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DIFFUSION OF ICT INNOVATION AND E-BUSINESS ADOPTION IN AGRIBUSINESS SMES: A DEVELOPING COUNTRY PERSPECTIVE

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Abstract

This paper describes how a UNIDO ICT centre innovation acted as a catalyst for ICT adoption and e-business innovation among Small and Medium sized Agribusiness Enterprises in Southeast Nigeria. Diffusion of Innovation Theory (DoI) has been applied to investigate the diffusion process of technology. However, the adaptation of Social Network Theory in the diffusion of innovation studies is comparatively recent and still at a very developmental stage. Semi-structured interviews were conducted with 27 Small Agribusiness Enterprises in Southeast of Nigeria. This paper argues that the balance between effort utilised in technology design and the effective diffusion of such innovation must be redressed. Greater emphasis must be placed in instituting end-user social networks as an antecedant that will enable end-user engagement and hence enable effective diffusion of the technology innovation through such end-user networks. The importance of sustaining the diffusion process of information and communication technology (ICT) innovation in order to facilitate the implementation of e-business in small and medium sized enterprises is a major challenge. This paper concludes with the finding that the potential adopters' conceptual and contextual knowledge of the innovation is a major factor in the adoption and diffusion process. The continuous sharing of information about the innovation through social networks constitutes the main success factor enabling the sustainability (maturation) of the technology.

Keywords: ICT; Diffusion of Innovation; e-Business; Maturation; Adoption; SMEs

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1. Introduction

In most developing economies, firms are urged to become internationally competitive to boost exports and decrease risk exposure; at the same time, these firms tend to be deprived of the superior technology and supporting infrastructure often found in developed countries through the adoption of Information and communication technologies and shared scale-efficient economic infrastructure and resources - that would facilitate reaching global markets (Porter, 1998). Because small and medium sized enterprises (SMEs) are common place in developing countries (Sengenberger, & Piore, 1990), entrepreneurs are also plagued with severe scale constraints on investment

in productive assets and development of international channels. A possible way to circumvent such scale and infrastructure limitations is to promote communication enabling technologies among SMEs (Markusen, 1999).

However, Turban et al., (2006) identify factors motivating small and medium enterprises in developing economies towards the adoption of Information and Communication Technologies (ICT) and also some factors hindering the SMEs from adopting ICT. Table 1 reflects some factors identified to be primarily affecting the diffusion and adoption of ICT within a developing country perspective.

Many organisations tend to focus more on technology design and new product development in a bid to solve some of their organisational problems or to remain competitive in the global business environment. This is done without paying reasonable attention to the implications of developing a sustainable diffusion process of such innovations. In this paper we propose that specific organisational, cultural, social and political issues surrounding effective diffusion of a particular innovation should not be reactively acknowledged after recording system failures or innovation discontinuance. Rather the benefits of sustainability of such innovation should be pro-actively addressed by developing knowledge that can ensure more effective diffusion of the innovation.

In order to highlight the implication of sustainable diffusion (maturation) of technology in small organisations, this paper focuses on a particular case of SMEs operating within the Agricultural communities in Southeast Nigeria, where an ICT project was commissioned by the Nigerian government in partnership with the United Nations Industrial Development Organisation (UNIDO) to address the digital divide experienced by these farmers. However the commissioning of this project does not translate to the effective diffusion of the technology innovation due to some human, social and environmental factors, some of which are reflected in Table 1 below. The first section of the paper critically evaluates a diffusion of innovation pathway in an ideal situation. The second section examines various definitions and opinions relating to small organisations' use of Information and communication technologies as can be found in the literature. The third section describes an extended social network model adapted in this diffusion of innovation study. The final section concludes that the potential adopters' knowledge of the conceptual basis of the innovation is a major motivation towards adoption. The continuous sharing of information about the innovation through social networks constitutes the main success factor enabling the sustainability (maturation) of the technology. Hence, we suggest that further research should develop more sophisticated end-user networks prior to, and during, the diffusion of innovation process to enable effective ICT adoption which will be more cost effective.

Table 1 ICT Adoption Factors among SMEs in Developing Economies

ICT Adoption Motivators	ICT Adoption Inhibitors
Inexpensive source of information	Lack of financial resources to fully exploit the web
Less expensive way of advertising and conducting marketing	Lack of technical staff or insufficient expertise in technical issues. These human resources may be unavailable to SMEs
Easier to identify competitors through online marketing	SMEs are less risk tolerance compared to large firms
Image and public recognition can be generated quickly thereby building trust in the organisation	Web opportunities are not suitable to many products such as food items
An opportunity to reach worldwide customers	Reduced personal contact represent the dilution of customer loyalty
Increased speed of customer payment and closer tie with business partners since communication is faster	Inability to afford entry to or purchase enough volume to take advantage of digital exchanges

2. Diffusion of Innovation, SMEs and ICT Adoption

Turban et al (2006) highlights the fact that SMEs worldwide have recently been offered huge support to enable them to explore the business improvement opportunities offered by implementation of ICT innovation. It was noted that almost every country in the world has a government agency or non governmental agency devoted to helping SMEs become more aware of, and able to, participate in electronic digital interchange of information. In line with that

some countries in the developing economies have built small business centres. This will afford the technology diffusion agents to expose the SMEs to the relationship between ICT adoption and e-business up-take. It is evident that in most cases; such Information system projects can be quite costly and at times without commensurate success in terms of realising the benefits of the technology among the prospective end users. On the part of the SMEs, they have always used financial constraint and lack of application skills as excuses for either zero adoption or late adoption of such useful technologies.

Many (diffusion of innovation) researchers argue that the classic diffusion of innovation pathway based on Rogers (1983) diffusion of innovation model may be used to assist our understanding of technology adoption generally and more specifically within SMEs. This is depicted in figure1.

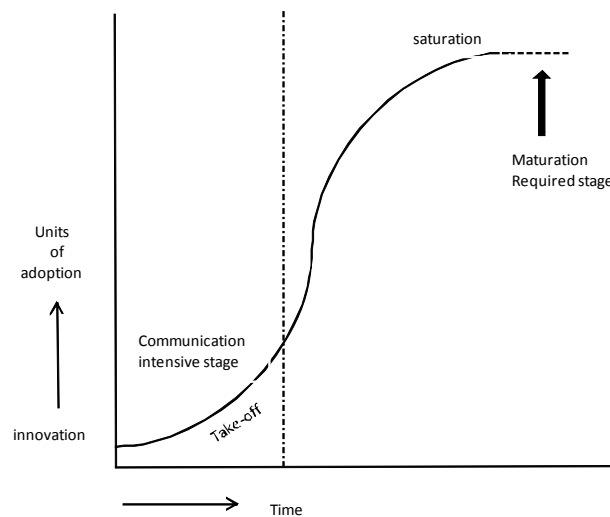


Figure 1: ICT Innovation Diffusion Pathway
Adapted from Rogers (1983: PP 66)

In simple terms this can be explained as follows; initially the take-up rate of a technology innovation is slow, as few of the potential adopter units are aware of the availability and the benefit of such innovation. As more enterprises or individuals begin to use the innovation and the success is achieved in business goals as a result of adopting such innovation, then the adoption rate accelerates. It finally peaks when the majority of potential adopters have implemented the technology. Rogers (1983) noted the point at which the majority of potential adopters have implemented the innovation as the saturation stage (critical mass stage). However, at the saturation stage there is a need for a renewed focus on the sustainability of the innovation in order to enable the continuous diffusion of the innovation. Sustainability of the innovation is what Teasley and Lockwood (2005) called **innovation maturation**.

