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## Practice, Trends and Challenges of Mobile Commerce in Nigeria

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**Abstract:** Advances in e-commerce have resulted in significant progress towards strategies, requirements and development of e-commerce applications in Nigeria. However, nearly all e-commerce applications envisioned and developed so far assume fixed or stationary users with wired infrastructure. Now that our daily transactions have gone mobile, E-commerce has also joined the band wagon, resulting in the ability to carry out commerce while on the move via mobile devices (phones, PDA's etc.). This is referred to as Mobile Commerce (M-commerce), the technology that holds great promises and challenges for both business and consumers alike. In this research, we consider the practice of Mobile Commerce in Nigeria, its enabling technologies and emerging applications. We envision many new e-commerce applications that will be possible and significantly benefit from emerging wireless and mobile networks. We also consider M-commerce success factors, prospects, challenges and future trends.

**Key words:** M-commerce, business, E-commerce, transactions, internet, mobile phones

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### INTRODUCTION

**M-Commerce defined:** Electronic commerce has attracted significant attention in the last few years. This high profile attention has resulted in significant progress towards strategies, requirements and development of e-commerce applications (Kalakota and Robinson, 1999). The growth forecast for both business-to-consumer (B2C) and business-to-business (B2B) aspects of e-commerce over the next few years is phenomenal by any standard. One point that should be made here is that nearly all e-commerce applications envisioned and developed so far assume fixed or stationary users with wired infrastructure, such as a browser on a PC connected to the Internet using phone lines or a Local Area Network (LAN). We envision many new e-commerce applications will be possible and significantly benefit from emerging wireless and mobile networks. We term these applications wireless e-commerce or mobile commerce.

M-Commerce can be defined as any transaction with a monetary value-either direct or indirect-that is conducted over a wireless telecommunication network. It was estimated that it will contribute about \$6.9 trillion to growth in total global e-commerce revenue by 2004 (Forrester Research, 2000), of which more than 200 billion will be derived from M-Commerce (Barnes, 2002). Wireless technology provides infrastructure to link portable computers to corporate distributed computing systems and other sources of information (Boukerche and Das, 2000). In Nigeria, there were approximately 30 million

Internet users and 65 million mobile phone users in 2004. According to a survey report (Gerber, 2000), it was estimated that 80% of wireless devices will have Internet access and there will be over 1 billion users worldwide by 2004. This has become a reality. As remote Internet-enabled mobile phones become available, the base of e-commerce customers will grow (Simon, 2000).

To millions of people all over the world E-Commerce has freed the customers from the constraints of time to deliver services day by day. The next stage in this development is the launch of mobile commerce services, allowing customers to access services independent of their location.

The mobile phone has become an essential tool for everyday life, offering voice and data communications. The mobile handset's use as a universal trusted device makes it the ideal terminal for secure and convenient financial services. It also benefits from wide familiarity amongst a customer-base.

**Background:** Before the advent of the electronic age, commerce used to be defined by the physical presence of both the buyer and the seller, now however, the Internet and constantly evolving computing and communications technologies such as mobile phones have redefined the business of banking and commerce. Traditional boundaries of time and geography have been erased and new opportunities created for banks and commercial organizations to reach and service an increasingly informed and empowered customer base. The implications of Mobile commerce are wide.

Probably the most important factor in the birth of wireless Internet has been the proliferation of digital cell phones in the last few years. The expanding network of digital cellular and Personal Communication Services (PCS) has created a solid foundation for wireless commerce services. It is estimated that there are more than 50 million Web-enabled cell phones in use. In 1997, Nokia, Motorola, Ericsson and Phone.com came together to create the WAP because they believed that a universal standard is critical to the successful implementation of wireless Internet (Fig. 1). Since then, more than 350 companies have joined them in the WAP Forum.

We believe that the world is about to experience an explosion in the uptake of WAP (Wireless Application Protocol) technology. Mobile commerce applications that combine the advantages of mobile communications with existing e-commerce services will be very successful. The need for Mobile commerce lies in the following advantages:

**Ubiquity:** Ubiquity is the most obvious advantage of a wireless terminal. A mobile terminal in the form of a smart phone or a communicator can fulfill the need both for real-time information and for communication anywhere, independent of the user's location.

