Information Systems and Management Information Systems: The backbone, sustenance and accomplishment of modern business.

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ABSTRACT

Information System (IS) has always been mixed up and confused with Management Information System (MIS) by many Information Technology professionals, and even in definitions ascribed to them thereby puzzling many users of Information Technology (IT). It should however, be noted that IS deals with the generality of the process of generating information from data; and MIS is definite about information generation for the use of management to enable them to efficiently / effectively plan, organize, direct, control and govern organisations. Any organisation lacking good IS and MIS for effective management of its functions / activities would be seriously handicapped, and as such could be doomed for collapse. Many modern organisations may be culprits of possessing the needed information for effective management of their enterprise, thereby denying the establishment of achieving its goals. It is a fact that achievement of organisational goals are synonymous with success of the enterprise, and management is required to attain the goals established with the directors of the company.

Key words: Information System, Management Information System, Technology, Backbone, Sustenance and Accomplishment.

INTRODUCTION

Information Systems (IS) and Management Information Systems (MIS) could better be explained when 'Data', 'Information', and 'System' are thoroughly explained, as these are catalysts which promote the understanding of IS and MIS. *Data,* as an input for generating information, is defined as a raw material, figure or fact (Kwadade-Cudjoe, 2015); examples are: 20, David and Kofi. Data is therefore, meaningless but very useful, as without data, one cannot generate information (Kwadade-Cudjoe, 2015). *Information*, on the other hand, is processed data which **is meaningful to the user** (Kwadade-Cudjoe, 2015). The emphasis here, 'is meaningful to the user'.

As a matter of fact, it is only the user of information generated from processed data, who can tell whether the processed data is meaningful or not. Example of information is 'David Kofi Mensah who is a student of the Knutsford University College, Ghana, is 20 years old'; this statement absolutely makes sense, as distinct from '20', 'David' and 'Kofi' cited above as examples of data. Unfortunately, but candidly, if the processed data is not meaningful to the user, the result from the processed data is still data; there should be no confusion about this at all!

Furthermore, a *system* is a group of related components that interact to perform a desired task or a set of things working together as parts of a mechanism or an inter-connecting network to achieve a desired goal, objective or aim (Hornby, 2001). Examples are human and computer systems. Every human being has many parts, e.g. eyes, ears, nose and head, and these parts work together to make a human being complete. Similarly, a computer system has different

parts, e.g. Memory, Control, Arithmetic & Logic units, Printer, Screen and Keyboard, and these parts work together to make a computer system.

DEFINITION: IS AND MIS

Information System (IS) could be defined as the integrated set of components for facilitating the collection, controlling, organising, storing / retrieving and processing of data into information. Management Information System (MIS), on the other hand, is the information on the people, technology and the organisation, and the relationships amongst them to ensure overall efficiency of the system (Nowduri, 2011). Through this relationship, MIS can provide vital information, which as a resource can help management to efficiently plan, organize, direct, control (Dessler, 2004; Hitt, Black & Porter, 2004) and govern (OECD, 2004) organisations. Cognizance should however, not be lost that 'people' in the definition of MIS includes employees, customers and consumers of the organisation, as they are equally important stakeholders just like the management and shareholders of the organisation.

Explanation of IS and MIS

According to Nowduri (2011), MIS can be described as people-oriented, as it is through **people** who use the facility on the activities of businesses, but with emphasis on service through technology, to provide the needed results. Though Nowduri describes MIS as people-centered, unfortunately, the **people** are limited to only those working in the organisation. It is important to consider and include the missing gap of knowledge of customers / consumers who are equally important and also stakeholders within the business environment, and as one of the revered stakeholders (OECD, 2004) for successful business. Customers patronize the products and services of the organisation, and as such are one of the important stakeholders within the organisation to be considered when evaluating the business environment. Hence, when the information on their purchase records is monitored, it can lead to improvement and hence contribute to the growth of the organisation.

