CHAPTER TWO

LITERATURE REVIEW

2.1 Review of relative literature

The Federal Polytechnic Ede and some other universities throughout the world have individuals/groups of students who have researched this study (Student Project Management System) / related field and provided research materials.

There is an existing system “Database Design for Students’ Project Management” in the federal polytechnic Ede. This research material and several other materials were studied.

Pieces of information were gathered from various materials to improve the existing system in terms of performance, design, and Implement new features**.**

A student project is a piece of academic work that a student creates as part of their study program at a university, college, or high school. These projects often involve in-depth research on a specific topic and are typically assigned once per course, semester, or academic program**.**

Student projects are assignments that students may be required to complete as part of their academic program. The purpose and requirements of these assignments can vary depending on the student's level of study and the institution they are attending. For example, a high school student may be required to complete a year-end project as part of their overall program. This project may be graded by a supervisor and may be necessary for the student to pass their grade. An undergraduate student project may be similar to a term paper and may involve in-depth research on a specific subject. This project may account for a significant portion of the student's grade for the semester or course. A graduate student project, also known as a dissertation, may be a long-term research project that a student works on throughout their graduate program. This project may require extensive research

and may be groundbreaking in their field of study. Students may need to defend their project in front of a panel of judges who are familiar with the subject matter.

The 1950s were designated as the start of the contemporary project management era and are when it all began. Before the 1950s, Gantt Charts and other ad-hoc methods and tools were mostly used to manage projects. Later, project management methods and tools were standardized into more refined, cutting-edge approaches. Project management solutions are in demand all over the world as a key force to finish projects within a stated scope, timeframe, and budgetary limitations are given today's rapid technological improvement, IT sectors, and globalization. The most cutting-edge project management systems of today provide creative solutions, and their management processes utilize the most recent tools, approaches, systems, and frameworks. But what exactly does project management mean on its own?

In order to complete a project and meet its schedule, financial, and technical performance goals, project management involves a number of steps that are added to the project execution process. Without a doubt, we might argue that project management is a meticulously managed and planned endeavor to achieve a certain one-time goal. It makes no difference if the funding is for building construction or the installation of a sizable new computer system. Then, what specifically does it include?

In order to define and confirm the goals and objectives of a project, a project plan must be developed. This plan should identify tasks and outline how the goals will be achieved. It is also important to quantify the resources needed for the project and determine budgets and timelines for completion. Project management also involves overseeing the implementation of the project plan and implementing regular controls to ensure that the plan is being followed and to identify any issues that may need to be addressed. Projects typically go through several stages, including feasibility, definition, planning, implementation, evaluation, and maintenance.

An important aspect of project management is risk management. In many projects, risks are identified and analyzed individually, which can be problematic because unplanned risks can arise and need to be dealt with on an emergency basis. A more effective approach is to identify risks and group them into categories, and then identify potential risks within each category. This allows common factors, potential impacts, and preventative or corrective actions to be discussed and agreed upon.

Categorizing risks is a way to systematically identify potential risks and provide a framework for addressing them. Each risk should be carefully analyzed to determine if the project team and organization involved in managing the project have the capability to successfully manage the risk if it arises. There are many different types of risks, and each project will need to decide how to handle each type. One example of a risk classification system is presented by Barry Boehm in his 1989 Tutorial on Software Risk Management.

2.2 CONCEPTUAL FRAMEWORK

Concept of Project

A project is fundamentally a "temporary undertaking intended to generate a unique product, service, or outcome." Operation and program differences are made between projects.

Temporary Endeavor

A project's performance against its schedule, or whether it begins and ends on time, is a crucial sign of its success. Being temporary denotes that there is a distinct and definable beginning and end; the management of a project requires tailored activities to support this characteristic.

Unique Deliverable

Whether it is a product, service, or outcome, the uniqueness of the deliverable necessitates a distinct strategy because there might not be a preexisting blueprint for the project's execution and there might not be a need to duplicate the project once it is finished.

