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A THEORETICAL FRAMEWORK FOR DESIGNING AN INFORMATION SYSTEM FOR BUSINESS ENTERPRISES

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Abstract

The purpose of this study is to demonstrate the importance of theory in Information system design. A business information system for business enterprises has to have firm conceptual background and theoretical framework if the rate of information systems failures is to be handled head on. This paper emanates from a recent Ph.D study in the University of South Africa in which a Business Information System Design for SMEs in Northern Uganda was designed. Based on that study it was discovered that many business information systems do fail because of a number of factors and prominent among them is the failure to follow well grounded logical steps in the IS design. This paper is therefore based on the literature review carried out and the authors' viewpoint. This paper recognises the need for clear understanding of the value of information as an ingredient for productivity and gives the IS design strategy that any BIS designer need to adopt and follow. The failure of IS in most developing countries is worring. This paper highlights well established conceptual and theoretical grounding necessary for designing BIS.

Keywords: *Information Systems Design, Business Enterprise, Information System*

Introduction

This study provides the background to understanding the key concepts and theories that any one who intends to design a business information system (BIS) need to know. Conceptual issues are examined and the theoretical background to information system (IS) design is explained by highlighting the important concepts and theories that can underpin the design approach. An examination of concepts and relevant theories on information systems provides the basis and framework for an empirical analysis of the subject matter of business information study.

Theory and Theoretical Frameworks

A theoretical framework is an orientation or paradigm that is rooted in a system of perception articulated in a theory. By "system of perception" we mean a way of thinking that involves structured processes as those of scientific research. Neuman (2003:62) observes that theoretical frameworks in Social Science research are ways of looking at the social world through certain collections of assumptions, concepts and forms of explanation theories. Theories play a critical role in the research process because they encapsulate what has already been established about a given phenomenon in such a way

that further thinking, investigation and discovery is intelligently guided. Thus there is often a need for a theory which in turn forces the researcher to first review the conceptual background of the research question, because only after these concept are clarified, is it possible to begin determining the relevant theories. Needless to say, a problem whose conceptual framework is clearly defined is a problem well articulated and hence the task of investigation can be well focused and undertaken. Likewise, the assumption of this paper is that it is important and vital to base the design of an information system on established theories. This assumption is further implemented into a study that was conducted to design an information system for business information services in Northern Uganda.

However, it is important to note that a theoretical framework is more abstract than concrete and hence contain more than one theory, so long as these theories share some commonality such as the concepts or assumptions. Thus when one theory is not sufficient to encapsulate a certain phenomenon, various theories can be brought together to provide a suitable framework for studying or understanding the given phenomenon. This is demonstrated in this paper whereby four theories are used in the framework underlying the design of an information system. These theories are explained further in section 3 of this paper.

Information Systems and Design

Leo Tolstoy is quoted by Brody (2005) to have written that "happy families are all alike; every unhappy family is unhappy in its own way". If we take that view one can deduce that every business organization would want to be happy implying that each interrelated component within the enterprise is happy with the way the IS is delivering output. The formal purpose of information systems is to support and bring about organisational change in order to improve the functioning of community businesses or organizations transactions. Unfortunately, according to Heeks (2002), Most information systems including current ICT projects in developing countries fail either totally or partially. Worse still, the same types of problems occur again and again; even the most exhaustive methods are not able to ensure success for the organizations or business enterprises. Fortune and Peters (2005) ably argued that despite people's best efforts in designing information systems, IS are particularly prone to failure. The "causes" of failure are complex and cover all phases of design, creation and use (Brody 2005). Some systems never materialize, others appear late and/or over budget and those that are implemented often fail to deliver the promised levels of performance (Fortune and Peters 2005). The consequences of these failures affect people throughout the organization concerned and beyond. Successful developing countries information system will be one that is based on clear understanding of the logical steps to follow during its design. Clear understanding of the conceptual issues, theoretical basis for the information system design is crucial if the failure rates are to be reduced. This paper specifically addresses pertinent issues that need to be considered when someone takes on an IS design project for especially the business enterprises. The paper looks at the conceptual issues that need to be considered, theoretical grounding relevant to the design of a business information system and the design strategic direction.

The main reason for Information System Design is to enable the production and provision of quality information for business transactions. This implies that information is a key element in an IS. But what is this information? What is its intrinsic value and characteristics? For a viable BIS design to be achieved, the BIS designer need to clearly understand and appreciate the value of information from a business enterprise context. This is when a BIS designer can value and put useful effort in the design of the system. It is on that context that this paper examines information in terms of quality, relevance to productivity, characteristics and its life in order to enable any BIS designer to appreciate the need for seriousness when designing an information system for business enterprises.

