Spring 4-9-2014

Social Network Adaptation, a Panacea to Information and Communication Technologies (ICTs), Innovation Diffusion: the Case of Small Scale Agribusinesses in Less Developed Countries

Bartholomew Ituma-Aleke
Ebonyi State University, Nigeria, bathleke@yahoo.com

Patricia Egwu
Ebonyi State University, Nigeria

Social Network Adaptation, a Panacea to Information and Communication Technologies (ICTs) Innovation Diffusion: the Case of Small Scale Agribusinesses in Less Developed Countries

[1]Bartholomew Ituma Aleke BSc ; MSc; PhD [2]Egwu Patricia

[1&2]Agribusiness Information Management; Faculty of Agriculture & Natural Resource Management, Ebonyi State University Abakaliki Nigeria

ABSTRACT

There is substantial research in the area of diffusion of innovation theory (DoI), and its application to information systems and information technology (IS/IT) innovation within organisations. However, scholars in recognition of the conceptual limitations of DoI, have called for the incorporation of certain aspects of social network theory (SNT) into DoI framework. In developing countries, one such justification for this theoretical stance is the fact that information communication channels through which technology innovation is diffused have been shown to substantially influence the rate of technology adoption.

In this study, the author focuses on exploring how diffusion of innovation (DoI) theory underpinned by social elements can be used to develop and enable the effective diffusion of innovation among small scale agribusinesses in Nigeria. Data was obtained primarily through qualitative research (semi-structured interviews, document analysis and field notes/observation). Data analysis and coding was conducted using template analysis (*Atlas.ti*). The findings of the research suggest that an understanding of the conceptual basis of innovation is a major driver of successful innovation adoption.

Keywords: ICT, Agribusinesses, DoI, Social Networks, Perception, e-business

1. Introduction:

The use of some ICTs components in small and medium sized Agribusiness industries represents adoption of technological innovation, especially for small agribusinesses industries operating in developing countries that have been using paper-based or face-to-face communication facilities (Filho et al., 1999; Weick, 2001; Rao, 2007). ICT adoption has for example driven significant changes by transforming the agricultural industries in developing countries which traditionally has not been innovative (Sassenrath et al., 2008). The reality however is that recognition of capabilities of ICTs by *agripreneurs* does not in any form enable efficient and effective process for technological innovation adoption (Rao, 2007). Neither does it transform to an automatic enhancement or improvement of productivity, or in fact an acceptance of use by potential users (Adrian et al., 2005).

Recognition of the importance of ICT to the agricultural industry has led to policy makers calling for the development and possible permeation of ICT that will facilitate uptake of e-business in the industry. There is this belief that uptake of e-business as a result of establishment of ICT facilities will also enhance agriculture productivity and entrepreneurship (Feder and Umali, 1993; Mishra and Park, 2005; Minten and Barrett, 2008). It is expected that this increase in agribusiness productivity will be translated into national economic development (Omamo and Lynam, 2003). Although the role of Small and Medium Agribusiness Industries in agricultural productivity cannot be over-emphasised, its productivity has been compromised by a range of factors. These factors include poor ICT policy formulation and implementation (Diso, 2005), a lack of targeted credit facilities (Jabber et al., 2002), a high level of illiteracy within the industry (Sabo and Zira, 2009), a changing customer base (Mishilli et al., 2009), the lack of access to relevant market information (Awoke and Okorji, 2004), poor supply networks which restricts their business transactions to within a confined region (Higgins et al., 2008), inadequate infrastructure (Martin and Jagadesh, 2006), and the non-possession of skills relevant to compete in a modern business environment (Weick, 2001). In most cases, all these problems are ultimately attributable to under-investment and the political realities of African management style (Leonard, 1987), which has led to a series of difficulties with policy making, administration and leadership. Developed nations for example invest about ten times more of their per capita income on research and development (R&D) as well as information and communication technologies (ICT) than Sub-Sahara African countries (Watts and Ashcroft, 2005).

2. Context

There is a divergent range of scholarly views in the area of adoption of ICT innovation among agribusinesses industries. For example questions are being asked not only whether agribusinesses can appropriately exploit ICT for operational and productivity gains (Weick, 2001; Cox, 2002; Adrain et al., 2005; Rao, 2007), but also about the possibility of sustaining the diffusion process among the potential agribusiness adopters. (Oseni and Winters, 2009; Aleke et al., 2011). Small and Medium agribusiness industries in Africa are particularly complicated because of numerous reasons. For instance, agribusiness entrepreneurs are noted to be highly resistive to change (Adrian et al., 2005). Scholars (Warriner and Moul, 1992; Romani, 2003) have also found that Small and Medium

Agribusiness industries in Africa were prepared to allow ethnic and tribal loyalties to overshadow sound entrepreneurial sense. Certainly in the case of Nigeria, matters had not been helped with the passage into law in 1977 of the indigenisation decree which was presented as an attempt of government to shield Small and Medium indigenous Agribusiness industries from foreign competitors. Mishra and Park (2005) observed that Small industries had little interest in electronic business and online sales technology. Therefore Adoption of such innovation was not in their priority list. According to Molla et al., (2006), such interest and expertise appeared more tenable in Small industries operating in developed countries.

