Politecnico di Torino

Master of Science Program in Engineering and Management

Remote Planning and Cost Control Engineering for MBTP in Ivory Coast

Author: Hussein Younes

Supervisor: Prof. Alberto De Marco

Turin, Italy

September 2024

Master's degree in Management Engineering

Management of Sustainability and Technology

Acknowledgments

I would like to express my sincere gratitude to Professor Alberto de Marco for his exceptional guidance, mentorship, and academic support throughout this research. His expertise, patience, and willingness to share their knowledge have been invaluable to my work. I deeply appreciate his flexibility and availability, which have greatly facilitated my progress. Professor De Marco's insightful feedback and constructive criticism have significantly enhanced the quality of this thesis.

I am also profoundly grateful to my family and friends, whose unwavering support has been a cornerstone of my academic journey. Their love, encouragement, and understanding have been integral to my success. I want to extend my heartfelt thanks to my wife and parents, who have stood by me, offering steadfast support and motivation. Their belief in me and their constant presence have been a source of strength and inspiration. This thesis would not have been possible without their dedication and support.

Declaration of Authorship

I hereby affirm that the research presented in this thesis is entirely my own work. I am the sole author of this master's thesis and confirm that I have not utilized any sources beyond those explicitly cited in the bibliography and references.

Date: ----------

Signature: ----------

Contents

Introduction

Background of the study

MBTP is a well-known company based in Ivory Coast that practices offering construction and building materials, coupled with various other related services focused on carrying infrastructure improvement and several construction projects all over the region. As there is an increased demand for well-developed infrastructure and housing in the Ivory Coast,

MBTP plays a vital part in meeting these needs by supplying quality materials for construction tasks. The company's offerings revolve around a variety of products likely steel, cement, and many other relevant building supplies that are required for tackling construction projects. These products offered by the company are essential for both residential and corporate construction projects. In this way, the MBTP has collaborated with one of the most renowned banks LCB for handling their construction projects with the help of multiple project planning and costing techniques. The project managers started with the meetings that were held remotely. Not only this, but the project managers and engineers also participated in the onsite activities. During the initial stages, zoom meetings were all about gathering the required information of the project from the client. This way, the project managers and engineers of MBTP gathered all the important details about the project that were needed to secure the project and close the deal. Firstly, the discussions were mainly about the services the client needed, and then it advanced to the cost and timeline needed to complete the entire project. Everyone is familiar with the fact that two crucial factors in managing a project are cost and deadline. While discussing project management in relation to construction, it has been observed that another important aspect is the project planning stage. The project planning stage is mainly about how the project will be handled while maintaining the quality of the work and items that are used during its execution. This way, the meetings focused on discussions that could help the project managers and engineers better understand the challenges of the tasks. This is because the planning and costing stages are controlled by the project managers and engineers. Consequently, the thesis sheds light on the planning and costing phase of this project for the LCB bank. The client, LCB Bank, is in Brazzaville, the Republic of the Congo, while the rest of the participants are in the Ivory Coast. The timeline for the completion of each task was different. For example, the manufacturing of wood carpentry equipment took 30 days, from Saturday, July 31, 2021, to Friday, September 3, 2021. Similarly, the installation of wood carpentry equipment took 7 days for completion, from Saturday, April 9, 2021, to Saturday, April 17, 2021. However, ALU CARPENTRY-GLAZING was completed in 37 days, from Saturday, July 31, 2021, to Saturday, September 11, 2021. The manufacture of aluminum carpentry equipment was completed in 30 days, starting from Saturday, July 31, 2021, and ending on Friday, September 3, 2021. The client wanted the project to be completed as soon as possible; this is why the project managers decided to expedite the tasks and charge more. This would also allow them to improve the efficiency of the work. Dividing tasks equally among all team members also helps save time, which is a primary requirement of the project.

Problem statement

The construction industry has to endure a variety of challenges while dealing with the construction projects, specifically regarding successful planning and cost control. With lots of technological advancements, many projects in the construction industry have to deal with budget overruns, delays, and poor performance as a result of ineffective project management techniques. However, during discussions about this project, the client requested a tight deadline, prompting the project managers and engineers to charge more to put additional effort into completing the task quickly. After the project management team asked the client to increase the budget, he initially refused; however, after more meetings, the team worked hard to convince him to pay more. Moreover, the project management team of MBTP also assured the client to focus on providing quality work only. However, the plastering is of good quality in the Ivory Coast, thus it is a bit expensive. In this manner, the project management team told the client that reducing the budget for the budget would badly affect the project quality. Moreover, it has a negative influence on the company's revenue.

These kinds of challenges being raised in the project management practices can sometimes reduce the chances of closing deals but by taking careful measures one can easily assure the client of the effectiveness of the work their team performs. As everyone knows how important it is to focus on ways to improve construction management techniques in these kinds of projects, this focus fosters effective project planning and cost control. This study aims to identify important issues through in-depth research on effective project management practices and to develop strategies for controlling project costs, considering the issues experienced by Ivorian construction industry. In this way, the research intends to enhance project management capabilities, consequently leading to successful project delivery and viability in the construction industry.

Objectives:

The study mainly focuses on the financial management and coordination of a building project in Côte d'Ivoire. In this case, LCB bank refers to the client that wanted to facilitate through the services of the project managers and engineers of the MBTP. The main goal of this thesis is to evaluate and enhance project planning and cost control methodologies, moreover, it also

focuses on addressing the challenges and opportunities associated with managing construction projects. On the other side, with the help of cloud-computing platforms, project managers bring about detailed project schedules, allocate tasks, and track progress anywhere in the world. These project management tools not only increase transparency but also help encourage collaboration. This collaboration further allows all the team members to talk about the issues they encounter and reach reasoned decisions promptly. For example, in this project, the deadline was very tight, so the project managers and engineers collaborated and focused on strategies that could help them complete the project on time without compromising its quality. In the initial stages of this project, once the meetings are finished, the project managers, engineers, and other stakeholders discussed the main topics that were covered.

Managing construction projects comes with distinct challenges and opportunities, especially during the planning and cost control practices. The inventions made in the digital world just because of the advanced digital tools and technologies have enabled project managers to perform these tasks with ease and comfort. In other words, it has converted the manual processes into automatic ones. Thus, these digital tools have paved the way to sustaining remote work and guaranteeing project success even with geographical barriers. On top of that, the thesis project also aims to shed light on the essence of these tools to make construction projects a huge success. In addition to this, the major objective of this thesis is to discuss the project planning and costing stages conducted for the LCB bank. Moreover, the thesis also discloses the budget and timeline to complete this project for better understanding of the criticality of this project.

The thesis also explores the significance of finer remote planning as well as cost control practices while dealing with construction project management. On top of that, the thesis highlights the type of methodologies that can be implemented in order to deal with this growing landscape. When examining project planning in construction projects, it is easier to state that this involves a comprehensive organization of all the project-related activities. In addition to this, strategic management also refers to all those resources and frameworks that are needed during remote planning in construction. This strategic approach demands exploring modern project management software and relevant tools for collaboration. These tools help in speeding up real-time communication among all the team members involved. These team members include the project manager, engineers, clients, stakeholders, site superintendents, and last but not least IT support.

Research questions

1. How do current project planning and cost control techniques boost the effectiveness of construction projects?
2. What kind of new strategies can be used in project planning and costing in order to manage the construction endeavours in Ivory Coast?
3. What impact can stakeholder engagement have regarding the effectiveness of remote project management and controlling costs in construction projects?
4. What are the takeaways from effective planning and cost control methods used in other countries that can be adjusted to align with the construction projects in Ivory Coast?

Significance of the study

Everyone knows how committed the Ivoirian government is while aiming to enhance and improve its nation’s infrastructure, thus, MBTP is suitably designed to support this initiative using a wide range of expertise and materials. Further to this, MBTP also specializes in facilitating and promoting construction activities, while guaranteeing the efficiency of the projects. The company tries its best to do the job to the highest standards. This mainly involves assistance related to project management and consultation services. These services further benefit in smoothing operations and overcoming challenges that could emerge throughout the entire construction process. As Ivory Coast continues to have an advanced infrastructure, the construction field is expected to encounter significant growth, offering countless opportunities for construction industries, like MBTP. The enlarged focus on both public and private corporations and foreign stakes in construction activities further highlights the essence of dependable suppliers in the domain.

