

## Computer Based Management Information System: Components, Functions and Challenges in Nigeria

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### **Abstract**

*In the past, business managers manage their data and information through the medium of paper which can be called paper based management information system (PBMIS). With the advent of ICT, this system has become laborious, time consuming and therefore inefficient. Computer based management information system (CBMIS) appear to have replaced the PBMIS. A CBMIS is an organized method for providing fast, present, and projected information on internal operations as well as external intelligence for directing firms' management information system and related operations. Due its numerous advantages over the PBMIS, organizations appear to be in a rat race to go computerized and also appear not to be getting it right. Although, CBMIS can help organizations run smoothly and efficiently, its adoption by firms must be carefully planned, organized and implemented otherwise, it can make organizations lose control of critical functions and tremendous amount of time and money. This paper therefore described the various computer components and communication technologies that will enable organizations to provide data and information in a way that is better, faster and with greater customization. Specifically, the paper discussed the basic hardware, software and communication technology that drives CBMIS. The issues of viruses/worms and computer criminal which are the problems that came with ICT were also discussed before the paper concluded.*

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**Keyword:** CBMIS, Component, Functions, Challenges

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### **Introduction**

Prior to the advent of information and communication technology (ICT), business data and information were captured, processed, stored and transmitted through the medium of paper – what can be called paper-based management information systems (PBIMS). For example, personnel records, sales, marketing, advertising, finance, production and other business data and information are in paper forms popularly called hard copy. Furthermore, these data and information are usually transmitted from one location to another physically and stored in files that often times are further stored in file cabinets with lock and key systems for security. Other

components of PBMIS are the human element, policies and rules that ensures the system runs smoothly.

Today, this manual system of managing business data and information appears to be gradually giving way to computer-based management information system (CBMIS). CBMIS is an organized method for using computers and communication technologies to provide data and information in fast, accurate and timely manner for business operations (Boon & Kurtz, 2006). Business data, records and information are now mostly in digital forms. That is, they are captured, possessed, stored and transmitted electronically. Also, files and file cabinets appear to be scanty in offices nowadays. They have been replaced with computer *databases*. A database can be likened to electronic filing cabinets where organisations' business information is stored for retrieval purposes (Senn, 2010).

The global information economy now depends on ICT backbone to process, store and transfer information from one person to another, within and between organizations and within and between countries (Baldauf & Stair, 2009). Corporate and government network and websites are now common. Organizations now have full-fledged CBMIS manned by ICT professionals. There are now many companies that specialize in data collection for commercial purposes. They are known as *information resellers* or *information brokers* that collect and sell people and organisations' data for profits. Also, there are now *Application service providers* (ASPs) who are experts in providing both the computers and the application support for managing information systems of business (Boone & Kurtz, 2006).

It can be successfully argued too that the greatest impact of ICT or computer on the society is in the areas of information storage, management, retrieval and distribution. Documents, photographs, music, artwork, etc., are now digitized, stored and can be transferred with the speed of light (Senn, 2010). The deployment of ICT tools and personnel in all spheres of human endeavours has resulted in digital economy and globalization (Lane, 1999)

As a result of its numerous advantages over the PBMIS, there appear to be a rat race among organisations to go computerize as a matter of necessity. This is because electronic commerce, e-governance, e-learning, e-medicines, etc are now business models. E-commerce, which is business transactions that takes place over telecommunication network has changed the world and continues to do so in exponential ways (Nieto, Deitel & Deitel, 2001). It allows us to discover new products that may not be available in our country or environment. For items that are available locally, it allows us to find better deals. Furthermore, we use e-commerce to monitor our bank accounts and make electronic transfer of funds. Businesses use e-commerce to streamline transition processes and reach new customers. Online stores and shopping platforms such as Websites and blogs are now available. There is also online clearing houses, and Web Auctions (Bloch & Segev, 1996). In all these, large volumes of business data and information are captured, processed, stored and disseminated electronically which has made CBMIS to become imperative.