Nigeria is one of the developing countries whose Small and Medium Agribusiness industries are yet to exploit the potentials of ICT in either e-business enablement or as entrepreneurship strategy. Nigeria is the most populous country in Africa with a population of over 140 million people (CIA, 2010). Nigeria's economy is the second largest in the continent (second to that of Republic of South Africa) and large proportion of the economy is derived from agricultural industries (Manyong et al., 2005). The agriculture in Nigeria is to a large extent subsistence-oriented (Aleke et al., 2010), and dominated by Small and Medium Enterprises (SMEs), which according to estimates by Nmadu (2002), Awoke and Okorji (2004), Oseni and Winters (2009), constitutes between 75 and 85% of the industry. Largely, Nigerian agribusiness proprietors have been unable to exploit the country's vast agricultural potential due to underdeveloped state of the country's agricultural system. The industry is highly vulnerable to unpredictable weather conditions particularly now that climate change is really manifesting (Tubiello and Fischer, 2007). Communication within agribusiness supply chain in Nigeria is regrettably poor (Aleke, 2010).

Although, there is a history of significant attempts to diffuse ICT in Nigeria more especially in the financial sector but such attempts are not significant among agribusiness industries that still rely heavily on paper-based or face-to-face communication facilities for engaging their customers. The rate of ICT adoption in Nigeria lags behind a considerable number of other African countries (Oyelaran-Oyeyinka and La, 2005). For instance, internet access density in Nigeria is estimated to about 17.5 users per 10,000 of the population, compared to the Republic of South Africa where it is 549 users per 10,000 of the population and Mauritius (728 users per 10,000 of the population).
It has long been advocated that ICT offers substantial potential for addressing many of the challenges that the Nigerian agriculture sector is experiencing especially in the area of information exchange and e-business uptake (Aleke, 2003; Aleke et al., 2009; Aleke, 2010). For example, locally produced and processed Abakaliki rice was primarily successfully exported to the Chinese market due to marketing effort spearheaded over the internet. The main advantage delivered by ICT to agribusinesses is in information provision (Wang et al., 2006). In this respect, agribusinesses are no more different in terms of the role ICT has to play in both their operations and productivity (Cox, 2002), than non-agriculture enterprises.

This particular research is set within the Southeast Nigerian State of Ebonyi. The area is predominantly rural. Compared to other regions of the country, it has the largest proportion of small and medium agribusiness industries in existence (Awoke and Okorji, 2006). This is estimated by Oseni and Winters (2009) to represent about 85% of the workforce in that region as compared to a

national average in the whole Nigeria which is 70%. This study is therefore justified for two reasons. In the first place, although Nigeria economy is dominated by the petroleum industry, agriculture contributes 30% of the country's GDP (CIA, 2010). The agriculture industry also directly or indirectly employs 60% of the entire population (Manyong et al., 2005) for thus making its viability crucial for the development of Nigeria economy. However, although the importance of the agricultural industry to the Nigerian economy cannot be underestimated, it is still an industry characterised by low efficiencies and productivity (Aleke, 2003; Aleke et al., 2009; Aleke,2010). The second justification for the study is that only a limited number of studies have focused on ICT diffusion in agribusinesses, and the impact of social processes on the process of diffusion in heterogeneous indigenous cultural settings. In the next section, we set out the areas of theory underpinning this particular study. Two frameworks will form the basis of our study. The first is the diffusion of innovation theory, while the second is social network theory.

3. Underpinning theories for the study:

Diffusion of innovation theory (DoI) asserts that the characteristics of an innovation either facilitates or inhibits the adoption of innovation. For this reason, understanding the concept and characteristics of each stage of the diffusion process (including new policies and procedures) can innovation adoption with the potential adopters more easily persuaded to accept the changes that will emerge as a result of such innovation.

