

THE UTILIZATION OF PROJECT MANAGEMENT TECHNIQUES IN THE CONSTRUCTION OF PYRAMIDS IN EGYPT WITH SPECIAL REFERENCE TO THE GREAT PYRAMID IN GIZA:

Joseph K Ngeno*

B: ED (Hons) UON; MMS (Carleton), PhD (cand.) UON

**Corresponding Author: -*

Email: jkngeno83@gmail.com

Biography

Joseph K Ngeno is a project management consultant and holds a Bachelor's degree from the University of Nairobi (UON), Kenya and a Masters degree in Project Management from Carleton University, Ottawa, Canada. He is currently a PhD Candidate at the University of Nairobi undertaking a course leading to the award of PhD degree in Project Management (Project Planning, Design and Implementation)

Abstract:-

This paper examines the utilization of project management techniques during pyramid construction in Egypt. The study is based on desktop research and literature review. Its purpose is to examine the extent to which project management techniques enhanced the construction of the pyramids. And while it is true that the pyramids were built some 4,500 years ago, it is equally true that the techniques used are valid now as they were then. A project management model developed by Goodman & Love (1988) is used as an analytical framework in this study. Results show that the construction met all the requirements of the model. The concepts of time, cost and specification were applied. The innovations adopted, challenges faced and how they were overcome were also explored. During the study it was found that the latest research indicate that the pyramids were built by the Egyptians themselves as opposed to slaves. Leading authorities in this subject including Salima Ikram, Zawi Hawas, Wideman and others, who have published extensively in this area, have provided irrefutable documentary evidence to support this view. These findings, provide a new dimension in the manner in which the workforce was recruited, organized and paid. This is a major consideration in project management. It is therefore important that as new information is obtained, its implications are examined. Finally, the literature review examined the latest developments in project management thereby contributing to the growing body of knowledge in this field. The study will also serve as a current reference material for students and researchers in project management and projects in antiquity.

Key Words: *Project Management, Pyramid, Innovations, Techniques*

INTRODUCTION

This study examines the extent to which project management methods were utilized in antiquity with reference to the Egyptian pyramids and in particular the great pyramid in Giza. Project management has been developed to enable organisations to run projects effectively and efficiently. It provides tools and techniques which assist organizations in planning, organizing, implementing and controlling projects. These methods have been in use since time immemorial although it was only recently when it was recognized as a distinct field of study (Seymour & Hussein, 2014). Ancient civilizations used these methods and techniques to implement monumental projects such as the pyramids, great wall of China, hanging gardens of Babylon, the Coliseum in Rome and many more. The construction of these monuments required great feats of engineering and tested the ability of the builders to the limit.

Records detailing these activities are scanty. Research is however on going. It is part of the objectives of this paper to assist in filling this gap. And while it is true that the utilization of project management started at the dawn of civilization, it was not until the 1950's, that modern methods and techniques were developed starting with the Manhattan project (Shaw, 2013). Modern project management is an evolution of processes which have taken place over time. The successful completion of each project increased the knowledge, techniques tools and skills for use in the next epoch. It is for this reason therefore that records are very essential since they keep track of all the new developments.

The paper provides a historical background of pyramid construction including the people who built them. It also provides an understanding on how they were accomplished as well as addressing some misconceptions. The project management model developed by Goodman & Love (1988) has been used to determine if the pyramid satisfies the conditions of being considered as a project. The model has four phases. The extent to which the pyramid construction incorporates these phases is fully described. The activities in each phase are analyzed from a project management perspective. Finally, the contribution of the Egyptians to project management is examined. The paper concludes by evaluating the Egyptian contribution and showing the importance of conducting research on projects in antiquity.

1. HISTORICAL BACKGROUND

Pyramids are ancient structures which are found all over the world including Egypt, Peru, Mexico and the Sudan (Cooney, 2014). They were constructed by ancient civilizations for different purposes. The most famous and enduring however are the Egyptian pyramids. They have stood the test of time and are considered as one of the seven wonders of the ancient world. There are around 118 pyramids which have been identified (Hawass 2011).