However, notwithstanding these numerous advantages of CBMIS, it has also thrown up lots of physical and managerial concerns that seem to be dampening the enthusiasms that greeted its adoption. For example, what are the ICT components needed to install CBMIS? If a CBMIS is

in place, does it work seamlessly? How can it be used in the most economical ways? Are there threats or challenges that can frustrate the system?

Based on the foregoing, the aim of this paper therefore, is to discuss the ICT structures to be put in place for a CBMIS to thrive. It will also discuss the concerns CBMIS has thrown up. The significance of these is anchored on Boone and Kurtz (2006) assertion that although, CBMIS can help organizations manage its data and information efficiently, its adoption by firms must be carefully planned, organized and implemented. Otherwise, it may make organisations loose control of critical functions and tremendous amount of time and money.

### **Functions of CBMIS**

To appreciate the role CBMIS plays in organizations, it will be instructive to pin point how computers help business. According to Boone and Kurtz (2006) computers and their related technologies continue to revolutionalise the methods by which businesses manage information. Furthermore, Boone and Kurtz noted that these technologies affect contemporary business in three ways. Firstly, the enhanced speed with which data and information are processed stored and transmitted now make organizations to be effective in decision making. Secondly, computer makes accurate, unbiased data available to all interested parties almost simultaneously. Thirdly, their information-sharing capabilities support team decision making at low level. Every industry has felt at least some impact as computers and information systems have spread.

Turning to CBMIS, computer or network computing has become significant management tool within the last 10 to 20 years (Lane, 1999). Networked computing is the infrastructure for electronic commerce and it is rapidly emerging as the standard for business (Applegate, 2001). Network computing connects multiple computers and other electronic devices that are located in several different locations by telecommunicating network. This allow users to access information stored in several different physical locations to communicate and collaborate with people that may be separated by great geographic distances. Although some people still use stand-alone computers exclusively, vast majority of people use computers connected to a global network known as the Internet (Daniels, Radebaugh, & Sullivan, 2013).

Speaking on the necessity and importance of CBMIS, Kalakota and Whinston (1997) noted that the new breed of computing is enabling large numbers of organizations, both private and public, in manufacturing, agriculture and services to excel and survive. Also, answering the questions *why are companies resorting to E-commerce?* Mankin (1996) and Gill (1996) noted that the reason is simple – IT in general and in e-commerce in particular has become the major facilitator of business activities in the world today. IT has become a catalyst of fundamental changes in the structure, operations and management of organisations (Dertouzos, 1997 and McLearn & McLearn, 1999).

### **Building the Structure**

No system works on its own without some basic components. For example, the human digestive system has physical human parts like the mouth, the esophagus, the intestines and the anal canal as its structure. Equally, the human flesh and other organs in the body are hung on a structure called *skeleton*. In the same vein, for every CBMIS there is a large list of necessary

functionalities that constitute the system (Callon, 1996). The CBMIS is therefore anchored on computers and telecommunication components including the human elements, rules and policies.

These components are basically hardware and software. According to Leary and Leary (2005), there are five components that form the backbone of CBMIS. They listed and explained them as follows:

**Hardware** consists of all tangible elements of a computer system. Typical examples are the input devices, the components that store and process data and perform required calculations and the output devices that present the results to information users are hardware's. Input devices allow users to enter data and commands for processing, storage, and output. Common input devices include the keyboard, mouse, scanner, modem, microphone, touch screen, etc. Storage and processing components consist of the hard drive, diskette drive, Zip drive, and CD-ROM drive. The newer CD-RW or DVD-RW drives can write disks as well as read them. This small portable device can store up to 128 MB of data when plugged into a computer USB port (Boone & Curtz, 2006).