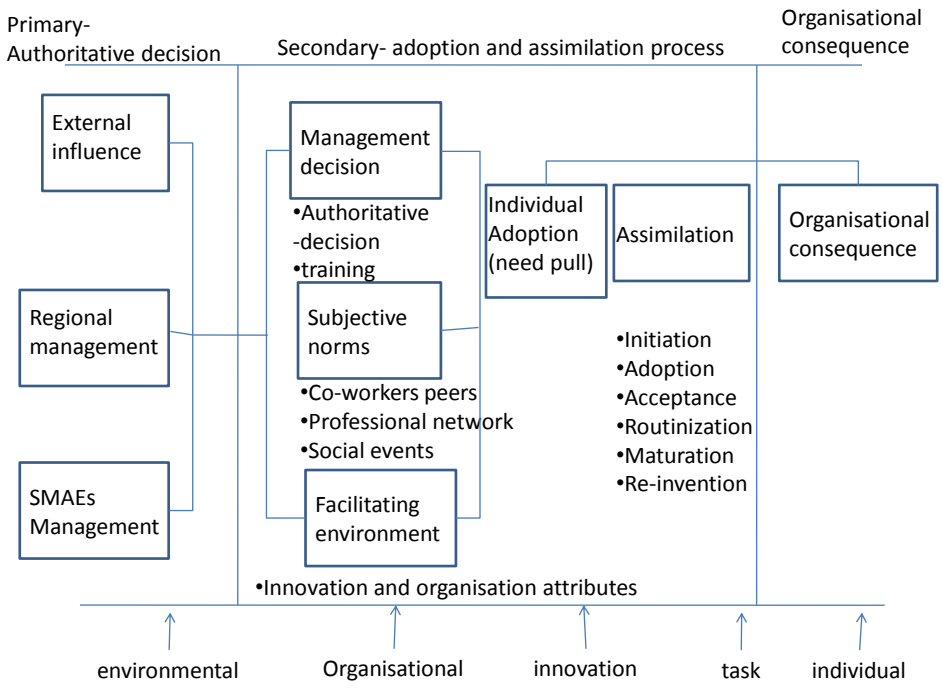
Numerous scholars (Rogers, 1995; Berger, 2001; Adrain et al., 2005; Feder and Savastano, 2006; Janssen and Ittersum, 2007; Spielman et al., 2009) have explored the notion of technology adoption in agriculture utilising diffusion of innovation theory (DoI) as a theoretical basis. The advantage of utilising the diffusion of innovation theory (DoI) is that it provides the contextual parameters that drive the acceptance of the technological innovation under diffusion. These parameters may include the characteristics of the technology, the channel that are employed to communicate information about the technology (process), the profile of the adopters and the degree of familiarity between those driving the adoption and the potential adopters. DoI has been broadly applied to areas ranging from the diffusion of new ideas to the diffusion of new machines. Although scholars have examined how technology may be diffused among agribusinesses, few if any of emergent studies have actually operationalised diffusion theory in agriculture by focusing on its social dimensions. Diffusion of innovation theory (DoI) might provide an explanation for successful ICT adoption which is critical for long term diffusion sustainability.

Diffusion of innovation research theory is not without its critics. Scholars such as Wainwright and Waring (2007) for example claim that its theories put forward heterogeneous statements that are vague and therefore needs to be addressed. The authors also claim that enhancement to the theory (see Table 1.0 below) appear only to produce a list of diffusion factors, which at times conflict with each other. We however consider the theory adequate within the present research context for two reasons. In the first place, the diffusion of innovation framework was originally based on the study of improved hybrid innovation within agricultural sector. For this reason, the framework represents a

starting point for our research. Doi theory has social elements adaptable within the context of this particular research.

Our study adopts a three-staged view of the DoI framework (Fig 1, adopted from Wainwright and Waring, 2007), which commences with the diffusion decision. Generally the third stage is where the effect of the maturation of the diffusion process is most likely to determine the sustainability of the diffusion of innovation process. It is at this stage that we focus on, and our interest is to gain an understanding on how ICT innovation diffusion possibly informed by social elements may be sustained. See Fig. 1 below for the adapted framework.

Figure 1: Conceptual framework adapted for the study



Source: Adapted from Wainwright and Waring (2007).

The original framework of this three stage diffusion process as adapted by Wainwright and Waring (2007) was very silent on social elements such as "co-worker's peer association", professional networks" and "social events". It is our intension in this particular study to adopt such social elements in order to determine how social elements can enhance and enable effective diffusion of innovation process. Without the social elements the original version of the adapted framework as modelled by Gallivan (2001) was only suitably for diffusion process using mass media and/or face-to-face canvassing. However the introduction of social elements by this particular study is in a bid to explore the influence of such social elements in a particular diffusion of innovation process.

