

INTEGRATION OF SMS AND ECOMMERCE FOR NIGERIAN AGRICULTURAL SYSTEM.

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Abstract: e-Agriculture is an emerging field in the intersection of agricultural informatics, agricultural development and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies. Electronic commerce commonly known as e-Commerce or e-Business consists of buying and selling of products or services over electronic systems such as the internet and other computer networks.

The main objective of this paper is to come up with a simple framework by integrating Simple Messaging Service into ecommerce for Nigerian farmers, in which a rural farmer can easily have access to ecommerce (online marketplace) using Simple Messaging Service, while the other customers can view the ecommerce platform online (Web Based). Some rural farmers are only familiar with Cell Phones, they cannot operate smartphones talk less of going online using personal Computers for e-commerce business. These framework also shows how to develop an m-commerce platform where the rural farmers can meet and discuss on farm information with the consumers all over the world..

Keywords: e-Commerce, e-agriculture, SMS, marketplace, mobile phone, farmers

INTRODUCTION:

Small Scale farmers account for more than 50 percent of the farming community in Northern Nigeria. Yet, they continue to face significant problems in accessing production inputs and high value markets for their products. Some of these problems emanate from the bad past agricultural policies that entrenched the patronage of the state over marketing of agricultural produce in Nigeria. According to e-Transform Africa “The strategic application of ICT to the agricultural industry, the largest economic sector in most African countries, offers the best opportunity for economic growth and poverty alleviation on the continent. Food security is paramount for the survival of individuals, families and ultimately nations, yet Africa’s agriculture sector has been in decline over the past 40 years. Poor farmers have largely remained poor with 73 per cent of the people living in rural areas subsisting

on less than a dollar a day.

Like other sectors, African agriculture is disadvantaged owing to factors that include:

1. Under-investment in rural areas,
2. Inadequate access to markets and unfair market conditions,
3. Inadequate access to advanced technologies,
4. Weak infrastructure,
5. High production and transport costs,
6. Gender asymmetry in access to assets and services,
7. Conflicts,
8. Natural disasters and
9. Deforestation, environmental degradation and loss of biodiversity.

The role that ICT can play in addressing these challenges is increasing as personal ICT devices such as mobile phones or tablet PCs – are becoming more widely available. ICT, when embedded in broader stakeholder systems, can bring economic development

and growth as it can help bridge critical knowledge gaps. Mobile technology, on the other hand, is increasingly being adopted as the technology of choice for delivery of ICT services and solutions.

LITERATURE REVIEW:

e-Agriculture

As FAO Proposes; FAO proposes the following definition: *“e-Agriculture” is an emerging field in the intersection of agricultural informatics, agricultural development and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies. More specifically, it involves the conceptualization, design, development, evaluation and application of new (innovative) ways to use existing or emerging information and communication technologies (ICTs).*

E-Agriculture goes beyond technology, to promote the integration of technology with multimedia, knowledge and culture, with the aim of improving communication and learning processes between various actors in agriculture locally, regionally and worldwide. Facilitation, support of standards and norms, technical support, capacity building, education, and extension are all key components to e-Agriculture.

There are several types of activity related to e-agriculture applications that are widely recognized around the world today. The delivery of agricultural information and knowledge services (i.e. market prices, extension services, etc) using the Internet and related technologies falls under the definition of e-Agriculture. More advanced applications of eagriculture in farming exist in the use of sophisticated ICTs such as satellite systems, Global Positioning Systems (GPS), advanced computers and electronic systems to improve the quantity and quality of production.

e-Commerce in Agriculture

Improved productions and high yields result in the need to look for profitable markets beyond local communities, and electronic markets are providing an opportunity to farmers to market and sell their produce to buyers at the global level. Electronic commerce (ecommerce), simply defined as the general exchange of goods and services via the Internet, is already having a significant impact on agriculture.

E-Commerce

E-commerce refers to the use of communications technology particularly the Internet to buy, sell and market goods and services to customers. The Internet has brought about a fundamental shift in national economies that are isolated from each other by barriers to cross-border trade and investment; isolated by distance, time zones and language; and isolated by national difference in government regulations, culture and business systems (Mohammad, 2004).