Knowing how quickly a technology innovation was diffusing at any given time and relating changes in this rate to characteristics of the firm or the industry, characteristics of the innovation and the strategic considerations allow us not only to identify the key factors for adoption but also to assess their impact across varying circumstances. For relatively short periods of time it is the adoption event that is important. For instance, the size of an Enterprise may be an important factor for adoption of technological innovations in the banking sector whereas size may not be a very important technology adoption factor in software industries. Instead, time of adoption is relatively important in such sectors. Caselli and Coleman (2001) investigated the diffusion of computers across a set of countries and they found that factors such as educational qualifications, infrastructure, and trade openness influence the time taken for innovation adoption.

Rogers (1983) categorised potential adopters based on when (at which stage of development) they adopted a particular innovation. Rogers (1983) argues that looking at past adoption trends based on time of adoption will help diffusion theorists to get an indication of which organisations are most likely to adopt a particular innovation sooner

than other organisations. Also the categorisation of adopters on the basis of innovativeness is particularly important. By dividing the population of potential adopters into different conceptual groups on a gradual and sequential order from the most innovative to the least innovative, it is easier to ascertain what distinguishes the firms that are successful in quick adoption from those that are not. It is a methodological technique aimed to assist our understanding of the diffusion phenomenon rather than providing a clear-cut distinction between innovators and non-innovators. Rogers (1983) classified the adopters based on time taken for adoption into;

- **Innovators:** these adopters are keen to take risks and invest great proportions of their business capital on new innovations. Therefore, Rogers (1983) described these set of innovation adopters as being venturesome. It appears that organisations that can be classified as innovators must meet a strict set of criteria. Such criteria include possession of substantial financial resources so as to recover in the event of an unsuccessful venture into capital intensive innovations and a high degree of technical understanding prevalent among the staff of such organisations is another criteria.
- **Early adopters:** This category of adopters according to Rogers (1983) is mostly high-yielding companies that can afford to take risks. This category of adopters is industry specific according to Shy (2001). The organisations that falls within the early majority category of adopters adopt innovations as soon as their decision making process allows such implementation. Rogers (1983) also argues that early adopters may pose as a model for other potential adopters. By implication, the adoption experience of the early majority send a clear signal about the success of the innovation, therefore they facilitate greater communication with other potential adopters and they contribute to the acceleration of the diffusion process.
- **Early majority adopters:** Rogers (1983) argues that the adoption decision of the early majority adopters is primarily owed to strategic considerations and it is always the product of lengthy deliberations. Therefore this group adopt new ideas just before the average number of adopters in such a social system. Being the greatest of all the adopter groups they send a clear signal about the acceptance of the innovation. Rogers (1983) also points out that the innovation that penetrates this group of adopters are also more likely to complete their diffusion cycle.
- **Late majority adopters:** At this stage a marginal majority of potential adopters has adopted the innovation. According to Rogers (1983) adoption of innovation by the late majority group may be dictated both by economic reality and pressure from competitors. Therefore this group only adopt when they are persuaded by the circumstances. The common characteristics of the late majority group of adopters are scarcity of resources in both financial and human resources.
- **Laggards:** this group is usually comprised of a set adoption units engaged in more traditional business. They are usually older Enterprises, with average older individuals in management positions according to Souitaris (2001). The scarcity of resources that characterise the late majority adopters is even more pronounced in the laggards group. Rogers (1983) identifies their economic position as the primary reason for their being unwilling to adopt new innovations.

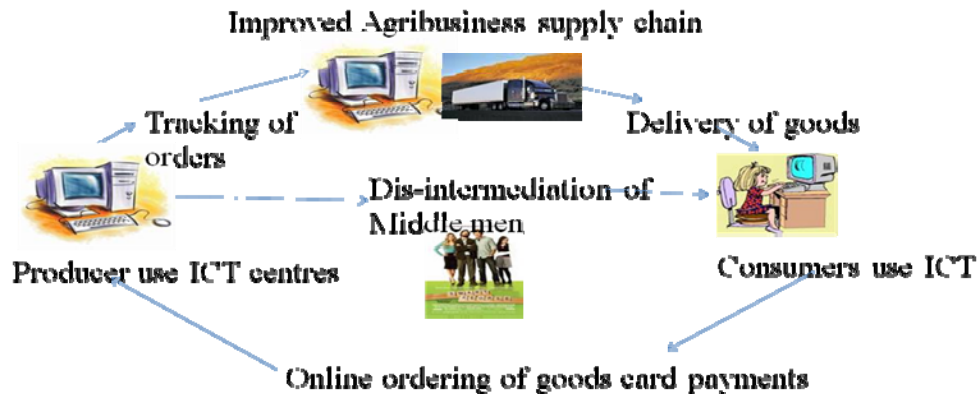
3. Highlights and Trends of Agribusiness: Problems & Opportunities in an Emerging Economy (EM)

The use of computers in Agribusiness and Farm records represents an innovative change (Mishra, and Park, 2005). It also represents significant challenges to farmers and proprietors of agribusiness enterprises (Sh. Al-Rimari et al., 2006). This is especially experienced by those agribusiness enterprises operating in developing economy where computer applications are still sparingly felt (Ellis et al 2007). Traditionally, Agribusiness proprietors have been so used to a bricks-and mortar system of transaction. In this method they deploy paper documentation for their transactions. These set of traditional actors according to (Shehata and Badrie 2007) were not concerned with applying advanced information technology that may require owner managers or proprietors to make decision and think critically about business process changes. Such traditional Agribusiness managers were observed by (Mishra, and Park 2005) not to be interested in rendering services to customers using collaborative technologies. Such a category of Agribusiness managers has little interest in online sales technology such as Internet Auction Systems (IAS) either for B2B or B2C business processes (Frambach and Schillewaert 2002).

It is evident that although computer usage in agribusiness is growing - the farmers' motivation for using ICT, and the outcome and effectiveness of using information sharing tools have not been extensively studied. This is particularly important because proprietors of small and medium agribusiness enterprises represent the largest social group of rural actors in most developing economies. For this reason, it is assumed that their perceptions of ICTs

usage are key determinants to successful implementation of e-commerce technologies (Schaper et al 2004). Fig 1 proposes an Agribusiness supply chain improvement when ICT is implemented by Small and Medium sized Agribusiness Enterprises (SMAEs). This scenario suggests the disintermediation of middlemen activities due to adoption of ICT in SMEs. The Logistics operations and supply chain is also likely to improve as the transporters will be able to track the shipping orders online. There is a direct link between the suppliers and the consumers rather than passing through the middlemen marketers and retail distributors.