**Software** is all programmes, routine and computer languages that control a computer and tell it how to operate. Over 80 per cent of personal computers use a version of Microsoft's popular Windows operating system. Personal computers made by Apple use the Mac operating system. Handheld computers use either the Palm operating system or a special version of Windows called Pocket PC. Other operating system include UNIX, which runs many microcomputers, and Linux, which is available for free in the public domain (Boone & Kurtz, 2009).

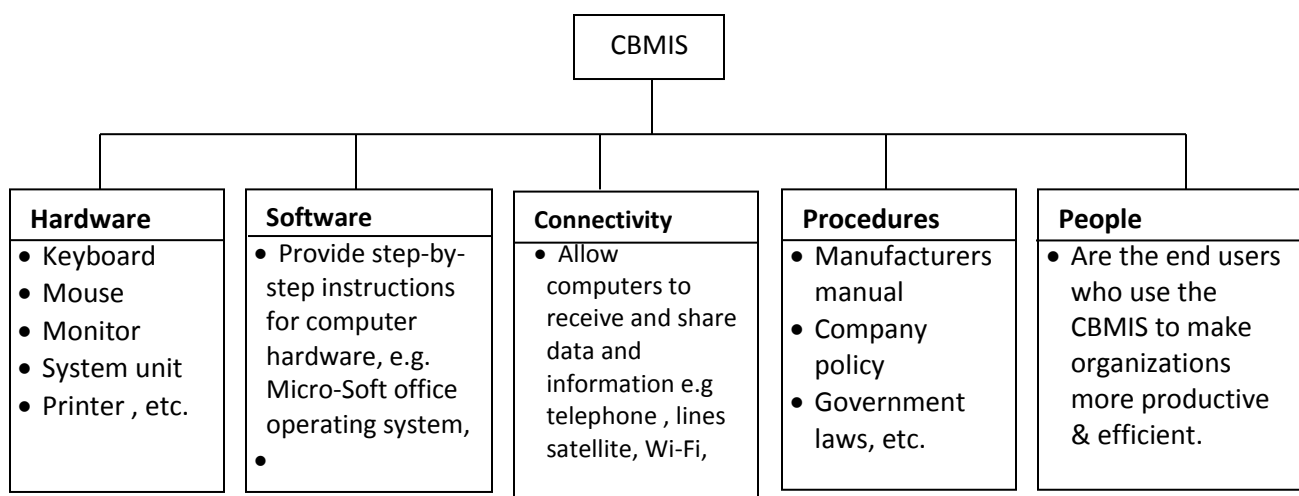
**Connectivity** allows computers to connect and share data and information. They are mainly communication facilities such as telephones lines, modulator (modem) and demodulators. It can also be cables and wireless means. All put together, connectivity facilities are called Information Technology (IT). Examples include telephone lines, coaxial wire, fibre optic, etc.

**Procedures** are the rules or regulation that guides people when using CBMIS such as the software's and hardware's manuals, policies guiding users and laws they should be aware of. While procedures and manual are written by software and hardware manufacturers, laws and policies do emanate from government and companies that have CBMIS.

**People** are the end users like you and me, who interface between the structure and the work environment. For organizations, they are mostly the employees who use the CBMIS to achieve the organisation's information management objectives.

These components put together will constitute an information system that is computer based. Figure 1 depicts this.

Figure 1: Components of CBMIS



Source: O’Leary and O’Leary (2005). *Computing Essentials*. McGraw-Hill Technology Education, Santiago. P.237.

Once organization is able to assemble these components, CBMIS is in place to capture, process, store, transmit and retrieve information for the organization locally or globally. However, this paper is of the opinion that these components may be adequate for effective CBMIS in Europe, America and other economically advanced economies, but they may not be too adequate in Nigeria’s setting where basic infrastructure like power and competent computer professionals are still in short supply. Therefore, it is the opinion of this paper that in Nigeria, the above five component may be elongated to include constant electric power supply and computer professionals to use and maintain the system.