Information-An Element of Information Systems

Malmsjö (2006) defines information as an internal change of state, a self-produced aspect of communicative events and not something that exists in the environment of the system and has to be exploited for adaptive and similar purposes. According to Moyi (2000), information is seen less, solely, as a mechanism of control and much more as a strategic weapon. A number of other authors, such as Bell (1986); Boon (1992); Camble (1994); Sturges and Neill (1998) agree that the lack of information impacts negatively on the development process. Information constitutes what the organization 'knows' about its environment and its tasks, and thus creates a basis for action (Choo 2007). Information not only creates entrepreneurial awareness, but also increases the knowledge base and inculcates new personal attitudes and characteristics (Moyi 2000). Information provides the main conduit through which new ventures are founded; new technologies are diffused; and small enterprises mature into large formal concerns (Moyi 2000). Because information plays such an important role in almost every human activity, its value in the development process has been a topic of extensive debate (Meyer 2005). Thomas and Ballard (1995:25) distinguish two types of assets that businesses possess. The first one is visible assets and the second - the invisible assets - is information. Information is an agent of coordination and control and serves as the glue that holds organisations, the business community, franchises, supply chains and distribution channels together (Pant and Ravichandran 2001:88). The recognition of the value of information in business activities and, especially, as a product of an information system, builds in a sense of serious commitment to the system development process. Every BIS should recognise this before embarking on any IS design.

Quality Information as an Ingredient for Productivity and the Need for a System

A business is operated with the objective of making a profit from the sale of goods or services (Green 2007). An information system designer should internalise and appreciate that quality information is an ingredient for productivity and hence a need to provide it. The information provided by the information system is considered crucial and is always determined by the decision-maker (Bharati and Berg 2003). In some studies, information quality has not been considered separately, but rather as an integral part of user satisfaction (Bailey and Pearson 1983) or user information satisfaction (Iivari 1987). Competitive strength lies, essentially, in productivity which is reflected in the quality of the products relative to their cost and in the efficiency with which products are delivered to the market

(Ricupero 1999:5). The information accuracy, completeness, relevance and timeliness are important aspects of quality required in information for correct and productive decision-making (Bailey and Pearson 1983; Miller and Doyle 1987; Srinivasan 1985; King and Epstein 1983; Gallway 2002). A better-informed business manager can choose from among many different offers and he/she will select the one that fits his/her enterprise best. This depends on the quality of the business information received. Possessing quality business information gives a firm the competitive edge over other firms and it enhances a better understanding of market trends and possible areas in which to invest capital (Thomas and Ballard 1995:3). Therefore, the need for quality information is crucial and calls for efficient mechanisms - information systems - to collect, process, store, retrieve and disseminate information. The quality of information has much do with the control measures instituted within an information system. Without a well-designed information system that can enhance access to quality business information efficiently, it would prove difficult to participate in the information economy. Given this scenario, what kind of business information system design should, therefore, be proposed to promote efficient access to quality business information for the business community remains an issue. The understanding that quality information is a vital ingredient for productivity helps to align the thinking of the BIS designer in order to come out with a system bound to succeed.

Competitive Advantage as a Characteristic of Information

Economists contend that there are some fundamental ways in which information differs from other organisational resources, and those differences form the basis of some of the emerging e-business models (Pant and Ravichandran 2001:88). Often the information component of the business is valued higher than the rest of the business. This is because information is the life-blood of a business and without it no planning or decisions-making can take place (Thomas and Ballard 1995:3). Information can be sold at a profit or it can be given away for free - in lieu of some other benefit. The economics of such business models are very attractive due to the unique characteristics of information products. There is a need to treat information as a key business resource and to plan properly for its use. If this is done effectively, a business may, then, turn information from a burden into a major source of competitive advantage (Thomas and Ballard 1995:3). Firstly, information is costly to produce, but has nearly zero marginal cost to reproduce. That is why there is a growing concern about the effectiveness of information systems in relation to the benefits for business (Remenyi and Sherwood-Smith 1999:29). This implies that the reproduction of information - as a service - should be integrated into the business information system for business enterprises. Secondly, sharing information adds value to information for both the sender and the receiver of the information. Thirdly, information goods and services must be priced - based on the value they hold for users and not based on the costs of producing/reproducing the information. These characteristics make selling information products a relatively scalable and high-margin business (Pant and Ravichandran 2001:88). Could this make it a reason for the designed business information system to sell information produced through the system to business enterprises? Are the business enterprises willing to buy the information frm the BIS designed? A BIS designer needs to consider asking such questions during the design process.

Whatever competitive advantage is attached to information, a BIS designer need to note that - like a human being - information has life.

Half-life of Information

Whether information is used for control and co-ordination in a business activity or sold as a product, its value is dependent on its half-life. The half-life of information refers to how quickly information becomes outdated or obsolete. Some information has a long half-life, while other information has a very short half-life (Pant and Ravichandran 2001:88). Pant and Ravichandran (2001:88) contend that news and stock quotes have a shorter half-life than commentaries and analytical reports. The claim is that "modern businesses must operate in real-time." This relates to the means used in the provision of, or access to, information. The faster the means is adopted, the faster information is transmitted. It is also important that problems that hinder information flow are addressed in any system if the real time of information flow is to be achieved. Generally, the half-life of information is a function of its timely dissemination and sharing. Consequently, the speed at which information needs to be exchanged between processes becomes an important information infrastructure design issue.