E-commerce offers a level playing ground for large businesses, as well as small and medium-scale enterprises (SMEs) to operate in the global market-place; and for regional businesses and communities to participate in social, economic and cultural networks seamlessly across international boundaries (Mary-Anne, 1998).

It equally fosters direct access to distant markets and promotes globalization of commercial activities; and blurs many of the current distinctions between domestic and foreign companies to an extent that it becomes practically impossible to determine the origin of products (Georges, 1997).

Hitherto, multinationals that operated in a number of countries had to adjust their products and services to accommodate the diverse operating environments at a relatively high cost, which the virtual marketplace has reduced.

E-commerce, is more than just electronics and commerce added together. It represents an entirely new way of doing business over a medium that changes the very rules of doing business. It is therefore, far more about strategy and business management than it is about technology.

Ecommerce Development In Nigeria

According to Ahmed (2015) “Despite the global popularity and growth of e-commerce, developing countries like Nigeria, seem to be lagging behind. As a developing country, ICT is growing gradually in Nigeria, with Internet users making up 16.1% of the total population (Internet World Stats, 2009). This shows a considerable increase compared to users in 2006 (3.1% of total population). With more people becoming computer literate and open to adopting ICT usage, e-commerce is gradually gaining popularity among many Nigerians.

However, previous studies have shown that e-commerce has not been fully adopted in the country. “A study by Folorunso et al. (2006:2226) shows that 70% of the respondents surveyed had heard about ecommerce before, but only 32% had used it. This shows that, only a very small percentage of the sample surveyed actually used e-commerce (about 22%) and is evident in most researches done on ecommerce adoption in Nigeria” (Ahmed et.al, 2015)

Nigerian ecommerce market is growing rapidly

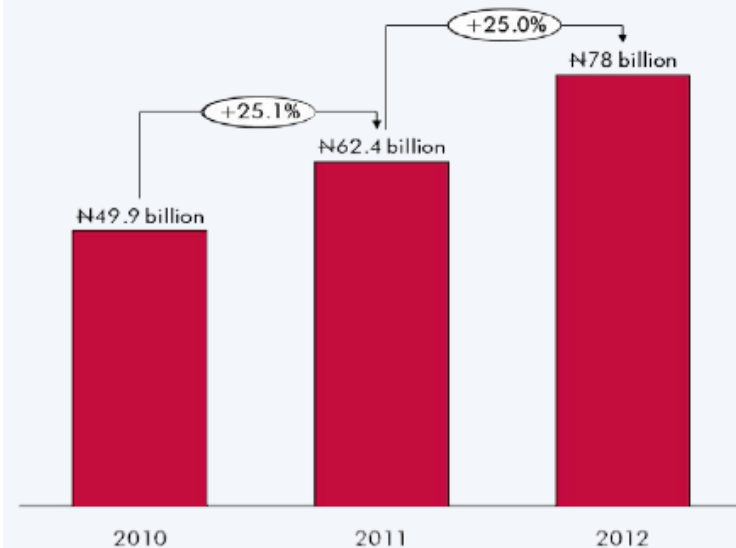


Fig 1 A chart showing ecommerce growth in Nigeria from 2010 – 2012

From the fig 1 above we will see that ;

1. 25% Cumulative Annual Growth Rate in Revenue
2. Over N2million online transaction per week, N1.3 billion monthly sales.

Conceptual method of analyzing smallholder farmers’ use of mobile phones for market linkage:

Conceptual Framework for Understanding Why Markets Fail for Smallholder Farmers

According to (Julius et. Al 2010), rural input and output markets in most developing countries operate imperfectly due, among other factors, to information asymmetry that result in high transaction costs (Poulton et al, 2006). Input market failure in rural areas is attributed to information asymmetry (Besley, 1998). Buyers and sellers in rural markets operate under conditions of limited and/or no information (Barrett, 2008). This results in market failure in the input markets, especially in credit, and insurance markets (Key and Runsted, 1999).

Lack of well-defined universal grades for traded products that is endemic in most rural markets also limits the trade and hence

participation of farmers in such markets (Fafchamps and Gabre Madhin, 2006). In many rural agricultural markets the rules/conventions (especially relating to product quality) that govern exchange in the output markets are either non-existent or poorly defined and hence only known by few traders (Fafchamps, 1996; Gebremedhin, 2005). Exchange in such market is therefore largely based on trust which can only build up with repeated transactions over many years (Fafchamps, 1996 & 2004; Fafchamps and Hill, 2005).