Figure 1 E-Business and Logistics in Agribusiness SMEs



Although the effective use of ICT in agribusiness has not been extensively studied, more recent studies suggest that with the increasingly popular use of computers farmers and other rural actors may no longer be developing strong negative attitudes towards ICT (Alpay & Russell, 2002). Figure 1 highlights effective communication between suppliers and consumers when market information is exchanged electronically instead of paper based. This electronic digital interchange (EDI) will eliminate the activities of the middle men marketers. This will allow the SMEs to interact with customers directly and also reap the profit of the business instead of being short changed by the middlemen. Nonetheless, barriers to ICT adoption do exist (Rogers 1995; Mustenon-Ollila and Lyytinen 2003; Lee, 2000). The sub-sections below will look at various issue and problems facing agribusiness especially in ICT applications.

4. Factors and Issues affecting ICT Innovation

Because the Internet connects computers all over the world, any business that engages in electronic commerce will be instantly regarded as an international business irrespective of size and location. Schneider (2007), points out that when SMEs use the web to improve a business process, they are automatically operating in a global environment. The key issues when such small enterprises face when they conduct international or global commerce includes: trust, cultural issues especially language, and infrastructure.

Trust Issues on the Web:

It is important for all businesses to establish trusting relationships with their customers. Enterprises with established reputation in the physical world often create trust by building a presence and trust based on personal interaction. These enterprises can also rely on their established brand names to create trust on the web (Schneider, 2007). New enterprises adopting online business face more difficult challenges because the anonymity that exists on the internet (Chaffey, 2006).

For example, a small organisation producing dairy milk may establish a website that offers services throughout the world. No potential customer visiting the site can determine just how large or well established the SMAE is simply

by browsing through the site's pages. Of course website visitors will not become customers unless they trust the enterprise behind the site.

Language Issues

DiMaggio (2001) emphasized that enterprises realize that the only way to do business effectively in other cultures is to adapt to those cultures. The phrase "think globally" and "act locally" is often used to describe this phenomenon. The first step which a web business usually takes to reach potential customers in other countries and in other cultures is to provide local language versions of its website. This may mean translating the website into another language or regional dialect. The studies carried by Child (1998) revealed that customers are far more likely to buy products and services from websites in their own local language even if they can read English well. However, it is problematic to meet the requirements of language issues in the business website design especially the small enterprises trying to adopt e-commerce.

Culture Issues:

An important element of business trust is anticipating how the other party to a transaction will act in specific circumstances. That is one reason why enterprises with established brands can build online business more quickly and easily than new enterprises that has no reputation. The brand conveys some expectations about how the company will behave. For example, a potential buyer might like to know how the seller would react to a claim by the buyer that the seller misrepresented the quality of the goods sold. Part of this knowledge derives from the buyer and the seller sharing a common language and common customs. The combination of language and customs is often embedded in culture. Researchers such as (Hubona, et al., 2006) agree that cultures vary across national boundaries and in many cases vary across region within nations. For example, the concept of private property is an important cultural value in many European Nations where as Asian culture do not support private properties. This implies that enterprises must be aware of differences in languages and customs that make up the culture of any region in which they intend to do business.

Technologies

Behind every mobile-commerce transactions or activities is a hardware infrastructure that supports the exchange of communication. Some of these infrastructures such as network access points, mobile communications server switches, cellular transmitters and receivers, computers, support the wireless connection. Other parts of this infrastructure (e.g. GPS locator, GPS satellite) support delivery of services over the wireless connection. Most of these components of the mobile Internet infrastructure are not cheap and are not simple to put in place.

Downin (2002) argued that many SMEs have identified Internet-based electronic digital interchange to be less expensive and affordable. In the scramble to deploy broadband-worthy Internet connections to the rural areas that are experiencing a digital divide, different methods, mainly divided between landline and wireless solutions, have surfaced. Mobile Universe was the first to initiate a solution to the digital divide using satellite hubs. Schneider (2007) pointed out that for many people in the rural areas; satellite microwave transmissions have made connections to the Internet possible for the first time. In the first satellite technologies, the customer placed a receiving dish antenna on the roof or in the yard and pointed it at the satellite. The satellite sends microwave transmission to handle Internet downloads at reasonable speed. Uploads were handled by a telephone service (POTS) modem connection.

6. Research Methodology

This research study was conducted between 2004-2009 with field work conducted in the South East of Nigeria. The process that led to the actual gathering of primary data started from setting up a particular social network site (namesdatabase- a social network site Web Internet based specifically designated for connecting friends) The choice of that particular SNS was as a result of the fact that it was the social network site in which people in the study area were familiar with at that time. Observations were conducted over four different trips to Nigeria for the purpose of the study. Primary data was gathered through focus group discussion, document analysis and 27 semi-structured

interviews. The focus group discussion was video taped while the interviews were tape recorded. The video tape and the recorded tapes were transcribed and analysed using Atlas.ti qualitative analysis software. Template analysis was used for thematic analysis and to code and categorise the data.

7. The Study

The conceptual framework of this study is informed by the adaptation of early Web 2.0 technology to induce a diffusion of innovation process. This approach became apparent since the deployment of traditional extension agents (advertising, radio, television, fax, leaflets) in diffusing new innovations among social groups were not seen to be effective. In the past, the Nigerian government has adopted the use of mass media as channels of diffusion of innovation. However the mass media channel (TV, radio, newspapers) has also fallen short of being an effective diffusion mechanism. Our research study investigated the use of a particular social network site (namesdatabase.com) as a factor in the diffusion network for UNIDO ICT centres among Agribusiness proprietors in Southeast Nigeria Agribusiness communities. This social network site served as a tool to identify the opinion leaders in the diffusion network. It has also enabled the identification of linkages between the nodes (Agribusiness SMEs). In order to conduct this longitudinal research, we adopted Gallivan's (2001) Diffusion framework and its later adaptation by Wainwright and Waring (2007). This framework as presented in Figure 2 (below) enabled us to track the diffusion of the UNIDO ICT centre in three stages. The primary stage was when the prospective adopters (proprietors of Agribusiness SMEs in Southeast Nigeria) were initially introduced to the innovation. The social network of adopters was also initiated through namesdatabase.com which was the Web 2.0 technology the end users were familiar with at that particular time. The secondary and Consequence stages of the diffusion of innovation process were also studied.