By complying with the demanding quality standards and regulatory requirements, MBTP not only fills the immediate gaps of construction projects but also ensures the long-term sustainability of the construction companies. In general, the MBTP's commitment to offering essential construction materials positions it as a major contributor to the continuous efforts to

boost infrastructure and encourage economic growth in Ivory Coast.

Thesis Motivation:

The motivation for this thesis lies in the necessity for successful management of construction projects especially its planning and costing stages. On top of that, this thesis also aims to address and counter the challenges faced while dealing with the client in order to understand their requirements and convince them to pay more when working on a tight deadline.

Literature Review

Controlling and managing the costs of construction projects is an essential characteristic of project management. This plays an important role in order to handle large projects that cost millions of dollars. In this way, delays during the execution and increased costs result in significant financial losses. Project managers measure the progress of such projects with the help of applying a variety of controls on the schedules and budgets designed for the project. For the LCB bank project, the project management team used an advanced approach to manage variables including tracking the performance of each team member. This approach helped project managers control the accomplishments of all construction-related tasks. Moreover, regular performance tracking easily detected the competency of every team member.

On the other side, universal plans & controls are introduced and implemented in the rapidly growing audit as well as the consulting companies. These frameworks further allow these industries to carefully handle business goals and compliance issues. The techniques of the project control play a vital part in these frameworks which enhance the chances of Project success (Bowen et al., 2007).

Project management literature involves a variety of articles that focus on the ways to control the costs of those projects (e.g. Lavingia, 2003; Emhjellen et al., 2003; Dell'Isola, 2002; Longworth, 2002; Zhan, 1998; Behrendt and Wulke, 2004) and managing the project schedules as well as its quality (Hormozi and Dube, 1999; Deng and Hung, 1998). This way, the project management team carefully discussed the schedules and costs with the client. This was primarily due to the importance of these aspects in effectively dealing with start-up ventures and their investments. This way, the project managers involved in the LCB bank project focused on avoiding delays in project tasks because these delays can be a significant burden on team members. Moreover, it would not be wrong to say that the type of projects that are delayed can cause a lot of problems for the investors.

On the other hand, the land that is required for the construction projects cannot be acquired easily, thus the projects do not start on time and get delayed over and over. This is the reason that the MBTP always suggests its workers to initially discuss everything about the land with their clients. This helps the project management team overcome the issues that could arise due to the land acquisition. However, these kinds of issues happen when tackling the tasks related to huge buildings, dams, and railway stations. Eden et al. (2005) have perfectly explained the reasons for delays of large projects. Moreover, Eden et al. (2005) have emphasized how these delays went far beyond the normal delays, and what type of lessons one can gain through this all. In this way, the uncertainties in order to examine the time needed to cover the main activities during the important tasks, the challenges in estimating the resource demands and their availability at the right time with a reasonable cost are all those aspects that the authors highlight because they hinder precise project cost estimate. Clients generally do not agree to offer a higher budget, and the same was true for this project. However, when the clients want the project to be completed quickly, they are willing to pay more and expect high-quality work.

Time, budget, and quality are some of those elements of this project that were defined at the start of it. In this way, some other conditions that pave the way to successful completion of a project include the capacity to outline the goals and address those objectives. All these characteristics put a lot of effort into making any project a huge success. In other words, the successful delivery of a project is completely dependent on these factors. In addition to this, the components of success are categorized as the primary and secondary ones. Customer engagement, schedule, cost, and quality are all called the primary ones. This is the reason that the project management team of the MBTP kept updating the client about the status of this project. In other words, the team stayed in contact with the client throughout the project and

updated them about how the work is going. As far as the secondary factors are concerned, advanced opportunities and planned coordination, along with the absence of additional barriers, are considered secondary factors (Albadvi, & Hosseini, 2011).

Moreover, Kerzner (2009) has carefully explained the success of projects. It means ensuring that the project is completed within the required time frame and has a fixed financial agenda. Furthermore, other factors such as customer engagement, modification in the scope, and consistent flow in the organizational work are also included in his definitions of the success of a project. Key elements that distinguish well-known metrics encompass issues addressed, the percentage applied, standardized units, and the completion percentage of the entire project (Belassi & Tukel, 1996).

On the other hand, Larry Leach (2003) has outlined the different "biases" that can have an effect on the project's budgetary requirements. In addition to this, the author Leach (2003) has described that biases can arise from the convergence of project paths in foreseen ways. These include neglecting tasks like documentation, and drawings which require some time and effort but may seem highly crucial to the project managers, errors, multi-tasking, mistakes, and so on.

Olawale and Sun (2013) have found a model named as Project Control Management Model (PCIM) that paves the way for the success of construction companies. They have shared the results of a survey performed by Iyer and Jha (2005), emphasizing the fact that engagement and communication among the team members are the actual keys to the successful outcome of a project. After analyzing numerous other models of project control devised by researchers, they maintained their focus on a process-based model that employs Dr Deming's principle of PDCA. With the help of this model and by carrying out a survey, they came about with 'Point could information modeling' (PCIM) which refers to a practice-based research methodology as highlighted by the contingent philosophy of formulating a theory to interpret a phenomenon. According to this survey, they pinpointed the 20 essential aspects that help in project cost control. In this manner, among all the other 20 aspects, the sixth one termed 'dispute among two of the project parties' was the most critical out of all.
The success of a project with the help of PCIM is possible when challenging situations are timely addressed and controlled through the efforts of both project teams. As a consequence, the 'point cloud information modeling' has limited relevance, as it is primarily general and extensive in nature. Although Barazza and Bueno (2007) have put forth a probabilistic model concerning project controls, this approach is still more theoretical in nature and can be applied to construction projects only.

According to the research and reports, it has been seen that there are plenty of ways and factors that are used to effectively proceed with project management. All these ways are different in nature but have the same goal of making the construction projects a huge success. Moreover, it is easier to conclude that there are still certain areas of project control, mainly project cost, that do not hold any common practices to meet the needs of all types of projects. Thus, it is important to initially research, analyze, and study every other technique that one may come across regarding project management. In this way, all the project managers and engineers of this project first analyzed the strategies that could help them overcome future challenges. The most effective strategy used by the project management team was to divide the tasks among all the workers, pay them more, and ask them to finish the project quickly. As a consequence, it has allowed the project management team to carefully deal with the tight deadline. By carrying out detailed research about every other technique, one can choose those that perfectly meet their project's criteria. As there are many different projects likely small-sized, medium-sized, and lastly the large sized projects, thus it is better to opt for the strategies based on the project' size. Although a significant development has been made in the quantitative evaluation of cost controls in construction projects, the value of the human angle has been recognized. The thesis paper highlights the progress made with a Project Cost Control System (PCCS) which further enables the blending of the human element with project cost control.

Project cost control

Everyone knows that submitting quality projects on time and within the required budget are the most challenging objectives for project managers (Ballesteros-Pérez *Et al.* 2020). However, it is important for the project managers to carefully analyze and define the scope of the project so that they do not have to encounter future problems (Fageha, Aibinu, 2014). While talking about the project that is already defined and analyzed, it can be concluded that

the project encompasses important data that is used to deeply evaluate the work that needs to be carried out (Chritamara, Ogunlana, and LUONG BACH, 2001). During the planning stage of a project, the needs and demands of the stakeholders are categorized as requirements. These requirements of the stakeholders further help in designing and developing the scope of the project (Gómez-Senent Martinez, 1997). Further to this, they also talk about the essential project deliverables, assumptions, and boundaries (Wang, 2008). Clearly explaining the scope also makes it possible to handle future project changes (Toffano Seidel Calazans, and Dias Kosloski, 2012). Construction costs are mainly divided into two types such as direct costs and indirect ones. In this case, the direct costs mean the equipment, workers, and resources, while the indirect costs refer to those that can be determined for a particular project but cannot be identified for individual elements of a project like supervision (Singh, & Taam, 2008). As far as this project is concerned, the direct costs, such as equipment, workers, and resources were collectively calculated by the project management team. After calculating all expenses for the execution of the project, the project management team shared the total budget with the client. In other words, the project management team calculated the finances of all the materials and equipment that was needed to be used for the construction of the buildings.