**Accessibility:** Reach-ability is important for many people who want to be in touch and be available for other people. With a mobile terminal, a user can be contacted anywhere anytime.

**Security:** Mobile security technology is already emerging in the form of SSL (Secure Socket Layer) technology within a closed end-to-end system. The smartcard within the terminal, the SIM (Subscriber Identification Module) card, provides authentication of the owner and enables a higher level security than currently is typically achieved in the fixed internet environment.

**Convenience:** Convenience is an attribute that characterizes a mobile terminal. Devices store data, are always at hand and are increasingly easy to use.

**Localization:** Localization of services and applications will add significant value to mobile devices. Knowing where the user is physically located at any particular moment will be the key to offering relevant services that will drive users towards transacting on the network.

**Instant connectivity:** Instant connectivity to the Internet from a mobile phone is becoming a reality already. Using GPRS it will be easier and faster to access information on

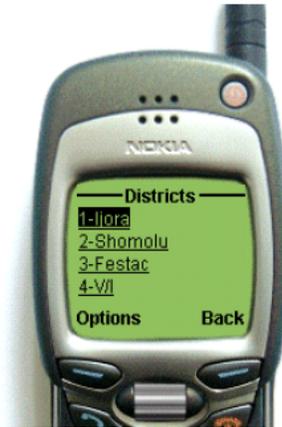


Fig. 1: A cell phone with wireless internet

the web without booting a PC or connecting a call. Thus, new wireless devices will become the preferred way to access information.

#### MOBILE COMMERCE IN NIGERIA

Communication without doubt is a major driver for the Nigerian economy. Emerging trends in socio-economic growth shows a high premium being placed on information and communication technology (ICT) by homes, organizations and nations. So far, the NCC has issued various licenses to private telecommunications operator. These include 7 fixed telephony providers that have activated 90,000 lines, 35 Internet Service providers with a customer base of about 17,000. Several VSAT service providers are in operation and have improved financial intermediation by providing on-line banking services to most banks in Nigeria. These licenses allowed Private Telephone Operators (PTOs), to roll out both fixed wireless telephone lines and analogue mobile phones. The return of democracy in 1999 paved the way for the granting of GSM license to 4 service providers: MTN, Nigeria; ECONET Wireless (now Vmobile), Nigeria; NITEL Plc in 2001 and Globacom in 2002. With all this facilities in place, the concept of mobile commerce comes into play.

The introduction of the GSM technology into the Nigerian market has helped to boost the idea and thus the implementation of the concept of Mobile commerce. With this, certain banks and other financial institutions including other service providing organizations introduced the concept of mobile commerce into their customer service accessibility options. Thus it was now possible for an individual in the Nigerian market to check his/her bank balance or even load his/her mobile phone without having to physically obtain any of these services.

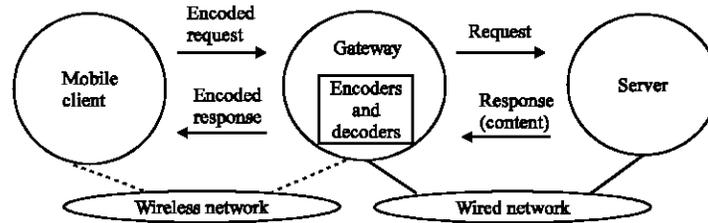


Fig. 2: WAP Architecture

The already implemented internet project, project Nigeria. COM had already introduced the commerce project which meant that individuals, institutions involving business transactions could then do business with the hope of faster yet safer transfers. First Atlantic Bank took the lead in 2000 and introduced the flash me cash policy. This policy allowed customers to check their bank balance via WAP services on their mobile phones. After this, other institutions have come up with other lucrative yet challenging concepts.

