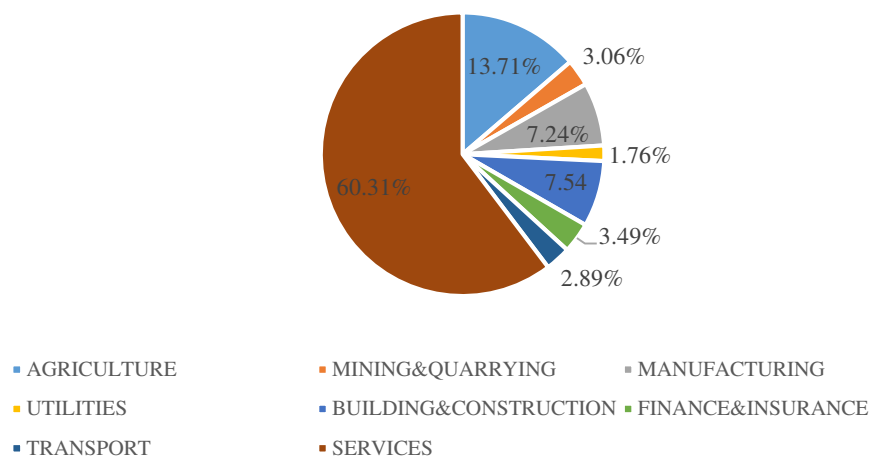
contributed by ICT sector to the services sector is ₦39,685.61 million, a significant improvement when compared with that of 2001 which is ₦6, 011.42 million. This accounts for 60.31% of the contributions by ICT sector to other sectors of the economy (see Figure 3). When the output contribution of ICT is decomposed into direct, indirect and induced effects, services sector enjoys ₦386.45 million, ₦8,916.08 million and ₦30,383.09 million amount of output respectively. Following the services sector is the agricultural sector which enjoys about ₦9,023.10 million, accounting for 13.71% of total output to other sectors. The total output contributions of ICT sector to other sectors such as building and construction, manufacturing, finance and insurance, mining and quarrying, transport and utilities are ₦4,961.65million (7.54%), ₦4,760.91million (7.24%), ₦2,294.03million (3.49%), ₦2,012.21million (3.06%), ₦1,901.23million (2.89%) and ₦1,160.92 million (1.76%) respectively. All these sectors recorded improvements when compared with the contributions of ICT sector to these sectors in 2001. The total output contributed by ICT sector to the economy in 2006 is ₦270,377.13 million, decomposed into direct, indirect and induced output effects of ₦512.65 million, ₦212,491.03 million and ₦57,373.44 million respectively. The percentage contribution of ICT sector in other sectors and in the whole economy are 0.35% and 1.45% respectively.

Table 3: Contribution of ICT Sector to Output produced in the Economy in 2006				
SECTOR	DIRECT (₦million)	INDIRECT (₦million)	INDUCED (₦million)	TOTAL (₦million)
AGRICULTURE	0.00	461.71	8561.39	9023.10
MINING&QUARRYING	0.69	306.69	1704.82	2012.21
MANUFACTURING	9.98	570.20	4180.73	4760.91
UTILITIES	14.07	390.18	756.67	1160.92
BUILDING&CONSTRUCTION	4.60	195.39	4761.66	4961.65
ICT	77.31	200731.06	3769.11	204577.48
FINANCE&INSURANCE	1.04	492.58	1800.41	2294.03
TRANSPORT	18.51	427.14	1455.57	1901.23
SERVICES	386.45	8916.08	30383.09	39685.61
TOTAL	512.65	212491.03	57373.44	270377.13
Total Output produced in the Economy				18709790.00
Percentage Contribution of ICT Sector in the Economy (%)				1.445%
Percentage Contribution of ICT Sector in Output of Other Sectors (%)				0.352%

Source: Computed by Authors from Nigerian Input-Output Data for 2006

Figure 3: Distribution of Contribution of ICT to other Sectors' Output in 2006

- AGRICULTURE
- MINING&QUARRYING
- MANUFACTURING
- UTILITIES
- BUILDING&CONSTRUCTION
- FINANCE&INSURANCE
- TRANSPORT
- SERVICES