The project cost control methods have experienced a massive improvement with the help of newly developed techniques such as the work-breakdown (WBS-based) structure in project management, applying the PERT (Program Evaluation Review Technique) and CPM (Critical path method). According to (Norman, Brotherton, and Fried, 2008), the Work-breakdown structure was first implemented in the mid-1960s by the US Defense Department in the processing and expansion of missile systems. This is the reason that the WBS-based structure is known to be the most important component of project management. The practices of this method were initiated by the US Department of Defense (DoD) as well as NASA (National Aeronautics and Space Administration) to plan and execute large-sized projects. In this manner, their main goal was to expand and deliver weapons and pieces of space equipment. They include several industrial contractors with accountability for the various elements of the systems, coordinated by a central administrative office, which could be either within the government agency or among prime contractors. Defining the project scope early on is an excellent approach to outlining project components and maintaining consistency with the project goals. All the tasks of a project are divided into activities and services that are offered with resources, timetabled, budgeted, and eventually, monitored (International Project Management Association, 2015). This procedure is designed by creating a work breakdown structure (WBS), given as follows.

Figure. Link between the work breakdown structure (WBS) and the project.

Work Breakdown Structure (WBS) according to International PM Standards

The ISO 21500 standard (Stellingwerf, and Zandhuis, 2013) states that work breakdown structure (WBS) must define and analyze all project deliverables involved and categorize them into smaller units for achieving the project goals. All the elements of the WBS should encompass identification codes that match the configuration management plan. Hence, the project management team can easily track and manage progress. In addition to this, the PM makes every effort to assign tasks only to the responsible individuals.

According to the International Project Association (IPMA), the project scope needs to clearly define what is included and excluded, specifying every single thing that needs to be accomplished (IPMA, 2015). A well-defined scope and set of deliverables minimize discrepancies and supports the project planning process. On the other hand, projects can be analyzed from various angles related to task allocation, organizational structure, project organization, information handling, documentation framework, and more (López Paredes, Pajares Gutierrez, and Iglesias Sanzo, 2013). The project structure in a hierarchical format serves as a vital tool for maintaining order and guaranteeing that nothing important is being missed (Kerzner, 2016). Further to this, the work packages (WPs) are distributed to a resource provider, the work is organized, costs are assessed, and finally, the work is commissioned, supervised, and finished.

According to the Project Management Institute (PMI) (Rose, 2013), the work breakdown structure segments all project-related activities into components, encompassing all its deliverables. Furthermore, the work breakdown structure (WBS) features a dictionary that helps arrange all required tasks into more clearly defined sections. The breakdown must align with the necessary deliverables (Buchtik, 2013). Within this framework, there may be two types of problems that arise while designing a WBS, such as the degree of depth and the guidelines for this breakdown (Hendrickson, and Au, 1989). Nevertheless, there is not any standard rule set for defining the level of detail that should be achieved. Project managers understand that project breakdown involves dividing all deliverables and components into their most basic elements, to the point where they can be confirmed as products, deliverables, or outcomes (Project Management Institute, 2000). The reason is that tasks in the work breakdown structure need to be eventually planned, resourced, budgeted, evaluated for risks, measured, and monitored at a later stage. Additionally, the decomposition of the WBS may also involve encompassing information regarding the contracts, quality standards, and technical guidelines for each component to foster effective project management. Yet, the WBS neither organizes the project tasks in a sequence, nor specifies their interlinkages.

According to the Project Management Association of Japan (PMAJ) (Engineering Advancement Association of Japan (2017), the WBS emphasizes the interconnectedness among processes and work, highlighting the importance of cooperation and compensation. Documentation needed for WBS is generated with an emphasis on the tasks and processes essential for meeting the objectives. Thus, the objectives are presented in the form of an overview of characteristics of the predictive qualitative outcome as well as the quantitative goals that are required to be achieved.

In order to complete the analysis of the most widely recognized international Project Management (PM) standards, it is crucial to highlight AXELOS's approach in its PRINCE2 2017 standard which is a collaboration formed by the Cabinet Office representing Her Majesty's Government and Capita PLC (Office, 2017). In this manner, the product breakdown structure (PBS) serves as the foundation of the project, rather than the WBS. The product breakdown structure means the products that are needed to be created during the planning process, but restricted to the products alone. While the work breakdown structure (WBS) covers all the tasks to be done during a plan, it involves only activities. Thus, the project managers must plan the project by categorizing the products or their outcomes first. This is what allows them to divide the tasks that are needed to create the products of the project. In that regard, the project managers followed the PBS structure and categorized all the items required for the construction of the buildings. In this way, some of the items used during this project include water drainage pipes, septic tanks, heavy BA slabs, power supply, telephone and lighting systems, and sanitary equipment.

In conclusion, the breakdown of the project scope and its transformation into a work breakdown structure (WBS) or product breakdown structure (PBS) entails the practices for

identifying the work and deliverables that are needed for the project's success (Stellingwerf, and Zandhuis, 2013). As a consequence, it leads to identifying the project boundaries (International Project Management Association, 2015). By doing so, it guarantees that all necessary work is included for the successful completion of a project (Project Management Institute, 2000) in addition to the efforts focused on achieving the project's objectives to the fullest (Murray, 2009). Hence, it would not be wrong to say that the work breakdown structure involves methods required for evaluating activities and the resources essential for meeting the project goals. Therefore, it secures both the accurate execution of the project and the accessibility of all required resources (Engineering Advancement Association of Japan, 2017). As a result, the key project management areas that are directly influenced and gain benefits based on the project WBS in line with the international standards are outlined below:

Table: Management domains based on the work breakdown structure:

Standard	Significance	Design	Variation	Quality	Duration	Resource	Supply	Expense	Risk	Delivery
ISO			X	X	X	X	X	X		
IPMA		X	X	X	X	X	X	X	X	
PMI			X	X	X	X	X	X	X	
PMAJ	X		X	X	X			X		X
AXELOS	X		X	X	X			X	X	

Activity-Based Costing

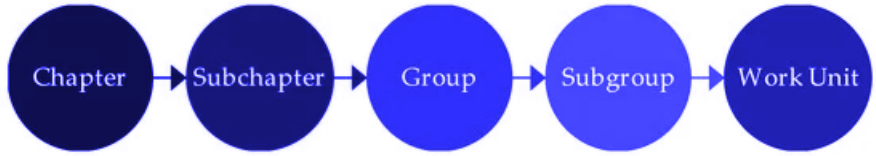
The activity-based costing system (ABC) is a technique that facilitates the issuance and division of indirect costs based on the activities performed (direct costs). Consequently, the main intention behind the use of this method is to be aligned with the value-added process and to accurately analyse the cost sub-inputs (Cooper, and Kaplan, 1988). A clear diagram of ABC is illustrated below. However, the ultimate outcome of the project can be divided into work packages. These can further be categorized into those activities which result in cost generation. After identifying the activities, indirect costs are allocated to those activities with the help of the cost drivers (Everaert et al. 2008).

The time-driven activity-based costing (TDABC) serves as an alternative to the activity-based costing system (Kaplan, and Anderson, 2007). In this manner, the time driven activity-based costing TDABC is less complex as compared to the ABC system, and gives more precise results with time being considered as a cost driver. After defining the activities, it is important to estimate their durations as a result of their resource usage, and consequently, one can easily calculate the rate of its cost drivers (Everaert *et al.* 2008).

In Spain and many other countries, construction projects lack a standard form for contract. The majority of the contracts between the clients and the suppliers rely on a quantity survey model. Moreover, these types of contracts apply to both the public and private sectors of the construction projects. Hence, contractors bear the risks of the upcoming fluctuations in unit prices, but not the modifications made to the bill of quantities due to design faults or the unplanned events. In comparison, contracts such as FIDIC (International federation of consulting engineers) are also employed in many countries, but only in the case where international financing is at play [25]. Further to this, the quantity survey contract helps overcome the contractor's confusions and encourages them to be more competitive by

adapting their profit margins (Marsh, P., 2017). Clients consider it highly important that all activities are included and properly identified regarding the scope and specifications (Hughes, Champion, and Murdoch, 2015).