### Networking the structure

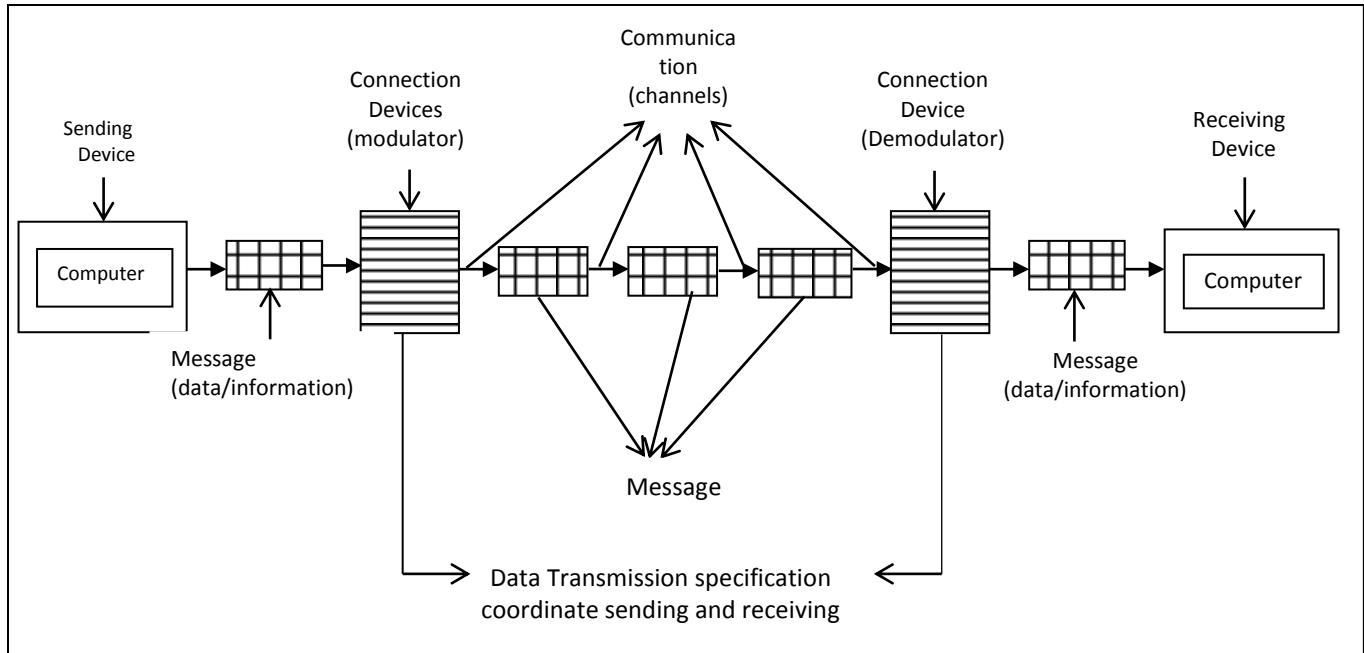
Though organizations still use stand-alone computers to process their data and information, majority are now using IT to link their offices and the Internet to enable them access the web resources. Computer network is the process of sharing data, programmes, and information between two or more computers made possible by connectivity (Senn, 2010). The basic technologies was listed and described by Hamel (2000) as follows:

- **Sending and Receiving devices** are often stand-alone computers. They can originate, send as well as accept (receive) messages in the form of data, information, and/or instructions. Typical examples here are handheld computers (handsets), desktop computers, laptops, etc.
- **Communication channel** is the transmission medium that carries the message. This medium can be physical or wireless. Examples of physical media are telephone lines, twisted pairs, cables, etc. Wireless channels include infrared, bluetooth, broadcast radio, satellite, etc.
- **Connection devices** are the technologies known as communication devices or IT. These devices interface between the sending and receiving devices. It converts outgoing data and information into forms which can travel across the communication channels. Example is the modulator and demodulator popularly called *modem*.
- **Data transmission specification:** These are rules and procedures that coordinate the sending and receiving devices by precisely defining how the message should be

packaged for it to travel across the communication channel seamlessly. Typical example here is file transfer protocol (FTP) or Internet protocol (IP).