Uniqueness does not preclude similarities to other projects; rather, it means that the deliverables for a given project must be produced within certain parameters, while taking certain risks, using certain resources, in a particular location, and within a certain amount of time; as a result, both the process and the deliverable itself are unique.

Progressive Elaboration

The third quality of a project is progressive elaboration, which is produced by this distinctive method and deliverable. Project management is a collection of connected procedures carried out in a step-by-step, elaborate fashion to achieve the deliverable. Progressive elaboration is the gradual disclosure and concentration of details. A general and broad concept, for instance, might serve as the design team's starting point in the engineering design process. However, as the design process progresses, the concept is narrowed to a specific scope and is further elaborated to achieve the finished design. Furthermore, it might continue to be elaborated and not be finalized until the product, service, or result is delivered.

Other "Projects"

Regarding the terminology used in the Reclamation, a clarification is necessary. A project in Reclamation is often a congressionally authorized or directed operation that enables Reclamation to carry out a particular task. As in the Central Arizona Project, Lower Colorado Dams Project, or Central Valley Project, projects are typically collections of infrastructure. The Reclamation "project" activities would include the customary planning, designing, and construction of structures, as well as contract negotiations and signing, operations plan development, and environmental compliance document completion. The operation and upkeep of the completed project are frequently referred to as parts of the "project" in historical reclamation jargon. Additionally at times in Reclamation, project managers are occasionally known by other names, such as team leaders, coordinators, activity managers, or program managers; those in charge of "projects" may also be known

as area managers or facility managers. Care should be taken to distinguish between Reclamation "projects" and projects as defined above due to these connotations.

A Project versus an Operation

An organization's operations are ongoing, repetitive tasks carried out to fulfill its objective and maintain the business, but they lack a clearly defined end to their performance and a singular result, meaning they are not produced or offered only once.

A Project versus a Program

A project differs from a program in that “a program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements or related workout side the scope of discrete projects in the program. Furthermore, programs often involve a series of repetitive or cyclical undertakings. In Reclamation, a program is typically a group of projects administered by Reclamation.

Reclamation programs do not have to be specifically authorized, and a program’s schedule may continue past any individual project. Examples of Reclamation programs are the Safety of Dams Program, the RAX Program, and the Title 16 Program.

Concept of Project Management

In today’s ever increasingly competitive markets, business and enterprises rely more and more in their information systems to achieve their purposes of effectiveness and efficiency. New technologies bring new opportunities to enhance business operations and interactions. Project management is concerned about the application of tools, skills, knowledge and techniques to achieve effectiveness and efficiency to survival in competitive market (PMI, 2000). The usefulness of project management cut across disciplines and it’s applicable to any industry regardless of the service and product it aims to achieve. Despite its wide application in different industries and products, project management has an enormous usefulness on effective development of IS to significantly increase the successful completion.

Kerzner (2013) pointed out that project management is successful due to its methodological approach of process integration, process creativity, effective planning, execution, supervising and control, and lastly closure to accomplished completed projects. Similarly, Heagney (2011) echoed that project management is highly effective particularly in IS due to its nature of process based. He further added that the sequential phases of project management directly enhance IS development, making it an invaluable means in facilitating successful completion of system corresponding to its original requirements. Hence, the issues of cost, project scope, time and quality is paramount to business efficiency and effectiveness which also defines project success particularly IS development in an organization (Atkinson, 1999). Project management assists organization management to be able to standardize their project and ensure that resources are available in achieving targeted project. It permits organization managers to be able to apply appropriate techniques and measures to ensure completion of projects with minimal cost and least resources.

When project management is incorporated in Information systems development, it leads to an improvement in usefulness and efficiency of business operations and interactions with minimal resources of the organization (Cadle & Yeates, 2004). The capabilities of the information system and characteristics of such business, its employees and the systematic development and implementation of the IS determine the degree to which that aim is accomplished. Coy (2004) explain that IS enhance the coordination of hardware and software to collect, filter, process, create and distribute date within a confine network to achieve business excellent. It aims to support business operations and managerial decision making in achieving business productivity and excellent. It deals with not only infrastructure but also the manner at which users interact with technology in support of business processes to achieve this excellent.