In addition, across different remote construction projects and government contracts, unit prices are derived from multiple construction price databases [10,11,12]. On the other side, the majority of Spanish regions have established their own price directories (e.g., Andalusia [43], Catalonia [51], Extremadura [49], Madrid [46] etc.). However, it is crucial to incorporate these prices into a project. Additionally, the private sector includes industries that have built their own in-house construction price databases (e.g., (CYPE Arquimedes (2019), (PREOC Premeti (2019), (PROSOFT Menfis (2019) etc.). The public and private databases are categorized into five major types, such as:



Use of Coding Systems in the Construction Industry:
An approach based on relationships and commonalities that supports organization and standardization is referred to as a coding system. Coding systems not only promote the standardization, but also the use of common techniques and ideas.
They possess the following traits (Mêda, and Sousa, 2014):

- Standardization (single categorization principle)
- Distinct nature of categories
- Comprehensiveness

One of the biggest challenges is to define the criteria that needs to be used in the dissection of WBS (work break down structure) (Garcia-Fornieles et al. 2003). Moreover, the International Organisation for Standardisation (ISO) established eight possible classification standards for construction-related information. These eight standards include element, project segment, space, products related to construction, building aid, characteristics, and management. On the contrary, some other authors have advised to segregate the construction tasks from engineering works (Kang, and Paulson, 1997). Specifically, the latter suggested a construction information classification framework in one angle (based on aid, space, procedure, element, and resource requirements), and an engineering data classification framework in contrast (this was based on construction category, life span, product or service, tasks, operation, and man-hour feature criteria) (Chang, and Tsai, 2003).

Hence, it became clear that these firmly established national methods would complicate the implementation of an international standard. As a consequence, a balanced agreement was required. It was asked to develop a framework for classification tables. This is because it would enhance the ease of communication among the classification tables used by different national organizations. This would inspire them to establish tables following the same criteria. This is the reason that in the second half of the 20th century, construction industries from across the globe started developing other classification and coding techniques (Kang, and Paulson, 1997). The best example in this case involves a standard core of measurement per Cost planning (CMCP). Additionally, this case is practiced in Europe. The core of measurement per Cost planning (CMCP) was proposed by the European Council of Construction Economists (CEEC), and that too with having the following countries: Belgium, Poland, Denmark, Estonia, the Czech Republic, Finland, France, Germany, Hungary, Ireland, the Netherlands, Portugal, Spain, Poland, Switzerland, and United Kingdom (UK).

BSAB from Sweden, the European system focuses on the classification and coding of the German standard DIN standards 276-1, and, to a small degree, on the standards from other nations, UK-based Uni class, Australia and New Zealand, TALO from Finland, Estonia and Russia, and DBK from Denmark, etc. The CMCP, and its follower ICMS, originate from

coordinating work approaches and circulating knowledge among construction projects. This is attained by providing a common set of measurement involving all the rules and important guidance relevant to cost management. According to the CEEC (Stoy and Wright, 2007), the WBS structure commonly used in construction projects goes through six stages. Similarly, the LCB bank project followed these six stages, which are demonstrated below:

1- The mutual collaboration of stakeholders, engineers, and project managers has helped determine the end result (or deliverable) that is required to meet the goals.

2- The project managers and the team analyzed the scope to confirm that the requirements align with the WBS deliverables.

3- The project managers organize the chapters (first level of decomposition) to enhance understanding by categorizing them into clearly separated divisions.

4- After that, the project managers keep on refining each chapter to a fitting level of detail.

5- The project management team breaks down the chapters to the most detailed level (construction element), where both the expenses and the timeline are reliable, leading to efficient project tracking and management.

6- Lastly, the project managers examine and adjust the WBS until all the key stakeholders achieve agreement regarding the planning and execution.

On the other hand, some additional coding systems have been introduced. In this case, in two of the most highly developed countries such as United States (USA) and Canada, two of the standards namely Masterformat and Uniformat (Construction Specifications Institute, 2010) have been introduced by Construction Specifications Institute (CSI) (Johnson, 2004). Masterformat maintains a material-based structure, while Uniformat follows a systems-based organization. The Omniclass standard came into existence as a consequence of the combination of these two systems (OmniClass, 2010). Through these systems, the CSI promotes effective management and exchange of information in the construction industry. The major agenda behind all these systems is to improve the overall performance of the construction projects.

In the same way, as a consequence of these unrelated initiatives, the international standards ISO (International Organization for Standardization, 2015) and ISO 2018 (International Organization for Standardization, 2018), were formed. As stated by the IOS, the construction industry's inconsistency concerning standardization was likely hindering the industry's development toward enhanced quality, operational efficiency, and productivity. Yet, most of the countries having construction classification systems have either given rise to the new standards based on the ISO standards, e.g., USA and Canada use Omniclass (OmniClass, 2010), Sweden utilizes CoClass (Swedish Building Centre (2018), Denmark employs CCS (Molio, 2019), and ICMS is used in Europe (See-Lian *et al.* 2019). Further to this, some countries have also revised the current standards such as, UniClass in the UK (NBS (2019), and TALO in Finland (Construction 2000 Classification Committee, 2000). A comparison of the approaches used by these coding systems is demonstrated in the given table:

Table 1: Comparison between all the internationally used coding systems.

ISO 12006-2	**ISO 81346-12**	**Omniclass**	**Coclass**	**CCS**	**Uniclass**
Information		Information		Documents	Forms
Products	Elements	Materials for products	Elements	Elements	Products
Stakeholders		Disciplinary roles		Documents	Agents
Resources		Tools		Equipment	Tools and machinery
Management		Services		Documents	PM
Procedures		Stages		Documents	Stages

Complexes			Complexes		Complexes
Components		Based on functions and forms	Components	Components	Components and Activities
Constructed areas	Areas	Based on functions and forms	Areas	Constructed areas User areas	Areas Locations
Components	Based on functions and techniques	Components	Based on functions and techniques	Based on functions and techniques	Functions Systems
Work Results		Work Results	Production		
Properties		Properties	Properties Landscape	Classes	Properties CAD

In contrast, the given table illustrates significant coding system proposals aimed at achieving standardization of project cost structures.

The implementation of BIM led to an increased need for data to be automatically managed. A unique and clear naming of all objects along with their attributes is essential, and utilizing reference libraries for object-oriented data is equally important. Consequently, resulting into the formulation of a new standard: The ISO 12006-3 (International Organization for Standardization, 2015). At the moment, this standard is under review.

Table 5. Advancement of the major coding systems in the construction industry.

Code		**Edition**	**Scope**	**Organization**
	First	**Last**		
Masterformat	1963	2018		
Uniformat	1973	2010	USA	Construction specifications institute
OmniClass	2006	2019		
DIN 276-1	1993	2008	Germany	Deutsches Institut für Normung
BSAB	1996	2005	Sweden	Swedish Construction Hub
CoClass	2015	2018		
UniClass	1997	2019	UK	Construction Project Information Committee
TALO	2000	2017	Finland	Foundation for Building Information
DBK	2006	2010	Denmark	Building data Technology, Productivity, and Guidelines
CCS	2012	2017	Denmark	Building data Technology, Productivity, and Guidelines
CMCP	2008	2014	Europe	European Committee of Construction Economists (Global consortium)
ICMS	2017	2019	Europe	European Committee of Construction Economists (Global consortium)
ISO 12006-2	2001	2015	World	International Organisation for Standardisation
ISO 81346-12	2018	2018	World	International Organisation for Standardisation

Combining Work breakdown structure (WBS) and Cost breakdown structure (CBS):

The first and foremost step for the estimation of activity costs is to determine the scope of the construction project and set up the WBS. After that, it is important to discover relevant unit cost items within construction price databases (Liu, Lu, and Al-Hussein, 2014). Due to the implementation of a unique coding system, the cost items that are linked to a project, organization, project package, resources, and supplies can be easily combined (Harrison, and Lock, 2017).

Duration and cost are called as the two primary goals of construction projects (Ballesteros-Pérez et al. 2014). Therefore, it is important to put a significant amount of effort during the planning and control stage of the project (Park *et al.* 2011). Moreover, the schedule and budget are closely related to each other. On the other hand, the timeline and budget performance are highly linked, this is because they both have similar management processes likely the shared information, resources, and quantity lists (Fan *et al.* 2016). However, project efficiency can be improved by creating a breakdown structure built upon the integration of CBS and WBS (Lee, Lee, and Kim, 2019). This would also increase the chances of the development and systematization of the upcoming management standards (Young-Bae, C., 2002).