At the meso level, the efficiency in inter-village level trade requires that the border price less the costs of moving the produce to the destination market (i.e., transfer cost) be equal to the price at the source market (Abdulahi, 2007). However, just as in the case of micro-level trade, the costs of transferring produce from one village market to another is affected by the availability of public and private market information services. Lack of market information increases the costs of exchange leading to a situation where price in the destination differs from that in the source market by more than the transfer costs. The high costs of moving the produce between markets dampens incentives for trade and can even eliminate trade (and/or participation in the market) altogether (Fafchamps and Hill, 2005; Barrett, 2008).

The importance of farmer access to information is in reducing the transaction costs of exchange caused by information asymmetry between actors (Bagetoft and Olesen, 2004). Provision of ICT based market information services can improve farmers' access to market information and hence facilitate trade (de Silva, 2008). However, for rural farmers to benefit from such market information services, they need to be aware of their presence and to use them. Undoubtedly, farmers will use ICT technologies that provide agricultural

information if they find it profitable to do so. In the case of mobile phones, the cost may include the expense of mobile phone calls seeking information, the cost of buying a mobile phone handset and the cost of recharging the phone battery

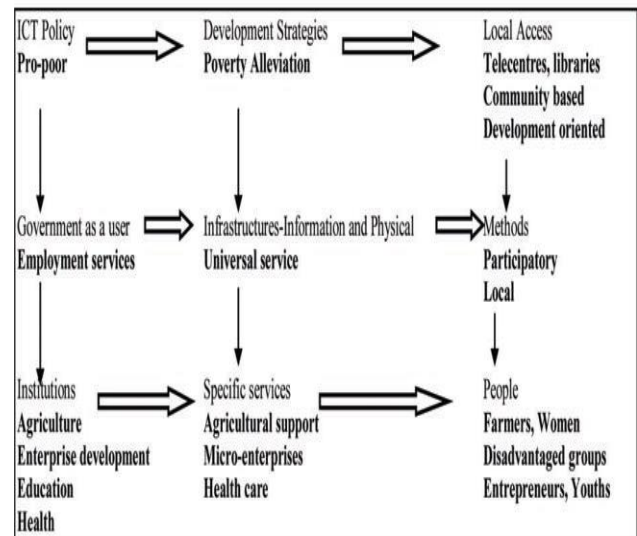


Fig 2: Framework for poverty alleviation using ICT. Source: Adapted from Harris, 2004

RESULTS

Framework of web based ecommerce and simple messaging system

Based on (Kapoor *et al.*, 2016) invention, mobile commerce offers convenience to users such that they can perform business transaction, anytime, anywhere. Though wireless application protocol (wap) has been around for several years, the market penetration of wap enabled cell phones, and other such web enabled wireless devices still remains quite low. The most established technology in the space of mobile commerce today is short message services (sms) on mobile wireless devices. With sms's high penetration and adoption rate in the market, it has been a prime target for mobile commerce usage.

Examples of sms notification with e-commerce functions contemplated by the present invention include the following:

- i. Marketing driven message to user:
e.g. Discount information, promotion and other commerce campaign information;
- ii. Notification for business events: e.g. Order received confirmation, shipping confirmation; and,
- iii. Notification for operational efficiency like payment due, or other deadline driven type reminders.

Encoding barriers

Sms messages, by nature are type less, stateless, session less and meaningless to data processing systems. Currently the main purpose of SMS messaging is person to person communication between mobile devices.

However, for SMS messages to be viable as means of business transactions, SMS cannot be just a casual exchange of two parties. Business transaction requirements include: trace ability, confirmation, and non-repudiation. It also has to be understood by any web application or other data processor that handles it. We collectively define these requirements as the 'semantics' of SMS messaging.

A given set of business rules may require that a subset of SMS messages be confirmed on delivery for non-repudiation of transactions such as:

- i. Confirmed arrival
- ii. Recorded timestamp of arrival for non-repudiation
- iii. Acknowledgement of reception of SMS messages

It may also be a business requirement that a given set of SMS messages are to be regularly delivered based on a given schedule. Examples include:

- i. Monthly reminders of invoices
- ii. Scheduled promotions via SMS messages

Broadcasting Type SMS messages may be

required by businesses to reach multiple users without the need of checking or confirming message arrival.