Unless the information from any information system actually contributes something new and useful to the user of the system, it is a waste of resources (Thomas and Ballard 1995:3). According to Lippeveld, Sauerborn and Bodart (2000:33), the implicit assumptions underlying information systems are twofold:

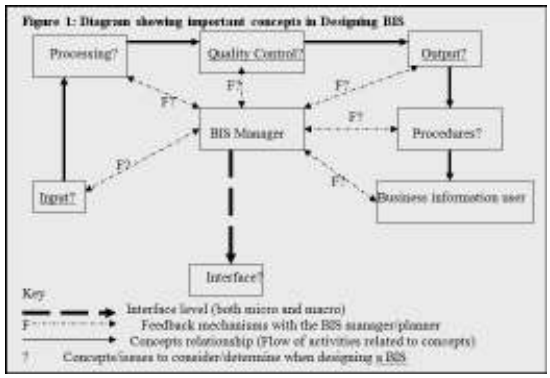
first that good data, once available, will be transformed into useful information which, in turn, will influence decisions in all business transactions. Second, that such information-based decisions will lead to a more effective and appropriate use of scarce resources through better procedures, programmes, and policies, the execution of which will lead to a new set of data which will then stimulate further decisions, and so forth in a spiral fashion.

These are important factors that need to be considered by the BIS designer to determine what to ask the BIS users.

Conceptual Issues in Information System

Information systems are one of the most important infrastructures for modern enterprises (Lee, Hwang and Wang 2006). Lippeveld, Sauerborn and Bodart (2000:2) maintain that an information system is any collection of components that work together to achieve a common objective. From another perspective, Aiyepeku (1991) and Omekwu (2003:448) define an information system as "anything" that delivers information that is useful to the consumers or to the user of the system. The concept, "anything", implies any mechanism that would ensure that the right person accesses quality information from the right source; at the right time; and from a convenient location. More specifically, Thoburn, Arunachalam and Gunasekaran (2000) define an information system as a set of interrelated components that collect/retrieve, process, store, and distribute information to support decision-making and control in an organisation. In addition to supporting decision-making through coordination and control, information systems may also help managers and

workers analyse problems; visualise complex subjects; and create new products (Thoburn, Arunachalam and Gunasekaran 2000). Thus, information systems (ISs) should be at the heart of any responsive organisation. In this paper, all interrelated components working together to produce quality information for business enterprises constitute a business information system. The information system concepts - interacting components that need to be considered when designing a business information system - include: input, processing, control, output or quality information, procedures, feedback and system interface. These concepts and how they relate are shown in Figure 1 and subsequently discussed.



Each of the concepts with question mark is important. Anybody destined to design a BIS need to determine carefully the underlying requirements of each of the concepts in the diagram plus the feedback loop as discussed below.

Input–A Determinant Factor

Input involves capturing and assembling elements that enter the system and have to be processed. An important consideration for the BIS design is that the input for the system should have a significant effect on the output which is considered to be important. The indiscriminate collection and accumulation of information can be wasteful in the long run. Having access to up-to-date, accurate, relevant and timely information is an important consideration for an efficient information system. Neelameghan (1992:27) observes that even if the best data is not always available, it is necessary to be aware of the attributes of the data being input into a system and that a practical method of filtering out useless data should be used from time to time. Assigning relevant parameters for rating the data can be such a filtering mechanism. This should not be a once only exercise, such as at the time of selecting data for input. As users need changes, so data usefulness changes. Hence, there should be a planned updating process to maintain the databases - as a whole - at an optimal level of usefulness (Neelameghan 1992:27). Basically, the input into the business information system relates to the better understanding of business activities; business information needs; and sources of data or information required by the users. Without a proper understanding of those, the quality of input into the system can be

compromised and, ultimately, this affects the quality of output. Any BIS designer should therefore ensure that what is an input should be sent for processing (see Figure 1) and must be based on the real needs of the business enterprises.

Processing–Knowledge Base

Information has become one of the most important resources for contemporary society. This is especially true for business and commercial ventures. Businesses create markets for their products and services through innovation, quality management, improved customer service, strategic planning and a host of other approaches and techniques. For these efforts to succeed, businesses require access to information that is relevant, current, accurate and comprehensive. Unfortunately, while today's business decision-makers may have electronic access to thousands of information resources, they often lack the time and the skills needed to search for - and retrieve - information; to interpret it; to synthesise it; and to apply it to their decision-making processes (Agada 1995). The result is that businesses often fail to take full advantage of the abundance of business information at their disposal. Business managers need "capsulated" information, which has been processed and rendered meaningful in the context of their business decisions (Agada 1995). Consequently, business information workers/librarians need to design information services for such clientele - based on a proper diagnosis of their business information needs. This makes the concept of information processing prominent in any information system.

Processing involves transformation processes that convert input into output (Lucey 1987). An example is the conversion of a technically produced document into a useable format or the conversion of a report produced in a printed format into an audio-visual format for an illiterate business community to utilise. Information processing entails a systematic process of adding value to information services. These value-added components would include - but are not limited to - information analysis, synthesis, editing, translating and transforming its symbolic and media formats (Agada 1995). Information processing also ensures currency; accuracy; pertinence; comprehensiveness; ease of comprehension – for example, on a technical level and in presentation style; and convenience of use – for example, in timing and format of coding. The better the quality of processing, the more value can be attached to the end product or output. A BIS designer should therefore clearly articulate or determine how and in which format will the business information be processed. It is an important step in the BIS design that should not be ignored.