This paper examines the evolution of pyramid construction in Egypt with particular reference to the Khufu pyramid in Giza. It took exceptional planning and effort to construct a pyramid. Many of the methods and techniques used were ground breaking, not only, in project management but in other fields as well. (Alekhya, Chaitanya & Chandramouli 2021) observe that the Great Pyramid has captured the world's imagination unlike any other monument in history. It has emerged as the most celebrated building structure with no equal from the golden times of the pharaonic rule. The Egyptians also excelled in the construction of other structures such as temples and *obelisks*¹. One such building is the magnificent mortuary temple of the female Pharaoh Hatchepsut at Deir El Bahari.

Initially, pyramids were built as burial places for its rulers, the Pharaohs (Borisov, 2019). This original purpose was to change over time and were eventually viewed as transformation machines to enable the soul of the pharaoh to join its ancestors among the stars. Before the advent of the pyramids, they were buried in structures known as *Mastabas*². It was not until the 3rd Dynasty in 2,500 BC that the first pyramid was built (Ikram, 2009). This was the step pyramid at Saqqara designed and constructed by the famous Egyptian architect and scholar Imhotep for pharaoh Djoser. Imhotep was the *vizier*³ and wanted to construct something special for his king's tomb.

The step pyramid is not, however, considered as a true pyramid. It took several years to develop and construct the correct version of this structure. The pyramid construction reached its zenith with the building of Kufu's pyramid in Giza in 2560 BC and were stopped altogether sometimes in 2,000 BC (Shaw, 2013). It has been argued that the life of the rulers of ancient Egypt must have been so good for them to go to great lengths to preserve it.

Who built the pyramids?

The logistics of pyramid construction were staggering given that the ancient Egyptians had no pulleys, wheels, iron tools or measurement instruments (Kumar, 2011). Their knowledge on the subject was modest at best. Nevertheless, their achievements in this field are astounding. The degree of precision attained in many of these structures is amazing. As a result, there are unresolved arguments about the workforce used to construct the pyramids.

There is an erroneous belief that the pyramids were built by slaves, notably the Israelis, or worse still by aliens or even the gods. There is, however, no archeological evidence or otherwise to support these views. On the contrary modern research, excavations and studies show that the pyramids were indeed built by the Egyptians themselves (Ikram, 2009). History shows that the Egyptians were not known to be a slave society but was an open nation whose citizens interacted freely and extensively with those of its neighbors. In addition, their record keeping was meticulous, a fact which is acknowledged worldwide. According to these sources no evidence has been found to indicate that the Israelis were ever present in Egypt in large numbers let alone being slaves and building the pyramids. More importantly,

¹ A tall rectangular monument, the top of which is a pyramid.

² Ancient Tombs for Egyptian pharaohs

³ the highest ranking official in ancient Egypt serving the Pharaoh

archeological discoveries have provided irrefutable proof that the builders of the pyramids were Egyptians (Tyldesley, 2003).

The discovery in Deir-El –Medina, an ancient Egyptian village which was home to the artisans who built the royal tombs in the Valley of the Kings, is quite revealing. (Lesko, 1994) states that the excavations at the site, found the most thoroughly documented accounts of community life in the ancient world that spans almost four hundred years. Records provide a very comprehensive knowledge and insights into the community life in pharaonic Egypt. It shows that these people were organized and led normal lives. The workers were paid, well treated and given time off. They had a legal system which allowed for divorce, property ownership and inheritance. (Bierbrier, 2016) notes that the presence of several temples is an indication that there was religious freedom a far cry from slavery.

Similarly, (Lehner, 2013) uncovered the ruins of an ancient settlement of workers who built the great pyramid and the Sphinx which he named the “Lost City”. The subsequent excavation revealed that a city, complete with all the necessary facilities including a cafeteria, had been built next to the pyramid to house the workers. These pyramid builders were well fed and received better rations including beer than those in the villages. Archeological evidence indicates that appropriate medical services were also provided, quite a rarity during this period. Further examination of their remains show that advanced complicated surgeries and bone settings were carried out. Those who died were buried next to the pyramid itself. This was a great honour and further proof that the builders were Egyptians and not slaves.