The framework has three stages (primary-authoritative, secondary-assimilation and organisational consequence stages) as shown above. The first stage is when the innovation is still being regarded as

an external influence, possibly coming from external bodies or foreign expatriates. The innovation is introduced in a region where the governments of the region will still be the people to decide whether their subjects will be allowed to experiment on the innovation. Also within this first stage, the owner-managers of small and medium Agribusiness industries may be invited by government to alert them of the innovation. The common characteristic of this stage is that decision regarding the acceptance of the innovation is made by authorities and not the individual end-users. In most cases the individual end-users are not involved in this stage. The second stage is a crucial because that is when managements of the small and medium Agribusiness industries will either authoritatively decide to go on with adoption after considering compatibility of the innovation with existing norms and practice within the region or seek alternative adoption process. In this stage, the social elements plays a role because it creates facilitating environment for the attributes of the innovation to be discussed within social meetings and by social groups such as professional networks and co-workers peer groups. The social process in this stage prepare environment for assimilation of the innovation after the adopter organisations (innovators) must have experimented on the innovation in their routine task. The resultant of the effect of what happened in the second stage will inform either the sustainability of the diffusion process (maturation) or the rejection of the innovation (discontinuance).

4. Research Methodology:

One of the key elements of a successful research endeavour is the determination of an appropriate choice of research methodology. Often, the choice of methodology may not be necessarily separated from researcher's philosophical orientation. We have highlighted that our research resides at the interface of two conceptual foundations namely; the diffusion of innovation theory (DoI) and social elements of social network theories (SNT). Our research is further compounded, as it is set within small and medium agribusiness industries leading to a need to consider entrepreneurship and organisational behaviours within the context of agricultural industry. The research is contextualised within a rural area (Ebonyi State) of a developing country (Nigeria), thus leading to need to incorporate development theories into our conceptual foundations. Based on this it is highly unlikely that this study could adhere to a set of predetermined rules. The implication is that the eclectic nature of the study may not be necessarily served by a research philosophy which has its foundation in classical instrumental research methods which are aligned to structured experimentation.

Instead our study is best served by a philosophical foundation which exhibits a diverse and rich set of theories, of which variables such as morale, judgement formation and an understanding of behaviours may be best understood. Based on this assessment, in contrast to the positivist paradigm (classical instrumental research methods), we adopt a phenomenological research philosophy (social constructionism). This focuses on understanding human behaviour from the participant's own frame of reference. The basic claim of social constructionism is that realities are constructed rather than discovered (Burr,1995), and that attitudes and behaviour are determined by their social setting. It follows therefore that researchers should seek to understand and explain phenomena in a particular localised setting, rather than seek universal laws that attempt to explain them outside of any context.

Data was gathered from semi-structured interviews of twenty-seven small and indigenous agribusiness proprietors affiliated with the Ebonyi State Federation of Cooperatives. (see Appendix A) for the distribution of the enterprises interviewed according to the nature of their businesses) The Ebonyi State Federation of Cooperatives (ESFC) is a constituent member of the South-eastern Nigeria Agribusiness Social Networks (SASNET), which consist of 325 Small and Medium Sized Agribusiness industries. The SASNET is a government initiative which was set up among other reasons to help facilitate the adoption of ICT to agribusinesses in the South-eastern States of Nigeria. Therefore there SASNET members formed the population from which the purposive sampling was drawn.

The interview process is based on verbal communication between an interviewer and respondents due to the fact some of the agriprenuers either has no telephone connection at all or that the line has been disconnected. Majority of the agribusiness proprietor experienced line disconnection when the national network (NITEL) was privatised; therefore the issue of telephone interview was ruled out. Interviews are regarded as the most widely used qualitative method of generating data in social science research (Denzin, 2001). It is seen to be particularly useful for non-experimental descriptive designs that aim to demonstrate reality (Mathers et al., 1998). Interviews are also usually seen as particularly suitable for research aimed at capturing and describing processes where variations could exist as in the case of this our study. In this particular study, semi structured interviews were used to collect data because of the flexibility of its approach. For example it allowed us not only for adaptation to varying context, but also encouraged the pursuit of unexpected paths (Correia and Wilson, 1997).
To commence template analysis, initial a priori codes were generated from relevant literature or frameworks. The codes developed a priori were meant to represent a test of prediction and therefore served good pointers when interpreting the data. Atlas.ti computer software was utilised during data analysis and interpretation due to the substantial amount of data generated from the interviews. Codes were refined, crystallised and immersed into high level code clusters

5. Findings:
The findings of this study is hinged on a adoption process of ICT centres introduced in the Agribusiness communities of South eastern Nigeria (our study area) by United Nations Industrial Development Organisation (UNIDO). Interviewees where asked questions and response were obtained with respect to the ICT centre innovation which served as our model for innovation adoption.

Many scholars agree on the need to respect the perception of adopters of any innovation (Mark and Poltrock, 2004; Mallet, 2007; Aleke, 2010). Responses from the interviews in our study is congruent to earlier work by Mallett (2007), showing that determining how human actors perceive a particular innovation is primarily a social process which is highly influenced by the perception of the adopters.