The results of the input-output analysis of employment contributions of ICT sector to its own sector and other sectors of the economy in 2006 are reported in Table 4. The table, shows that the employment generated by ICT across sectors of the economy in 2006 is 959,108 decomposed into 33,533 direct jobs, 51,096 indirect jobs and 874,479 induced jobs. Among the other sectors, services sector ranked first in terms of employment gain from ICT sector with total number of 133,108 jobs (49.43%), followed by agricultural sector, manufacturing sector and transport sector with 40,225 jobs (14.95%), 40.134 jobs (14.90%) and 25,119 jobs (9.33%) respectively (see Figure 4).
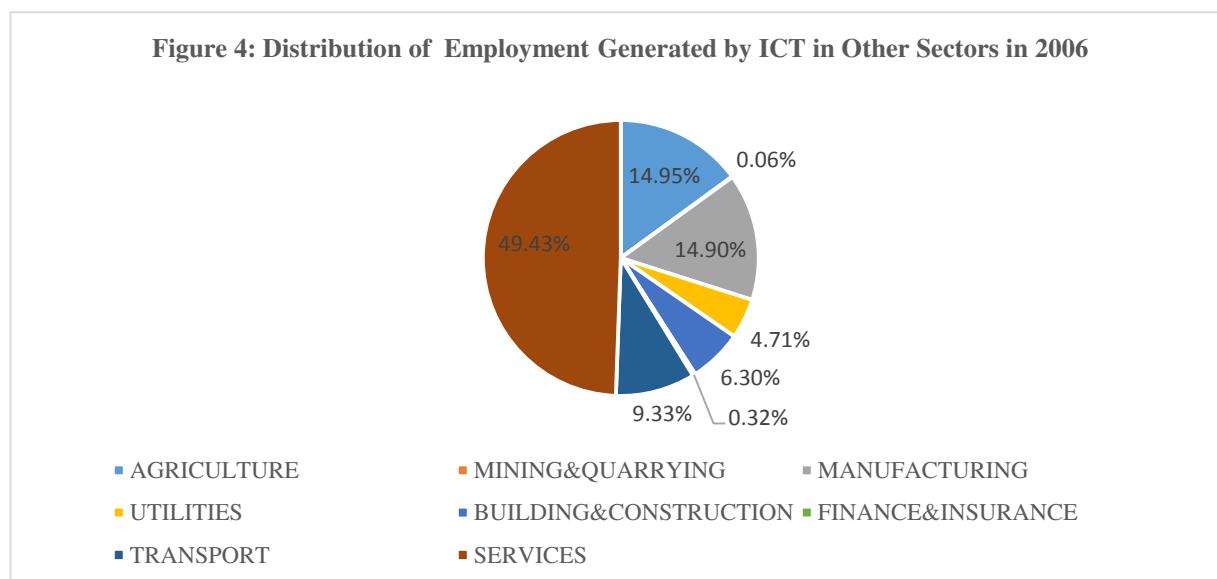
Among other sectors, mining and quarrying sector remains the least sector with lowest employment gain from ICT sector's activity in 2006, albeit there is an improvement when compared with the employment gained by the sector in 2001. Most of the employment generated (through intersectoral relation with ICT) in other sectors in 2006 comes from the induced employment effect. For instance, services sector gains 100,487 jobs from induced employment effect compared with about 32,621 jobs from indirect employment effect. The same is obtained in other sectors as shown in Table 4 and Figure 4 respectively. The employment contribution of ICT sector in other sectors and the economy stands at 0.54% and 1.91%. It is an improvement when compared with the percentage contribution to employment in other sectors and in the economy of 0.19% and 0.29% in 2001 respectively.

The ICT sector also benefits from its own sectoral activity in terms of output and employment in 2006. The total output gained by ICT sector from its own sector is 204,577.48 million, disaggregated into direct, indirect and induced effects of ₦77.31 million, ₦200,731.06 million and ₦3,769.11 million

respectively. The total employment generated by ICT sector in its own sector is 689,810 jobs with 33,533 direct jobs, 322 indirect jobs and 655,955 induced jobs.

Table 4: Contribution of ICT Sector to Employment in the Economy in 2006				
SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
AGRICULTURE	0	2060	38195	40255
MINING&QUARRYING	0	26	146	172
MANUFACTURING	0	4891	35243	40134
UTILITIES	0	4421	8275	12695
BUILDING&CONSTRUCTION	0	684	16278	16962
ICT	33533	322	655955	689810
FINANCE&INSURANCE	0	184	670	853
TRANSPORT	0	5888	19231	25119
SERVICES	0	32621	100487	133108
TOTAL	33533.32	51095.95	874478.99	959108.26
Total Employment in the Economy				50,284,901.83
Percentage Contribution of ICT Sector to Employment in the Economy (%)				1.907%
Percentage Contribution of ICT Sector to Employment in Other Sectors (%)				0.536%