For a business therefore, to function properly and report on its activities accurately, there is the need for **people** of the organisation to use information at the various levels of operation (including purchases by customers), by collecting, controlling, organising and storing the data generated from these levels. Subsequently, retrieving and processing the stored data will generate information, from which the needed reports would be produced for effective decision-making by management of the organisation.

The reports (or output) has variously been called different names; however, data that is processed to help management make meaningful, effective and timely decisions is called **Information** (Institute of Information Technology, 1996). Information is vital for the effective management of organisations. Businesses become crippled when they do not have the information needed to help define and report on the operations performed.

In this technological age, competition among organisations is keener and more pronounced for competitive advantage (De Wit & Meyer, 2004). Therefore, an enterprise that lacks information for accurate reporting on activities performed, would be crippled, and doomed to collapse. Subsequently, that organisation may be wiped out entirely. This might however, be one of the bones of contention that has led to greater number of businesses dying-off early, instead of surviving the start-up phase to enable them to offer the needed products and services to clientele.

Review of IS and MIS

Academically, IS and MIS actually came out of 'System Thinking' idea which was initiated by Peter Senge in the 1920s within several disciplines, for example, Biology and Engineering, due to the inability of scientific analysis to explore these disciplines (Senge cited in Really Learning, 2012). 'System Thinking' apparently introduced the inter-relationships and inter-relatedness (whole) between different processes / activities rather than the cause-and-effect concept popularly known at that time.

According to Sachenko (2012), the intense competition among organisations in the 1990s, might have led to further development of the 'Systems Thinking' idea through the Systems Life Cycle concept to building information systems to become an integral component of business processes / activities; this enabled organisations to gain competitive advantage in the market-place globally. During this time, the grouping of different information management methods linked to the automation of human decision-making activities (Nowduri, 2011) became vogue, and IS emerged. It was from the IS that, for example, Transaction Processing System (TPS), Expert Systems (ES), Management Information System (MIS) and Decision Support Systems (DSS) materialised. According to Nowduri (2011), IS could be categorized into three main groupings, namely:

- Transaction Processing Systems (TPS),
- Expert Systems (ES), and
- Management Information Systems (MIS).

TPS is a computer processing in which the computer responds immediately to user requests. Each request is considered to be an activity that needs performance. Transaction processing requires interaction with a user, and is normally divided into individual, indivisible operations, called transactions. Each transaction must succeed or fail as a complete unit; it cannot be only partially complete. Automatic Teller Machines (ATM) for banks is an example of transaction processing (Nowduri, 2011).

ES are computer programs that simulate the judgement and behaviour of a human or an organisation that has expert knowledge and experience in a particular field. Typically, such a system contains a knowledge base of accumulated experience and a set of rules for applying the knowledge base to each particular situation that is described to the program. Among the best known expert systems are those that play chess and systems that assist in medical diagnosis (Nowduri, 2011).

Nowduri (2011) has specifically informed that MIS has several subsets for example:

- Decision Support System (DSS), and
- Executive Information System (EIS).

DSS is user-friendly software that is versatile for analysing an organisational business inputs (data) by modelling the various decision-scenarios based on the condition / situation existing at any particular time of using the inputs (Nowduri, 2011; Rouse, 2012). DSS therefore, as an informational application system takes data (inputs) for modelling and produces answers for solving business problems and queries. The input that gives the best answer for solving, for example, business problems, becomes the input for developing your decision. This makes MIS an important business tool and a powerful resource for assisting corporate management in taking strategic business decisions to achieve organisational sustainability and competitive advantage (De Wit & Meyer, 2004; White, 2004).

EIS is another type of MIS that facilitates and supports senior executive information and decision-making needs. It provides easy access to internal and external information relevant to organisational goals. EIS emphasizes graphical displays and easy-to-use user interfaces. They offer strong reporting, and with powerful capabilities. In general, EIS are enterprise-wide DSS that help top-level executives analyse, compare, and high-light trends in important variables so that they can monitor performance and identify opportunities and problems (Nowduri, 2011). However, in recent years, the term EIS has merged with Business Intelligence (BI). BI is a set of theories, methodologies, architectures, and technologies that transform raw data into meaningful and useful information for performing business activities, including decision-making by management (Nowduri, 2011).