The above findings and analysis provide proof enough that the workers who build the pyramids were well treated and looked after. As a matter of fact, many of them considered it an honour to work at the pyramids. This dispels the notion that they were foreigners, slaves or aliens.

2. PROJECT MANAGEMENT MODEL

It is the objective of this paper to examine the utilization of project management techniques during pyramid construction. In this regard, a project management model which was developed by (Goodman and Love 1988) has been used. The model has four phases which are planning, selection and activation, implementation and evaluation. These phases constitute the project life cycle. The unifying force in these phases is the power relationships which are vested in the policy and decision makers.

Was pyramid construction a project?

It is important to examine whether a pyramid can be considered as a project before exploring the manner in which project management techniques were utilized. A project is defined as an activity which has a definite duration with start and finish dates, cost and must be performed according to certain specifications (Kerzner, 2009). It should also be capable of being broken down into work packages. There is therefore need to explore the extent to which the pyramid construction meets the conditions; namely:

- i. Time
- ii. Cost
- iii. Specifications
- iv. Divisibility

Time

Every project has a specified time limit. Similarly, it should also have a start and finish date. The construction of the Egyptian pyramids started during the reign of an individual pharaoh and was to be completed before the pharaoh died. In addition, each King wanted to build his own pyramid since the successors would concentrate on constructing their own and not those of their predecessors. The difficulty, however, was that no one knew for certain when the pharaoh would die.

It was a matter of intuition, estimates based on life expectancy and the age of the particular pharaoh. Historical evidence, however, suggests that the majority of pharaohs lived long enough to see their pyramids completed. This is an indication that the time criterion was met. (Müller-Römer, 2015) writes that life expectancy in ancient Egypt was 35 years. The methods and techniques to be used during the construction was determined by the estimated time available. In some cases, pharaohs increased the workforce so that the pyramid could be completed much faster, which is synonymous to crushing the project.

Cost

It takes resources in terms of materials and labour to implement any project. The pyramids were no exception. These resources should be quantified, costed and expressed in monetary terms. The amount spent in constructing the pyramid was enormous and is one of the reasons why they were discontinued in later years. The costing of these structures presented considerable challenges since they were built during the time when market economies did not exist. As a result, the amounts could not be expressed in monetary terms. Barter was the mode of exchange. The Egyptians used this system to determine the cost of the pyramid and were able to construct it within the budget of their economy. (Smith, 2004) estimated in 2003 that the pyramid would cost US\$ 4 billion. (Bier, 2008) concludes that the completion of the pyramid, without bankrupting the country, is an indication that the cost factor was considered.

Specifications

Specifications in a project, refer to the degree of quality and scope to which the end product should be completed. This is an area where the Egyptian excelled. The pyramid had very definite quantitative and qualitative specifications to meet. These measurements had to be exact and precise otherwise the pyramid would collapse. In project management, it is not enough for a project to possess specifications. The end product must be completed according to these specifications. Fortunately for this criterion, the pyramids still exist. It is therefore possible to determine the degree to which this criterion was met. There is unanimity among researchers in this field (Hawass 2011), (Ikram 2009), (Yassen, 2018) and others that the pyramids were completed to a very high degree of precision.

The dimensions of the Giza pyramid, for example, are extremely accurate Dash (2012). The site was leveled to within a fraction of an inch over the entire 13.1-acre base. This is comparable to the accuracy possible with modern construction methods using laser leveling. Similarly, the pyramid is aligned to true north to within one-tenth of a degree. Its height is approximately 147 meters and stood for more than 4,000 years as the tallest building on earth until it was surpassed by the Washington Monument with a height of 169 meters in 1885. Lehner posits that the builders of ancient Egypt with their 'rudimentary tools,' were about as accurate as their contemporaries in the 21st century.

Divisibility

A project should be capable of being divided into distinct phases which can be broken down into individual activities. In this regard, research has shown that the pyramid can be broken down into distinct phases which can be outlined in a work breakdown structure (WBS). (Wideman, 2021) states that a WBS can be prepared by identifying and analyzing all the steps required in constructing the pyramid beginning with the identification of the site to the point where the last casing stones were placed and the ramps are removed. The simplest WBS comprises; the pyramid design, assembling the workforce, cutting and transporting the stones and finally the actual construction. This shows that the tasks involved in the pyramid construction are indeed divisible.