110 Rice Miller/Marketers, 30 cassava processing Cottage industries, 2 Organic Fertilizer manufacturing industries, 7 animal feed producers, 42 flower/horticulture farmers, 56 poultry farmers, 6 tractor hiring enterprises, 19 vegetable oil producing industries, 2 Agribusiness consulting firms, 49 Quarry/stone crushers and 3 fish pond farmers made up the population for purposive sampling

Mallett's (2007) opinion is also shared by Dattee and Weil (2007) who maintained that social imperativeness as used in the context of this paper, highlight social engagement and social acceptance; all which has a substantial impact in the adoption of technology innovation. 70% of the respondents affirmed that they heard about the ICT centre innovation from social engagements.

The essential aim of this section in this paper is to draw together the voices of the respondents in order to understand how social dynamics impact on the diffusion of ICT centre innovation. For this reason, it was felt that a reflection on earlier work on data interpretation put forward by Alvesson and Deetz (2000), which include; intensifying interpretation, language sensitivity, historical context and politics is essential at this point. We recognise that language does not transport meaning outside the context it was displayed. It is worthy of note that through the crystallisation and immersion of the codes we identified cultural antecedents, societal norms, and social affiliations played major roles on how information are communicated within the study area instead of mass media. In line with the above we also discovered that any technological innovation that has elements of social attributes stands a chance of diffusing faster than those that do not have such attributes. So what does this imply? To give answer to this question let us elaborate further on the findings of this study.

South-eastern Nigeria is a geographical region dominated by the people called Igbos who are well known for their commercial and entrepreneurship acumen. Their style of marketing is embedded in social activities due to the fact that traditionally the Igbos have routine four-day market cycle (Orie, afor, nkwo and eke). In any farming community there will be places of commercial activities where people will come together to buy and sell their commodities. This study found also that any other social function that will attract huge audience will have to be annexed to the usual market place so that many people will know of it without extra cost of publicity. Nnaedozie (2002) and Fredrick (2008), in their studies had already identified that there is a correlation between tribal and ethnic background and entrepreneurial behaviour.

The Igbos worldwide exhibits a relationship based manifest where lifelong relationships may start from contacts information exchanged even at a market place. Most often men date women they saw at markets. Relationships are formed within family, masquerade groups, age grades and titled societies (Henderson, 1966). This explains why we found evidence of high degree of social collaboration amongst the interviewees. There is evidence of networks such as farmer's cooperatives, farmer's clubs and farming trade unions in existence before this study, more especially among the indigenous agribusiness that engaged in agro-processing and agro-marketing. It is only few of them like (ESFC and SASNET), had been set up as part of a wider government initiative to aid the diffusion of the ICT centre innovation. Another finding of this research worthy of mention at this

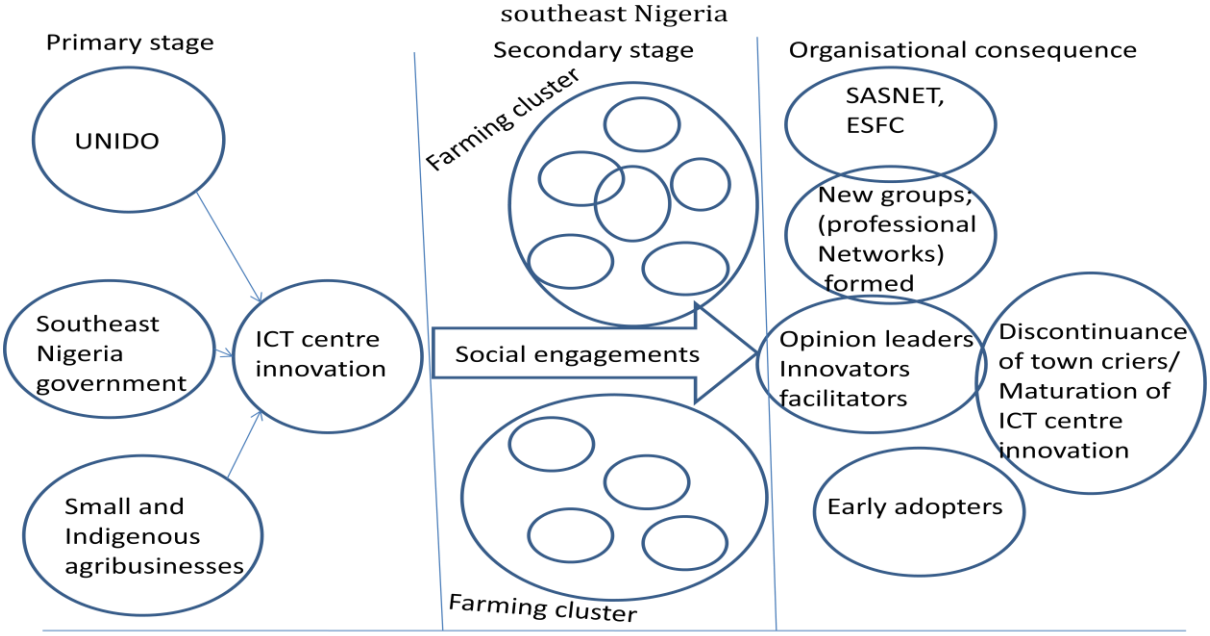
point is that substantial number of interviewees, particularly the early adopters of the ICT centre innovation agreed that the innovation empowered them socially. When they were asked to explain further what they meant by empowering them socially, they were able to reference norms in the Igbo societies especially gathering together in the evening after tedious farm work is our norm. Therefore the ICT centre ended up serving other purposes; as a local community centre. In the words of one of the interviewee;