These network components can be represented graphically as shown below:

Figure 2: Basic elements of CBMIS



Source: O’Leary and O’Leary (2005). *Computing Essentials*. McGraw-Hill Technology Education, Santiago. P. 237

Let us use the process of sending an email to illustrate figure 2. If you want to send an email to a friend, for example, you could create the message using your computer or handset following the protocol to compose and send emails. When you click the *send* button, the computer will send the message to the modem which is the connection device that converts the message into forms and formats that suits the transmission medium which could be physical or wireless. In a matter of seconds, the message then hits the connection devices (modem) at the other ends which in turn converts it (the message) to its original form and pass it to the recipient computer.

As noted in the illustration, the communication channel could be physical or wireless. Physical connections use solid medium to link the sending and receiving devices (McGonale & Vella, 1999). On the other hand and as the term implies, wireless connections do not used solid substances to connect the sending and receiving devices. Rather, they use air itself (Leary & Leary, 2005). We used Table 1 to bring together the physical and wireless transmission channels.



Table1. Physical and Wireless communication media.

Physical	Wireless
<p><b>Telephone wires</b> are usually strung on poles or pass through underground pipe. It consists of twisted pair which culminates in a wall jack into which one can plug phones and computers. Telephone lines have been the standard transmission medium for years for both voice and data transmission. However, they are now being phased out by more technically advanced and reliable media.</p>	<p><b>Infrared (Line-of-sight communication)</b> uses light waves to communicate over short distances. For example, infrared can be used to transmit data and information from a portable device such as between two mobile phones and notebook between desktop computers.</p> <p><b>Wi-Fi (wireless fidelity)</b> network that connects various devices allows them to communicate with one another through radio waves.</p>
<p><b>Coaxial wires</b> are high-frequency transmission cable which replaces multiple telephone lines with a single solid copper core. In terms of the number of telephone connections, a coaxial cable has over 80 times the transmission capacity of twisted pair. Coaxial cable is used to deliver television signals as well as connect computer in a network.</p>	<p><b>Bluetooth</b> like infrared is a short range wireless communication that uses microwave to transmit data over short distances of up to 33 feet. But unlike infrared and microwave, does not require line-of-sight communication, rather, it uses radio waves that can pass through nearby walls and other non-metal barriers.</p>
<p><b>Fibre-optic cable</b> transmits data as pulses of light through tiny tubes of glass. In terms of the number of telephone connections, fibre-optic cable has over 26,000 times the transmission capacity of twisted pair. Compared to coaxial cables, fibre-optic is faster, lighter, and more reliable at transmitting data and is rapidly replacing twisted pair and telephone lines.</p>	<p><b>Broadcast radio</b> uses special sending and receiving towers called <i>transceivers</i>. It sends and receives radio signals from wireless devices such as mobile phones, pagers, walkie-talkie, etc. to access the Web from remote locations.</p> <p><b>Microwaves</b> travels in a straight line over short distances. It is a good medium for sending data between buildings in a city or a large college campus.</p>

### Networking the structure

When an organization has been able to put in place these computing components, then it can communicate and share information using any of the media described above. Such organization is now ready as far as computer networking and sharing information and resources are concerned (Lane, 1999). A computer network is two or more computers linked to one another so that they

can exchange information and share resources within or outside the organization (Leary & Leary, 2005). For Baldauf and Stair (2009), computer networks connect computers, client, server, hub, network interface Card (NIC), network operating system (NOS), Network manager, etc. These specialized terms were described by Baldauf and Stair as follows:

- **Node** is device that is connected to a network. It could be input or output devices such as microcomputer, mouse, speakers, modem, telephone line, camera, printer, etc. For example, our mobile phones are nodes to a communication network.
- **Client** is a node that requests and uses resources available from other nodes. Typically, a client is a user's microcomputer.
- **Server** is a node that shares resources with other dedicated server which specializes in performing specific tasks, and depending on the specific task, they may be called an application server, communication server, database server, file server, printer server or web server, etc.
- **Hub** is a center or central node for other nodes. This device can be a server or simply a connection point for cables from other nodes.
- **NICs** are expansion cards located within the system unit that connects computers to a network, e.g. browsing modem.
- **NOS** mean network operating system. Controls and coordinates the activities of all computers and other devices connected to a network.
- **Network Managers** are computer specialist, also known as network administrator, responsible for efficient network operations and implementation of new networks. Their roles in monitoring the use and maintaining the systems are very crucial. A Network Manager is someone who is capable of understanding and harnessing technology in such way that the company can communicate internally and externally in seamless operations (Boone & Kurtz, 2006).

### **Network types**

Computer Networks in organizations have evolved over time to increase business activities, efficiency and effectiveness (Lane, 1999). Business activities and transactions are now moving from brick-and-mortar stores to on line virtual stores ( Kings, Lee, & Chung, 2002). Most large organizations now have a complex and wide range of networks. They now apply Internet technology to support business operations, and communicate within and between organizations using *Intranets* and *Extranets* networks (Senn, 2010).

### **Intranets and Extranets**

Intranet is a private communication network within an organization that resembles the Internet. Like the public Internet, Intranets uses browsers, Websites, and Web page (Porter, 2001). Intranets typically provide email, mailing lists, newsgroup, etc and accessible to members of the organization only. For example, it can be observed that all the banks in Nigeria, except perhaps,



the micro-finance banks have their own intranet they use to communicate within and between their branches.

Extranet on the other hand, is a private network that connects *more than one* organization using Internet technologies. According to Porter (2001), this allows for example, suppliers and distributors to have limited access to the organisation's networks they deal with. The purpose is to increase efficiency and reduce costs. Docktor (2002) cited example of General Motors, a company in America that has thousands of suppliers for the parts that go into making their automobiles. By having access to the production schedules, suppliers can schedule and deliver parts as they are needed at the General Motors assembling plants across the globe. Again, it should be noted that these networks generate, process and transmit lots of data and information thus making CBMIS to be imperative.

### **Protecting and Securing CBMIS**

Security of business documents, records and information is one major aspect of the traditional or paper based management information system (PB MIS). It often present a big challenge to organizations because, in spite of their efforts, information still gets leaked, documents still get lost, intercepted, forged, destroyed by fire, flood or deliberately mutilated for sinister purposes.

However in CBMIS, the challenge for securing data and information is even greater than in the past (Daya, 1996). A computer system consists not only of hardware, software, procedures but also people and because there are people, computer systems have been used for both good and bad purposes (Baldauf and Stair, 2009). While everyone agrees that technology had very positive impacts on human lives, it is important to recognize the potentially negative influence as well (Mell & Wack, 2000). For example, a network administrator in one of the first generation banks instructed the bank's computer network to deduct (pinch) and move all the *kobo* fractions in all customers account at the bank to a specified account opened in his name. In a matter of seconds, huge amount of money was accumulated in that account which he then withdrew in bulk (Balogun, 2014). The other half of this paper will therefore focus on the threats and challenges facing the implementation of CBMIS.

Effective deployment of CBMIS involves maximizing its positive effects and minimizing its drawbacks. The most significant of these drawbacks are the issues of privacy, security, ergonomic and the environment (King, Lee & Chung, 2002). For them, privacy is concerned with how personal and organisations' data/information are collected and used. Security challenge involves how to keep data/information safe from ordinary/computer criminals, natural disasters, and civil unrest. Ergonomic tries to minimize the effects of computer on people's physical health, while environment issue look at the impact of ICT on the environment such as e-waste. However, for this paper not be unduly lengthy the focus here will be on security.