Similarly, Kroenke (2008) defined IS as an interaction formed by users and information technology (such as process, data, models, applications, machines and others) to achieve

some organizational functions and purposes. This interaction can occur within or across organizational boundaries. An information system is the technology an organization uses and the way in which the organizations interact with the technology and the way in which the technology works with the organization's business processes. Hence, Information System (IS) is the interconnection and operation of information technologies and human managerial skills to achieve business productivity and excellence.

In the same scenario information systems development (ISD) can be seen as the process of interaction by which some collective work activity is facilitated by new information-technological means through analysis, design, implementation, introduction and sustained support, as well as process management to achieved business excellence (Korpela, Mursu, & Soriyan, 2002). It is the developmental change in process that is aim at achieving certain business objectives or purposes by using information systems. This change is targeted toward business operational excellence and productivity. Several information development approaches have been used since the origin of information technology to achieve business excellence. Mingers (2003) identified Waterfall, Prototyping, Incremental, Spiral, Rapid application development (RAD) and Extreme Programming approaches as commonly used in IS project and system development. However, these approaches have been found not to be sufficient on their own to achieve inclusive business excellent that is been anticipated by developers and business managers. For inclusive business excellent and comprehensive solution to complex system development, a multi-methodological approach is considered the most effective strategy (Iden, Tessem, & Paivarinta, 2012; Higgins, Taylor, & Francis, 2012).

In IS development, no one approaches is regarded as the preeminent because of the dynamic nature of business and its requirements needed to achieve operational excellence. These requirements are based on the ever-increasing competitive global market which every business must survive. Although information systems (IS) have become one of the most precious assets in the ever increasingly competitive global market yet development

of such system usually encounter many problems. Among the most imperative are low productivity, a large number of failures, and an insufficient relevance of information system with business needs. Petersen (2011) submitted that low productivity occurs when the business operation functions and excels better in manual mode compare to the IS mode. In the same vein, Conboy (2010) reported that IS development (ISD) efforts resulted to failure sometimes due to economical mismatches, such as budget, schedule overruns, poor product quality and insufficient user satisfaction. This was supported by Yeo (2002) and Standish Group (1995) revelations that only 16% of all projects are delivered on time and within their budget. This was carried out as a survey among 365 information technology managers, it also revealed that 31% of ISD projects were cancelled prior to completion and the majority, 53%, are completed but over budget and offer less functionality than originally specified. Correspondingly, from the business point of view, Goyal (2012) identified growing criticism of poor alignment of ISs and business needs. He observed that while an increasing part of business' resources are spent on recording, searching, refining and analyzing information, the link between ISs and business performance and strategies has been shown to be dubious. For example, most managers and users are still facing situations where they cannot get information they need to run their units (Rockart & Hofman, 1992). Hence, ISD is continually challenged by the dynamic nature of business together with the ways that business activities are organized and supported by ISs.

Project management is the process of the application of knowledge, skills, tools, and techniques to project activities to meet project requirements." That is, project management is an interrelated group of processes that enables the project team to achieve a successful project. These processes manage inputs to and produce outputs from specific activities; the progression from input to output is the nucleus of project management and requires integration and iteration. For example, a feasibility report could be an input to a design phase; the output of a design phase could be a set of plans and specifications. This progression requires project management acumen, expertise, tools and techniques, including risk management, contingency development, and change control.

Process Groups: The project management process groups are initiating, planning, executing, monitoring and controlling, and closing.

Initiating: defines and authorizes the project or a project phase.

Planning: defines and refines objectives and plans the course of action required to attain the objectives and scope that the project was undertaken to address.