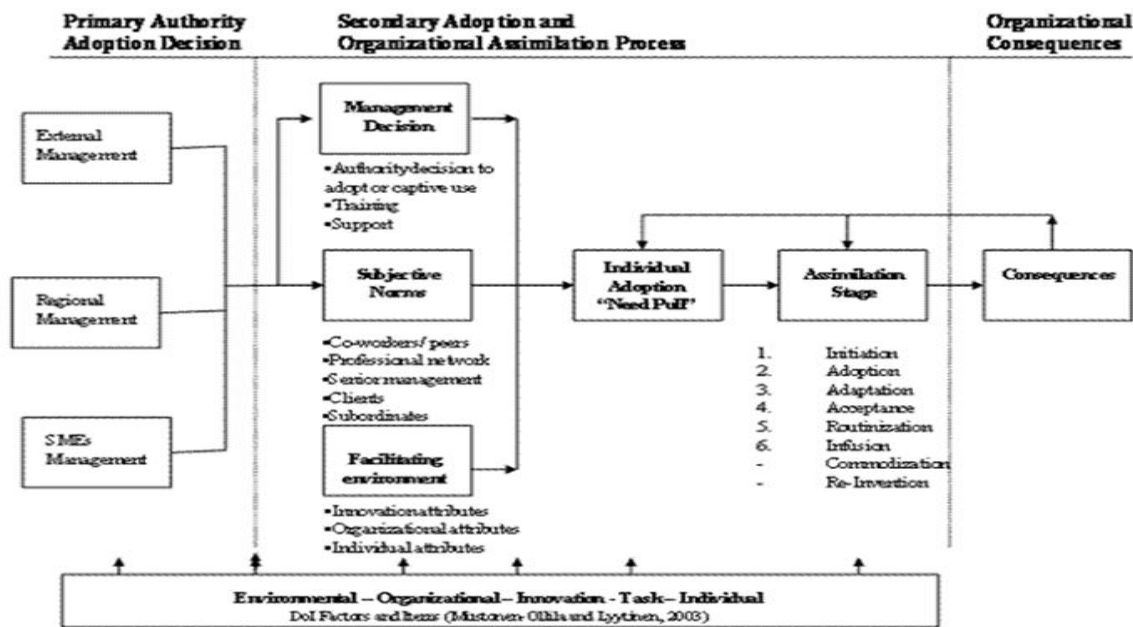


Figure 2 Adapted Conceptual Framework
Wainwright and Waring (2007) adapted from Gallivan (2001)

It may be argued why a new channel of sharing information about the innovation is necessary. It will be recalled that deploying extension agents to reach out to farmers can be quite labour demanding and costly. Likewise the use of mass media is not consistent. Therefore a more cost effective way of sharing information about the innovation is believed to be helpful to enable the achievement of the maturation of the diffusion of innovation process. The path of communication exhibited by the nodes is reflected in figure 3. The educated managers and those who have ICT application skills before the implementation of the UNIDO ICT centres have taken the central position in

coordinating the exchange of information regarding the innovation. It was observed that the early adopters emerged and those early adopters were consistent in inviting friends, family members, old class mates, professional colleagues to join the social network which later translated to the adoption of the UNIDO ICT centres. The flow of information across the nodes without undue effort or overhead cost expresses the effectiveness of this particular method.

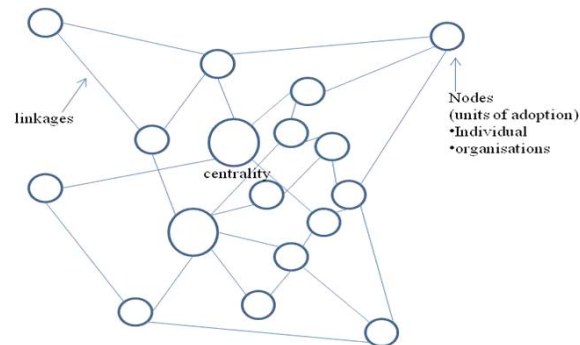


Figure 3 Social Network Context of Diffusion of Innovation
Source: Researchers' Reflection

8. Findings

The findings of this study raise important issues for technology innovation diffusion agents. Firstly, it was identified that levels of perception differ significantly among different people. With some having preference for a particular type of ICT facility due to its conforming with their values. This implies that having a predetermined standardised diffusion pattern may lead to wrong decisions in taking appropriate diffusion strategies. In this particular case the diffusion agents or the technology interventionists need to recognise the diversity of innovation perception held by the managers of Small and Medium Agribusiness Enterprises in Southeast Nigeria. This is particularly important, so that the appropriate diffusion channel can be adapted to ensure successful diffusion of the innovation. And also this will enable the diffusion agent to give appropriate advice to the adopter organisation; Since their role is more advisory rather than directly influential. It was found that collaboration and interaction with end-users are necessary in order to protect their interest in the system designed for them. This is consistent with (Scott, 2004) and Robertson et al (2008)

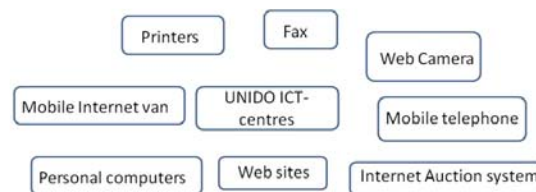


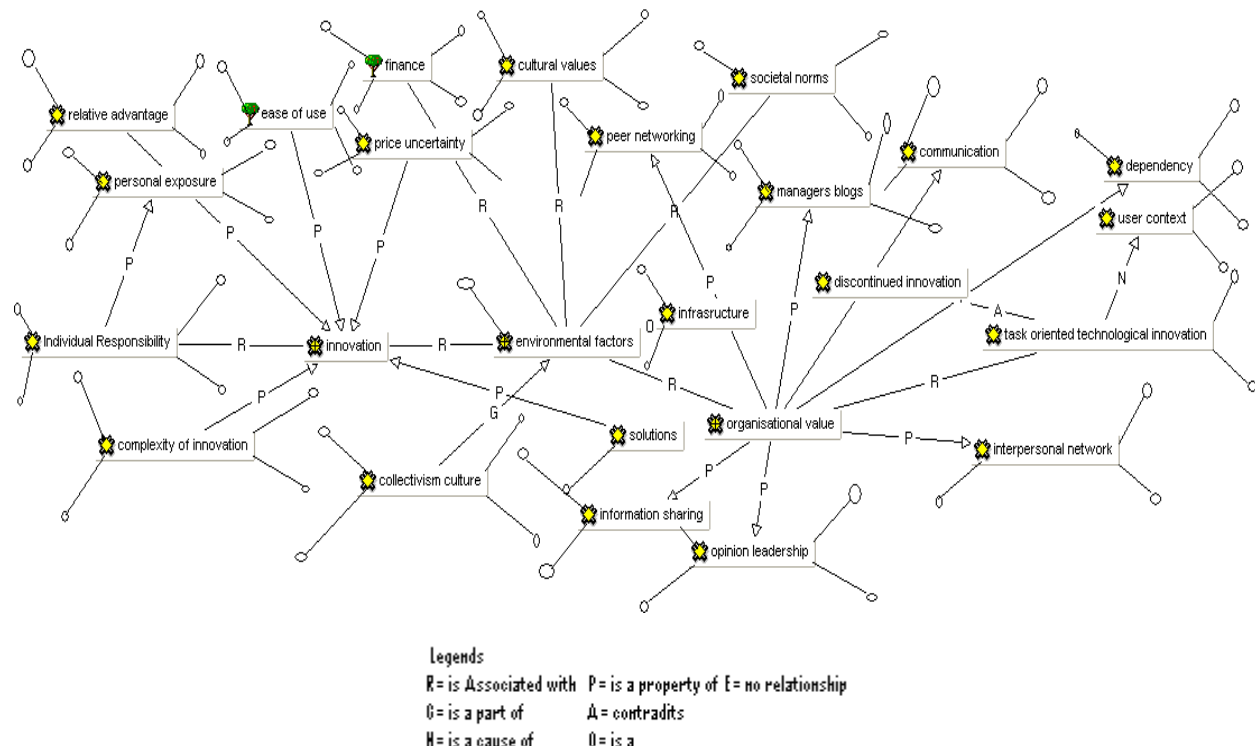
Figure 4 Information Communication Technology Products Facilities
Source: Field study

The participants were asked to mention facilities that enable them to communicate electronically, especially the facilities they had no previous knowledge about until they started to engage in social networking, figure 4. The UNIDO ICT centres located in designated sites as to serve SMAEs were mostly mentioned. This was followed by mobile internet vans being a technology specially designed to alleviate the communication gap of nomadic cattle farmers. Third, in the hierarchy is a personal computer. The rest consisting of mobile phones, printers, personal website, web camera and fax were also identified- but these Information and Communication Technologies are under utilized as most of the adopters are still deploying them for mere office administration. The facilities were not deployed as business enabling strategies or to directly enable e-business operations.