When a user wants to send in a SMS message to make a transaction, the intent of the user (e.g. to buy an given item) as encoded in the SMS message text has to be unambiguously understood by a web application or other application that handles the user's incoming SMS message.

Correctly encoding SMS messages to accurately represent business intent is a technically complex and difficult task and is highly prone to human error. Human errors in encoding are often very expensive and difficult to debug and correct. Business users want efficiency and reliability in using SMS to achieve their business objectives. They require sheltering from such technical complexity when using SMS messages in their business processes. Business users typically only want to focus on:

- i. Determining the business intent of a given SMS message;
- ii. Forming the correct wording of the message (without worrying about the different technical details of encoding); and,
- iii. Being informed of error if the message sent does not meet the intent of that message classification.

Business users who initiate these business transactions now face the significant technical challenge of manually encoding all of these SMS messages correctly so that they map accurately to the particular different business objectives that they set out to achieve.

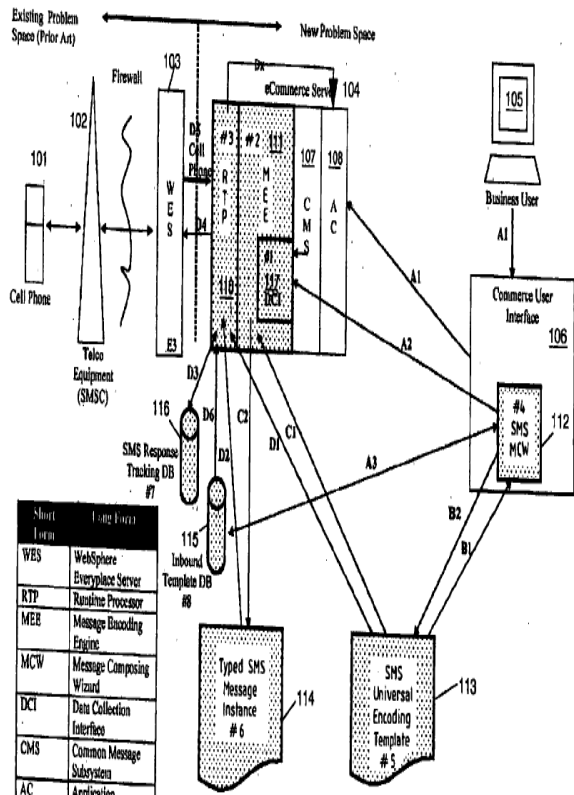


Fig 3 A complete ecommerce SMS system adopted from (Kapoor et.al 2016)

Technical Complexities in Encoding SMS Deter Business Users from Adopting its Usage

The originators of business SMS messages are business users who have business needs to send business messages. Their prime concern is to focus on the business logistics of the message (like the timing of sending, to whom to send the message to etc.) and the message itself (like the choice of wordings etc.). They do not want to be (and typically cannot afford to be) burdened with the technology of the delivery medium. For example, the technical knowledge of how to send a SMS message is something that the business users do not want to deal with and expect to be handled for them. Transparency

and user friendliness is important to a business user.

Confirmation in e-Commerce Usage

A key requirement of to use SMS in ecommerce is the need for confirmation from SMS message recipients. The following is a list of examples for such critical requirements in SMS usage in ecommerce:

- i. Upon receiving a SMS notification from the commerce server, often the recipient needs to respond by sending an SMS message back to the ecommerce server. For example: the recipient may send an SMS message back to the ecommerce server to buy an item advertised by an SMS promotion message.
- ii. To fulfill the non-repudiation requirement, for example: all customer touch points need to be recorded.
- iii. Confirmation also requires the confirmation of user ID in an inbound message.

Security in ecommerce Usage

Another key requirement for using SMS in commerce is the need for security in carrying out a business transaction. This requirement includes:

- User ID authentication by a web application
- Web application authentication by the user so that the user knows for sure that the correct Web application is handling the user's request
- User authentication to confirm that no unauthorized mobile device is used for the transaction; a PIN could preferably be used as an additional layer of user confirmation.