Technology as the innovation that drives IS and MIS

This section explains *how* IS and MIS are developed. Technology, according to Hornby (2001), is scientific knowledge consisting of instructions, which are written and embedded in a machine to solve a problem, example, organisational problems. IS and MIS create the environment through which technology (example, computer system) can be used to solve organisational problems. IS and MIS are produced through the use of technology, as it is through the help of technology that data, a raw material, could be processed to produce information.

According to Gaines, Hoover, Foxx, Matuszek and Morrison (2012), MIS that is properly designed and implemented has become a valuable strategic resource for improving organisational competitive advantage. Every manager needs to make effective decisions so as to be able to efficiently run the organisation. However, a manager could only make effective decisions when s/he has at her / his disposal an effective MIS. A lot of organisations, including Microsoft, Dell and IBM have used technology to develop good working environment of IS and MIS to carve a niche, create higher-market-share, and been able to achieve competitive advantage for their organisations (Thompson & Strickland, 2001).

Modern global businesses, for example Multinational Conglomerates (MNCs), thrive on the use of technology. Technology, as one of the institutional-based drivers (Peng, Wang & Jiang, 2008), helps MNCs to produce effective IS and MIS and assert themselves internationally for competitive advantage in their industries (Thompson & Strickland, 2001). Business computer systems that originated from technology were earlier used primarily for relatively simple operations, for example, payroll and general ledger preparation. Now the operations are complex, as larger amount of data is processed into desired information (outputs) for management decision-making activities.

The computer system, according to Hornby (2001) is a versatile programmable machine, which automatically carries out arithmetic and logical operations on data fed into it to produce information (output). A lot of applications have been created from these outputs for different assignments based on management needs within the enterprise. However, the most popular application for management decision-making activities is MIS, because of its versatility for solving organisational and managerial application problems and queries. MIS however, may variously be referred to, as Database Management Systems, Enterprise Resource Planning and Customer Relations Management (Nowduri, 2011).

RESOURCE MANAGEMENT INFORMATION SYSTEMS

The importance of (the) *where* IS and MIS have been in use (or resourced) is expounded in this section. Resource Management Information Systems (RMIS) are databases that contribute to

the processing and managing of specialized managerial tasks as opined by the Institute of Information Technology (1996). RMIS may be developed for general use (normally purchased *off-the-shelf*, i.e. at the counter), in-house or by a contractor for a specific functional task, making the software *tailor-made (*or *custom-made)*. Business Process Re-engineering (BPR) is one of the areas, where specialized databases are recommended for achieving dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed to maximize value-added content of businesses, thereby enhancing their competitive advantage (Hammer, 1990; White, 2004).

Methods of designing Database
There are three main approaches for designing databases – Hierarchical, Network and Relational Database Management System (RDBMS) - but the latter gives the best relationship among the data elements, for example, one-to-many and one-to-one relationships (Institute of Information Technology, 1996). It is therefore, the recommended approach for developing databases (Brookes, Grouse, Jeffery & Lawrence, 1982). Nevertheless, other approaches are still emerging, for example NoSQL – Not only SQL, which is becoming popular with big data management. However, according to Ballard (2019), the NoSQL databases will not be able to do the job because, they have limited functionality and reliability to improve upon data quality.

Evaluation of Databases
Reviewing RMIS and databases will help in explaining their importance to management decision making. This would help to hammer the usefulness of IS and MIS for managers to effectively / efficiently plan, organise, direct, control and govern (Dessler, 2004; OECD, 2004; Hitt et al., 2004) operational performances for growth of their business.

Information on three examples of where RMIS / databases have been in use is reviewed below to illustrate the importance of IS and MIS for efficient management decision-making activities.

a. Airline Management Information Systems (AMIS)
This is a database for airline aviation industry, especially the management of the industry. The operative function of airlines is to move people and goods from one location to another, and safely on time. There are different opinions and expectations about the service (ScdlPune, 2020).