Source: Computed by Authors from Nigerian Input-Output Data for 2006

Figure 4: Distribution of Employment Generated by ICT in Other Sectors in 2006

- AGRICULTURE
- MINING&QUARRYING
- MANUFACTURING
- UTILITIES
- BUILDING&CONSTRUCTION
- FINANCE&INSURANCE
- TRANSPORT
- SERVICES

5.4. Output and Employment Generated by ICT Sector in 2011

Table 5 reports the output contributions of ICT to the Nigerian economy in 2011. It can be seen that the output generated by the sector in the economy is ₦2,166,888.37 million. The direct, indirect and induced output effects of ICT sector's activity are ₦112,033.83 million, ₦1,532,658.97 million and ₦522, 195.57 million respectively. At sectoral level, services sector continues to benefit more than any other

sector from activity within ICT sector as it gains about ₦925,584.37 million worth of output. The percentage distribution of ICT sector's contribution to output across other sectors is contained in Figure 5. It is interesting to note that most benefits that accrued to other sectors from ICT sector come from induced output effect which arises from the expenditures of individual household members who receive income from ICT sector and other sectors that are linked to ICT activity. Only the ICT sector benefits more indirectly from the output generated by its own sector. The contribution of ICT sector in other sectors and in the aggregate economy in 2011 are 2.69% and 3.68% respectively.

Table 5: Contribution of ICT Sector to Output produced in the Economy in 2011				
SECTOR	DIRECT (₦million)	INDIRECT (₦million)	INDUCED (₦million)	TOTAL (₦million)
AGRICULTURE	0.00	44215.84	76212.41	120428.25
MINING&QUARRYING	110.38	59794.46	18831.75	78736.59
MANUFACTURING	960.56	147168.39	77512.21	225641.16
UTILITIES	67.96	1790.48	3884.64	5743.08
BUILDING&CONSTRUCTION	5235.06	56699.83	112998.89	174933.77
ICT	662.13	557964.26	24421.33	583047.71
FINANCE&INSURANCE	193.14	6172.27	5999.98	12365.40
TRANSPORT	4384.04	27560.23	8463.77	40408.03
SERVICES	100420.57	631293.21	193870.60	925584.37
TOTAL	112033.83	1532658.97	522195.57	2166888.37
Total Output Created in Nigerian Economy				58812360.78
Percentage Contribution of ICT to Output produced in the Economy (%)				3.684%
Percentage Contribution of ICT to Output produced in Other Sectors (%)				2.693%