Quality Control

The ISO 8402 Standard - which represents the official international terminology of quality, defines quality as the "sum of characteristics of a product or a service which satisfies users' needs" (Gallway 2002). Gallway (2002) notes that quality information should be,

- Relevant - meet the criteria of the question and be useful;
- Credible - the source is well known;
- Topical – up-to-date or a hot topic;
- Balanced - represent an important and, perhaps, under-represented point of view; and
- Accessible - easily available and written in a clear way.

To ensure that the required quality business information is produced, adequate control measures are required and these should be determined by the IS designer. The control measures are, directly, related to the management of the information system. The information providers or specialists need to have the required library and information science skills and knowledge for information acquisition, processing, storage, retrieval and dissemination. Before the information is declared appropriate output, certain parameters of evaluation are required. For instance, some questions an information manager needs to ask include: Does the information produced meet the enterprise's information needs?; Is the information in appropriate language and understandable by the target users?; and Should the information be disseminated by offline or online means?

To address control issues, the establishment of training of - and ICTs competencies of - the current information providers concurrently with the satisfaction derived from the business information provision by the business community is important. Control involves activities that measure deviations from planned performance and it provides information upon which corrective action can be taken - if required - either to alter future performance to conform to the original plan of the system or to modify the original plans (Lucey 1987:13). The control function, then, makes necessary adjustments to a system's input and processing components to ensure that it produces proper output. This calls for standards that specify actual performance. These standards are called the sensors and their achievements have a great deal to do with the management team of the information system. How well-equipped are the information providers or specialists to ensure that what is processed measures up to the expectations of the business community? All those issues need to be addressed when the BIS is to be designed to meet the actual needs of the enterprises.

Output Quality Information

Output - quality information - is the end product of a transformation process within an information system (Lucey 1987:30). The term, "information", appears as a fundamental concept not only in the study of information systems of organisations/enterprises but also in the theory of other subjects, like communication, library studies, economics and cybernetics (Avgerou and Cornford 1998: 112). It is imperative that the concept of quality information is clearly understood by the BIS designer. This is only when the system can strive to generate quality output.

Although the quality of output quality information depends highly on input and processing and control measures exercised, adequate care needs to be taken into consideration of the distribution or dissemination of the output to the right users. Which appropriate means should be used? Should it be by means of online delivery, television, radio, notice boards or the telephone? The concept of procedure of access becomes important.

Procedures

Procedures refer to methods or routines of doing something (Neelameghan 1992). For BIS design project, the methods or means for using an information system for the intended results constitute an important research and design concept. How should the users access the required information? Should the business enterprises physically visit the system and

service provision centres to access information or can interactive procedures be created? Will the text message be an integral part of access means? These questions need to be addressed through an appropriate system requirements determination. A BIS designer need to carefully determine the procedure to be used otherwise the BIS would be redundant.

Feedback

Feedback is data about the performance of a system (Lucey 1987:150). Control within a system is exercised by feedback loops, which gather information on past performance from the output side of a system (Lucey 1987: 150). It is a conventional means through which relatively small variations between actual and planned objectives are noted in order for corrective action to be taken to bring performance in line with the plan. The strategic measures adopted to ensure that the feedback on with what business enterprises are provided and their responses to the services should constitute the feedback for the business information system. The BIS designer should ask questions like: How will the feedback on the system be got? Will the feedback be got through telephone messages or through online means or using questionnaires? These need to be established during the analysis stage.

System Interface

The features - areas or constraints - which delineate a system are its interface or boundaries (Lucey 1987:31). When dealing with any form of social organisation or business enterprise, boundaries are not easily defined and are often flexible - with changes occurring over time or as adaptations to meet changing demands and activities. The eminent question, therefore, for BIS designer relates to the ways in which other organisations, ministries and Community Based Organisations (CBOs) are to interface with the business information system. Should there be a rigid, impermeable interface? In a bid to understand the system interface for a business information system, access to business information from different organisations should be established.

The seven concepts of information systems discussed above are the basis on which an information system need to be designed. An understanding of these various components or concepts of a system provides a focused means to determine what should be established for the input; the process; the control measures; the procedures; the output; the interface; and the environment for the system's operations. This congruence - between information system concepts and business information systems design requirements - is absolute in a meaningful BIS design.

However, understanding relevant concepts to design a BIS without a focus on the theoretical ground can not lead to a very healthy design. It is crucial that systems analysts use some relevant theories to shape their enquiry and design. This is because theories help in determining legitimate tools and methods to use and the questions for investigation or the issues to be dealt with (Avgeron and Cornford 1998:136). The section below examines the relevant theories that BIS designers can use.