One set of people believe in good service, convenience, prices, seat comfort, meal quality, treatment by the crew and the ground staff, including the facilities at the airport (ScdlPune, 2020).

Another set of people have a perception of a unique service, the pre- and post- travel periods. This means assistance in the travel arrangement, arranging the hotel accommodation and surface travel to and from the airport (ScdlPune, 2020).

A third set of people believe in the service of solving passengers' problems immediately at the front desk with no hassle of moving from counter to counter (ScdlPune, 2020).

There may be others with different perceptions, other than those stated above.

However, the MIS application for the airline industry should be able to support all decisions from these different set of people. This would make the airline database provide the objective of offering a distinctive service to the different set of customers, having different expectations and perceptions (ScdlPune, 2020).

b. Energy Management Information Systems (EMIS)

This is a database used in the energy industry which shows a 17-year serial production report (1989-2005) of, for example petroleum products, consumption and exports, and developed by Energy Planning and Policy Office – EPPO (2015) of the Ministry of Energy, Thailand. Furthermore, EPPO (2015), Ministry of Energy, Thailand sees energy, a natural resource, playing a crucial role for mankind, and accordingly made it a fundamental factor for national development. The Government therefore, established the EPPO to oversee and formulate policies and plans, as well as make recommendations regarding energy measures, so as to effectively satisfy energy needs of the country, leading to sustainable energy security. Consequently, EPPO, Ministry of Energy, Thailand, developed the EMIS, which gave out a 17-year serial report (1989-2005) of petroleum products produced (EPPO, 2015). See Appendix 1 for sample database report from the EPPO, Thailand.

3. Statistical Management Information Systems (SMIS)

This is a database used by the Presbyterian Church of Ghana – PCG (2015), and has been in use for producing the Church's statistics since 2002. The SMIS of the PCG (2015) was developed in Visual Basic and MS-Access, and also uses the RDBMS approach. The Church restructured its Administration in 1992, and created a national committee on Information Management, Strategic Planning and Statistics (IMSP&S) under the Department of Administration and Human Resource at the General Assembly Office (PCG, 2015). In order to improve upon the Church's decision-making activities, the committee decided to re-engineer the production of its membership statistics (from Excel Worksheets to Visual Basic and MS Access) by using technology to enhance its information processing, management and decision making (PCG, 2015). Consequently, the committee developed a membership SMIS which captures data on the membership of the Church in the form of generational groups of Children, Junior Youth, Youth, Young Adult and Adults (all in male and female groupings), and produces three reports for management decision making activities. One of the reports is a PCG Membership report, which gives globally, details of the seventeen (17) Presbyteries, fifteen (15) in Ghana and two (2) in North America / Australia and Europe within the PCG Church (PCG, 2015). See Appendix 2 for a sample database report from the PCG, Ghana.

Relationship and similarities between IS and MIS

Information Systems (IS) and Management Information Systems (MIS) are computer applications created to help the organisation (including management), to function efficiently and effectively. Both are developed with the use of technology, especially, the computer system. Information Systems, as defined earlier, is an integrated set of components that facilitate the collection, controlling, organizing, storing / retrieving and processing of data to produce information ((Nowduri, 2011). The information produced from the processed data is, normally stored in the computer system and retrieved later for use whenever needed.

The above business processes are automated, and the three (3) main types of Information Systems, which are used within the organisation are: Transaction Processing Systems (TPS), Expert Systems (ES) and Management Information Systems (MIS), as mentioned earlier. TPS is a type of computer processing in which the computer responds immediately to user requests. ATM used by the Banks is one example of TPS. ES are computer applications that simulate the judgement and behaviour of humans, in a particular professional field. A good example is a computer application that assists in medical diagnosis of patients in a hospital. MIS is the third type of Information Systems, and it is information on the people, technology and the organisation, and the relationships amongst them for their efficient use (Nadowli, 2011). MIS

deals specifically with management information needs, and examples are: Decision Support System (DSS) and Executive Information System (EIS).