From the above analysis, it is clear that the pyramids met the four important criteria of a project which comprising time, cost, specifications and divisibility. In addition, there is no evidence to indicate that this was not the case. It is, therefore, reasonable to conclude that the pyramids were indeed projects.

3. UTILIZATION OF PROJECT MANAGEMENT TECHNIQUES IN PYRAMID CONSTRUCTION

Since it has been shown that the pyramid satisfies the condition of being considered as a project, it is therefore necessary to examine the utilization of project management techniques during its construction. Emphasis is given to the great pyramid. (Bartlet, 2014) argues that because a considerable portion of the pyramid is still intact, it is possible to determine how the various tasks were performed by analyzing the construction itself. In this regard, the four-phase project model described above will be used to examine the various methods and techniques used in the different phases. The challenges faced in each phase and how they were overcome will be explored.

3.1 Planning

The principal tasks associated with planning, which is the first stage, includes project identification and formulation, feasibility study, appraisal and design. Historical evidence indicates, that it took several years and enormous effort design and construct a true pyramid. Several factors had to be taken into account, not least religious. The specific tasks involved in planning are outlined below.

Project Identification

Project identification is the process of getting ideas from different sources and then selecting the best idea. Formulation, on the other hand, is the process of turning the project ideas into formal statements from which further decisions can be made. This includes a needs analysis (Kerzner, 2009). In this case, the pyramids had long been identified as burial places for the pharaohs. The individual pharaohs had no choice about it. There was certainly no public participation. The principal consideration was that each king wanted to build a bigger and better pyramid. This apparent competition placed substantial stress and pressures on the part of the planners and designers.

Project Feasibility Study

When the project has been identified, a feasibility study is undertaken. The objective of this exercise is to determine if the project as designed and with the available resources can be successfully implemented. The Egyptians must have considered this requirement. The choice of the site is a case in point. The site had to be selected very carefully. The foundation had to be strong enough to support the huge structure. In addition, it had to be close to source of the raw materials required which were stones. In the case of the Giza pyramid some 2.3 million blocks were used. The successful completion of the pyramids is a clear testimony that feasibility study was conducted.

Project Design

The design process involves the provision of comprehensive information and scientific data which forms the basis of efficient and effective project implementation including the preparation of the final specifications. The tasks to be accomplished during this stage comprise the finalizing the project structure, cost, duration, inputs, management strategy and methodology among others. The success indicators and deliverables are also developed at this stage. These activities can be performed sequentially or concurrently.

The design and sophisticated planning of the pyramid baffles many even today Bierbrier (2016). The specific drawings and calculations needed a written language, paper and some form literacy; not an obvious thing in those days. Luckily for the Egyptians, they had *Hieroglyphics*⁴ and the *Papyrus*⁵. They also had scribes, the intellectuals of the day. The designs of the pyramid required some of the most advanced mathematical and engineering knowledge, then unknown at that time (Smith, 2004). In addition, internal chambers, access tunnels and other facilities were also required. The pyramid itself had to be aligned to particular stars for religious purposes. This required some basic knowledge in astronomy. These are just but a few of the challenges they faced.

The Egyptians devised novel innovations, tools and techniques to overcome these difficulties. They used ingenuity, trial and error and experience. Their skills and expertise were tested to the limit. Their understanding and use of this scientific information is amazing. As a result, they were able to accomplish these very difficult and demanding tasks. The exact different specifications required have been stated elsewhere in this paper. The endurance of the pyramids themselves is a clear indication that they were well designed (Morkot, 2005).

3.2 Project Selection and Activation

Project selection applies in situations where more than one project is being considered. This is true in governments and large organizations where there are several departments engaged in project planning. As a result, there are several choices facing the authorities. In this case, however, there was only one pyramid to be constructed. As soon as the feasibility study and the design process were completed, the project was activated.