As outlined before, benefiting through a coding system is crucial for the incorporation of the project structure. Thus, the timeline and budget of a project can be smoothly planned (Yang et al. 2012). Additionally, this incorporation fosters a more precise definition of the characteristics of all project elements, and it also helps guarantee consistency (Park, and Lee, 2011). For the past thirty years, there has been an increased demand for enhanced control (e.g., Hendrickson, and Au, 1989, Teicholz, 1987, Rasdorf, and Abudayyeh, 1991). For instance, integrating the CBS and WBS could allow the formation of a matrix that tracks the location of each element as well as the progress of each activity being performed throughout the project (based on WP and CA). Certainly, a significant number of contemporary integration models focus on controlling and directing the projects with the help of measuring the progress rate throughout the execution period. The purpose of this is to determine if they are moving forward as per the planned timeline and costs (Cho, Hong, and Hyun, 2010). This could be further enhanced due to the integration of CBS databases and units based on WBS.

Utilizing BIM Applications in the Project:

The project management team of this project for the LCB Bank has decided to leverage BIM during the construction of buildings. The use of BIM has helped the management team manage construction data, including documentation that ranges from the design stage to subsequent maintenance and operational procedures. BIM has advanced its endeavors within various sectors, including facility management (FM) (Cavka, Staub-French, and Pottinger, 2015), lean management (LM) (Terreno, Asadi, and Anumba, 2019), and, last but not least, the railway industry (Bensalah, Elouadi, and Mharzi, 2019). The main reason behind its use during this bank's project was that the BIM systems hold a large volume of information. Consequently, the use of BIM has eased the process of exchanging that information with other team members who were involved remotely for a short time. Moreover, it has also enabled the management team to interconnect data, leading to improved assistance concerning a variety of analyses, such as PM analyses encompassing framework, quality, timeline, expense, and risk. With the growing popularity of BIM, data automation, especially in terms of acquisition and management, is ensuring greater dependability, precision, and exactness in scope definition and estimating financial requirements. As a consequence, these circumstances have resulted in improved engagement and greater participation from all the stakeholders involved in this project.

In this way, when conditions involve more data, it is essential that all available data is both reliable and confidential, making standardization crucial throughout the entire construction process. This can be easily executed with the integration of a WBS within the BIM model (Nam, Jo, and Park, 2017). The WBS has established itself as an outstanding tool for avoiding and managing cost overruns, delays, and risk activation (Subramani, and Sivakumar, 2018), particularly when used alongside PM software (Aziz, and Kumar, 2019). In fact, many BIM-based tools have been established for construction scheduling and cost estimation (Liu, Lu, and Al-Hussein, 2014), yet most of them place emphasis on the item and component level (Sun, Man, and Wang, 2015).

It has been seen that the BIM-driven WBSs have been implemented in construction

industries from time to time (e.g; creating a prototype that connects the CBS and the WBS (Nam, Jo, and Park, 2017). Despite that, the major focus of these systems is the products (such as the buildings or their infrastructure) while ignoring the management aspect. When integrating the CBS and the WBS, it is important to consider this dual aspect (the outcome and the required efforts to implement it) (Lee, Lee, and Kim, 2019). On the other hand, the process categorization system as well as the cost categorization system both need to be grouped into BIM models. As a consequence, the multi-faceted activities should be coordinated with cost statements in accordance with the combined use of WBS and CBS categorization systems at the same time. However, the object-oriented strategy for building information modelling promotes the establishment of standards for various WBS databases (Ibrahim *et al.* 2007).

When considering remote work, it is clear that BIM provides exceptional automated techniques for generating precise quantity measurements (Sattineni, and Bradford, 2011). All the information regarding the management of the project involving its progress, budget, safety, and quality is merged using 3D models, supplying beneficial information for project managers (Ding *et al.* 2012). Furthermore, BIM also offers much expertise related to engineering information, such as saving architectural models that comprise geometric and technical details.

Nevertheless, an important problem in today's 3D BIM models is the difference between the element breakdown structure (EBS) and the WBS (Work breakdown structure) in the project timeline. Incorporating construction records into BIM is still a challenge due to the variety and unstructured nature of data formats (Park, and Cai, 2017). Although many construction reports are generated during the construction phase, including schedules, building methods, site documentation, budgeting reports, change directives, and other relevant documents, but they are not included in the as-built records.

Advancements in computer software

The advancements in computer software have enabled the tracking and supervision of projects down to the smallest level of detail. The best example in this case involves the widely used project management software like MS Project and Primavera that led to monitoring the project-related tasks remotely. This way, the project-related complications, improvements, quick modifications, reports, and standardized communications have all become convenient and simpler than ever (e.g. Jayaraman et al., 1999; Muthuraman et al., 2000a, b, c; Singh et al., 2001 have optimized the processes like the planning, designing, implementing, empowering and executing the commercial output of large projects). Although many improvements have been made and procured in project management (Jayaraman et al., 2000), there is still a lack of unity and commonly followed practices for managing the expenses of a project. The main reason is found in the very essence of the subject – every task involved in the project is generally a one-time effort and the associated uncertainties make it exceptionally difficult to standardize. Therefore, the people involved in a project need to continuously improve and adapt to the new techniques. In other words, they need to analyze and incorporate those techniques within their project to find what suits them best.

The impact of communication technologies on remote project management

Transferring data, knowledge, and ideas among workers inside an organization or group is called organizational communication (Cacciattolo, 2015). It includes both the official as well as unofficial channels through which data and information are shared among employees working at different levels of the organizational structure. Effective communication among the employees helps an organization achieve many goals and objectives, encompassing transparency in the employee’s responsibilities, decision-making, problem-solving, dispute resolution, and the creation of a positive organizational culture (Verčič, 2021). On the contrary, effective communication can cause a lot of problems for an organization as well as its employees. Increased conflicts and decreased productivity are some of the problems faced by an organization that lacks focus on effective communication between the employees.

The coronavirus pandemic has allowed the world to experience a sudden move from a traditional to a virtual workspace due to a lockdown that has also disturbed daily life activities. As a consequence, business professionals switched to online means of communication in order to meet their needs. This advanced approach to looking for new

online communication tools during the time of the pandemic has allowed researchers to dive deep into analyzing the best available options. Many researchers have studied the impact of using digital tools at the time of the coronavirus pandemic. They tried to assess the project performance (PP) as a result of utilizing digital communication tools.

Communication is the most important aspect of our everyday lives, because of its massive use during business meetings as well as personal conversations. Communication comes from a Greek word named ‘communicate’. Moreover, communicate refers to the word ‘share’. This involves a setting that allows two or more individuals to share their ideas and perspectives through verbal talks. This helps the individuals better understand each other’s points of view. In this day and age, its essence is clear in the fact that communication is the core need for the better survival of both individuals as well as corporations. This way, the organizations conduct corporate communication (Thøger Christensen, 2002). The first one is concerned with the internal communication processes, and the second one helps manage the relationship with third-party stakeholders. A range of international and local organizations such as the United Nations (UN) have an additional program - focused on communication for the purpose of development (Murphy, 2006). This program makes use of a variety of communication tools and techniques that allow the community to perfectly engage with others, Moreover, it highlights the essence of two-way communication to facilitate discussions that encourage positive outcomes in the humanitarian context.

Best practices for project planning and scheduling in construction projects:

A project schedule refers to a well-defined timetable that arranges and sorts out tasks, inventory, and deadlines in such a manner that allows a timely project completion (Hartley, 2020). The schedule of a project is finalized during the planning stage and comprises the following points:

- Timeline with project starting date, end, and milestones.
- The project team members are accountable for their activity (Burga, and Rezania, 2017).
- Work needed to achieve the project’s intended objectives.
- Costs, materials, and dependencies are linked to each task.

Formulating a robust construction project schedule (CPS) is one of the most effective ways to make the construction project a huge success. Over and above that, sticking to the project schedule is proving difficult because of the factors like reliability of the project timeline (Gannon et al. 2012), selection of CPS techniques (Abou-Ibrahim et al., 2019; Al Nasseri et al. 2016; Xu et al. 2018), level of project complexity (Abou-Ibrahim et al., 2019), likely presence of schedule risks and proficiency in risk prediction (Choudhry et al., 2014; Liu et al. 2015; Luu et al. 2009; Shen et al., 2017; Soto Ramírez et al. 2018), funding for the project (Larsen et al., 2016), level of teamwork during the project (Sinesilassie et al. 2017) and additional factors.