### **Securing CBMIS**

Once business operations have moved online it can be likened to someone moving from a small village with very small population and little socio-economic and political activities to a very big city with large population and sophisticated economy. While the business access to large market is dramatically increased so is its exposure to all kinds of risks. In the same vein, when a stand-alone computer is connected to the Internet it becomes visible to billions of Internet users and

also a target to millions of viruses and computer criminals popularly called *hackers* (Scanbray, McClare & Curtz, 2000).

The two major threats that faced CBMIS is how to protect the system from viruses/worms and hackers' attacks. Virus and worms' problems have not only made many computers and websites to shut down but also, computer criminals have made individuals and corporate bodies to lose billions of dollars. Equally, hackers are wrecking havocs on organization's network on daily basis.

### Computer viruses/worms

Virus is a programme that attaches itself to a file, spread to other file and delivers a *payload* which Baldauf & Stair (2009) described as their disruptive activities. They can corrupt computer files, data and information. In severe cases, the damage could be the total loss of data and breakdown of the system (crash). As shown in table 2, Baldauf and Stair provided an overview of the most common types of viruses and their payloads.

Table 2: Varieties of Viruses

Virus	Description
Boot virus	Infects a computer start-up programme so that the virus becomes active as soon as the computer starts up.
Direct action virus	Drop payload and spreads when defined condition are met; can usually be removed without damages to infected files using anti-virus software.
Directory virus	Changes the paths that indicate the location of file on the computer system.
Encrypted virus	Encrypt itself so as to be hidden from scans, decrypt itself before performing its task.
File virus	Attaches to other software so that the virus instructions are processed along with the software instruction.
Logic bomb	Delivers its payload when certain system's conditions have been met, for example the absence of an employee's name from the corporate database.
Macro virus	Infects macros embedded in data files created with other software. Infects and spreads to other files viewed by that software.
Multipartite virus	Creates multiple types of infections using several techniques thus making the virus difficult to detect and remove.
Overite virus	Delete information contained in the files. It infects and renders them partially or totally useless.
Polymorphic virus	Encrypts itself in different forms every time it infects a system, making it very difficult to detect.
Resident virus	Hides permanently in the system's memory controlling and intercepting all systems operations.
Time bomb	Delivers its payload when the system date and clock reached a specified time and date.

Source: Baldauf & Stair (2009) *Succeeding with technology: Computer system concepts for real life*, Centaga Learning, USA. P. 420.

On the other hand, worms are a special type of virus that does not attach itself to programs and data bases, rather, it fills a computer system with self-replicating information which clog the system so that its operations are slowed or stopped (Leary & Leary, 2005). Table 3 show some variety of worms.

Table 3: Variety of worms

Name	Description
Apology-B	Follows every outgoing emails with a second email containing Virus.
KuKworm	Automatically attaches to outgoing emails.
Love Bug	Recreates itself through Microsoft outlook; rename files.
Stages-A	Copies itself on all available network drives.
Thus	Deletes data on December 13 <sup>th</sup> .

Source: Baldauf & Stair (2009) *Succeeding with technology computer system concepts for real life*, Centage Learning, USA. P 423

### Hackers/cracker

Computer criminals are those who gain unauthorized access to a computer system or theft of system resources for personal use (Senn, 2010). Over time the terms *hackers* and *crackers* have become associated with computer crimes. However, King *et al* (2002) asserted that, originally, the term hacker referred to a shared culture of expert programmers and networking wizards that worked on the first time-sharing minicomputers and the earliest APERNET experiments. But with time, the terms came to be applied to rogue or network wizards who illegally broke into computers and its networks for malicious purposes. King et al also opined that crackers are people within the Internet community who engage in unlawful or damaging hacking. Unlike hackers whose motivation may be professional or community enhancement, the motivation of crackers is *generally to cause mischief, create damage or to pursue illegal activity such as data theft or vandalism*. These hackers or crackers could be organization's employees, outside users, organized crime groups, etc. Table 5 briefly states and describes some of these criminals.