**Challenges:** The emergence and introduction of Mobile devices and infrastructures into Nigerian economy has engendered the following challenges:

- How to sustain the growth and progress recorded so far
- Getting the funds required to do the great task of ensuring that mobile commerce drives the economy and bridges the digital divide
- Developing an IT promoting attitude in the large population in Nigeria
- Convincing the private sector to reduce the cost of access to Mobile commerce devices and technologies to enable the common man have access,
- Security and privacy issues that are unique to wireless networks and mobile devices.
- Middleware issues that are unique due to device, network and protocol limitations.
- Role of different wireless networking standards,
- Adoption factors of mobile devices that are significantly different in different parts of the world.

**M-COMMERCE ENABLING TECHNOLOGIES**

For an economy to witness significant growth in the M-commerce market, there are necessary enabling technologies that must be developed and deployed. In this section we analyze and present below the architecture that M-commerce is built upon and various technology enablers that are pertinent to the development of the market and their impact on M-commerce.

**Wireless application protocol (WAP):** Wireless application protocol (WAP) is an application environment and set of communication protocols for wireless devices designed to enable manufacturer-, vendor- and technology-independent access to the Internet and advanced telephony services.

WAP is an effort, with broad industry support, to define a standard for communicating Internet-type information to devices that have roughly the same form factor and processing power as the average mobile telephone. In fact, the majority of WAP-enabled devices in people’s pockets right now are also mobile phones. The WAP architecture is presented in Fig. 2.

WAP bridges the gap between the mobile world and the Internet as well as corporate intranets and offers the ability to deliver an unlimited range of mobile value-added services to subscribers-independent of their network, bearer and terminal. Mobile subscribers can access the same wealth of information from a pocket-sized device as they can from the desktop. WAP also defines a wireless application environment (WAE) aimed at enabling operators, manufacturers and content developers to develop advanced differentiating services and applications including a microbrowser, mobile commerce, scripting facilities, e-mail, World Wide Web (WWW)-to-mobile-handset messaging and mobile-to-telefax access.

**Network technologies:** Mobile protocols are all very similar and are ultimately chasing the same applications. All of the protocols are client-server based and involve new functions on the mobile phone and new servers connected to the mobile phone network.

**GSM:** GSM (Global System for Mobile Communication) operates in the 900 MHz and the 1800 MHz (1900 MHz in the US) frequency band and is the prevailing mobile standard in Nigeria. GSM is used by more than 215 million people (October 1999), i.e., representing more than 50% of the world’s mobile phone subscribers.

**GPRS:** GPRS (General Packet Radio Service) is a packet switched wireless protocol as defined in the GSM

standard that offers instant access to data networks. It will permit burst transmission speeds of up to 115 Kbit sec<sup>-1</sup> (or theoretically even 171 Kbit sec<sup>-1</sup>) when it is completely rolled out. The real advantage of GPRS is that it provides an always on Connection (i.e., instant IP connectivity) between the mobile terminal and the network.

**EDGE:** Enhanced Data Rates for Global Evolution (EDGE) is a higher bandwidth version of GPRS permitting transmission speeds of up to 384 Kbit sec<sup>-1</sup>. EDGE allows mobile network operators to offer high-speed, mobile multimedia applications.

**3G:** 3rd generation (3G) is the generic term for the next big step in mobile technology development. The formal standard for 3G is the IMT-2000 (International Mobile Telecommunications 2000). The goal of being able to have one single network standard (CDMA) and use one handset throughout the world is capable of being reached by this technology.

#### **Service technologies**

**SMS:** Since 1992, Short Message Service (SMS) has provided the ability to send and receive text messages to and from mobile phones. Each message can contain up to 160 alphanumeric characters. About 90% of SMS messages are voice mail notifications or simple person-to-person messaging. The rest is mobile information services, such as news, stock prices, sport, weather, horoscope, jokes etc. Additionally, SMS e-mail notification, SMS chat and downloading of ringing tones has been offered recently in some markets.

**USSD:** Unstructured Supplementary Services Data (USSD) is a means of transmitting information via a GSM network. A USSD message can have up to 182 characters. It is relevant for real-time applications, such as mobile stock trading, where a confirmed information transmission is needed.

**SIM application tool kit:** SIM Application Toolkit (SAT) technology allows network operators to send applications over the air as SMS or as Cell Broadcast message in order to update SIM cards with changed or new services.