Activation

Activation encompasses all activities associated with coordination and allocation of resources to make the project operational. It includes selecting personnel and setting up an organization to run the project including the appointment of the project manager known in Egypt in those days as the **overseer**⁶. Research shows that it took the efforts of many people of various professions and skills to construct the pyramid (Lesko, 1994). These included architects, astronomers, engineers, doctors, accountants, cooks, skilled and non-skilled labourers.

The overseer was a person of extraordinary talent and ability. His duties required special administrative and managerial knowledge, skills and expertise. He was responsible for establishing and managing the administration necessary to construct the pyramid.

Archeological evidence shows that between 10,000 and 20,000 people were required to construct the pyramid (Martin, 2001). These people were recruited from all-over Egypt and were paid in food, clothes and tax rebates. These workers were rotating but the core of professionals was permanent. Considerable challenges were experienced in assembling, transporting, managing and providing for this workforce. The means of communication, transport and administration were rudimentary. There were no phones, computers or the internet. There were no cars, buses or trains. Despite these challenges the ancient Egyptians were able to assemble, coordinate and manage this large workforce and to achieve the objectives for which they were assigned. After activation phase is completed, the project is passed on for implementation.

3.3 Implementation

This is the most important and visible phase in any project and is sometimes mistaken for the project itself. During this phase the project manager becomes the main focus. The major tasks to be accomplished during the implementation phase are:

- i. Scheduling,
- ii. Control and Supervision,
- iii. Completion and Termination.

Scheduling

Scheduling involves identifying and establishing inter relationships and sequencing of all the major tasks necessary to accomplish a project. The scheduling process includes the preparation of a work breakdown structure which is further segmented into activities. This segmentation depends upon the complexity of the project. The Egyptians performed this task with exemplary precision. (Smith, 2004) using Primavera Project Planner, was able to develop a critical path containing 80 activities and 15 major tasks for the Giza pyramid.

⁴ Formal writing system used in Ancient Egypt.

⁵ Writing material made of papyrus plant found in Egypt

⁶ A modern-day project manager

The major tasks in the WBS comprised the following work packages.

- i. Quarrying and Dressing of stones
- ii. Transportation
- iii. Construction: - Laying the building stones
- iv. Managing the workforce

Quarrying and Dressing

Quarrying was a very important activity since a large quantity of building stones were required. (Tyldesley, 2003) estimates that 2.3 million blocks of limestone each weighing between 2 and 2.5 tons were used in the construction of the great pyramid. These stones had to be quarried and dressed. This is a case where the location of the site was very important. This was a major consideration during the planning and design phases. The tools were very basic. Some hard stones such as granite required special tools. The Egyptians, however, came up with several innovations including the use of dolerite balls and were very successful.

Transportation

The stones had to be transported to the site after they had been dressed. Transporting these stones was a task of monumental proportions. Roads had to be surveyed and constructed. On average the stones weighed about 2.5 tons (Ikram 2010). Even then some weighed as much as 60 tons. The Egyptians devised ingenious systems of transportation. They used sledges which were pulled manually along the sand. They poured water on the sand in order to reduce friction. Hawas further states that other materials which were not available at site were transported by river or seas. This is an indication that the Egyptians were also good sailors.

Construction

When the stones reached the construction site, maneuvering them into position is a riddle which is yet to be unraveled. Some stones weighing over 3 tons had to be raised to a height of over 100 meters. The sarcophagus inside Kufu's burial chamber weighs over 60 tons and must have taken considerable effort to place it there. Research shows that the builders of the great pyramid did not have pulleys, wheels or cranes to move or lift the heavy stones (Isler, 2001). They used wooden sledges to move the stones over short distances while ramps were constructed for longer distances and to raise the stones to higher levels. It is thought that these ramps were later removed. The precise methods used to place stones in position is still work in progress. There are several theories which have been advanced including John-Pierre Houdin's theory of an internal and external ramp.

Organizing and managing the workforce

(Lehner, 2013) argues that Egyptians faced an immense challenge in establishing and managing a very huge workforce to carry out the work. An effective and efficient administrative system had to be established to mobilize and manage the welfare of workforce. The manner in which this task was accomplished by the Egyptians is considered as one of humankind's most brilliant achievements.