The finding of this study in relation to ICT innovation reflects the fact that the upward adoption bias that heralds the introduction of new products in a system kept decreasing over time as users get used to the product due to acquaintance with daily routine tasks. Another significant observation of the study indicates that 'relative satisfaction' and relative expertise is derived from end-user continuous interaction with diverse products instead of sticking to one product. The UNIDO ICT centre is the most recent among the facilities represented in the diagram above. Previously, the agribusiness owner-managers only patronised cyber cafés whenever they wanted to engage in tasks involving word processing. This is mostly used when they want to produce some documents in view of submitting it to the government. But since the inception of UNIDO ICT centres in 2004, several managers have diverted to the ICT centres instead of using commercial cyber cafes. When asked what they are using it for at present, they did confirm that it is just for storing files and typing documents. Their secretaries use the computer because they themselves do not. Therefore most of the e-commerce product innovations present within the social group studied are under-utilized at the moment. Reasons are obvious; the users have yet to integrate those facilities properly into their business strategies. Most of the managers are still placing more social values on the e-commerce technology facilities over economic values instead of creating a balance between the two value systems.

The interview data was analysed using template analysis to identify relevant themes, categories and codes. This data was also further refined to identify possible relationships between factors by the use of causal maps – see Figure 5 below. Pidd (1998) advocates the use of causal maps (in soft operations research) as an effective way of making sense of rich qualitative data.

Figure 5 Diffusion of Information and Communication Technology Innovation Factors



The findings of this research reflected factors that affected the diffusion of ICT innovation in either positive or negative ways. The participants were asked to identify in their own words what factor they presumed, that have significant effects on the diffusion process of the innovation. Altogether there are 22 factors identified as shown in the diagram above. Each factor has a certain level of inter-rater reliability denoting its degree of theoretical importance (based on counting the number of interpreted codes/sub codes). The results show that individual responsibility is the cause of [N] personal exposure. It is noticed that personal exposure occurs as a result of how interactive the individual is in the process of doing businesses across his/her locality. It can also come as a result of education or training which makes the actor more information rich over his/her associates.

The second group of factors as shown in the diagram refers to the context of the innovation. Participants mention the complexity of the UNIDO Information and Communication Technology (ICT) innovation, ease of use of the technology, relative advantage, the possibility of the innovation fostering solutions to their marketing problems and the cost of implementation. It was identified that the UNIDO ICT innovation was meant to empower Small and Medium Agribusiness Enterprises (SMAE) in Southeast Nigeria to implement e-business and it had a relative advantage over their traditional marketing arrangement. For the very first time in history groups of rice farmers were able to exchange e-mail communication with unknown customers and eventually attracted customers from China to the region. Thus it was actually identified that e-mail communication is faster and cheaper than postage. Another set of diffusion factors identified refers to the environmental issues. It was noticed that e-commerce technology is a direct opposite of the value system the agribusiness managers are used to. Significant among the environmental issues are the infrastructure that supports e-commerce technology diffusion is not consistent. Evident from our findings are that the Internet connections in the UNIDO ICT centres are still analogue connections using modem to plain old telephone services (POTS). This is an obsolete technology since the asymmetric digital line services (ADSL) have come to replace the old analogue connections. It follows from the findings on the environmental factors especially on the infrastructure issues that there is a likelihood of innovation discontinuance due to low speed of connection to servers. Societal norms are also part of the factors affecting the diffusion of e-commerce technology innovation. The owner managers of agribusiness small enterprises are used to starting business in the morning time and retiring to their house in the evenings. This is contrary to what e-commerce technology can afford. With e-commerce technologies one can transact business 24/7. But our participants saw the innovation as a threat to traditional times of rest after 9-5 work time.

Organisational values of the Small and Medium Agribusiness Enterprises studied differed from each other even though there are some elements of commonality among organisational values of some SMEs. Some SMEs permit their staff to share information relating to the organisation with their friends from another SME whereas in some other organisation it is completely forbidden. Some of the managers interviewed believed that allowing their staff to discuss business with a stranger is an avenue to leak business secrets. In some organisations the managers are the 'omni-boss'. Even when members of their immediate family are staff of the enterprise, such staff are not allowed to contribute to the key decisions affecting the organisation. Taking decisions are exclusively for managers. Leadership structure in most of the SMEs is bureaucratic which is likely to affect the diffusion of e-commerce technology innovation which other studies such as Gubitta and Gianechinni (2002); Messenghem, (2003) have identified to thrive better in a more dynamic leadership structure. Based on the diagram, the last set of factors emphasize the technological orientation of the prospective adopters (SMAE managers). It is observed that the orientation of the participants to technological innovation is characterised by a quick discontinuance to the innovation. That is to say they are used to experiencing low rates of maturation of technological innovations. This discontinuance after adoption is not distanced from risks and uncertainties surrounding e-commerce technology implementation.

Risk, Uncertainty and Trust

".....computers is the easiest way to manipulate documents, with computer you can forge somebody's identity, and you can hack other peoples' computers and do all sorts of things without people recognizing whom you are"(Owner-manager II)

It is necessary to point to the fact that one of the motivations of the end users to adopt the ICT centre innovation is that instead of travelling to distant markets with huge sums of cash, the actors are now advised to make payment in the local branch of their banks and send the details of the payment to their clients through text message or e-mail. However, in some occasions there are media reports of ATM card cloning even though ATM (automated teller machine) services have just been introduced recently in Nigeria. This formed the basis of the quotation above from one of the respondents. Similarly the issue of risk involvement in terms of the capital intensive nature of ICT innovation is reflected in the following quotes.

".....agribusiness in Nigeria is family inclined and for that most at times our wives and children are indirectly the staff of our business organisations. In most cases our wives and children do not have the technology application skills. So any technology innovation you are adopting means taking extra risk because for it to be implemented in our businesses there has to be training which increase the cost of doing business" (Owner-manager IV)