SIM Toolkit applications are built in Java for a client server environment. SIM Toolkit, handsets have been developed by all major cell phone manufacturers.

**Blue tooth:** Blue tooth is a low power radio technology that is being developed to replace the cables and infrared links for distances up to ten meters. Devices such as PCs,

printers, mobile phones and PDAs can be linked together to communicate and exchange data via a wireless transceiver that fits on a single chip.

**SmartCards:** Smartcards, i.e., chip cards with a small microprocessor can have credit/debit functionality as well as digital signature or electronic wallet functionality. They are also capable of being used as a loyalty card or as a health record card.

**Synchronization:** Synchronization is a key technology enabling mobile commerce, because there will be demand for both web-centric and local applications on a PC or any type of mobile device. Synchronization is the process by which identical versions of applications and data are maintained wherever and on whichever device the user chooses.

### **EMERGING M-COMMERCE APPLICATIONS**

Wireless and mobile networks have experienced exponential growth in terms of capabilities of mobile devices, middleware development, standards and network implementation and user acceptance. Currently, more than 800 million cell phones and other mobile devices are in use worldwide and out of those, more than 65 million users are in Nigeria alone ([www.wow-com.com](http://www.wow-com.com)). The worldwide numbers are projected to rise to 1 billion soon, thereby exceeding the combined total of all computing devices several fold. According to estimates by GartnerGroup, in 2004, at least 40% of business-to-consumer e-commerce will be initiated from smart phones supported by WAP (Wireless Application Protocol). A study from the Wireless Data and Computing Service, a division of Strategy Analytics, reports that the mobile commerce market may rise to 200 billion by 2004. The report predicts that transactions via wireless devices will generate about \$14 billion a year.

In this section, we analyze emerging m-commerce applications first in a consumer context and thereafter in a business context.

### **CONSUMER M-COMMERCE APPLICATIONS**

According to estimates from a report by Durlacher (Muller-Veerse see URL), more than half of the European mobile commerce market in the next few years may consist of financial, advertising and shopping services. In this paper, however, we attempt to cover a comprehensive range of mobile commerce applications under different classes with varying requirements in terms of devices, middleware and networks.

**MOBILE FINANCIAL SERVICES**

Financial service is a key commercial driver for the mobile commerce market in Nigeria and beyond. Retail banking and stock broking markets are in the midst of major industrial restructuring. Taking their online activities to a mobile device opens a new service channel for the financial Institutions. In a recent survey by Nokia, looking at which application types various parts of the market might demand and when carried out, Mobile banking was the top application demanded by more than 85%. The structure of several mobile financial services are shown in Fig. 3.

**Mobile banking:** Mobile banking is a subset of online banking, a service that is being offered by only about 20% of all banks in Nigeria. The motivator for mobile banking from the bank’s perspective is to have an additional distribution channel and to further cut costs, as every transaction on the internet, fixed or mobile, is saving money on the bricks and mortar operations side. Based on an existing back office online banking operation, mobile banking can be deployed in a straightforward manner.

The services mainly considered for offering true mobile banking are:

**Public information**

- Check exchange rates
- Check interest rates

**Private information**

- Check account and credit card balances
- Administer credit lines
- Check interest earned on deposits
- Check last transactions

**Transaction**

- Transfer funds
- Pay invoices
- Apply for credit line

The simplest mobile banking solutions can be pull-base via a voice call to an IVR (Interactive Voice Response) system or via an SMS request. Alternatively, the service could be push type, thus sending information on an event basis, depending on a certain time or value. All information is currently typically sent via SMS over GSM networks. Interestingly, Mobile Banking services can generate some additional revenues where banks are sharing in operator revenues generated by the SMS enquiries.

**Mobile broking:** Mobile broking is a killer application for mobile commerce. Location independent, real-time information about a share price reaching a particular stop mark and the possibility to act on it provides a very high value to many stock traders, private or professional. Shares exceeding certain price points could trigger messages asking whether to buy or sell. In Nigeria a few online brokers are already offering mobile trading via cell phones or Palm VII. Mobile broking provides a new differentiator and increases customer loyalty. The online trading commissions will still be charged, but trading volumes are expected to be higher as clients have more opportunities to trade.