Executing: integrates people and other resources to carry out the project management plan for the project.

Monitoring and controlling regularly measures and monitors progress to identify variances from the project management plan so that corrective action can be taken when necessary to meet project objectives.

Closing formalizes acceptance of the product, service, or result and brings the project or a project phase to an orderly end. Figure 28 illustrates the relative depth, breadth, and interrelationship between these process groups.

Several significant observations regarding the nature of project management can be made from this figure. The breadth or range of project management is comprehensive—that is, it begins with **initiating** and continues through **closing**; these processes are coincident with the start and end of the specific project itself, respectively.

Monitoring and controlling occur throughout the duration of the project and have a range relatively similar to that of **executing**. Indicating a project's temporary nature and the importance of the timing of the deliverable, **closing** begins relatively shortly after **initiating** concludes. **Planning** and **monitoring and controlling** have a collective depth similar to that of **executing**, illustrating that these activities require a level of effort and have an implication similar to that of constructing the product, providing the service, or producing the result.

Process Group Interaction

The level of interaction of the five processes indicates a strong relational dependence not exclusive of one another. One process does not simply end and the next one begins. The presence of this interrelationship and range is a function of progressive elaboration. Projects are executed in increments and details are exposed and developed through the progression of time—objectives are developed, discoveries are made; investigations, studies, and surveys are completed; analysis is performed; constraints are changed; resources are amended; contingencies are exercised; changes are managed; risks are mitigated; and *Force Majeure* (unforeseeable or unpreventable circumstances) occurs. To manage the breadth or range of a project, active and proactive project management is required throughout the duration of the project. It cannot be simply initiated and/or planned and left alone; it must be continually planned and monitored and controlled. Sustained reactive project management is indicative of incomplete or absent planning and/or monitoring and controlling.

Project Phases versus Process Groups: Project management process groups are not project phases. In fact, the process groups may need to be repeated for each phase, such as study, programming, engineering, procurement, construction, and commissioning. A process group or project phase is not discrete; they are interdependent and require integration.

Also, project management must ensure continuity as a project progresses through processes and phases.

Concept of Project Success

A standard must be established by which to define and measure project success. Fundamentally, project success is the delivery of the required product, service, or result on time and within budget. To meet these objectives is to deliver a quality project. PMI illustrates project quality through the concept of the triple constraint—project scope, time and cost. Project quality is affected by balancing these three interrelated factors. “The

relationship among these factors is such that if any one of the three factors change, at least one other factor is likely to be affected.

Cost and time are intuitive, but the role played by scope warrants further discussion. To understand the significance of scope, one must appreciate the relationship between scope and the project objectives. For the scope to contribute to project quality, it must be managed to meet the demands of the project objective by reliably providing the required functions, nothing more or nothing less. It is not simply a matter of keeping the scope from creeping, or a matter of completing the cheapest and fastest project; it is establishing the appropriate scope and delivering the commensurate product, service, or result.

Concept of Project Manager

The key responsibility of the project manager is to successfully accomplish the project objectives by balancing the competing demands for quality, scope, time, and cost. Derivative responsibilities include identifying the project requirements; establishing clear and achievable objectives; and adapting the specifications, plans, and approach to the different concerns and expectations of the various stakeholders. Fundamentally, the project manager must direct the project from its inputs, through its nucleus, to delivery of its outputs. In order to accomplish these multifaceted responsibilities, the roles of the project manager include that of a leader, administrator, entrepreneur, facilitator, arbitrator and mediator, liaison, and coordinator.

The project manager must lead teams to operate cross functionally towards a common objective while assuring cohesiveness and continuity as the project progresses through project processes and project phases. “The project manager acts as the key catalyst to stimulate effective communication and coordination between design, procurement and construction activities.”

In order to effectively manage these responsibilities and assume these roles, a project manager must have experience in the following project management knowledge areas:

project integration, scope, time, cost, quality, human resources, communications, risk, and procurement management.