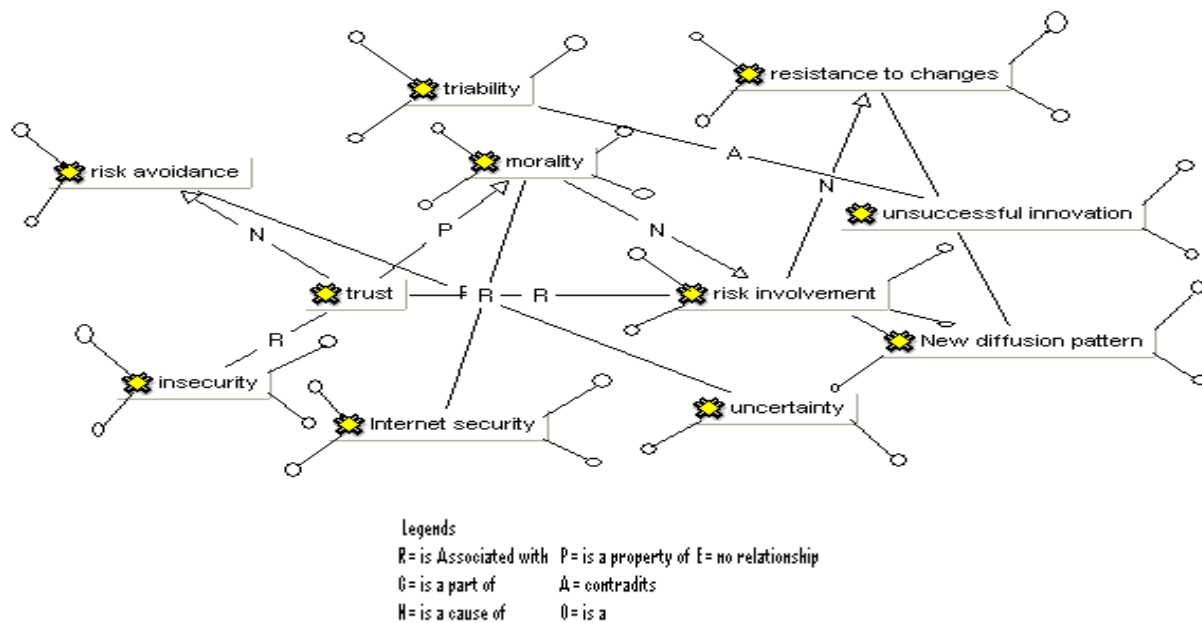
The results suggest that risk involvement is the cause of resistance to change ideology identified in some enterprises. The evidence presented in the quotes shows that the very small organisations are risk averters. Small enterprises are

not willing to take much risk involved in trying new innovations. This follows that insecurity is informing their decision not to adopt due to the nefarious activities of the hackers. Bunte et al (2008) argued that control of information in the Internet is not always guaranteed since it has been put in such a public domain.

“.....Nigeria remains a nation with big debts. The inflation rate has been on the increase, the purchasing power of naira declines daily, and this makes every business you are doing to be risky. In short the current economic climate in Nigeria is generally characterised by uncertainty, insecurity, high inflation rate, high unemployment rate and lack of social welfare” (Chief Executive Officer II)

Figure 6 (below) reflects on the factors identified by the respondents as the major risk concerns involved in adopting the ICT innovation.

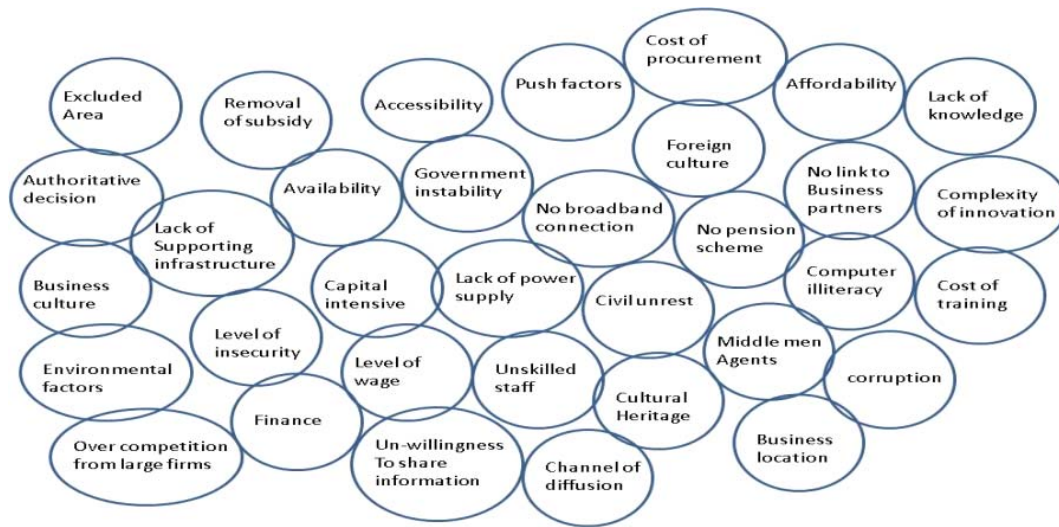
Figure 6 Risk in ICT Adoption



Further, the responses from the participants, when they were asked to mention the societal factors that have or may stop them from adopting Information and Communication Technologies (ICTs) into their business strategies - the factors reflected in the diagram above emerged. The result suggests a code family relating to risks and uncertainties of computer mediated communication.

The result suggests that risk perceptions can be the cause of resistance to a change ideology experienced in some organisations. The result shows that the very small organisations are risk averters. Small enterprises are not willing to take much risk involved in trying new innovations. This follows that insecurity is associated with [R] trust. Risk avoidance is associated with [R] uncertainty. Internet security is associated with [R] morality. Again, trust is the cause of [N] risk avoidance. To further elaborate the result based on risk issues other factors such as integrity of information communicated over the Internet, non-repudiation, authenticity, confidentiality, privacy and availability were mentioned. Some of the issues relating to risks and uncertainty translated to the constitution of diffusion of innovation barriers.

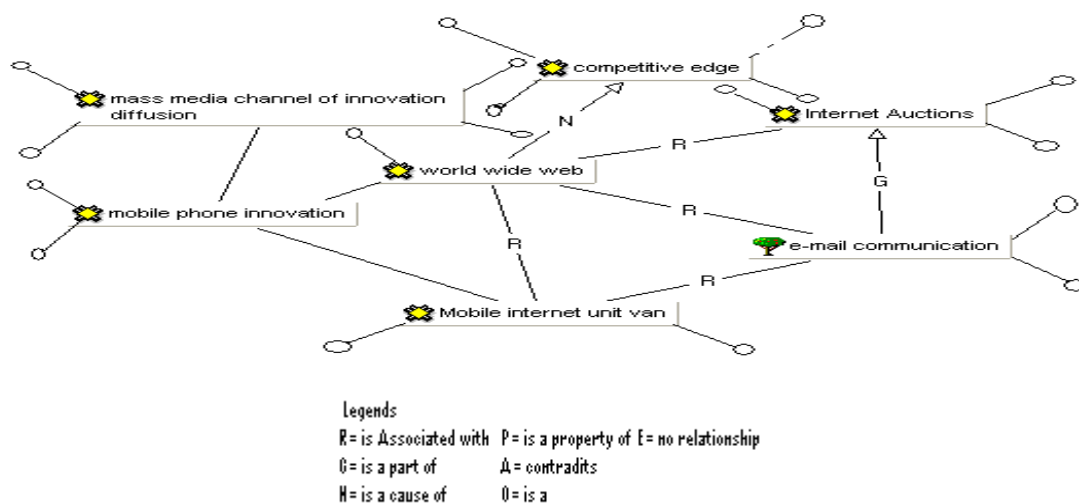
Figure 7 Diffusion of Technology Innovation Barriers



Source: Field study

Respondents were asked to mention factors that seem to be the barriers to diffusion of ICT among agribusiness actors in the study area. In the first place, respondents were concerned about accessibility, affordability and availability. Subsequently respondents were concerned about previous government approach to innovation diffusion and also the authoritative trend of decision taking which seems to have been traditional among SMEs. Because the owner-managers have always been the sole decision maker, it always followed that staff are not consulted before taking the decision to adopt the technology. Similarly, the results show that complexity of the technology innovation will impact negatively on the relative of usage. Again, the lack of a social welfare scheme broadens the digital divide among the technology rich and the socially excluded communities. Environmental factors and over competition from large organisations equally raised concerns.