Mobile broking provides the following key functionalities:

- Receive alerts about price-movements
- Receive message when order is executed
- Check quotes
- Manage portfolio
- Buy and sell stocks, options, mutual funds, other financial instruments
- Browse and delete existing orders

It is believed that mobile broking will be a regular way to trade shares in the whole of Nigeria within the next ten years. Many more people will own a mobile phone than a PC by that time and a new level of convenience and timeliness of decision making can be reached. Thus, the application will help to drive mobile commerce as a whole.

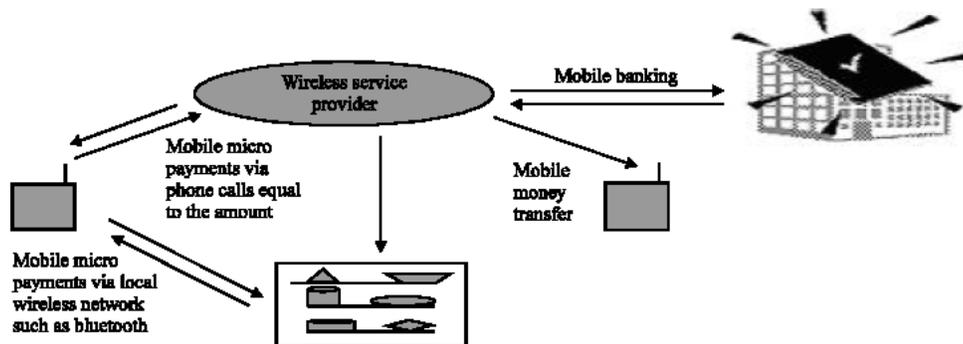


Fig. 3: Several mobile financial services

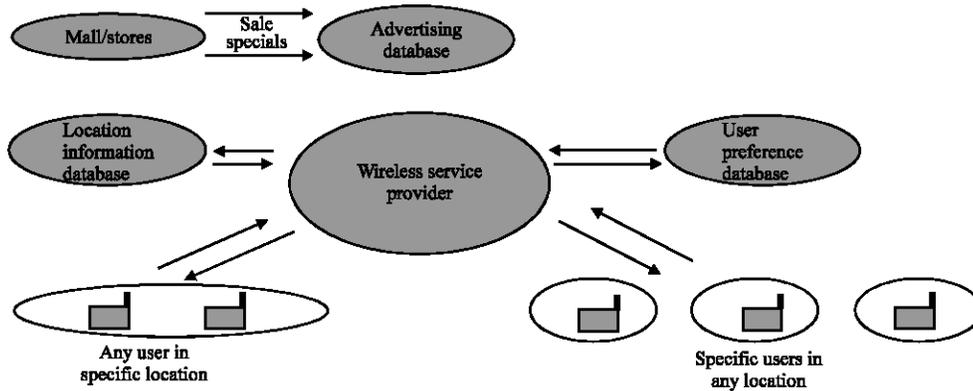


Fig. 4: A possible scenario for mobile advertising and shopping

**Mobile e-bill:** You can receive electronic bills to an e-mail address or to a mobile phone, e.g., from your telephone company, which can be paid via semi-direct debit from the hand held terminal. Thus, no paper invoice is sent any longer. This will cut costs significantly for the bill issuer saving in both production costs and postage. For the user, mobile e-bill will significantly reduce the effort required to pay bills to trusted parties. The security issue in respect of the digital signature must be solved in order to roll out this service to the entire market.

**Mobile e-salary:** In some organizations, employees have to choose today whether they would like to receive their monthly pay slips via e-mail or via SMS to their mobile phones. Paper pay slips will no longer be produced and distributed to employees by default.

**Mobile security services:** The mobile phone with its integrated SIM card is an ideal bearer for the private key digital signature of a PKI system. Thus, the mobile device can become a security tool, for example for secure payment in e-commerce and m-commerce.