Concept of Project Management Plan (PMP)

A project management plan is a fundamental tool for the project manager to deliver the project successfully. This document is a strategic and formalized roadmap to accomplish the project's objectives by describing how the project is to be executed, monitored and controlled, which includes creating a project work breakdown structure, identifying and planning to mitigate risk, identifying manners in which to effectively communicate with stakeholders and other project team members and developing a plan to manage changes. It is essentially a guide for executing the project, and a manner in which to gain buy-in and approval from stakeholders and sponsors prior to commencement. This plan is a living document that is updated and revised throughout the project at strategic milestones or significant events to accommodate the progressive, elaborative nature of the project. The project management plan will vary based on size, complexity, risk, and/or sensitivity of the project. Implementing the project management plan requires competency in all of the project management knowledge areas and is critical to the success of the project.

Concept of Management Systems

A management system is a group of interrelated components that work collectively to carry out input, processing, output, storage and control actions so as to convert data into information products that can be used to support forecasting, planning, control, coordination, decision making, and operational activities in an organization (Hardcastle, 2008). A project management information system (PMIS) is thus the systematic process of creating, identifying, and collecting, organizing, sharing, adapting and using project information. Information management means identifying what information is needed, who has the information, how we can capture and store the information, and finding the best method for its distribution and use. It is a process the project uses for identifying all the information it needs, to define the methods to collect and organize the information, and use

the best methods for its distribution and use. Information is therefore a key resource that needs to be available to the organization to know if the project has met its objectives.

Information management deals with issues such as data bases, abstracts, publications, management information and good practices. Project information, as well as project information resources can be managed and can contribute to becoming more effective and efficient. The most important aspect is that the project information needs to be used. Hence the management of information concerns the management of the information process and not only the product. Every actor in the process is at the same time a user, an intermediary and a producer of information.

Concept of Project Management Systems

Projects must create an information system that will meet their own particular needs, both for managing the data they collect and for delivering information to different groups of users in formats they can understand and make use of. In order to develop such information systems it is important to have strong support from decision makers. It is therefore very important to make decision makers aware that an information system is a priority tool for project resources governance.

Project management information systems do not have to be sophisticated. In southern Africa and other developing countries, a project management information system may be quite simple. What is important is that it should be affordable and work for the project in question. The most important thing is that the information system is accessible to all stakeholders. It needs to be interactive, accessible, affordable, appropriate and equitable.

As put forward by the Global Water Partnership (2009), information needs to be appropriate to the task in hand, proven through research and development, tested in the field and pitched to the capacity of institutions, practitioners and stakeholders to understand and use it. Information needs to be affordable, preferably free, so that there is no discrimination between information providers and users because of lack of funds. Information needs to be accessible to all practitioners through the channels they normally

use, not dependent on major upgrades of technical infrastructure and information processes should be equitable. This means that information systems should respect cultural needs, gender issues and embrace stakeholders distanced from decision making because of their location, or economic or social status.

The information system should be designed to fit the financial and human resources available to the project. Too often large initial investments are made, often with external financial support, to establish sophisticated systems that are then not sustainable due to a lack of funds or lack of human resources. Therefore, before deciding what type of system should be used, it is advisable to estimate the running costs and clearly indicate the size of budget available to ensure the initial investment will not be wasted (Global Water Partnership, 2009).

The problems related to availability, accessibility and sharing of project data and information are widespread and occur at all levels (regional, national, local). Solving these problems means that those involved in the project management must adopt rules for sharing, accessing and using data and data services. Common measures and rules specifically concern:

- Sharing responsibility for producing, gathering, processing and disseminating data and information (who does what and access rules) in order to avoid duplication and create synergies.
- Sharing data. Public authorities should have easy access to data and data services related to the project. This access can be hindered when it depends on ad hoc negotiations between public authorities each time data is required. Partners should remove practical obstacles to data sharing by setting up, for example, agreements between public authorities.
- Interoperability of information systems and the organization of network services to facilitate, for example, data identification, consultation and downloading (Global Water Partnership, 2009).