(Tyldesley, 2011) states that the workforce was highly organized and was divided into gangs of about 2,000 members with each gang having a name such as Friends of Khufu or Drunkards of Menkaure. The gangs were further sub-divided into groups of 1000 and later into phyles of approximately 200 workers. These phyles were then split into units of about 20 individuals. The units had their own team leader and were allocated specified tasks. This arrangement maximized the productivity of the workforce by making it efficient, easy to coordinate and monitor. (Bierbrier 2016) concludes that the Egyptian society could have been more advanced in their social organization than was previously supposed.

Supervision and Control:

Supervision is the coordination of the different organizations and activities involved in the project (Kerzner, 2009). Communication and coordination are frequently cited as the major causes of problems. The need to resolve these issues is integral to every complex project. These same challenges undoubtedly faced the builders of the Great Pyramid.

During the pyramid construction, efficient sequencing and scheduling of activities was required to keep the skilled workforce busy all year round. A continuous supply of stones had to be quarried and transported to ensure that the work was uninterrupted. In addition, specific precision and quality had to be met. The pace was also very fast. In the great pyramid, one building block had to be laid every three minutes for 20 years (Yassen, 2018). This required an incredible level of coordination and communication. In the absence of any formal training the supervisors must have used experience, intuition and instinct.

Finally, the flawless nature which the pyramids were constructed and completed including the fact that they are standing some 4,000 years later means that the correct procedures must have been followed. This is a case of synoptic planning where the end justifies the means

Completion and Termination:

This is the last stage of project implementation and is concerned with the planning for the phasing out and preparation for hand-over of the project. It involves orderly dismantling of the project organization. It includes terminating, relocating and transferring the remaining resources both human and physical. The newly completed project can be merged into

ongoing projects in an organization or handed over to a new organization set up specifically for that purpose. When the pyramid was completed, it was handed over to the pharaoh or more precisely the vizier to await the King's death and eventually his burial.

3.4 Evaluation

Project evaluation is premised on the fact that the success of new projects depends on the pitfalls and lessons learnt from the old. It is argued that plans, however implacable in theory can only become successfully operational if they take account the experiences of actual practice (Marashly, 1990). There are two forms of project evaluation. These are project evaluation and post project evaluation. Post project evaluation aims at providing useful data and lessons learned which will be incorporated into future plans so as to enhance their chances of success.

Project evaluation, on the other hand, is a continuous process which begins at the planning stage. Its objective is to provide useful and timely information which is vital to efficient project execution. The bent pyramid of Dashur located 40 kilometers south of Cairo is a clear indication that the Egyptians carried out project evaluation (Brier, 2008). The angle of elevation of this pyramid was changed during the course of its construction. This change became necessary when it became clear that the pyramid would collapse on itself unless corrective measures were taken. This shows that evaluation was carried out. From the above analysis it's clear that project management techniques were indeed used although they may not have been designated as such.

CONTRIBUTION TO MODERN PROJECT MANAGEMENT

The contribution of the Egyptians to progress of mankind in all fields of human endeavor is outstanding. They advanced mathematics, science, medicine, agriculture, public administration and astronomy to name but a few, to very high levels (Hawass, 2011). In the process, they laid a firm foundation and inspiration for future generations. It is in project management, however, where their contribution is most pronounced. This has not always received the appreciation that it deserves. The model used in this study shows that they utilized all the project management methods and techniques that are in use today although they may not have recognized them as such.

Similarly, in the process of overcoming the challenges faced, which were staggering, they invented and perfected many of the modern techniques. Time, cost and specifications are now well-established project management concepts. Their scheduling techniques were most effective. They ensured that the work continued all the year round for a period of 20 years to complete the great pyramid.

CONCLUSION:

It is clearly evident that the Egyptians accomplished monumental feats using simple tools and knowledge. They faced seemingly insurmountable challenges but somehow, they managed to overcome them. Their skills, knowledge and patience were tested to the limit. The magnitude, complexity and logistical requirements of the pyramid project meant that a single individual or an uncoordinated group could carry out such a task. The fact that the Egyptians could plan, organize, and execute such an undertaking is a clear testament to their remarkable skills in project management.