".....I have been to the ICT centre in several occasions not necessarily for business need but there is never a time you will not see someone you know there-Vegetable oil production manager)

The ICT centre we are referring to consist of a single building on which a communication satellite dish is mounted. Cables run from the dish to routers which are installed inside the building where about 75 networked computers are located. Data is transmitted through high speed internet modems. Each centre is meant to serve two or three industrial clusters according to how the UNIDO team grouped the Agribusiness industries into clusters within Southeast Nigeria. The centre is open six days in a week (8am-10pm on weekdays and from 8am-6pm on Saturday). The main advantage of the ICT centres as identified from this study is that they provide ready connectivity to the agricultural community in area. Small and indigenous agribusiness proprietors are able to conduct some of their business transactions electronically (e-business) within the facility which also provide on-demand basic IT skills courses (again at a discounted rate). However we were able to identify that despite the advantages of the ICT centres, there are still considerable challenges. This identified that during the peak of rainy season there is always a temporary discontinuance of this innovation due to flood. Most of the area will be flooded that access to the centres will be blocked thereby forcing the agriprenuers to resort to staying put in their farm house or fall back to mobile internet vans for communication. The mobile internet unist (MIUs) are the communication innovation that preceded the ICT centre.

The second parameter we recognized as having a high social context is medium of information dissemination. Traditionally, information dissemination among the small and medium agribusiness industries was through the social networks which we had already discussed and noted as being quite strong. Information dissemination in the area as we observed is also facilitated through extension services provided by the government (Leonard, 1987; Eze et al., 2006). The extension officers assigned by the Ministry of Agriculture to each industrial cluster will pass messages across to owner-managers during contact meetings. The extension officer assists in disseminating information, primarily through two avenues. One is through direct contact with the managers. In this case, authority is sought from the cluster's representative who in most cases doubles as opinion leader and authorises the extension officer to address other proprietors during a scheduled meetings. The second approach is to engage the services of town criers who operating from a van mounted with public address system, drives around the streets of the industrial layout bellowing out information. A reflection of the findings of this study is presented in the Figure 2 below.

Figure 2: ICT centres as a model of technology innovation within agribusiness in southeast Nigeria



Source: authors' reflection.

The findings of this study reflected in the diagram above followed the sequence of the three-stage model adapted for this study (See section 3-underpinning theories and models). The reflection suggest that to ensure the success of the adoption and sustainability of technology innovation, it requires not only efforts to manage the diffusion process, but also as mentioned earlier when we discussed our conceptual framework; a need to address questions of sustainability. The question of adoption of innovation and the sustainability of the process has as far as 1984 (USAID, 1984) been identified by the United State Agency for International Development as one of the major concerns of technology diffusion in Africa.

In the case of this study it was noted that during the primary stage it was more of negotiation and collaboration among UNIDO, Southeast Nigerian government and proprietors of small and medium agribusiness industries (agriprenuers) instead of authoritatively coercing the adopters to accept the innovation. During the secondary stage, the information about the innovation was passed down through social engagements instead of the usual town crier or mass media (radio, magazines and television) approach. The consequence is that the information about the innovation has kept making top stories during social engagements and new social networks kept emerging. Like we mentioned earlier that entrepreneurship is all about problem solving and solution generation this particular study has opened up a formidable ideology that adoption of innovation is nested to entrepreneurship provided appropriate dynamic approached is adapted for the diffusion process.

6. Conclusion:

In this paper we examined how social variables manifested within the diffusion stages in an adoption process of information and communication technology (ICT) innovation among small and medium agribusiness industries in Southeast Nigeria. Although numerous factors influence diffusion of ICT

centre innovation under study, we focused on factors that denote cultural impact and factors that influenced information dissemination with considerable social imperative.