Prior research (Bakry et al., 2016; Ghod-dousi et al., 2017; Russell et al., 2013, 2014) depicts that allocating a management reserve, for instance, allowing buffer time, proves to be very beneficial in managing significant challenges and uncertainties. According to Poshdar et al. (2016, 2018), a suitable buffer can be determined by estimating the initiation and completion time of each activity. Additionally, an enhanced focus on planning efforts by practitioners helps in the creation of reliable CPS (Lekshmi & Unnikrishnan, 2018; Lines et al., 2015). In recent times, researchers have been putting their efforts into emerging technologies like four-dimensional building information modelling (4D-BIM) which connects 3D geometric design with project scheduling (Chan et al., 2015).

Techniques for accurate cost estimation and budgeting in project management

Many recent studies have also demonstrated the several dimensions of controlling budgets for construction projects. For example, Harper et al (2014) shed light on the deployment of performance benchmarks to enhance the precision of cost estimates concerning highway and construction projects. Highlighting the requirement of maintaining and transferring cost-

estimating skills that influence project budgets, Alroomi et al. (2016) indicated the ways in which structural equation modelling can be employed to integrate knowledge frameworks connected to estimating. Ilbeigi et al. (2017) came up with the use of some advanced time-series models to predict the costs of asphalt and cement with the aim of improving the precision of construction project's cost estimates, meanwhile, Shahandashti and Ashuri (2016) suggested the application of vector error-correcting models to achieve the similar improvements in the project's cost accuracy. In the traditionally secured commercial building industry, Adafin et al. (2016) picked out several major risk factors that control variability between project budgets at the time of the design stage and the overall contract values for analyzing construction costs.

The costs of the construction project for the LCB Bank in Ivory Coast are estimated by applying a 'bottom-up' method that divides the cost of each task into different components, where the estimator calculates the respective labor, materials, and additional costs separately. While estimating the cost of the highway construction project, it has been observed that highway organizations normally depend on historical data of standard bid amounts to develop this kind of bottom-up cost estimate. On the other side, since everyone knows how difficult it is to estimate the costs of each activity during the conceptual planning phase, a method can be used with the help of ''high-level'' project aspects that can be obtained through increased confidence (AASHTO, 2013). When performing conceptual estimates, the existing information about the cost estimation during the construction projects mainly shows shared dependence on the skilled staff of the highway agencies and recognizes potential gains through the top-down cost estimating technique.

Strategies for effective project monitoring and cost control

The cost control process of this project revolves around managing the entire budget and cost of each activity being performed during the project. The project managers involved in this project understand the fact that project needs effective management of costs no matter what industry or field it has. This way, the major aim of the project managers was to manage those costs in order to keep them in control so that they do not cross the estimated budget. This mindset helped them complete the project within the estimated budget and they did not have to deal with the problems concerning the overbudget. The cost control process of this project encompassed various aspects, including the blockage of expenses, variance detection, and the implementation of suitable practices that needed to be carried out when costs exceeded the estimated budget. Thus, it is easier to conclude that the successful cost control of this project ensured financial viability and the fulfilment of project requirements.

Strategies Used by the Project Management Team for Effective Project Monitoring and Cost Control

It is advised to leverage a set of techniques for project monitoring and controlling its budget. This way, some of the strategies used by the project management team for the LCB Bank project are as follows.

1- Realizing the importance of cost control

The success or failure of a project is totally dependent on how perfectly the cost control practices are carried out. To put it in another way, the process of adjusting the project's budget and its timeline according to the resources is also called cost control (Burke, R., 2013). The essence of cost control cannot be ignored from the perspective of the Project manager, client, stakeholders, and lastly, other team members involved in the project. Paying heed to cost control helps achieve the desired project-related goals (Patanakul, and Shenhar, 2012). The correct use of cost control strategies has allowed the project managers to efficiently use all the resources needed to complete the project. The project managers and other team members, such as the engineers, architects, and stakeholders involved in this project, benefitted from measuring the progress of the project with the help of useful cost-control practices. Not only that, but the client who was receiving updates while sitting in Brazzaville was also satisfied to see the loyalty of the project management team when practicing cost control. This is because the project managers and engineers have mutually decided that their major aim will be to ensure that the project corresponds to the client's requirements and desires. On top of that, it also encouraged the client to engage and offer project-related suggestions, which further helped the team better understand the criticalities of the project. This way, it was easier for the client to give regular feedback regarding the

project cost and its estimates. Like every other factor, the project management team has encountered numerous benefits as well as challenges caused by cost control. The accurate estimation of project costs was one of the major challenges faced by the project management team. The cost of a project is determined with the help of so many factors such as its quality, scope, assumptions, and uncertainties (Atkinson, Crawford, and Ward, 2006). In this manner, the project team strived to understand the definitions and meanings of all these terms when estimating project costs. Thus, this enabled them to analyze the complexities of cost estimation terminology and find techniques that could be highly beneficial.

2- Specifying Project management and cost control

Project management refers to an approach of planning, implementing, managing, and finalizing a project to reach defined goals and objectives while complying with the specified limitations in terms of budget, scope, quality, and deadline (Westland, J., 2006)**.** When discussing the major elements involved in the management of this project, it is important to understand the significance of cost control and its role. The actual objective of the project management team while implementing cost control practices was to evaluate the estimated and final costs of the project to ensure that it is executed within the approved budget and provides the expected advantages. As a consequence, the project managers applied different techniques to address the expected risks and challenges they may encounter during the project. These techniques adopted by project managers have helped them minimize the variance in project costs from the authorized budget and maximize the efficiency of available resources.

3- Outlining drivers for a project budget

The first step taken by the project management team was to determine the project cost factors, which play a pivotal role in controlling the cost of a project. In this case, they divide the cost drivers into different types: external, internal, fixed, variable, manageable, and uncontrollable (Anderson, 2006). Thus, it is important for the project managers to first identify these project cost drivers for the purpose of monitoring all the project tasks and setting a clear estimate of their budget. Some of the highly renowned cost drivers used in this project include:

1- Scope:
The scope of a project expresses the ideas it aims to deliver and the things that it will not deliver. In this project, the scope was defined by analyzing the project goals, demands, outputs, and acceptance standards. Scope works as a solid pillar behind the success of a project (Rosenau, and Githens, 2011). In other words, it helps achieve timely output and gain quality results. The alternations made in a project scope can impact its results and quality of work. Not only this, but it also increases or decreases the budget because of the changes made to it. Therefore, the management team has first defined the project scope and controlled it by following careful practices. Additionally, the project managers have leveraged some tools such as the work breakdown structure, scope statement, and last but not least scope baseline in order to record and communicate the things regarding the project scope. The modifications needed in the project scope were carefully assessed, authorized, and recorded by the project management team through a change control process. The best example for the changes carried out in project scope means including or excluding some of the details or tasks from the project outcomes.

2- Resources:
The resources of this project involve the individuals, equipment, and goods that were required to complete the job. The resources can also be considered as an important cost driver because they help in identifying the cost required for the labor, equipment, and goods. In addition to this, the availability of resources, labor, and materials also impacts the project's cost and ultimately its progress (Assaf, and Al-Hejji, 2006). In order to efficiently manage all the resources, the project managers used tools like resource calendars and resource histograms for defining and distributing the resources. Furthermore, the changes made to the resources were being tracked and directed through a resource management strategy. One example of a resource change that happened during this LCB Bank project was hiring or terminating personnel who were exhibiting lower productivity during work hours. Moreover, resource change may also include the purchase or rental of equipment, and gathering

materials from different suppliers (Pagell, Wu, and Murthy, 2007).

3- Time:

The time needed to complete a project means the period and schedule for all the project-related tasks (Chin, and Hamid, 2015). Time is also considered one of the most crucial cost drivers of a project. This is because time leaves a lasting impact on the labor costs, goods, and overall equipment of a project. As the project duration increases, project costs also rise (Memon, Rahman, and Azis, 2011). On the contrary, the shorter the project duration, the lower the project cost. As far as the project for the LCB bank is concerned, the case was completely different. The shorter the project duration, the higher the budget. The **reason** behind this difference was that the project needed to be completed on a tight deadline. This is why the project management team, including engineers, architects, project managers, and other stakeholders, decided that the project needed more people to finish quickly. Thus, in order to hire more people for the work, they needed a larger budget for compensation; therefore, they asked the client to pay more. In addition to this, they assured the client that the quality of their work would be the best and that they would use high-quality items during construction. For example, the plastering used by MBTP is always of high quality; this is why it is expensive. Moreover, high-quality plastering is used only for projects with a substantial budget.