Relevant Theories

A look at the plurality of theories - used in information systems research and practice -

indicates that they can be found in a few, widely, influential reference theories (Avgerou and Cornford 1998: 127). Reference theories refer to the intellectual constructs that provide general principles for making sense of the world. Kersten (2000) argues that theories influence the way we think; the way we interpret our world; and the actions we take. Avgerou and Cornford (1998) point out that theories are often explicitly used as a conceptual vehicle to conduct research and guide practice - for example, to determine questions for investigation or issues to be dealt with; to present them in conceptual terms; and to determine appropriate methods for their investigation. It is for this reason that this paper identified four theories that a BIS designer need to ground the design into. The theories are: Metcalf Theory, the Actor-Network Theory, the Systems Theory and the Organisational Theory.

The Metcalf Theory: Usefulness of a System

The Metcalf Theory states that the usefulness - or utility - of a system equals the square of the number of users (Pant and Ravichandran 2001:88). The central point of this theory is that any system should endeavour to increase its utilisation by attracting many users. However, usage of the system will depend on its usefulness to the users. The number of users of a system depends on the quality of the services provided through the system. For the system to have value, the coverage of the users' real needs; the availability of preferred information sources; and the format in which information is accessed are important factors. The number of users of the system will - to a large extent - depend on the system's capability to meet the needs of its users. The greater the number of people who use a system because of the value attached to the system, the more challenges and innovativeness are created in the system's operations. Given this argument, it is reasonable, therefore, to assume that the greater the number of people, machines, and networks that interact with one another through a business information system, the higher its value. This implies that the designed system should be broad in interest coverage and focus on the real needs of the users. The implication of the Metcalf Theory is that the wide range of business information needs of the business community; the sources preferred to access business information; and the information formats preferred should be established. If the users' needs; the sources of information; and the information formats preferred are properly established, a higher value of usefulness of the system would be achieved that creates global communities of customers, business partners and suppliers.

The Actor-Network Theory (ANT): Socio-technical Alignment

It is vital to understand the main actors that drive information systems processes - both human and non-human. According to The Actor-Network Theory (ANT) - society is regarded as a socio-technical web where technical objects participate in building heterogeneous networks that bring together actors of all types - whether human or non-human (Braa and Hedberg 2002:114). ANT claims that any actor, whether it is a person, an object or an organization, is equally important to a social network. As such, societal order is an effect caused by a smooth-running actor network (Actor-Network Theory Encyclopaedia 2006). ANT is distinguished from other network theories in that an actor-network contains not merely people, but objects and organisations. In developing an information system where a bottom-up alignment of heterogeneous actors is required,

the ANT is important to consider. In terms of this theory, Monteiro (2000) - in Braa and Hedberg (2002:115) - sees it as heterogeneous in that there is an open-ended array of "things" that need to be aligned, including work routines, structures, training and societal roles. This is important because it provides a theoretical base to consider: when drawing up the information flow of a system, the institutional structure of the sector should also be identified (Braa and Hedberg 2002:119). For instance, how should the BIS interface with the environment in which it is operating? Should the BIS be a closed or a flexible one? This theory teaches the BIS designer on the need to identify the institutions at a macro level to interface with the BIS.

Although the controversy surrounding ANT is caused by its lack of distinction between people and objects, a commonly held view is that people are fundamentally different from animals and also fundamentally different from objects (Tatnall and Gilding 1999; Actor-Network Theory Encyclopaedia 2006). In addressing this controversy, people should be considered very important for the design of the BIS. In mapping the business information systems structure, it is important to note that people are the active, skilled agents who produce, sustain and transform social life. The system should, for example, be user friendly; the business community should be comfortable with the language used; and the community should appreciate the skills required for information systems usage. To achieve this, the language preferred; the ICT literacy needs of the business community should be identified and adopt the bottom-up approach of system users' involvement for the design. The bottom-up approach is where the opinion and interest of the main users of the information system are established before the policy-makers make contributions. This helps in the design of user supportive information systems for business enterprises.

The Systems Theory: Organisational/Enterprise Complexities

Systems theory or systematic is an interdisciplinary field which studies systems as a whole (Wikipedia 2007). System theory is basically concerned with problems of relationships of structures, and of interdependence, rather than with the constant attributes of objects (Hong…et al n.d). The factual content regarding information systems can also be viewed from the Systems Theory enunciated by Lucey (1987:29) who maintains that the systems approach - also known as systems thinking or General Systems Theory (GST) - does not provide a ready made list of answers to organisational or societal problems. Instead, it recognises organisations or communities as an example of complex entities with multiple relationships and helps to avoid taking a blinkered and mechanistic approach to the examination of organisational operations and problems. Rather than being an end in itself, the Systems Theory is a way of looking at things. It is an internally consistent method of scholarly inquiry that can be applied to all areas of social science (Walonick n.d). For example, looking at - and attending to - the information needs of a business enterprise, without understanding the problems faced, might be a blundering effort towards an efficient information system design. It is imperative that a BIS designer should use the Systems Theory approach to establish the interrelated factors that contribute to a successful accession of the required business information. The holistic approach - used to identify the interrelated factors, such as the business activities carried out; business information needs; sources; and means preferred, for the supply of quality business information is

important in the design of the business information system. However, the weakness of the Systems Theory is that it ignores issues of power and status that influence small group decision-making, particularly when groups are embedded in large organisations (Kersten 2000). For example, should the influence of the experienced and influential business managers in the business community be ignored? To avoid this loophole the BIS need to create a link with informal systems to create an integral system