**Mobile shopping:** Mobile Shopping extends our ability to make transactions across time and location and creates new transaction opportunities. It is important to note that only a part of the purchasing process is conducted with the mobile terminal. The basic point is that you need to know what you want in advance of making a mobile purchase. Moving forward, it seems most likely that a shopping list might be created with a web interface, which may then be executed from a mobile.

**Mobile retailing:** There have been a number of network-based services with respect to mobile retailing already

available but there has been little success so far. A value-added GSM service makes it possible to get connected to a call centre and order via credit card.

**Mobile ticketing:** Mobile electronic purchase or reservation of tickets is one of the most compelling proposed services, because ticket reservation/purchasing are hardly a pleasant expertise today. Either one has to go in person to a ticket booth, or has to call an agency or the outlet. It is clearly more convenient to select and book tickets for movies, theatres, opera and concerts directly from the mobile device, because often the decision to purchase is made while outside or on the move among friends.

We believe that ultimately, the tickets will be downloaded onto the mobile device and the device will communicate with the check-in counter at the movie theatre or at the airport via Blue tooth or infrared.

**Mobile advertising:** There is a widespread opinion, that mobile internet will not be as dependent on advertising revenues as the wired internet. Among the justifications for this view are that mobile phones currently have a very small user interface and that graphical visualization on the screen is very limited. Advertising on mobile devices, whether a smart phone or a communicator, will continue to have a strong business case, because it is the dream environment for every marketer (Fig. 4).

It is possible to mass customize a mobile phone for particular user requirements, which then in return would allow one-to-one marketing. It is business critical to market to the individual consumer through very pinpointed and localized messages.

The conditions for one-to-one marketing are ideal using the mobile device. The mobile operator or service

provider has not only all the demographic data of the subscriber, but also has been able to build a data profile with lots of information about that user's calling patterns. Additionally, by providing a mobile portal the network operator can get even more information on the subscriber, as he is requested to input his or her preferences and information needs, so that he will receive personalized and thus more valuable, information. Finally, with the use of mobile positioning technology, the network operator can identify fairly exactly what is the location of the subscriber.

All of these factors combined would create the ultimate marketing tool. Since most business transactions are local and the mobile device is the only tool that enables location dependent services so far, personalized advertising via the mobile device seems to make sense. Vendors can reach their target customers when they are near the actual outlet.

#### **BUSINESS M-COMMERCE APPLICATIONS**

A variety of business processes could be streamlined by integrating mobility. Below we indicate a selection of some areas of e-business, where we believe wireless will have a significant impact.

**Job dispatch:** Mobile phones and communicators are increasingly becoming an integral part of groupware and work flow applications. For example, non-voice mobile services can be used to assign new jobs to a mobile employee. The target application areas for mobile field, delivery and dispatch services are:

- Transportation
- Utilities
- Field Service
- Health Care
- Security

A dispatching solution allows improved response with reduced resources, real-time work order tracking, increased dispatcher efficiency and reduction in administrative work.

**Mobile sales force automation:** The current sales force automation tools are already integrating a software architecture that is aimed for M-commerce applications. The sales force on the road will be equipped with WAP enabled mobile phones in order to have easy access to customer data at the central office. Key data, which can be

retrieved, would include contact management information, order entry, product and spare parts availability and deal tracking. If the WAP device is a communicator type, sales forecasting and opportunity tracking could be done as well. The travelling salesperson is able to check the latest status of his customer, just before she is going into her office and she will be able to enter a successful business win immediately. One could argue that the demand for this kind of mobile tool, to get access to the office and valuable information fast, is latent with all travelling salespersons. We believe that we will see increasing applications in this space.

#### **KEY SUCCESS FACTORS FOR M-COMMERCE**

The successful development of the M-commerce market will depend on operators taking advantage of the following capabilities within the mobile environment:

**Customer ownership:** Subscriber data, such as billing address, mobile phone number, e-mail address, choice of mobile device and calling patterns, are becoming ever more valuable in the light of mobile commerce. In addition to passive collection of user behavior and data, companies will be able to benefit from users actively providing and specifying their own choices and preferences to the portal provider.