As far as the importance of scheduling is concerned, the project managers should always focus on estimating, controlling, and scheduling the duration of a project precisely and sensibly. Moreover, the tools like critical path method and Gantt charts make project planning and tracking smoother than usual (Pellerin, and Perrier, 2019). Additionally, they also save time and effort and consequently lead to bringing quick and accurate results. Moreover, some project managers prefer using the highly used tool called network diagrams to monitor and track the work schedule.

This way, the changes made to the time need to be assessed, acknowledged, and reported with the help of a schedule management plan (Steffens, Martinsuo, and Artto, 2007). Delay in the project activities and milestones is the best example of this project deliverable.

4- Creating a budget and cost benchmark

By formulating a precisely outlined budget and cost framework, project managers achieved financial control and made strategic choices during the course of the project lifecycle for the LCB bank.

1- Getting a clear picture of the Project Scope:

Before establishing a budget, it is essential to have a clear understanding of the project scope (Dorey, 2013). The first step taken when creating a well-defined budget was to gain a proper knowledge of the project scope. This way, the project manager defined the project goals and resources. Furthermore, the project managers identified project objectives, deliverables, and the project timeline. After gaining a clear know-how of the project scope, project managers calculated the resources needed and distributed the budget accordingly.

2- Performing cost estimation:

The next step following the project scope was for the project manager to perform a cost estimation. This refers to defining every possible expense related to the project such as the goods, labor, and equipment, along with additional costs (Kaplan, and Cooper, 1998). Carrying out a well-detailed cost estimation process helped the project managers design a budget that meets the project needs and works for the client as well. This is why the client agreed to pay more for exceptional quality.

3- Including contingency in project planning:

It is crucial to include a contingency amount in the budget to account for unforeseen circumstances or risks that may arise during the project. This contingency amount acts as a buffer and helps mitigate any unexpected cost overruns (Paquin *et al.* 2022). For that regard, project managers assessed the project's complexity and allocated an appropriate contingency percentage to ensure financial resilience.

4. Emphasizing cost control initiatives:

Emphasizing cost control initiatives is essential in an era where project management is widely practiced (Meredith, Shafer, and Mantel Jr, 2017). Thus, in order to gain maximum

positive results and increase the effectiveness of the project, project managers paid heed to cost control measures. When project managers started focusing on cost control initiatives, they applied several strategies such as cost-effective engineering, resource efficiency, and effective sourcing techniques. Through active cost monitoring and management, project managers spotted possible cost-saving openings and guaranteed compliance with the set budget.

5- Observing and managing Expenses:

During the complete project lifecycle, regularly monitoring the expenses is essential for project success (Pinto, and Slevin, 1989). The project management team assessed actual costs in relation to the standard budget and detected the presence of variances if found any. By carefully controlling and tracking expenses, the project managers were able to identify budget deviations from the established cost and take timely actions to address any issues.

Target Costing Method in Remote Construction Projects

Target costing is a very essential tool for controlling and lowering the costs of a project. Unlike traditional costing techniques, target costing relies on the expected selling price as the market price. This method allows organizations to precisely estimate the costs, mitigate profit risks, and yield quality results within no time (Jusohb, & Baharudina, 2015). The primary goal of target costing is to estimate cost based on the objective chased by the company in a competitive marketplace. Every other company follows its own set of techniques for using the target costing method. Some of the commonly used steps by most of the companies involve setting a target price as per the market prices, competition in the industry, setting a crystal-clear profit margin, identifying the cost needed to be acquired, and calculating the project costs using the existing methods & techniques. Once the target cost is calculated, the organizations rush to follow a set of processes to make the best use of the target costing method. In this manner, developing a team of skilled professionals that help with the designing and planning stages is the first and foremost step followed by many organizations. The tools used by organizations while establishing a team of professionals include value engineering for the designing of buildings and infrastructure and kaizen costing in order to control and minimize the cost of the project (Melo, & Granja, 2017). The main purpose behind the use of target costing is to calculate costs grounded in the goal chased by the organization's competitive marketplace (Sharafoddin, 2016).

Performance-oriented costing for Construction Projects

In order to better understand the concept of performance-oriented costing, one needs to grasp the idea that project-related activities utilize resources and the products involved in a project consume activities. Performance-oriented costing deals with the activities instead of their cost (Ayorinde, Osarenren Osasrere, & Ademola Adeniran, 2015). The performance-oriented costing also refers to a system that works as an overhead cost accounting framework focusing on cost-driven activities linked with the task pool and targeted costs. It means that the project overheads are allowed to be assigned to the project-related tasks that are derived from cost drivers. Further to this, the activities can be classified into batches, projects, units, and overheads that support facility activities (Jaya, Pathirage, & Sutrisna, 2010).

Dividing activities can result in the elimination of tasks without the presence of value-added aspects. This method is useful for providing information on resource needs and cost objectives for strategic decision-making (Damjanovski, 2013). One of the competitive edges of activity-based costing and a typical costing approach lies in the project's cost drivers. The costs that are not estimated in the traditional method are also calculated using activity-based costing. Not only this but the total cost of the project is calculated using logical reasoning (Tang *et al.* 2015). Moreover, the project overhead costs are distributed among the project tasks that are determined by the cost drivers (Jaya, 2013). Just like every other technique, this approach also comes with a variety of challenges and limitations for its utilization in construction projects. A step-by-step process for performance-oriented costing used to manage the construction of this project is given below.

- First of all, the project activities were defined and a theme was selected
- After that, project overheads and their cost statements were determined
- The overhead cost including its unit, batch, and project were divided
- A cause-and-effect linkage between project-related tasks was developed.

- The Quantity drivers were optimized
- Preferred cost drivers were measured
- Cost accounts were divided among all project-related activities

As per the issues identified in the activity-based costing model, Namazi in the year 2009 came up with a next-generation costing model, called performance-focused activity-based costing (PFABC). This approach can be incorporated using the organization's resource planning and performance tracking system. In comparison to the process of classifying project activities into four different classes using the traditional ABC model, this system leverages two types of costs namely flexible costs and the committed costs. Furthermore, the method is carried out by taking advantage of the simplified approach to calculate the flexible (variable) costs. This system also helps in determining the cost drivers such as the rate and the level of fluctuation a project goes through. The process also helps track individual workers' productivity as well as the overall productivity of the organization, and it evaluates two of the most common elements of productivity, efficiency and effectiveness (Namazi, 2009; Namazi, & Shamsodini, 2016).

To gain accurate cost information that aligns with cost objectives, a study has put forth a cost distribution method that further enhances the quality of the first-generation activity-based costing model. This model gives more precise information than other traditional methods and it simplifies the first-generation activity-based costing model into a one-step process (Bent, & Caplan, 2017). According to a study that explains target costing in the Iranian market, it has been stated that target costing refers to a cost management tool aimed at lowering costs during the initial phase of design and product planning. Target costing also helps in identifying cost-effective prices and client's requirements. Furthermore, the application of value engineering and activity-based costing is important for effective application of target costing (Sharafoddin, 2016).

According to another research, the target-focused life cycle costing model has been introduced using the basis of the ABC model and this further indicates that the use of target costing and ABC technique within the manufacturing industry has yielded strategic gains of target costing combined with ABC's functional payoffs. Moreover, by applying cost control strategies, minimising cost and ensuring quality control results in fostering synergies related to cost management and offers accurate data for informed decision-making (Yuksel Pazarceviren, & Dede, 2015). Nevertheless, the research findings established a model for process management system in the manufacturing sectors, with an absence of clear evidence that is needed to contribute to the reinforcement of the difference between project management and process management (Toosi, Sebt, & Maknoon, 2014). On the other hand, ABC's application has been utilised within another research in order to boost management efficiency and pricing decisions. Additionally, improvements made in the decision-making practices for controlling or terminating activities, as well as modifying pricing policies to enhance product diversity, have been placed above 80% that is highly impressive.

Using the target costing method for accurate pricing decisions for the project at the LCB bank led to improved customer satisfaction and faster outcomes. As a consequence, the ability to deal with the changes applied to advanced cost management techniques is vital (Ayorinde, Osarenren Osasrere, & Ademola Adeniran, 2015). Many countries have utilized the target costing method in order to better deal with the construction projects. Thus, it is easier to state that target costing plays a critical part in the successful functioning of the construction projects. Research carried out for integrating target costing in the real estate industries has resulted in generating a proposal to serve as a proper guide. During this research, they formulated a set of guidelines starting with the creation of target costing and competitive pricing alongwith the ongoing assessment of components and choosing the key suppliers. It also includes discovering opportunities and controlling project costs on the basis of value engineering (Melo, & Granja, 2017).