The Organisational Theory- Management Concern

The fourth theory that is important for BIS design - and that contributes to the development of the issues to investigate - is the Organisational Theory. The theory states that the success of any innovation in information systems depends on the effectiveness of management within an organisation (Avgerou and Cornford 1998). Originally, the Organisational Theory stressed the technical requirements of the work activities of organisations. In the 1970s the rise of the Systems Theory forced scientists to view organisations as open systems that interacted with their environment (Walonick n.d). Information systems often incorporate - or build on - the requirements of the stakeholders. Strassman's research (1985 and 1990) notes that in collecting data from firms that have invested in - and have hope in - a system, managerial effectiveness is the most significant factor predicting the success of information system innovations. This theory raises the question of understanding that organisation do not operate in isolation of the informal and formal systems in an area. A BIS designer need to recognise the informal and formal information systems that are in place and evaluate their services to create a better understanding of how they can influence the operation of the BIS to be designed. Questions like: Do the existing public libraries, Government Resource Centers, Telecenters, NGO resources centers, Business Associations, Internet cafes etc do provide business information to the business enterprises? need to be asked. Based on the organisational theory – it imperative to make the respondents decide on possible appropriate managerial structures for business information. One of the weaknesses of the Organisational Theory - that a BIS designer has to address is the assumption that all organisations are, somehow, alike (HRM Guide 2006). This assumption should be addressed by having a broader outlook of the respondents or the business community. The BIS designer needs to have equal proportion representation of the concern stakeholders where necessary.

Though the underpinning point in understanding an information system design lies in the concepts and theories applied, the culture-neutral consideration factor is essential. The section below examines the need to have an information system that values the culture of the community it serves.

The Need for a Culture-Neutral Information System

A culture-neutral information system refers to an information system that is designed free of a set of beliefs [culture] that affect its functioning within a community (Harvey 1997 and Galliers 1998). The study carried out by Coombs, Doherty and Loan-Clarke (1999:145) notes that community information systems have - to date - been modest with all the average successes within communities. This does not mean that the implementation of other community information systems has succeeded. Galliers (1998:89) warns that among the various factors that affect the implementation of information systems cultural factors

are often cited as being important for the success of an information system. An attribute of information that can influence its usefulness as a development resource is that it is culture dependent - involving conceptual and cognitive differentiation (Meyer 2005). Cultural differences have a great impact on the technical and procedural aspects of information systems (Sagi … et al 2004:45). Culture plays an important role in assessing the current status of a nation; its impact on people's daily lives; and it presents an understanding about a great deal of human behaviour. Zakaria, Stanton and Sarkar-Barney (2003:49) suggest that cultural values that are held in common by individuals within societies reflect a complex of preferred patterns for social interaction, communication, and the exchange of information. Cultural values influence the typical ways in which communication artefacts and other technologies are used within a society. Could there be some cultural practices that affect access to business information? The issue of culture is important, since information systems expand beyond the confines of national boundaries to support the global operations of business activities (Harvey 1997:132). That is why it is vital to have a culture-neutral system; involve users; understand enterprise sizes; and have a socio-cultural set up - based on the existing theories. Cultural issues that affect access to information need to be addressed when designing a BIS.

A focus on the concepts, theories and cultural fit of society - without elaborate consideration of the design principles of an information system - is a step towards a failed system. The following section discusses an information system design strategy for the study.

Information System Design Strategy

After understanding the conceptual and theoretical issues underpinning the system design, how then should the BIS designer proceed? According to Capron (1996:232) and Bohl (1990:211), the system development life-cycle can be described in six phases:

- Preliminary investigation – carrying out a feasibility study
- Analysis
- Design – planning/proposing the new system
- Development – working to bring the new system into being
- Implementation/test/maintain – enactment of the plan or converting to the new system
- System evaluation – reviewing the system that has been developed to determine how well it meets its objectives.

Represented in diagrammatical form, the system development life-cycle - showing the steps to follow in designing a BIS and the areas of concern is given in Figure 2.

Source: Researchers' conceptualisation based on the understanding of Capron (1996:232) and Bohl (1990:211).

A BIS should be concerned with the first three phases - the preliminary investigation/ feasibility; the analysis; and the design of the information system. The last three phases - system development; implementation; and evaluation/revision - are beyond the scope of the BIS designer and could be further pursued in follow-up. The three phases, which are the BIS designer areas of concern, are explained in the following sections.

Preliminary Investigation Phase

The preliminary investigation phase - often called the feasibility study or system survey or pilot study - is the initial investigation or brief study of the problem (Capron 1996: 234). It consists of the groundwork necessary to determine if the project should be pursued. The findings of the preliminary study should give an indication to proceed and how to proceed. Were the methods for data collection appropriate? How much time and resources will be required? A BIS designer need to carry out a pilot study based on the concepts and theories explained earlier.