If the project information system is to be useful, it must allow all categories of users to retrieve data in a form they can easily understand. As far as possible, the information system should be structured to allow users to retrieve information and accomplish routine tasks easily.

The Current problems with Project Management Information Systems

The following are the major current problems with project management information systems as outlined by Siles (2004):

1. Isolated systems; one of the consistent and recurring messages is that projects are creating and using systems that are too narrow in scope and limited to track project activities and not project outcomes. These systems are designed to manage the information needs of a specific project and as a result, efforts to consolidate information are almost impossible.
2. Drowning on data and starving of information; some project systems focus too much on collecting, organizing and reporting data giving little time to critically analyze the information and make sound decisions.
3. High expectations; people involved in the collection of data receive high expectations as to the value of the data requested from them, only to never see the information come back. In these cases information tends to flow in one direction.
4. Low priorities in information management; PMIS is often relegated to outside consultants or given to staff with inadequate skills or responsibilities. It is often that these responsibilities are not well assigned and accountability becomes diffused.
5. Technology myopia; expectations that technology will be the final solution has led to an inappropriate focus that resulted in spending more time in managing the technology than managing the information.
6. Systems disconnected from the log frame; PMIS are developed but only respond to the immediate needs of the project; reporting on project activities without creating

the connections with the desired objectives. Systems designed to monitor progress do not show how the progress relates with what the project has set out to achieve.

7. Reports for reporting sake; reports are not connected with the decision process of the organization. Reports stay at manager's desks and no relevant information is extracted from them.
8. No standard PMIS process; the lack of a standard process has led to the development of many systems, each with its own processes, and all disconnected from each other. Organizations have to deal with information coming from different systems, making the collection and consolidation of information impossible. Systems are tailored to specific project and donor needs.
9. Duplication of efforts; each project develops its own PMIS system, which results in a duplication of efforts and costs to the organization.
10. Training and maintenance costs for each system; costs to train and maintain the system are seldom considered in the design phase resulting in unexpected expenses not budgeted by the project.
11. Little or no experience in PMIS; lack of experience leads to poor systems or failures at a high cost to the organization. Systems developed with low quality require a high dependency on consultants to keep fixing the system.
12. Projects with little or no IT support; PMIS perceived as a luxury that requires high IT investments. Certain development organizations have a low technology capacity that has not been structured to support complex project PMIS requirements.

Characteristics of Project Management Information Systems

In order to have flexible and responsive interventions, a project information system needs to be more than just a reporting mechanism. It must serve as a powerful management tool for advancing an organization's programme goals of accountability, transparency and partnership. According to Siles (2004), a good PMIS needs to contain the following characteristics:

- The project information system should incorporate both quantitative and qualitative data and feedback from participatory assessments and evaluations continuously through every phase of the project. Systematic monitoring and evaluation of program processes and outcomes are particularly important where new programmes are being implemented;
- PMIS supply the necessary information and feedback so that potential problems are identified and solutions are implemented early before becoming constraints. The system should be able to generate timely information to initiate corrective actions;
- A PMIS is a tool to collect, analyze, store and disseminate information useful for decision making in a project. A good PMIS builds on a project's successes while using lessons from earlier experiences to improve project performance;
- PMIS differ from other management information systems (financial, payroll, etc.) because their demand-driven approach requires it to be flexible and adaptable to the changing conditions of the project;
- Flow of information is central to PMIS and constitutes an empowerment agenda that includes:
    a. Transparency - the availability and access to information by all project stakeholders;
    b. Accountability - the use and application of information to monitor the progress of the project and correct deviations;
    c. Inclusion and participation - where project participants are given control over decision-making, including decisions on appropriate criteria and indicators to judge the performance of the services provided by the project.

Identifying a Project's management System Needs

The list below (adapted from Siles, 2004) can help project managers identify the information required to define and develop an information technology solution for the

PMIS. This step is needed in order to evaluate the complexity of the information the project will manage.