Source: Computed by Authors from Nigerian Input-Output Data for 2011

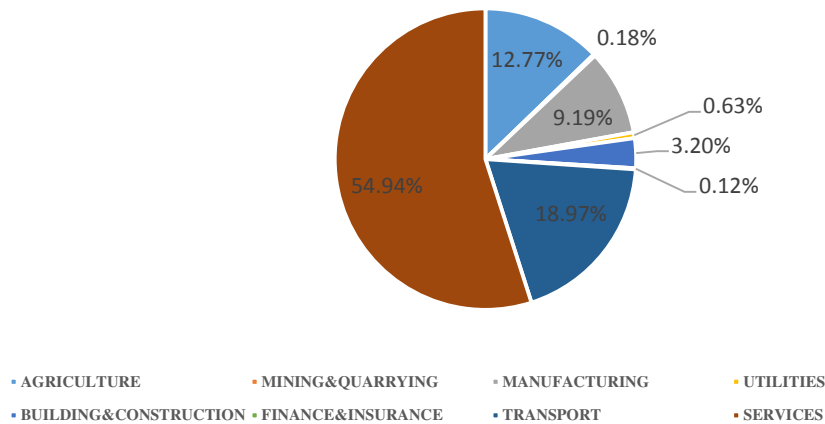Figure 5: Distribution of ICT contribution to Output produced in other Sectors in 2011
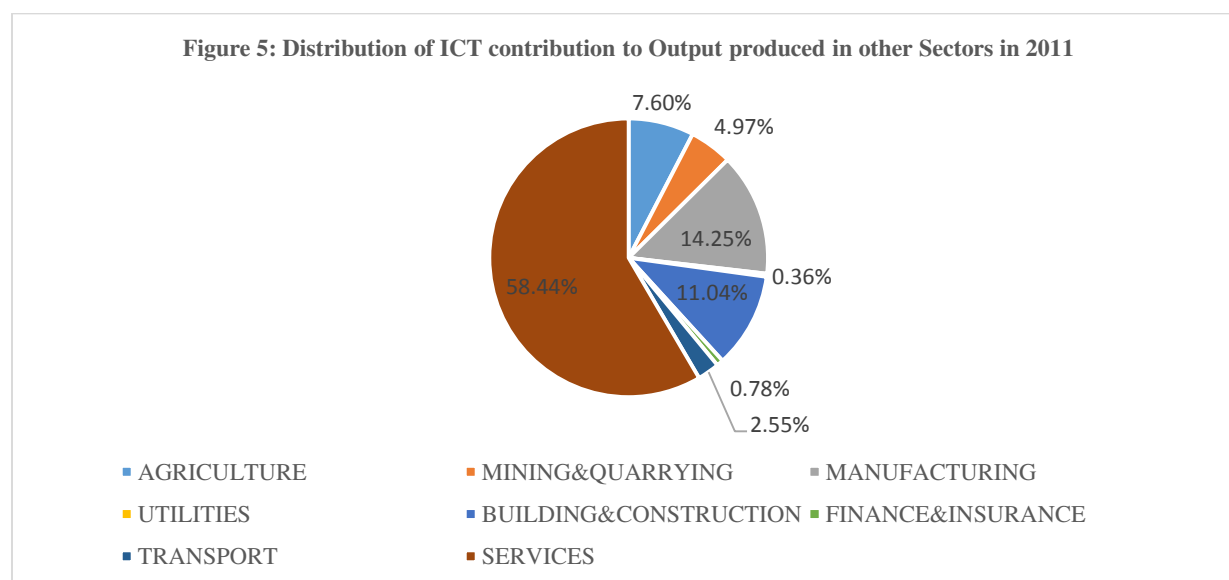
In 2011, the biggest beneficiary of employment contribution of ICT sector's activity is the services sector with about 879,990 jobs, which is 54.94% of employment generated in other sectors (see Table 6). The services sector is followed by transport sector with 303,862 (18.97%) people being employed. Agricultural sector is the third sector that benefited in terms of employment, employing about 204,488 people, representing about 12.77% of the total employment generated by ICT sector in other sectors. Manufacturing sector ranks fourth as its employment is boosted by about 147,243 people (9.19%) on account of ICT sector activity. The ICT sector's contribution to employment in building and construction sector, utilities sector, mining and quarrying sector, and finance and insurance sector are 51,278 (3.20%), 10,119 (0.63%),2,852 (0.18%) and 1,869 (0.12%) respectively (see Figure 6). As it can be observed from the Table, most of the sectors benefited from the indirect effects through intersectoral buying and selling among the sectors. It is the agricultural sector and utilities sector that benefit the more from induced employment effect of ICT sector. The percentage contribution of ICT sector to employment in other sectors and in the whole economy increases further in 2011 as it hovers around 3.12% and 3.35% respectively compared with what obtains in 2006 which stands at 0.54% and 1.91% respectively.

Table 6: Contribution of ICT Sector to Employment in the Economy in 2011				
SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
AGRICULTURE	0	75079	129409	204488
MINING&QUARRYING	0	2170	682	2852
MANUFACTURING	0	96662	50581	147243
UTILITIES	0	3274	6844	10119
BUILDING&CONSTRUCTION	0	18155	33123	51278
ICT	112179	2262	5003	119443
FINANCE&INSURANCE	0	962	907	1869
TRANSPORT	0	240216	63646	303862
SERVICES	0	695669	184321	879990
TOTAL	112179	1134449	474517	1721145
Total Employment in the Economy				51411897
Percentage Contribution of ICT to Employment in the Economy (%)				3.348%
Percentage Contribution of ICT to Employment in Other Sectors of the Economy (%)				3.115%

Source: Computed by Authors from Nigerian Input-Output Data for 2011

Figure 6: Percentage of Employment Contributed to other Sectors by ICT in 2011

- AGRICULTURE
- MINING&QUARRYING
- MANUFACTURING
- UTILITIES
- BUILDING&CONSTRUCTION
- FINANCE&INSURANCE
- TRANSPORT
- SERVICES