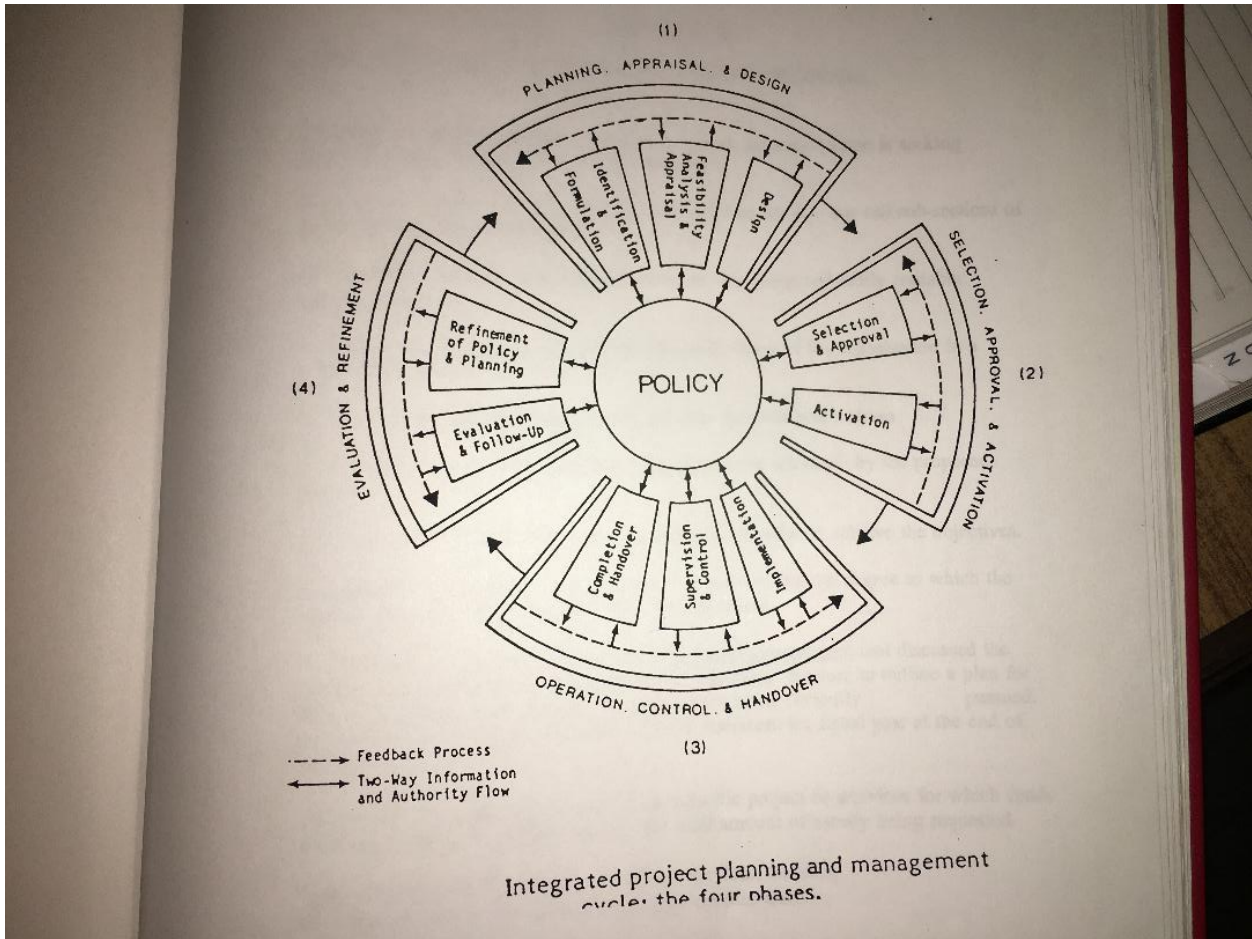
In overcoming these shortcomings, they were forced to come up with ingenious and novel solutions and thereby contributing to the advancement of knowledge, not only, in project management, but in other fields as well. This is not without precedent, the taming of the flooding of river Nile is a case in point

This paper has also shown the importance of research. In particular, it has revealed that project management techniques and methods were used in antiquity. It has highlighted the fact that the Egyptian pyramids were not built by slaves but by the Egyptian people themselves. Finally, new insights emerge when historical projects are viewed from a project management perspective. It has also been shown that the lessons learnt and their contribution to this field is a matter which still requires further research.