Session in eCommerce Usage

Another key requirement of using SMS in commerce is that of the session. Often, when a web application sends out an outbound

message to its users (e.g. campaign message like ‘all fertilizers 50% off if purchased in the next 6 hours), the web application used expects the user to respond back in SMS to the corresponding outbound message within the specified time period. Typically, this requirement of session includes:

1. A request and response model mapping to outbound and inbound SMS messages;
2. A time out mechanism; and,
3. A Session Data sharing mechanism.

In addition, for SMS to be adopted in commerce application, there is a strong requirement for security mechanisms to provide user authentication; web application identification; receiving confirmation from SMS message recipients; and the ability to associate user responses with the intended ecommerce

DISCUSSION

System Integration

The Ozeki NG - SMS Gateway has been designed to help enterprises address these challenges in mobile communication. The Ozeki NG - SMS Gateway is a software product that will help maximize the productivity of IT by reducing the complexity of creating, deploying, and managing mobile communication applications. It empowers developers through a rich, flexible, modern development environment for creating secure, high performance solutions based on the SMS technology.

PHP is usually used in web development environments. It is quite common that a PHP script is called when a webpage is requested. Most PHP enabled websites use a database server (MySQL or PostgreSQL) for data storage. These database framework integrate well with the needs of PHP developers. Setup an SQL SMS Gateway configuration for the system (Figure 4).

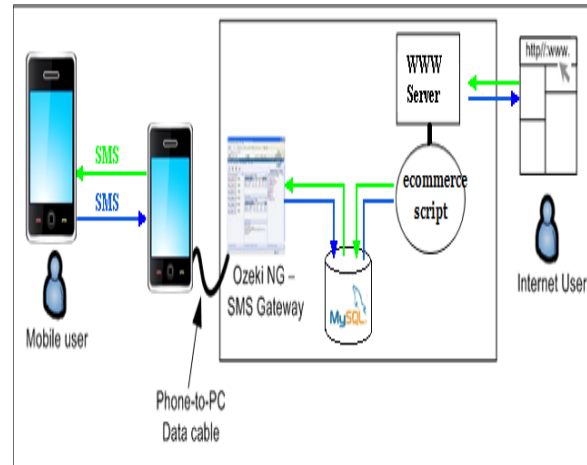


Fig 5: Sending SMS from PHP through a MySQL database server

In the diagram above (**fig:5**) you can see an Internet user, a web server with the PHP application, an SQL Server, Ozeki NG - SMS Gateway, a mobile phone attached to the server computer and a mobile user receiving the message. Wherever the Internet user is, if they know the IP address or URL of the computer running the PHP script, and if they are authorized to log in, they can compose and send messages to any recipients. After the Internet user's action, the PHP application inserts a row with the data of the SMS to be sent, which will be selected by Ozeki NG - SMS Gateway from the database. Ozeki NG will forward the message to the GSM network through a mobile phone attached to the PC with a data cable, and the mobile user will receive the SMS message.

CONCLUSION

In this period of economic transformation in Nigeria, it will be very important if there will be an agricultural policy to create new market institutions that would improve agricultural market organization in the country. As a result of the policy wholesale markets and commodity exchanges will be created. These markets will become important institutions for marketing channels development and price creation on the Nigerian agricultural market. The

markets also will undertake initiatives of innovation in trade such as e-commerce of agricultural products.

In conclusion if we look at the current situation most of Nigerian farmers are from rural communities, most of this farmers are not literate, this research is targeting the poor Nigerians how they can benefit from ICT in developing their farming. We know that his rural farmers are only familiar with Cell Phones, they cannot operate smartphones talk less of going online via PC for e-commerce business.

These framework shows how to develop an m-commerce platform where the rural farmers can meet discuss on farm information with the consumers all over the world, need to be implemented and supported by government agencies and stakeholders.

However electronic markets are not popular among Nigerian farmers yet. It is expected that electronic agricultural markets will become more popular when younger generation of farmers appears on the market. Also improvements in information technologies will probably diminish such barriers of EC development like the importance of face to face contacts when making transaction and the agricultural product complexity.

Currently this market has no competitors; therefore we can assume that there would be no electronic market of agricultural products in Nigeria if not the initiative of SidmachTech in collaboration with National Information Technology Development Agency (NITDA) and Ministry of Agriculture. The e-commerce creation required capital investment but also farmers' trust to the institution that created the market was also very important.

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