Figure 8 Disruptive Attributes of ICT Innovation



Source: Field study

This section reflects the successive information communication methods previously and currently adapted by farmers in southeast Nigeria. Communication has moved from oral face to face canvassing to the current time where the internet is mediating the electronic digital interchange. Communication and information sharing among these farmers have changed both in form and process.. The Internet auction is now quite a practical strategy in agribusiness. E-mail communication' is gradually replacing paper based communication.

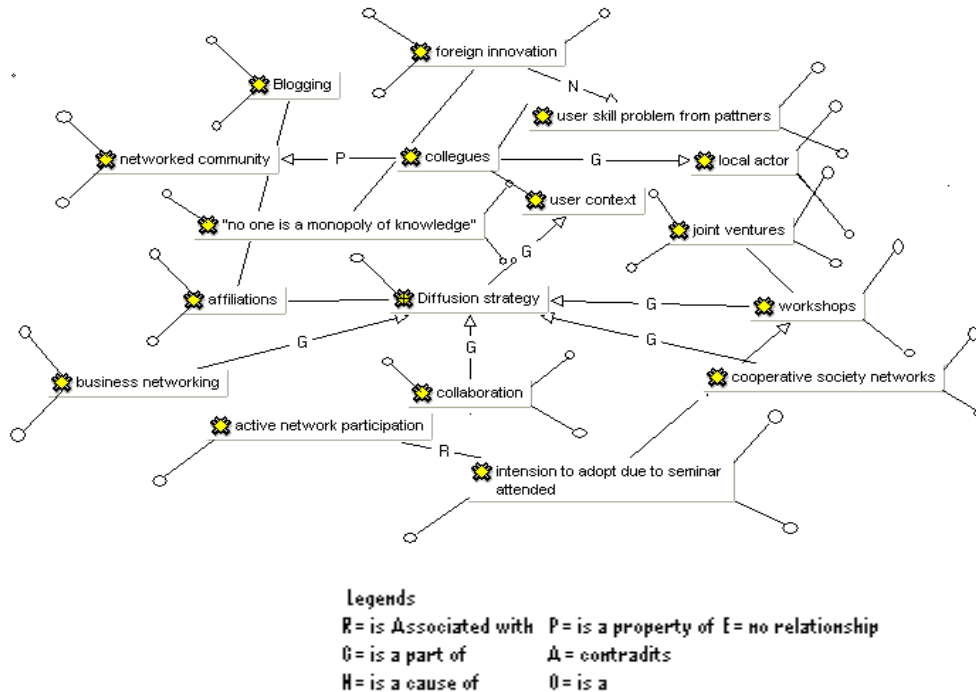


Figure 9 End- Users' Integration and Relationship Building

It was identified that the agribusiness managers studied have identified with at least one other business enterprise either as a supplier or as a customer. There was significant evidence of physical collaboration among business partners. The evidence of collaboration is most pronounced in the fact that each business has details of office address and telephone contact of business partners. At times the contact details can contain names of contact person of that particular firm, which is either the manager or the farm secretary. The causal map in figure 9 reflects the level of end-user integration and relationships identified among the social group. Cooperative society networks and Business networking are perceived as good enabling environments for collaboration and integration As noted by the relationship symbols between the nodes, it was identified that business networking is part of [G] diffusion strategy. It was identified that collaboration among business partners is part of [G] diffusion strategy. Further observation shows that active network participation of business partners is associated with [R] intention to adopt new innovations.

A manager pointed out that his reason for networking his business with other businesses and also engaging in social networks sites (SNS) is that no particular individual or firm is a monopoly of knowledge. Even when some of the respondents argued that there could be chances of business information leakage which they see as negative impact of business networking or social networking.

Considering technological innovations as foreign culture is associated with [R] end-user skill problems. Such consideration contradicts [A] the intention to adopt the technology innovation. Another contradiction identified reflects on the position of some managers as not willing to collaborate or engage in joint venture partners with someone who does not know anything about what their business is doing.

Discussion

The findings of this research suggest the need for re-conceptualising the technology innovation diffusion process to incorporate more nuanced interactions and feedback mechanism between adopters and the innovation, the diffusion agents and the adopters and also among the adopters themselves. This research identified that the dispersive nature of agribusiness influences communication among the actors negatively. From this perspective, a more interactive platform is necessary to share information about technology innovation and for knowledge transfer.

Social networking provides a platform for interaction and information communication (Wainwright and McLean, 2008). The platform for information communication provided by social networking amongst agribusiness managers of small and medium enterprises in southeast Nigeria resulted in greater sustainability of the diffusion process. Maturation was achieved when information about the innovation was able to cross to the innovator of another network. The feedback opportunity offered by the social network enabled diffusion model played a significant role in the maturation rate of the innovation.

In order to explain the usefulness of adapting Web 2.0 technology (social network sites) in a diffusion process of ICT innovation it is useful to explore the components of the model in figure 10. (below).

- **Characteristics of Innovators:** In this case the innovator initiates the social network cluster. The innovator is privileged to receive the information about the innovation from the change agents. This study has identified the innovators as risk takers who identified with the UNIDO ICT centre before all the other people. Further inquiries revealed that they had travelled outside the confines of the region in search of business opportunities. The innovators deliver the information firstly to a couple of business partners or school mates of even friends who later constitute the early adopters. The ability to speedily form clusters is the major strength of the innovators.
- **Ideas:** The main idea behind this social network enabled diffusion of innovation model is the multiple fusion capacity of the network. This means that as the cluster keeps expanding, at a certain point the cluster will disintegrate thereby giving rise to a new network. This is a continuous exercise and so long as new networks keep emerging from the old cluster, information about the innovation is continuously and progressively transferred to new entrants.
- **Knowledge Sharing:** The Model reflects the possibility of knowledge sharing and positive knowledge management. The old members of the network transfer knowledge to new members that come to their network either by signing them up in the Social Network Site (SNS) or sending e-mails to new members. During the process of new members trying to respond or pass the information to another friend, a communication path is maintained. When such communication paths becomes a routine activity, the diffusion process remains ongoing. Hence, maturation of the innovation is achieved.