5.5. Discussion

From the foregoing analysis, it is apparent that services sector of the economy in Nigeria benefits from the reform carried out in the ICT sector in 2001 in terms of output and employment. This is not surprising because services sector has many firms that make use of ICT output. In fact, after the reform, several enterprises sprang up that are ICT-based. Most of these enterprises provide jobs for the teaming population of unemployed. This employment created in the services sector leads to the surge in the output of the services sector which in turn generates more output in the sector. It is also observed that manufacturing and building and construction sector enjoy more output emanating from the ICT sector reform. In terms of employment benefit, most benefits accrued to the other sectors come from induced effects, particularly in 2001 and 2006 respectively. The sectors that benefit from the induced employment effects are agricultural sector, transport sector and manufacturing sector. This implies that income spent by household members employed in those sectors enable the sectors to generate more employment. It also shows that there is intersectoral linkage among the three sectors. Although sector such as the building and construction sector benefit from the output effect of ICT sector, this is, however, not translated to the employment in that sector. This shows that a small number of people are being employed in the sector despite the major building and construction works springing up in the country. The same scenario is witnessed in the financial and insurance. The sector enjoys output growth which does not translate into the employment in the sector. The finding is also plausible because banking and insurance companies that make the majority firms in the sector employ less workers as their operation

requires more capital input. The least sector affected by the ICT sector reform is the mining and quarrying sector. However, the ICT contribution to the sector increased from 2001 to 2011.

Overall, ICT sector reform has made some contribution to the Nigerian economy in terms of output and employment as shown by the impact of ICT sector on other sectors and the economy as a whole.

6.0 Conclusion and Policy Recommendations

The reform of the ICT sector in Nigeria in 2001 has led to the development in the sector that revolutionises the economy in terms of output growth and employment generation. The reform paves way for several ICT-driven large and small scale firms and it also serves to bring into operation huge ICT firms (GSM firms), which have been providing the backbone for other sectors/firms that require information and communication services. Despite this development, little or no empirical study has been conducted to quantitatively assess the contributions of ICT sector to the Nigerian economy. Using input-output tables of Nigeria for the periods of 2001, 2006 and 2011, this study assesses quantitatively the contributions of ICT sector to the sectors of the economy including the ICT sector itself as well as the aggregate economy. Specifically, the study examines the contributions of the ICT sector through its direct, indirect and induced output and employment effects on the sectors of the economy.

The results show that ICT sector has a positive impact on the Nigerian economy, particularly in terms of generating additional output and employment opportunities in almost all the sectors considered. In 2001 when the reform was carried out, the ICT sector contributed output worth of ₦28, 699.66 million to the Nigerian economy. At the *end of 2011, the output contribution of the ICT sector has risen to* ₦*2,166,888.37 million (2,138,188.71* million *naira). Similarly, the total employment in the economy rises from 124,617* thousand *people in 2001 to about 1,721,144.61 million people in 2011. This implies that within the space of 11 years, the ICT sector has contributed about 1,596,527.61million jobs to the economy.* Still on the output contributions of ICT sector, services sector appears to be the most beneficiary among all the sectors considered. The second sector that benefits from the ICT sector is the manufacturing sector while the building and construction sector and agricultural sector occupy the third and fourth positions respectively. The least beneficiary sector is the mining and quarrying sector. In the case of employment contributions of ICT sector, services sector is also the biggest benefiting sector among the sectors while the sectors such as manufacturing sector, agricultural sector and transport sector also benefit from employment generated as a result of ICT sector expansion. The least benefiting sector remains mining and quarrying sector, albeit the little benefit accrued to the sector increases during the period under consideration. It is equally discovered that most of the benefits that accrue to other sectors

come from induced effects that stem from ICT sector activity. Apart from having direct effect on its own sector, ICT sector benefits more from the indirect effect arising from the firms that are purchasing and supplying ICT products. It, however, sparsely benefits from the induced effect.

From the findings, it is apparent that ICT sector has a potential to sustain the Nigerian economy for a very long term. Thus, it is expedient for all the stakeholders and the government through the Ministry of Communication and Nigerian Communication Commission to work out appropriate policies that would engender the creation of a conductive environment for the ICT-related firms to continue to thrive in the country. Appropriate framework that would further integrate the ICT sector into the other sectors of the economy should be put in place.

References

Adebayo, A. A., and Ekejiuba, C. O., (2016). A review of the contributions of telecommunications to the economic growth of Nigeria. *IJEEE*, Vol. 3, Issue 2, pp. 10-13

Adi, B., (2015). An evaluation of the Nigerian telecommunication industry competitiveness: Application of Porter's five forces model. *World Journal of Social Sciences*, Vol. 5, No. 3, pp. 15-36

Akanbi, B. E., Adebayo, A. A., and Olomola, A. A., (2015). Analysis of telecommunication service expansion, employment and poverty in Nigeria. *International Journal of Development and Sustainability*, Vol. 4, No. 12, pp. 1126-1137.

Arifin, Z. (2012). *THE impact of mobile phones on household welfare in Indonesia: Evidence and implications* (Doctoral dissertation, University of Pittsburgh).