DSS is a user-friendly informational application system that takes various inputs (data) for modelling and, from which is derived the input that would produce the best output (answer) to solve a business problem or query. A good example is the consequences of different decision alternatives, given past experience, from which one consequence would give the best decision. EIS is also a type of MIS that facilitates and supports senior executive information and decision-making needs. It emphasizes graphical displays and easy-to-use user interfaces; thereby offering strong reporting with powerful capabilities to help top-level executives analyse, compare, and high-light trends in important variables so that they can monitor performance and identify opportunities and problems within the organisation.

DIFFERENCES BETWEEN IS AND MIS

There are differences between IS and MIS, and some are:

i. MIS is limited to management information needs, whilst IS is normally general, in the sense that, it is concerned with the generation of information from data for general organisational use;

ii. MIS is one aspect of IS, whilst IS has many types, including MIS;

iii. MIS is very popular within the IT environment, whilst IS is not too familiar to many people, even users of information within the organisation;

iv. MIS may be a specialization course within an institutional IT Department, whilst IS is a general program students could offer at the university; and

v. MIS is concerned with the information on the effective relationship among people, technology and the organisation, whilst IS deals with the processes (collection, controlling, organising, storing / retrieving and processing) associated with deriving information from data.

CONCLUSION

In this technological age, there is no gain saying that every organisation needs to have efficient / effective IS and MIS to enable it to effectively manage its operations, as competition among enterprises is keener for competitive advantage. Though there are similarities and differences between IS and MIS, however businesses need good and adequate IS and MIS to enable them operate efficiently. It is a fact that businesses without the needed information for effective / efficient reporting on operations and decision-making, due to inadequate IS and MIS are crippled, and therefore, doomed to collapse. A lot of organisations are not sustainable, and are dying-off these days, possibly due to lack of requisite information for effective and efficient reporting and decision-making activities.

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APPENDICES

Appendix 1

Year	Gasoline	Regular	Prem.	Kero	Diesel	Hsd	Lsd	Jp	Fuel Oil	LPG	Total
1989	4.1	3.9	0.2		5.4	5.4					9.5
1990	9.3	8.5	0.8		14.5	14.5					23.8
1991	16.7	16.0	0.7		17.4	17.4		0.3		0.2	34.6
1992	105.6	104.5	1.1		23.3	23.3		6.2		59.4	323.4
1993	304.2	301.5	2.7	0.3	54.1	54.1		7.2	19.5	87.2	830.8
1994	239.4	235.1	4.2	0.4	71.2	71.2		9.6	25.5	27.0	683.6
1995	274.0	255.8	18.2	0.3	87.3	87.3		13.6	44.5	187.9	968.9
1996	1,236.8	705.3	531.5	39.1	1,071.1	1,071.1		195.4	1,014.8	364.5	6,229.6
1997	1,948.7	935.0	1,013.6	13.7	1,953.1	1,953.1		277.5	715.2	872.7	9,682.6
1998	1,716.1	635.8	1,080.3	26.3	2,203.2	2,203.2		236.8	199.4	873.3	9,174.4
1999	1,708.5	486.3	1,222.3	302.2	1,976.0	1,976.0		820.8	330.8	1,346.1	10,169.0
2000	1,235.6	463.1	772.4	391.7	1,676.8	1,676.8		816.4	769.3	1,240.5	9,042.6
2001	1,480.6	382.8	1,097.8	394.7	1,647.4	1,643.9	3.5	487.8	1,535.9	1,403.3	10,077.7
2002	1,230.4	220.9	1,009.5	318.5	2,331.6	2,331.6		920.7	766.8	1,269.9	10,399.9
2003	1,108.3	251.1	857.3	109.4	2,148.2	2,148.2		558.0	779.9	1,426.1	9,386.5
2004	1,359.5	316.5	1,043.0	58.9	2,381.6	2,381.6		367.1	1,078.3	1,648.6	10,635.1
2005	2,021.90	738.50	1,283.40	3.80	1,809.00	1,809.00		599.30	903.40	1,755.30	10,923.6

Export of Petroleum Products in million litres
Sample EMIS Database Report from EPPO
Source: Ministry of Commerce, Thailand