- requirements of information from the donor;
- requirements of information from the organization;
- the methods the project will use to collect, and organize all the information;
- the frequency the project needs to analyze and report the information to key stakeholders;
- the volume of information it needs to collect from beneficiaries;
- the types of visual reports required, such as graphs, tables, maps, etc.;
- the types of access, security and controls to manage, modify and update the information;
- The need to develop especial reports in defined formats; and the need for complex analysis on the information collected.

The next step is to evaluate the current information technology (IT) capacity of the project. This will identify the IT capacity that will satisfy the information requirements.

- available funds for IT resources dedicated to the project;
- the current capacity of the project capacity to manage technology;
- the need for communications, email, internet and other online systems;
- the number of staff that will use computers in the project;
- The level of computer literacy of the project staff; and the IT support required by the project.

Once a project has identified its information requirements it needs to define its technological requirements and start to design a technological infrastructure that will provide with the appropriate hardware and software needed to manage the information.

One of the most critical steps in developing an automated PMIS is the development of a software solution that will meet all the information management requirements. For most projects, and development organizations, the options are to configure a commercial

package or develop a customized solution from scratch. Configuring a commercial package means in most cases that the selected product will not be able to meet certain requirements and that the project will need to make a careful identification and selection process to use the system that meets most of its needs and find other methods to fill in the gaps. In other instances, the project may decide to contract a consultant to develop customized solutions that can meet all of its requirements.

2.3 THEORETICAL FRAMEWORK

The Systems Theory

The American heritage dictionary of the English language (1992) sees a system as 'a group of interacting, interrelated, or interdependent elements forming a complex whole'. The Oxford English dictionary (1995) defines a system as 'a set of assemblage of things connected, associated, or interdependent, so as to form a complex unit; a whole composed of parts in orderly arrangement according to some scheme or plan'. A system is thus a set of interrelated elements functioning as a whole.

A system and its interdependence characteristic is best described by Durkheim's collective conscience, mechanical and organic solidarity thesis (captured in Haralambos and Holborn, 2000). Both mechanical and organic solidarity are a result of the forces of collective conscience. In organic solidarity people are different but need each other. For example, a farmer needs a teacher to teach his children as much as a teacher needs him for food. Various parts are different yet work together to maintain the organism as in the case of the heart, liver, brains and so forth in the human body.

A system is made up of subsystems. Therefore a subsystem is a system within a system. For example, organizations are composed of various subsystems: the external interface subsystem (the external environment), the task subsystem, the technological subsystem, the structural subsystem, the human social subsystem and the goal subsystem (French and Bell, 1978).

An educational institution like a university is composed of libraries, laboratories, lecture theatres, hostels and the administration as subsystems which can be regarded as systems in their own right. Whatever happens in any of these subsystems affects the operations of the university as a whole. All interventions in the university system must be put in their conceptual context. Otherwise they end up having a negative effect on its operations. As put forward by the Institute of People Management of Zimbabwe (IPMZ) (1994: 10), 'Within this viewpoint, it is not possible to simply consider one part of an organization without looking at its relationship with all the other parts, because changes and influences in one part affect all other parts of the organization'. Anything that affects one part of the system also interacts with other parts of the system.

The systems thinking is based on 'an interdisciplinary theory about the nature of complex systems in nature, society and science, and is a framework by which one can investigate and/or describe any group of objects that work together to produce some result'(http://en.wikipedia.org). This could be a single organism, organization or society, or any electro-mechanical or informational artifact. The Wikipedia (2009) further states that the systems theory first originated in biology in the 1920s out of the need to explain the interrelatedness of organisms in ecosystems. Bertalanffy, a biologist, is credited with coining the phrase 'general systems theory'. Bertalanffy (1988) noted the following characteristics of systems studies common to all sciences:

- The study of a whole or organism;
- The tendency of a system to strive for a steady state of equilibrium;
- An organism is affected by and affects its environment.