Asogwa, F. O., Ohaleme, K. K., and Ugwuanyi, R. O., (2013). The impact of telecommunication on expenditure on economic growth in Nigeria. *Journal of Economics and Sustainable Development*, Vol. 4, No. 13, pp. 40-45

Awoleye, O. M., Okogun, O. A., Ojuloge, B. A., Atoyebi, M. K, and Ojo, F., (2012). Socio-economic effect of telecommunication growth in Nigeria: An exploratory study. *Interdisciplinary Journal of Contemporary Research in Business*, Vol. 4, No. 2, pp. 255- 262.

Aydoğuş, O., Değer, Ç., Tunalı Çalışkan, E., and Gürel Günal, G. (2018). An input–output model of exchange-rate pass-through. *Economic Systems Research*, *30*(3), 323-336.

Azubuike, C., and Obiefuna, O., (2014). Wireless communication: The impact of GSM on the economic lives of Nigerian rural users. *Journal of Education and Social Research.* Vol. 4, No. 7, pp. 79- 87.

Bazzazan, F., (2009). *The economic importance of ICT in Iran: Input-output approach.* 2009 International Conference on Information and Financial Engineering. DOI 10.1109/ICIFE.2009.11.

Bertot, J. C., Jaeger, P. T., and Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government information quarterly*, *27*(3), 264-271.

Borges, R. E. S., and Montibeler, E. E. (2014). Input–Output Matrix study: A theoretical frame to study the impact of Brazilian IPI reduction in final demand. *EconomiA*, *15*(2), 228-241.

Ceccobelli, M., Gitto, S., & Mancuso, P. (2012). ICT capital and labour productivity growth: A non-parametric analysis of 14 OECD countries. *Telecommunications Policy*, *36*(4), 282-292.

Central Bank of Nigeria, (2017). *CBN statistical bulleting various issues*. Abuja, Nigeria.

Cui, L. B., Peng, P., and Zhu, L. (2015). Embodied energy, export policy adjustment and China's sustainable development: a multi-regional input-output analysis. *Energy*, *82*, 457-467.

Danielis, R. and Gregori, T., (2013). An input-output-based methodology to estimate the economic role of a port: The case of the port system of the Friuli Venezia Giulia Region, Italy. *Maritime Economics and Logistics* 15, 222-255. doi:10.1057/mel.2013.1

Dedrick, J., Gurbaxani, V., and Kraemer, K. L. (2003). Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys (CSUR)*, *35*(1), 1-28.

Deloitte, (2015). *Nigeria's telecommunications industry: Looking back and looking forward*. Inside Tax. pp. 1

Di, Carlos, C., and Santarelli, E., (2010). *Contribution of ICT to economic growth in Italy: Input-output analysis*. Department of Communications, Ministry of Economic Development

Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., and De Vries, G. (2013). The construction of world input–output tables in the WIOD project. *Economic Systems Research*, *25*(1), 71-98.

Duc, D. T. V., and Linh, D. H., ((2018). Contribution of ICT to the Vietnamese economy: An input-output analysis. *VNU Journal of Science: Economics and Business,* Vol. 34, No. 5, pp. 1-17.

Garza-Gil, M. D., Surís-Regueiro, J. C., and Varela-Lafuente, M. M. (2017). Using input–output methods to assess the effects of fishing and aquaculture on a regional economy: The case of Galicia, Spain. *Marine Policy*, *85*, 48-53.

Gera, S., Gu, W., & Lee, F. C. (1999). Information technology and labour productivity growth: an empirical analysis for Canada and the United States. *The Canadian Journal of Economics/Revue canadienne d'Economique*, *32*(2), 384-407.

Ghosh, A., (1958). Input-output approach to an allocation system, Economica 25, pp. 58–64.

Hoang, L. T. H. (2017). *Input-Output Analysis of Exchange Rates and Trade* (Doctoral d dissertation, Yokohama National University, 横浜国立大学).

Ijewere, A. A., and Gbandi, E. C. (2012). Telecommunications reform in Nigeria: The marketing challenges. *JORIND Volume*, *10*, 193-198.

Irawan, T., (2013). *ICT and Economic Development: Conclusion from IO Analysis for Selected ASEAN Member States*. Discussion Paper 192. University of Wuppertal, Bergische Universität Wuppertal.

Ivanova, G. and Rolfe, J., (2011). Using input-output analysis to estimate the impact of a coal industry expansion on regional and local economies. *Impact Assessment and Project Appraisal*, 29(4), pages 277–288, DOI: 10.3152/146155111X12959673795840.