Analysis Phase

The purpose of this phase is to further understand the existing situation on the ground and to establish system requirements. The best way to understand a system is to gather all the data you can about it and this data must, then, be organised and analysed (Capron 1996:237). During the system analysis phase, a BIS designer is concerned with the following:

- Data gathering - Gathering the background information to understand the information system users; how they survive in the existing system; and what they want from the new system, is important. In doing that, a systems analyst or researcher uses different methods of data collection.
- Data analysis – Data analysis is the second activity of system analysis phase. It is the basic function of the system analysis phase that helps to determine the system requirements. As facts are collected, they must be recorded, organised and evaluated. There are a variety of tools – charts and diagrams – that may be used to analyse data. A BIS designer is at liberty to choose any which best suits the investigation and data collected.

Generally, the purpose of gathering and analysing data is twofold: to understand the system needs and - as a by-product of that understanding - to establish the system's requirements. Once the system's requirements have been determined, the design phase can begin.

Design Phase

The design of the information system can only be accomplished after a proper analysis has been completed. The system design phase is the phase in which the analyst or researcher actually plans the new system. The design of an information system requires the translation of user requirements - determined in the analysis stage - into design specifications. The process of the conversion of the user requirements into design specifications takes into account the following:

- Specification of the logical design elements
- Relevance to the business activities
- Ensuring that system features meet user requirements
- Ease of use
- Production of Data Flow Diagram (DFD).

Specification of the Logical Design Elements

This refers to the detailed specifications for the system and their description in relation to the features or design concepts - input, process, control, output, procedures and feedback. Although the design of a system can consist of a logical and physical design - the production of program software, working system, etc., the physical design element should always be left to the programmers if it is to be automated. In the logical design - what goes into the system as input determines the eventual output. The implication is that the business information needs require to be, appropriately, determined. As noted by Okello-Obura… et al (2008), business enterprises need different kinds of business information that should be considered when dealing with the logical design of a business information system.

Relevance to the Business Activities

A fundamental objective of the design of an information system is to ensure that it supports the business activities - established during the analysis phase - for which it is developed. One essential business objective is the timeliness of access to the required business information. A system that slows the movement of information hampers business. The design implication of this is that the preferred means or channels of information access by business enterprises need to be established. For instance, if the system is designed in such away that access to information should be through notice-boards, then how long will it take for the business enterprises to access this information?

Ensuring that System Features Meet user Requirements

The objective of a system design is to achieve the right system that produces the right output (Kendall and Kendall 2002:421). User requirements should be translated into system characteristics during the design. An information system will satisfy user needs if it accomplishes the following:

- Performs the correct procedures
- Produces accurate results
- Provides an acceptable interface and means of interaction
- Presents information and instructions in an acceptable and effective manner
- Is perceived by users to be a reliable system.

Information systems are - first and foremost - a tool of business and, therefore, fitting the system to suit the organisation or community is essential. Features that support the enterprises' success strategy are an integral part of information system's design applications and this requires the careful consideration of user information needs and opinions. The system should conform to design standards in accordance with the prescribed rules or culture of the society – a reason why designing a cultural-neutral information system is important if user needs and the objectives of the system are to be met without resistance.

Ease of Use

An appropriate information system design should provide a system that is engineered for ease of use by business enterprises. Users are the central parts of information systems (Lee, Hwang and Wang 2006). The usability and efficiency of an information system are among the determinant factors for productivity of employees (Compaq 1999; Lee, Hwang and Wang 2006). The ergonomic design factors of an information system that affect the performance, comfort and satisfaction of direct users, need consideration. For example, the location of the services provided - and cost of access to the desired information by the users - should be considered as important design strategies to ease of use of the system. Generally, the formulation of an information system design according to Lee, Hwang and Wang (2006), should strive to

- incorporate system features that are easy to understand and use.
- provide enough flexibility to fit a variety of individual user needs.
- deter user errors or carelessness.
- function, generally, in a way that seems natural to the user.

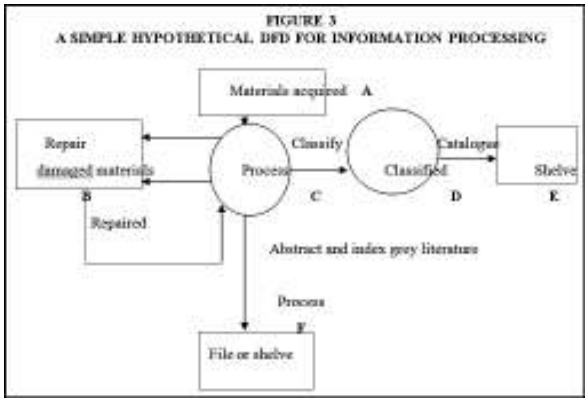
Production of Data Flow Diagram (DFD)