REFERENCES

- [1] Alekhya, B., Chaitanya N, S., & Chandramouli, K., (2021). A Study on Pyramids in Egypt. *International Journal for Modern Trends in Science and Technology* 7(7):267-273 ISSN: 2455-3778
- [2] Bartlet C. (2014). The Design of The Great Pyramid of Khufu. *Nexus Network Journal* 16(2):299-311. DOI:10.1007/S00004-014-0193-9
- [3] Bierbrier M. L., (2016) "*The Tomb-builders of the Pharaohs*", American University in Cairo Press ISBN-10: 9774167465
- [4] Borisov, K., (2019). What was the function of the Pyramids, *Atlantis Rising* 134
- [5] Brier, B. (2008). *The Secret of the Great Pyramid: How One Man's Obsession Led to the Solution of Ancient Egypt's Greatest Mystery*. Smithsonian Press
- [6] Cooney, K. (2014). *The woman who would be King*, Crown Publishing,

- [7] Dale M. (2018) To what extent is the Fourth Dynasty Great Pyramid complex a coherent religious and architectural entity? DOI:10.13140
- [8] Dash Glen, (2012), New Angles of the Great Pyramid, *Ancient Egypt Research Associates 13 (2)*
- [9] Ikram Salima (2009). *Ancient Egyptian; an Introduction*, Cambridge University Press,
- [10] Isler, Martin (2001). *Building the Egyptian pyramids* University of Oklahoma Press, 2001
- [11] Kerzner, H. (2009). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. Wiley Publishers (2009) ISBN: 978-1118022276
- [12] Kumar R. I. (2011). Pyramids and their shapes effect, *Journal of Arts Science and Commerce ISSN 2231-4172*
- [13] Lehner. M., (2013). The Lost city of the pyramids, *Ancient Egypt Research Associates 14(1) ISSN 1944 - 0014*
- [14] Lesko, L. H. (1994). "Pharaoh's Workers: The Villagers of Deir El Medina". *Cornell University Press*,
- [15] Marashly A.F., (1990) Project Management as Perceived from Ancient Egyptian Projects, in *Dimensions of Project Management pp 275 - 290*
- [16] Morkot R. G., *The Egyptians: An Introduction*, London & New York, 2005, p. 21
- [17] Morsi, S., (2015) Reasons Why the Great Pyramids of Giza Remain the Only Surviving Wonder of the Ancient World: *Journal of Civil Engineering and Architecture 9(10) DOI:10.17265/1934-7359*
- [18] Müller-Römer F. (2015) Basic considerations on the construction of pyramids in the Old Kingdom *International Congress of Egyptologists XI, Florence*,
- [19] Shaw, Jonathan. (2013). Who built the Pyramids, *Harvard Magazine*, 2013
- [20] Smith B. C. (2004). *How the Great Pyramid was built*, Smithsonian Institution Press, ISBN-13: 978-1588342003
- [21] Seymour T.J., & Hussein S (2014). The History of Project Management, *International Journal of Management & Information Systems (IJMIS) 18(4):233 DOI:10.19030/ijmis.v18i4.8820*
- [22] Tyldesley, Joyce A. (2003) 'Khufu's Great Pyramid' in *Pyramids: The Real Story Behind Egypt's Most Ancient Monuments*, Viking, London, 2003, pp. 121-140.
- [23] Wideman Max. (2021). How the great pyramid was built: In Smith Craig in *How the great pyramid was build ed. Book Review, AEW Services, Richmond Hill, ON 2021*
- [24] Yassen A. (2018). Architecture of the Great Pyramid of Giza Concept and Construction. *International Journal on Proceedings of Science and Technology 2(1)*, DOI:10.21625
- [25] Zahi Hawass (2011), *Secrets from the Sand*, American University Press in Cairo



PROJECT MANAGEMENT MODEL: THE FOUR PHASES