Jalava, J. and Pohjola, M., (2005). *ICT as a source of output and productivity Growth in Finland*. Discussion Paper No. 52, Helsinki Center of Economic Research, University of Helsinki, Finland.

James, J. (2014). Internet Use, Welfare, and Well-Being: Evidence from Africa. *Social Science Computer Review*, *32*(6), 715-727.

Jorgenson, D. W. (2001). Information technology and the US economy. *American Economic Review*, *91*(1), 1-32.

Jorgenson, D. W., and Stiroh, K. J. (1999). Information technology and growth. *American Economic Review*, *89*(2), 109-115.

Keček, D., Žajdela Hrustek, N., and Dušak, V. (2016). Analysis of multiplier effects of ICT sectors–a Croatian case. *Croatian Operational Research Review*, *7*(1), 129-145.

Khan, H., and Santos, M. (2002). *Contribution of ICT use to output and labour-productivity growth in Canada*. Bank of Canada.

Kim, H. and Kim, B., (2015). Economic impacts of the hotel industry: an input-output analysis. *Tourism Review*, Vol. 70 Issue 2, pp.132–149 http://dx.doi.org/10.1108/TR-11-2014-0056

Kofoworola, O. F. and Gheewala, S., (2008). An input–output analysis of Thailand's construction sector. *Construction Management and Economics*, 26:11, 1227-1240.

Kuriyama, T. and Oniki, H., (1992). Contribution of New Information Technology to the Growth of the Japanese Economy for 1974 – 85: Am Application of Input-Output Model and Productivity Analysis Part 1. *Journal of Applied Input-Output Analysis*, Vol. 1. No.1, pp. 24-42.

Kuznets, S., (1965). *Economic Growth and Structure*, New York: W.W. Norton

Lee, S. (2018). *A Research on the effect of ICT Capability on the Society's Welfare: Multidimensional Deprivation Analysis including Technology as Attributes*. The 22nd Biennial Conference of the International Telecommunications Society: "Beyond the boundaries: Challenges for business, policy and society", June 24th - 27th, 2018, Seoul, Korea.

Leontief, W. (1967). An alternative to aggregation in input-output analysis and national accounts. *The Review of Economics and Statistics*, 412-419.

Leontief, W. W. (1936). Quantitative input and output relations in the economic systems of the United States. *The review of economic statistics*, 105-125.

Leontief, W. W. (1951). *The structure of American economy, 1919-1939: an empirical application of equilibrium analysis* (No. HC106. 3 L3945 1951).

Lindberg, G. and Hansson, H., 2009. *Economic impacts of livestock production in Sweden-An input-output approach.* Swedish University of Agricultural Sciences Working Paper Series, 2009/1.

Mattioli, E., and Lamonica, G. R., (2013). The ICT role in the world economy: an input-output analysis. *Journal of World Economic Research*, Vol. 2, No. 2, pp. 20-25.

Michael, O. I., and Samson, A. J. (2014). The impact of information and communication technology on youth and its vocational opportunities in Nigeria. *Journal of Good Governance and Sustainable Development in Africa*, *2*(1), pp. 106-112.

Miller, R. E. and Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extensions*. 2nd edition, New York: Cambridge University Press.

Mitra, A., Sharma, C., and Véganzonès-Varoudakis, M. A. (2016). Infrastructure, ICT and firms' productivity and efficiency: an application to the Indian manufacturing. In *Globalization of Indian Industries* (pp. 17-41). Springer, Singapore.

Nam, T. (2018). Examining the anti-corruption effect of e-government and the moderating effect of national culture: A cross-country study. *Government Information Quarterly*, *35*(2), 273-282.

NCC (2014). *Strategic management plan (SMP) 2014-2018: Building sustainable development of the communications market*. The NCC Value Creation Strategy.

Ndukwe, E., (2011). *The telecommunication revolution in Nigeria*. The text of the Convocation Lecture delivered at the Igbinedion University Okada on the 2nd December 2011 at the Annual Convocation Ceremony of the University

Norton, S. W. (1992). Transaction costs, telecommunications, and the microeconomics of macroeconomic growth. *Economic Development and Cultural Change*, *41*(1), 175-196.

Ogunsola, G. O., Salman, K. K., and Popoola, O. A., (2015), Effect of telecommunication on poverty status of rural households in Nigeria. *Global Journal of Human-Social Science: E Economics*, Vol. 15, Issue 3, pp. 48-56

Ogunsola, L. A., and Aboyade, W. A., (2005). Information and communication technology in Nigeria: Revolution and Evolution. Journal of Social Sciences, 11(1), 7-14.