A common analysis process that can also be used in the design phase is the one used by DeMarco (Capron 1996:239). This is the method that studies the way data travels - and is transformed - within an information system (Avgerou and Cornford 1998). The method used to describe this is the Data Flow Diagram (DFD), which describes, diagrammatically, how data flows between processes - or steps - and external data sources or data recipients. A DFD can be used for this study to help in the design of the BIS that would facilitate access to business information for business enterprises. The choice of a DFD is based on the simplicity with which it can be drawn and read (Avgerou and Cornford 1998:70). This makes it a useful tool for communication in the system development process. According to DeMarco (1978); Avgerou and Cornford (1998); and Capron (1996), what one needs to know is the set of definitions and conventions for the symbols used to depict the DFD. These include:

- **Data flow** - "a pipeline through which packets of information of known composition flow." It is represented by a vector ( ). A vector must come from, or go to, a process circle or bubble.
- **Processes** - the actions taken on the data, such as comparing, checking, deciding on formats, etc. In other words, they are the transformation of incoming data flow(s) into outgoing data flow(s)' and is represented by a circle ("bubble").
- **File or data store** - "a temporary repository of data", represented by two parallel lines ( ).
- **Data Source or sink** – "a person or organisation, lying outside the context of a system, that is a net originator or receiver of the system data" and is represented by a rectangular box ( ). This will be separated with an interface.

A simple, hypothetical example to illustrate a DFD is given in Figure 3.

FIGURE 3
A SIMPLE HYPOTHETICAL DFD FOR INFORMATION PROCESSING



A – A data source where information materials are acquired, recorded and prepared for processing.
B – A temporary repository of data consisting of damaged materials. Repaired materials are taken back for processing in **C.**
C – A process where decisions are taken on how to process material and the format for processing material. For example, the classification scheme.
D - Another process where decisions are taken on how to catalogue classified information materials. For example, tools to use: AACR1 or AACR2? Sears List of Subject Headings or Library of Congress Subject Headings?
E and F - Sinks where processed materials are filed or shelved for users to consult.

It is important to note that each element of a DFD must have a clear, meaningful and unique name so that the diagram is a self-explanatory picture. This can be achieved by establishing appropriate guidelines.

Guidelines in Drawing a DFD

In drawing up a DFD for the business information system, the following guidelines could apply:

- Identify all net input - based on the findings from data collected.

- Fill in the DFD body by concentrating on data flows first, and then putting bubbles – circles - at the points where data is to undergo needed transformation.
- Label all data flows with names relevant to the study.
- Label bubbles to indicate actions taken to transform the in-coming data flows into the out-going ones. Where system controls are needed, they will be depicted.
- Identify all net output data flows to be used by the business enterprises.

Conclusion and Recommendations

Despite cases of successful IS development projects, it is widely accepted in the field that an unacceptable number of projects fail. The main reason for this is that IS development is still regarded as a technical effort and not as a socio-technical process that unfolds within an organisational setting (Goulielmos 2003). This causes concern if IS is to deliver quality business information. The type of data and information needed for planning, management, marketing and operation of business enterprises activities and programmes cover a wide range. They need to be selected from different sources, processed, consolidated and repackaged for effective and convenient use by the different user groups among the business enterprises. This requires an efficient IS in place. Evidently, the design and development of information systems and services that can provide such value-added information calls for close interaction and collaboration between the information system designer/information specialist and the users of the information system and services (Neelameghan 1992:143). Striking though is the understanding of the value and characteristics of information. The significance of concepts and theories for a BIS design lies in guiding the BIS designer's understanding of the theoretical and conceptual basis upon which information systems can be designed. Given the change in market expectations and the demands for new products in communities, a shift in the bottom-top approach in information systems design - based on proper analysis - is vital. Conceptually, the input, process, control, output, procedures, feedback and interface - as key concepts for the design are important. On the theoretical side, the authors do advise for the grounding of relevant theories – the Metcalf Theory, the Actor-Network Theory, the System Theory and the Organisational Theory - to guide the study in terms of functional requirements determination for a successful BIS. In other words we do recommend that BIS designer should:

- Understand and appreciate the role of information and its intrinsic value in productivity before embarking onto any design
- Clearly understand the reasons as to why designed systems fail and take precautionary measures when determining the systems' requirements.
- Determine the system requirements based on:
  input to the system
  processing methods and formats
  quality control measures to ensure that the information the BIS will produce will meet the users' needs
  Output – what type of out is expected. This has a bearing on the input into the system, processing techniques/methods and control measures attached to ensure quality
  Procedures users want to access the information

Desirable means/ways to obtain feedback
Interface levels. Who will the BIS designed interface with?

- Clearly understand relevant theories like: the Metcalf Theory, the Actor-Network Theory, the Systems Theory and the Organisational Theory in order to ground shape the design.
- Clearly understand the need for a culture-neutral information system for efficient implementation
- Demarcate the boundary to stop in the system life cycle. A BIS designer cannot handle all the phases as shown in Figure 3 in the system life cycle. Preliminary investigation, analysis and design or proposal for the design needs to accomplish by a BIS designer.
- Ensure that the designed BIS adheres or considers the logical design elements. It should be relevant to the business activities of the enterprises, easy to use and meets user requirements.

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