Appendix 2

No	Rpt Date	Presbytery	Ch-m	Ch-f	CH-T	JY-m	JY-f	JY-T	Yth-m	Yth-f	Yth-T	YAdm	YAdf	YAd-T	Adt-m	Adt-f	Adt-T	TOTAL	Tprvyr
1	31-Dec-11	XXXXX	8,684	12,145	20,829	4,705	6,500	11,205	4,899	6,778	11,677	3,203	4,836	8,039	9,703	19,544	29,247	80,997	74,562
2	31-Dec-11	XXXXX	12,813	16,550	29,363	6,160	8,322	14,482	7,074	9,633	16,707	5,465	7,761	13,226	12,231	20,723	32,954	106,732	100,911
3	31-Dec-11	XXXXX	2,246	3,069	5,315	1,109	1,493	2,602	959	1,282	2,241	623	1,222	1,845	2,032	4,454	6,486	18,489	17,552
4	31-Dec-11	XXXXX	5,292	6,974	12,266	2,671	3,881	6,552	2,195	3,027	5,222	1,142	2,061	3,203	7,224	15,408	22,632	49,875	48,783
5	31-Dec-11	XXXXX	2,421	3,126	5,547	1,157	1,466	2,623	1,154	1,498	2,652	719	1,165	1,884	2,992	6,643	9,635	22,341	22,254
6	31-Dec-11	XXXXX	18,396	23,191	41,587	9,654	14,032	23,686	11,202	16,079	27,281	6,988	11,138	18,126	20,351	40,416	60,767	171,447	170,884
7	31-Dec-11	XXXXX	5,487	7,302	12,789	2,874	3,947	6,821	3,028	4,452	7,480	2,260	3,647	5,907	4,835	9,253	14,088	47,085	44,419
8	31-Dec-11	XXXXX	3,882	5,023	8,905	1,956	2,472	4,428	2,511	3,014	5,525	1,891	2,575	4,466	3,785	5,610	9,395	32,719	30,777
9	31-Dec-11	XXXXX	1,833	2,494	4,327	845	1,133	1,978	812	999	1,811	388	650	1,038	1,898	3,423	5,321	14,475	13,668
10	31-Dec-11	XXXXX	3,319	4,356	7,675	1,532	1,972	3,504	1,483	2,556	4,039	899	1,432	2,331	3,240	7,081	10,321	27,870	26,215
11	31-Dec-11	XXXXX	2,173	2,962	5,135	1,101	1,552	2,653	1,069	1,455	2,524	717	1,176	1,893	2,188	4,739	6,927	19,132	18,577
12	31-Dec-11	XXXXX	4,605	5,861	10,466	2,149	2,468	4,617	2,271	2,918	5,189	1,391	2,079	3,470	4,215	8,183	12,398	36,140	34,354
13	31-Dec-11	XXXXX	869	1,026	1,895	522	677	1,199	665	823	1,488	444	505	949	629	895	1,524	7,055	6,170
14	31-Dec-11	XXXXX	4,389	5,681	10,070	1,725	2,422	4,147	1,755	2,506	4,261	925	1,737	2,662	2,851	6,331	9,182	30,322	28,294
15	31-Dec-11	XXXXX	4,890	6,566	11,456	2,677	3,706	6,383	2,021	2,855	4,876	1,688	2,664	4,352	3,888	7,780	11,668	38,735	37,601
16	31-Dec-11	XXXXX	81	94	175	40	45	85	24	39	63	26	48	74	559	806	1,365	1,762	781
17	31-Dec-11	XXXXX	1,893	2,504	4,397	1,378	1,811	3,189	1,312	1,664	2,976	732	1,477	2,209	790	2,862	3,652	16,423	16,147
Grand Total:			83,273	108,924	192,197	42,255	57,899	100,154	44,434	61,578	106,012	29,501	46,173	75,674	84,411	164,151	247,562	721,599	691,949

PCG Presbytery Report
Sample SMIS Database Report from the PCG, Ghana
Source: Presbyterian Church of Ghana (PCG), Head-Office, Accra. Ghana.