One important social element of the Igbos being the ethnic tribe that occupies the study area which was discussed in the context of culture is the centrality of the market place as the nexus where people gather after farm work to socialize and interact with friends. This research identified that the dispersive nature of agribusiness influences on the ICT centre innovation adoption process. The findings of this research suggest that to ensure successful and sustained ICT innovation adoption process among small and medium agribusiness industries, there is a need to re-conceptualise the innovation diffusion process to incorporate more viable social and cultural imperatives of the people who are expected to adopt the innovation.

References:

Adrain, A., Norwood, S., and Mask, P. (2005) Producer's perception and attitudes towards precision agriculture technologies. Computer and Electronics in Agriculture, Vol. 48 Issue 3 Pp256-271

Aleke, B. (2010) Developing a Model for Information and Communication Technology Diffusion among Small and Medium Sized Agribusiness Enterprises in Southeast Nigeria. Unpublished PhD Thesis, University of Northumbria at Newcastle upon Tyne United Kingdom

Aleke, B., Wainwright, D., and Green, G.,(2011) "Policy Issues of e-Commerce Technology Diffusion in Southeast Nigeria: The Case of Small Scale Agribusinesses" The Northumbria Built and Virtual Environment Working Paper Series, Vol.2 Pp.39-54.

Awoke, M., and Okorji, C. (2004) "The Determination and Analysis of Constraints in Resource Use Efficiency in Multiple Cropping Systems by Small-Holder Farmers in Ebonyi State Nigeria". Africa Development, Vol.29, No.3 Pp58-69

Berger, T (2001) " Agent-based spartial models applied to agriculture: a simulation tool for technology diffusion, resource use changes and policy analysis" Agricultural Economics Vol.25 Issue 2-3 Pp245-260

Burr, V (1980) An Introduction to Social Constructionism. London Routledge

CIA. (2010) Nigeria- World Factbook. http://www.cia.gov/library/publications/the-world-factbook/goes/ni.html, accessed 07/04/2011

Cox, S. (2002) "Information technology: the global key to precision agriculture and sustainability". Computers and Electronics in Agriculture, Vol.36 Issue 2-3 Pp93-111

Dattee, B., and Weil, H. (2007) Dynamics of social factors in technological substitution. Technological Forecasting and Social Change, Vo.74 Issue 5, Pp 579-607

Denzin, N (2001) The reflective interview and a performative social science. Qualitative Research Vol.1 No.1 Pp23-46

Diso, L. (2005) Information technology policy formulation in Nigeria: Answers without questions. The International Information & Library Review, Volume37, Issue 4 Pp 295-302

Eze, C.C., Ibekwe, U.C., Onoh, P.J., and Nwajiuba, C.U. (2006) Determinants of Adoption of Improved Cassava production technologies among Farmers in Enugu State Nigeria, Global Approach to Extension Practice, vol.2 No.1 Pp37-44

Feder, G and Savastano, S (2006)" The role of opinion leaders in the diffusion of new knowledge: The case of integrated pest management" World Development, Vol.34 Issue 7 Pp1287-1300

Filho, H., Young, T., and Burton, M. (1999) Factors Influencing the Adoption of sustainable Agricultural Technologies: Evidence from State of Espirito Santo, Brazil. Technological Forcasting and Social change, Vol.60 Issue 2 Pp97-112

Fredrick, H (2008) Introduction to special issues on indigenous entrepreneurs, Journal of Enterprising Communities: People and Places in the Global Economy Vol.2 No.3 Pp185-191

Gallivan, M (2001), Organisational adoption and assimilation of complex technological innovations: development and application of new framework, Data Base, Vol.32 No.3 Pp 51-85

Henderson, R (1966) "Generalised Culture and Evolutionary Adaptability: A Comparison of Urban Efik and Ibo in Nigeria. Ethnology, Vol.5 No.4 Pp365-391

Higgins, V Dibden, J and Cocklin, C (2008) " Building alternative agri-food networks: Certification, embeddedness and agri-environmental governance", Journal of Rural Studies, Volume 24, Issue 1 Pp15-27

Jabbar, M., Ehui, S., Von Kaufmann, R (2002) "Supply and Demand for Livestock Credit in Sub-Saharan Africa: Lessons for Designing New Credit Schemes" World Development, Vol.30 Issue 6 Pp1029-1042

Janssen, S and Van Ittersum, M (2007) " Assessing farm innovations and responses to policies: A review of bio-economic farm models" Agricultural Systems, Vol.94 Issue 3 Pp622-636

Lapadat, J and Lindsay, A (1999) Transcription in research and practice: from standardisation of technique to interpretative positioning. Qualitative inquiry, Vol.5 No.2 Pp64-86

Mallett, A (2007) Social acceptance of renewable energy innovations: The role of technology cooperation in urban Mexico. Energy Policy, Vol.35 Issue 5 Pp2790-2798