Oladimeji, T. T., and Afolayan, G. B., (2018). ICT and its impact on national development in Nigeria: An overview. Research and Review: *Journal of Engineering and Technology*. Vol. 7, Issue 1. pp. 5-10

Olumide, A. A., (2011), Telecommunications reform and effects of competition on availability, quality and cost of services in Nigeria. *Public Policy and Administrative Research*, Vol. 1, No. 3, pp. 8-20.

Otello, J. J. (2010). Does use of ICT-based market information services (MIS) improve welfare of smallholder farmers? Evidence from Kenya. In *Proceedings of the 4th Americas Information and Communications Research Network Conference, Brasilia, Brazil* (pp. 1-10).

Otieno, A. V. (2010). Application of ICT strategy in enhancing competitive advantage among commercial banks in Kenya. *Unpublished MBA thesis, University of Nairobi*.

Pietroforte, R., and Gregori, T. (2003). An input-output analysis of the construction sector in highly developed economies. *Construction Management and Economics*, *21*(3), 319-327.

Raa, T. T. (2006). *The Economics of Input-Output Analysis. Cambridge*: Cambridge University Press.

Raji, A. A., Jedin, M. H. and Subhan, M., (2017). The privatisation of telecommunications sector in Nigeria. Prospects and Challenges. *International Journal of Research in Business Economics and Management,* Vol. 1, Issue 1, pp. 1-21

Razavi, S. M. H., Ramezanpoor Nargesi, G., Hajihoseini, H., and Akbari, M. (2016). The impact of technological innovation capabilities on competitive performance of Iranian ICT firms. *Iranian Journal of Management Studies*, *9*(4), 855-882.

Rohman, I. K. (2013). The globalization and stagnation of the ICT sectors in European countries: An input-output analysis. *Telecommunications Policy*, 37, 387–399.

Rohman, I. K., and Bohlin, E. (2010). *On the ICT economy in the European countries: Investigating the contribution of the ICT sectors using the input-output model,* 21st European Regional ITS Conference, Copenhagen 2010, ITS Europe, Berlin

Roller, L. H., and Waverman, L. (2001). Telecommunications infrastructure and economic development: A simultaneous approach. *American economic review*, *91*(4), 909-923

Romer, P. M., (1986).Increasing return and long-run growth. The Journal of Political Economy, 94(5), 1002–1037.

Romer, P. M., (1990). Endogenous technological change. The Journal of Political Economy, 98(5), 71–102.

Rosenberg, N. (1972). *Technology and American economic growth* (p. 75). New York: Harper & Row.

Rosenberg, N., and Nathan, R. (1982). *Inside the black box: technology and economics*. Cambridge University Press.

Schuschny, A. R., (2005). Tópicos sobre el Modelo de Insumo-Producto: teoría y aplicaciones. Serie de Estudios Estadísticos y prospectivos 37, CEPAL, Naciones Unidas. Santiago de Chile.

Silveira, T. S., Fabris, D. R., Neto A. N., Junior, C. A. G., Cardoso, B. F. and Shikida, P. F. A., 2015. Input-output analysis for agricultural and livestock sector in the Brazilian economy. *Rivista di Economia Agraria*, Anno LXX, n. 1, 33-54.

Sofowora, O. (2009). The potential of using information and communication technology for poverty alleviation and economic empowerment in Osun State, Nigeria. *International Journal of Education and Development using ICT*, *5*(3), 131-140.

Surugiu, C., (2009). The Economic Impact of Tourism. An Input-Output Analysis. *Rom. J. Econ.*, 29, 142–161.

Tisdell, C. (2014). *Information Technology's Impacts on Productivity, Welfare and Social Change: General Observations* (No. 174091). University of Queensland, School of Economics.

Williams, G., (2016). Economic impacts from development of the Coastal Town in Queensland on tourism and regional economy. *Resources*, 5, 48, pp. 1-16. doi:10.3390/resources5040048

Yamada, G. and Imanaka, Y., 2015. Input-output analysis on the economic impact of medical care in Japan. *Environ Health Prev Med*, 20: 379-387.

Yih, H., Hsu, J., & Li, F. (2018). The economic effects of the tax reform: Dynamic input-output model approach. *International Journal of Economics and Financial Issues*, *8*(4), 140.

Zuhdi, U., Mori, S. and Kamegai, K., (2012). Analyzing the role of ICT sector to the national economic structural changes by decomposition analysis: The case of Indonesia and Japan. *Procedia-Social and Behavioural Sciences* 65, 749-754