Table 4. Other types of computer criminals

Computer criminal	Description
Organisation's	The largest category of computer criminals are some organization employees that use them to perform their daily assignments therefore they consist those with the easiest access to organization's computers and network. Most time they steal hardware, transfer fund illegally and

Employees	sabotage activities.
Outside users	Not only employees but also some suppliers, clients/customers may have access to a company's computer system or network. Example are bank customers who use their automated teller machine and online banking facilities. Like employees, these customers may be able to obtain confidential passwords and begin to transfer funds from one account to another.
Organised crime Group	Members of organized crime group have discovered that they can also use computers just as people in legitimate businesses do, but for illegal purposes. For example, computer are now used for online recruitment, but fraudsters have illegal recruitment portals which requests applicants to buy scratch card and log in to apply for almost non-existent jobs
Terrorists	Knowledgeable terrorist groups and hostile government could potentially crash satellites and wage economic warfare by disrupting navigation and communication system. For example, FBI (2010) reported that its computer systems were probed approximately 250,000 times in a year by unknown sources.

### Effects of computer criminals

The types of crimes these categories of criminals can commit are numerous and unimaginable. However, the most common ones are writing and distributing viruses/worms, denial of service attacks, Internet scams, theft and data manipulations (Leary & Leary, 2005).

**Denial of service (DoS) attacks.** Like worm, DoS attacks attempts to slow down or stop computer system or network. However, unlike worms that self-replicate, a DoS attack floods a computer or its network with requests for data. Once under attacks, the server at the ISP or the Website becomes overwhelmed with requests and therefore unable to respond to legitimate users. As a result, the ISP or Website is effectively shut down. The targets of this attack are usually Internet Service Providers (ISPs) and Website.

**Internet scam.** A scam is a fraudulent or deceptive act or operations designed to trick individuals into spending their resources (time and money) or giving away vital information. Internet scam is therefore a crime committed using the Internet. For example, requesting job applicant to go and buy scratch cards to apply for one or two vacant posts that may not be existing in organizations. Table 5 lists some types of Internet scams.

**Table 5: Types of Internet Scams**

Types	Description
Identity theft	Individual(s) pose as ISP, bank's representatives, or government agency requesting personal information. Once obtained, criminals assumed these identities for variety of financial transactions.
Chain letter	Classic chain letter instructing recipients to send nominal amount of money to each of five people in a list. The recipient will remove the first name in the list, add his name at the bottom and mails the chain letter to five friends.
Auction fraud	Merchandise is selected and payment sent. The merchandise is never delivered.

Vacation prize	<i>Free</i> vacation has been awarded. Upon arrival at vacation destination, the accommodation is dreadful but can be <i>upgraded</i> for a fee.
Advance fee loans	Guaranteed low rate loans available to almost anyone. After applicants provide personal loan related information, the loan is granted subject to an <i>Insurance fee!</i>

Source: Baldauf and Stair (2009) *Succeeding with technology computer system concepts for real life*,  
Centage Learning, USA.

## Conclusion

There is no gainsaying the fact that ICT now rule the world, particularly in the area of business operations and management. ICT has enabled CBMIS to replace the PBMIS and organizations are struggling daily to catch up with the trend.

In a bid to enlighten our readers, the paper discussed the major components, which we called the backbone of CBMIS to manage organisation's business information. It also discussed how these components could be linked to the global village (Internet) for it to access and explores the information super highway.

Establishing CBMIS with its numerous advantages is now imperative for organizations but making sure it works seamlessly and protected from computer viruses and criminal hackers are the challenges that do come with it. The second half of the paper dealt with these major threats and their activities which information officers in organizations are to watch out for.

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