Bertalanffy (1988) describes two types of systems: open systems and closed systems. Open systems are systems that allow interactions between their internal elements and the general environment within which they operate as illustrated in Figure 2.1 above. Bertalanffy (1988: 4) defines an open system as a 'system in exchange of matter with its environment, presenting import and export, building-up and breaking-down of its material components.'

Closed systems, on the other hand, are considered to be isolated from their environment. Thus, a system is closed when it is self-supporting and can exist independently of a particular environment. It is open if it is dependent on the environment in which it operates, the environment is dependent on the system, and there is a specific interaction between the system and the environment.

Other authorities like Nobert Wiener (1894-1964) adopted the word cybernetics in place of systems. The study of cybernetics showed that all systems could be designed to control themselves through a communications loop, which fed information back to the organism, allowing it to adjust to its environment. This feedback meant that an organization could learn from and adapt to possible changes in its environment.

The application of systems thinking is founded on the gelstat concept. According to this concept the whole is more than a mere summation of its constituent parts (Davies, 1971). It is a perspective for going beyond events, to look for patterns of behaviour, to seek underlying systemic interrelationships which are responsible for the patterns of behaviour and the events (Ehlers, 2002). Ehlers (2002) further argues that the systems approach embodies a worldview which implies that the foundation for understanding lies in interpreting interrelationships within systems.

According to Siles (2004) one of the key concepts from a systems perspective are causal streams, that is the flow of cause-effect linkages. Causal streams are a sequence of conditions or factors linked by cause-effect logic that contribute to a predefined problem.

Although scientific research once focused on one level and in closed systems, research now evolves towards a transdisciplinary approach that integrates human and social sciences in an attempt to embrace the multiple levels of reality (Brelet and Selborne, 2004). This is reflected in most African communal cultures where anthropological studies of values and beliefs show that ethics and normative values are still closely linked to an equitable utilization of natural resources philosophy, a scenario closely resembling Karl Marx’s primitive communalism. The scenario actually reveals an astute ecological cleverness, both

anticipatory and adaptive, in maintaining natural resources for future generations (Brelet and Selborne, 2004). Humans are not traditionally regarded as separate from their natural environment, but as another part of the same highly complex ‘metasystem’. This knowledge comes from the holistic observation of the many interdependencies which make up the natural world. Human and natural systems are mutually responsive and interactive.

2.4 EMPIRICAL REVIEW

The comprehensive comparisons of CMS had been made by various parties like Unal (2011) and Bremer (2005), especially the two commonly employed systems: Moodle (Dougiamas, 2003) and Blackboard (Blackboard Inc., 2013). Clocking IT (Clocking.com 2008) is a general project management system with licensing free of charge. It provides basic management function like task management with priority assignment to tasks, so that project manager can better arrange manpower and plan the schedule of project. Moreover, it has chat function and forum for ease of communication, while at the same time, it provides share folders for user to access documents and source code simultaneously. This system also included some advanced functions like Gantt chart generator which is a standard tool for project scheduling.

Clement and Bounds (2013) shared similar goal as our system in facilitating the management of FYP. While, their focus was to better connect students with potential supervisors before the project allocation starts. Their system also included tools for assessment submission and collection which are normal functions in a CMS. Bakar et. al. (2011) had reported their experience in developing and using an FYP management system at Universiti Kebangsaan Malaysia. Their system consists of three major modules including user profile, project monitoring and appointment setting modules. Our system also contains similar functional modules as Barkar’s, while we have additional modules like project allocation, file repository and online communication. The HKU CS Project Management System (2014) is a project management system that developed in the

University of Hong Kong, Department of Computer Science. The system can show project information, news, schedules and project allocation. In the main page of this system, it includes functions like blogs, calendar and forms downloading. Also, there is a list of projects and related information, as well as some advanced function like providing a virtual machine for students as servers for their FYP.