Manyong, V.M., Ikpi, J.K., Olayemi, S.A., Yusuf, B.T., Omonona, V and Idachuba, F.S (2005) Agriculture in Nigeria: identifying opportunities for increased commercialization and investment IITA, Ibadan, Nigeria P159

Mark, G and Poltrock, S (2004) "Groupware adoption in a distributed organization: transporting and transforming technology through social worlds", Information and Organisation, Vol.14 Pp297-327

Martin, S and Jagadish, A (2006) Agricultural Marketing and agribusiness Supply Chain: Issues in Developing Economies. Proceedings' of New Zealand Agriculture and Resource Economics Society Conference. 25th-27th August 2006

Mathers, N., Fox, N., and Hunn, A (1998) Using Interviews in a research project. Trent Focus for Research and development in Primary Health Care

Minten, B and Barrett, C (2008) "Agricultural Technology, Productivity and Poverty in Madagascar" World Development, Vol. 36 No 5 Pp797-822

Mishra, A.K., and Park, T. A (2005) "An Empirical Analysis of Internet Use by US Farmers, Agriculture and Resource Economics Review Vol.34 Issue 2 Pp253-264

Molla, A., Taylor, R and Licker, P.S (2006) "E-commerce Diffusion in Small Island Countries: The Influence of Institution in Barbados", The Electronic Journal of Information Systems in Developing Countries Vol.28 No 2 Pp1-15

Mustonen-Ollila, E and Lyytinen, K (2003) "Why Organisations Adopt Information System Process Innovations: A Longitudinal Study Using Diffusion of Innovation Theory. Information Systems Journal, Vol.13, No.3 Pp275-297

Nmadu, J.N (2002) Analysis of Sorghum Production Trend in Nigeria and the Estimation of its Supply Functions. Unpublished PhD Thesis Ahmadu Bello University Zaria

Nnaedozie, E (2002) 'African indigenous entrepreneurship: determinants of resource and growth of Igbo entrepreneurship during the post-Biafra period. Journal of African Business, Vol.3 No 1 Pp49-80

Oyelaran-Oyeyinka, B and La, K (2005) "Internet Diffusion in Sub-Saharan Africa: A cross-country analysis" Telecommunications Policy, Vol. 29 Issue 7 Pp 507-527

Omamo, S and Lynam, J (2003) Agricultural science and technology policy in Africa. Research Policy, Vol.32 Issue 9 Pp 1681-1694

Oseni, G., and Winters, P (2009) "Rural nonfarm activities and agricultural crop production in Nigeria" Agricultural Economics, Vol.40, No 2 Pp189-201

Pande, R (2006) Profits and Politics: Coordinating technology adoption in agriculture, Journal of Development Economics, Vol.81 Issue 2 Pp299-315

Rao, N (2007) A framework for implementing information and communication technologies in agricultural development in India. Technological Forecasting and Social Change, Vol.74 Issue 4 Pp491-518

Rogers, E. M (1995) Diffusion of Innovations (4th edition) New York: The Free Press

Romani, M (2003), "Love Thy Neighbour? Evidence from Ethnic Discrimination in Information Sharing within Villages in Cote d'Ivoire, Journal of African Economics Vol.12 No.4 Pp533-563

Sabo, E and Zira, D (2009) Awareness and effectiveness of vegetable technology information packages by vegetable farmers in Adamawa State Nigeria. African Journal of Agricultural Research Vol.4 No.2 Pp65-70

Spielman, D., Ekboir, J and Davis, K (2009) The art and science of innovation systems inquiry: Applications to Sub-Saharan African Agriculture. Technology in Society, Vol. 31 Issue 4

Tubiello, F and Fischer, G (2007) Reducing Climate Change impacts on agriculture: Global and Regional effects of mitigation, 2000-2080 Technology Forecasting and Social Change Vol.74, No.7 Pp1030-1056

Wainwright, D and Waring, T. S (2007) The Application and Adaptation of a Diffusion of Innovation Framework for Information System. Journal of Information Technology Vol.22 No 3 Pp44-58

Wang, N., Zhang, N and Wang, M (2006) Wireless sensor in agriculture and food industry-Recent development and future perspective. Computer and Electronics in Agriculture, Vol. 50 Issue 1 Pp1-14

Warriner, G and Moul, T (1992) Kinship and Personal communication network influences on the adoption of agriculture conservation technology. Journal of Rural Studies Vol.8 Issue 3 Pp 279-291

Watts, C and Ashcroft, L (2005) ICT skills for information professionals in Developing Countries: Perspective from a Study of the Electronic Information Environment in Nigeria. IFLA JournalVol.31 no 1 Pp146-153

Weick, C (2001) Agribusiness technology in 2010: directions and challenges, Technology in Society, Vol.23 Issue 1 Pp59-72