**Personalization:** Personalization is about creating services that customize the end-user experience for the individual subscriber. It is based on one-to-one relationship management and therefore provides the ideal tool for one-to-one marketing. An intelligent personalization platform must be able to learn from both user preferences and past behavior of the user.

The application must be personalized enough to optimize the interaction path, enabling the user to reach the services they want with as few clicks as possible and presenting information in a compact form optimized for the smart phone or communicator. Companies must also be proactive with respect to service behavior, i.e., anticipating future requirements of the user and suggesting a likely choice. We believe that personalization is the difference between a usable application and an unusable application.

**Localization:** There are several competing technologies that enable mobile location or positioning services. Location-sensitive information becomes key in mobile commerce. Knowing the location of the user drives the

service and application offering to a level that creates significant value to the user. User needs local information about their normal local environment. Location specific information is even more valuable in new environments, when travelling.

**Ubiquity:** The ability to receive information and perform transactions from virtually any location is especially important to time-critical applications, such as stock and options trading as well as betting. Providing mobile users with a similar level of access and information to that available in the fixed line environment is key road to success.

**Timeliness:** Mobile enables the transmission and use of time-sensitive information whose value is inherent in its immediate delivery. Information transmitted too late can incur significant opportunity costs. It is in such environments that mobile information services come into their own.

**Convenience:** We are strong believers in technology, but only with the purpose of making life easier for people and taking away the pain of unpleasant tasks and activities. One should always question how a solution could provide added convenience to the user. Technology in itself is exciting, but only its use to increase the quality of life makes it valuable.

#### **DRAW BACKS OF M- COMMERCE**

- Some proponents of M-commerce blame the withdrawal on economic conditions.
- Dwindling expectations of M-commerce revenue due to reduced revenue in every area.
- Low bandwidth and a paucity of data services required for M-commerce.
- Inter-carrier cooperation issue: For true M-commerce to work, it will have to run seamlessly among different carriers, networks and handhelds. There has to be basic interoperability.
- Cold response and patronage from the users: People need to become comfortable with the whole concept of mobile commerce.
- Pure M-commerce may only come to exist in narrow areas.

#### **FUTURE TRENDS OF M-COMMERCE IN NIGERIA**

It is believed that in the nearest future the backbone of commerce in Nigeria will be the mobile phone without

which no transaction can be completely implemented. Here we predict the future of M-commerce in Nigeria.

- WAP gateways will be widely implemented in Nigerian Organizations as the cost of access to this mobile services will be reduced considerably thus bridging the digital divide in Nigeria.
- The use of Personal Digital Assistants (PDAs), such as Palm, HandSpring and the Pocket PC, will continue to rise.
- M-commerce Will Supplant E-commerce.
- Mobile Workers Will Become More Prevalent.
- Wireless Everywhere! It is conceivable that all networks will be wireless in five to ten years. The next couple of years will see tremendous growth in similar technology.

#### **CONCLUSION AND FUTURE RESEARCH DIRECTION**

There are still many things to be done to enable us bridge the digital/economic divide. However, it is nice to note that a lot of progress has been made in the last six years. We believe if we can make the political class the crusaders of IT and also create awareness among individuals we will have much more progress in Nigeria.

**Interesting research issues in mobile commerce:** There are many interesting research problems in mobile commerce. Some of these are unique due to the limitations of mobile devices and wireless networks and some are similar to research problems that are currently being addressed by e-commerce researchers and developers. The problems that are unique to m-commerce are:

- Novel applications and services made possible due to the wireless networks and mobile devices,
- Security and privacy problems
- Middleware issues and protocol limitations
- Role of different wireless networking standards
- Adoption factors of mobile devices that are significantly different in different parts of the world.

The research problems that can be addressed by the existing e-commerce research with some modifications and extensions are:

- Strategy of new service offering
- Role of m-commerce providers
- Trust building.

- Adoption of new services
- Pricing models and sensitivity analysis.

We are pursuing some of these research problems and work will be presented in future articles. It is our hope that current and new researchers would find these problems to be of considerable research interest and our work will fuel advances in M-commerce applications, adoption, networking, pricing and other emerging areas.

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