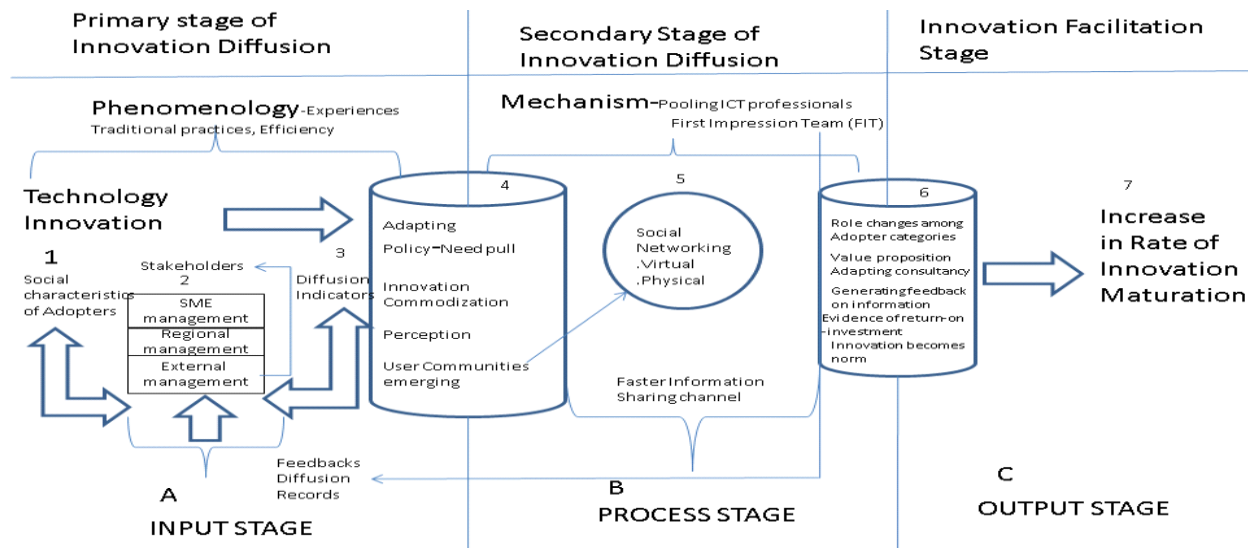


Figure 10 Stages in the Diffusion of ICT Innovation

The first stage represented by letter 'A' is the primary stage of the innovation process. In this model it is highlighted as the 'input stage'. This implies that the primary stage is the conceptual stage of the innovation. At this stage the innovation is snowballed into the system. The conception of the innovation may be influenced by either 'push pull' or 'need pull' at this point. The second stage is represented with the letter B. This is highlighted as the secondary stage and it is the 'process stage' in this context. The process stage is characterised by strategies adapted to motivate the diffusion. The last stage C is the output stage highlighting the maturation stage where success or failure is determined.

Our study identified seven significant steps in the social network enabled technology innovation diffusion process. Step 1 reflects identification of socio-economic and phenomenological experiences of the prospective adopters. In this context, the adopter SMEs are predominantly poor and socially excluded communities with less or no access to ICT facilities. They are also undermined by inadequate markets for their products and unbalanced trading activities of intermediaries. Step 2 shows the stakeholders forum initiating the strategy for diffusion based on previous diffusion experiences. Step 2 addresses the pro-innovation bias that may manifest during the process stage. Step 3 emphasizes the adopter organisation or individuals whilst identifying the key diffusion factors as discussed in Klein (2001). Paramount to this study is step 4 where evidence from the findings of this study suggests that step 4 is the first critical point where the diffusion process transits from the primary stage to the secondary stage. Step 5 is the diffusion strategy adaptation point. In this context the social network was adapted as the mechanism for interaction to share information about the innovation. Also paramount to this study is step 6 which highlights another critical point of transition to stage C. The findings of this study show that at step 6 the first group of managers that adopted the ICT innovation has started to change roles. Return-on-investment on ICT is clear to the adopter SMEs. Re-invention of the innovation was equally highlighted. All this signified a successful diffusion process. Intermittently some barriers to diffusion are noticed. Finally, step 7 is the result of the process which can either highlight maturation or process failure.

7. CONCLUSION

There has been an increase in the number of empirical studies that have explored diffusion patterns of technology innovation in small businesses such as (Mustonen-ollila and Lyytenen 2003; Corbitt et al, 2004). Some studies have explored use and the power of social network sites in information communication, for instance (McLean and Wainwright 2008). Other studies have also looked at diffusion of ICT in organisations (Wainwright and Waring, 2007), and role of ICT innovation in bridging the digital divide and combating social exclusion (Hellawell 2001); Cushman and McLean 2008). There have been relatively few or no studies that have provided an in-depth analysis of the impact of social networks in the rate of maturation of ICT innovations. Some studies such as (Chiemeke and Longe 2007; Obe and Balogun 2007) have explored the rate of penetration of ICT in Nigeria. A few other studies

have examined the rate of adoption of ICT and perception of owner managers of small business in a non-European or North American context. Our particular study provides valuable insight into the impact of social networks in the diffusion process of ICT innovation among the socially and digitally excluded agribusiness communities in Nigeria. This has advanced our knowledge in the area of aligning technology innovation in business process of small enterprises by contributing the Nigerian perspective and context within a wider discourse. The adaptation of a particular social network site (namesdatabase.com) was a very successful and practical way of exploring user skill of the managers. This approach has contributed an insight to existing IS literature stressing the negative perception of ICT innovation due to lack of user skills.

Secondly, this study provides insights into the internal process of technology innovation diffusion in Nigeria. The social network enabled diffusion model developed from the findings of this research contributes to further research and development of theories in this area. For instance, while this research identified 'increase in maturation' of ICT innovation as a peculiar impact of social networking in the diffusion process, there may be other peculiar impacts embedded in different national contexts that are yet to be discovered. The transition points in the diffusion process identified in the model provides the mechanism for tracking progressions in a diffusion process. The two tacit values (dynamic and epidemic) of the model are reflected. The epidemic value of the model suggests that actors will always encourage formation of networks to enable them to share information with friends, business partners and customers. The analysis shows that this action could be periodically repeated hence be viewed as routinization. This contributes the understanding of how opinion leaders emerge. Such opinion leaders have the ability to catalyze an innovation diffusion process. The dynamic value results from the demand side. The actors demanding to be part of network to enable them access to information and business coordination. Although it is difficult to establish the existence of other tacit values of the model, it is obvious that such values may emerge in a different context.

Finally, while strategic alignment of ICT and the adoption of emerging e-business processes are widely recognised as research areas in the information system (IS) literature, the question of whether SMEs are ripe for implementing ICTs has not yet been resolved. This is a relatively unexamined area of inquiry, particularly in developing economies where SMEs lack the basic infrastructure and have less motivational incentives. Also the diversity in perceptions of adopters is yet to be addressed. The adoption of ICT innovation in Agribusiness is actually reliant upon its acceptance by owner-managers of such businesses. Many Small and Medium sized Agribusiness Enterprises (SAME) managers in Nigeria are not familiar with the conceptual basis and potential benefits of ICT. The social network enabled diffusion of innovation model developed from this study points out that maturation of innovation stems from a knowledge of the conceptual basis of the innovation by the end user. The potential adopters' knowledge of the conceptual basis of the innovation is a major motivation towards adoption. Whereas the continuous sharing of information about the innovation constitutes part of the critical success factors (CFS) towards sustainability (maturation). Finally, the findings of this research suggest the need for re-conceptualising the technology innovation diffusion process to incorporate more nuanced interactions and feedback mechanisms between adopters and the innovation, the diffusion agents and among the adopters themselves. This research identified that the dispersive nature of agribusiness influence communication among the actors negatively. From this perspective, a more interactive platform (enabled by emerging Web 2.0 technologies) is necessary to share information about technology innovation and for knowledge transfer.

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