Martha Jaya designed a model for controlling overhead costs through first-generation performance-based costing and calculating overhead for each task around cost drivers to bring accurate estimates, project budget, and costs in construction projects (Jaya, 2013). In Zimina, Glenn, & Pasquire, (2012), a new technique named target costing and lean methods has been implemented for designing target value of 12 construction projects, which targets construction cost savings in the project's completion regarding cost, quality, and time. The

application of the target value design during these construction projects has contributed to meaningful changes and lowered the final cost to 15% compared to market costs (Zimina, Glenn, & Pasquire, 2012). On the other hand, some studies depict that the target costing is utilised for identifying the cost of a building before starting the designing process, it also facilitates the management of the design process to gain target costs. For designing and constructing the building for the project of LCB bank, the project management team used BIM (Building Information Modelling) to structure the costs and components of the building before designing it as per the employer's needs. Moreover, the BIM also states that the target costing results in gaining a proposed value and cuts down on waste (Pennanen, Ballard, & Haahtela, 2011).

Research Methodology:

The study plans to implement a qualitative research methodology for collecting the data. To gather qualitative research data, in-depth interviews were conducted with primary sources, such as contacts from Brazzaville construction companies. Further to this, the data that is collected with the help of the interview process is considered primary data, providing the research with precise and relevant information on the subject. On the other hand, secondary data involves information gained from the government. Moreover, it also encompasses the companies' yearly financial and non-financial reports. This way, the information gathered from these reports is categorized as secondary data, which facilitates the primary data collected through interviews. However, the research questions help streamline the entire data collection process.

Data collection Procedure:

In this study, we have used both the primary as well as the secondary data collection procedure. In this way, the primary data that is collected with the help of the meetings is centred around the questions that are prepared to be addressed during the meeting. The meetings were conducted using highly renowned remote meeting software like Zoom and Google Meet. The meetings held were all about the project-related strategies that may benefit the project in its planning and costing stages. Moreover, the project managers, Management (costing and planning) engineer, and architects were all involved during these meetings to better understand its agenda. All the meetings were aligned not only with the client but also with the involved stakeholders. In other words, this project dealt with many other meetings that were held only between the stakeholders such as the management engineers, architects, and the project managers. On the contrary, the secondary data collection process is carried out with the help of the companies' previous projects and doing research on various academic studies. Considering the project for LCB Bank, the companies' previous projects include construction activities performed with the help of the project management team. To correspond with the data collected throughout this study, secondary data was obtained by collaborating with the project management teams that handled previous projects for the LCB bank. In this manner, the project managers shared the information and guidelines about how to tackle these kinds of projects and what risks need to be avoided. Moreover, the challenges that they have encountered because of the remote work were also disclosed by the project managers who carried out old projects for the LCB bank. From the data gathered with the help of these studies, we have identified that remote construction projects mainly flourished after the coronavirus pandemic.

Construction industry has to deal with a variety of challenges and risks; thus, it includes the scenarios where uncertainty is typically expected (Smith, Merna, and Jobling, 2014). Due to the unpredictable nature of the construction project, risk management is considered as the core need in order to suitably manage the tasks (Akintoye, and MacLeod, 1997). Although there are many challenges and mishaps faced when working on a construction project, one can still overcome these situations through the prompt use of effective risk management strategies (Hubbard, 2020). In this way, there are two ways to analyse the risks including the quality analysis and the quantity analysis (Aven, 2015). Both these methods come up with a variety of methods and techniques that further prove to be highly beneficial in better management of the risks involved in construction projects. As far as this research is concerned, we have used the PMBOK technique in order to identify risk management following a variety of steps. PMBOK techniques offer strategies designed to mitigate the impact of risk on the project (Barghi, 2020). The steps carried out during the project planning phase are as follows.

1- Risk management planning

2- Risk identification

3- Quantitative Risk Analysis

4- Qualitative Risk Analysis

5- Risk Mitigation Planning

6- Risk tracking and management

One of the most critical points while discussing the risk analysis is uncertainty. Uncertainty while calculating the time and cost concerning this project was one of the biggest challenges faced by project managers. As a result, risk analysis proved to be one of the most effective solutions in order to resolve these issues during the project. Risk management refers to the structured implementation of management guidelines, processes, and systems that are related to risk analysis, evaluation, and control measures (Naderi, Manteghi, & Safaei Moghaddam, 2014). Hence, before the project began, the project management team identified and evaluated the project risks, followed by the adoption of some suitable strategies to avoid their occurrence or to reduce their effects. Thus, the project management team identified only those risks that could have a substantial impact on the project's timeline and budget. This is because identifying every single risk in project management can become quite time-consuming and fruitless (Jaafari, 2001). After identifying and evaluating significant risks, it is recommended to take action, as effective risk management occurs only when risks' impacts are addressed and reduced through careful planning at the moment of occurrence (Aven, 2016). To achieve this, the project adopted a technique that facilitated quicker qualitative analysis and reduced uncertainty in the decision-making process, leading to positive results. Therefore, this research focused on the use of qualitative risk analysis techniques that have helped the project managers and engineers involved in yielding desired outcomes.

1- Risk management planning

Risk management planning is an important aspect of project management that refers to various stages such as the identification, assessment, and mitigation of the risks that further pave the way to achieving a project's successful completion (Zwikael, and Sadeh, 2007). During the risk management planning for the LCB bank, the major aim was to ensure that the tasks are completed timely and are carried out within the budget. Moreover, maintaining its quality standards is also a priority for the project managers. This is the reason that the team members appointed to handle the project for the LCB bank were assigned different tasks and those tasks were divided among all the team members.

2- Identification of Risks

The project management team has to deal with various risks when working on construction projects. The risks can be in the form of safety hazards, rules & regulations, lack of resources, and delayed tasks (Mohammadi, Tavakolan, and Khosravi, 2018). The following are some of the risks that the project management team of the LCB bank encountered during project planning and costing.

Technical Risks: The technical risks faced by the project management team include the mishaps concerned with the technology used during remotely tackled meetings (Morrison-Smith, and Ruiz, 2020). Many times, the software failure has caused a lot of problems for the project management team, especially the project managers.

Financial Risks: Increases in costs, unexpected expenses, or going over the budget can put the project's success at risk (Raz, Shenhar, and Dvir, 2002). While talking about this project, the team members stated that they faced issues like unexpected expenses. Though they have tried their best to highlight the essence of every single risk that may hurt the project's success, they still have to face some.

Operational Risks: The delays in the project schedule because of the unexpected issues that may arise during the project-related activities lead to several challenging situations (Thamhain, 2013). In this case, disruptions in the supply of items or lack of available resources or labor can impact project delivery.

Regulatory Risks: Changes in rules or adherence obligations in Ivory Coast can sometimes have a large impact on how the project performs. These changes may necessitate adjustments in project techniques to ensure compliance and combat potential risks.

Risk Assessment

Once we have identified the risks, we assessed them in order to identify their possible impact

and likelihood of occurrence. The evaluation of risks took place with the help of qualitative methods, such as:

- **Qualitative Analysis:** The qualitative risk analysis has helped us categorize risks based on their severity and likelihood, leading all the project managers to prioritize which risks need immediate attention. This way, first of all, we tried to deal with the technical risks. This is because we have been carrying out a lot of meetings using Google Meet and Zoom. In this way, we mainly focused on making the meeting process stress-free and smooth. This is because the dealings and budget were all handled through these meetings with the client; therefore, we needed to be more mindful of how we could maximize the impact of these meetings by minimizing technical barriers. Many times, software failure can cause a lot of problems for the project management team, especially for the project managers. Moreover, collaborating and communicating with those who tackled old projects for the LCB bank also highlighted that they have also encountered these problems during the meetings. This way, we have implemented a few strategies that helped us overcome these risks beforehand. In that regard, we maintained continuous communication with all the stakeholders involved. Moreover, we have also encouraged the stakeholders to engage throughout the project to maintain consistency and address the issues promptly. Thus, we became able to combat 60% of the problems that might have been raised during the project. This is because lack of communication can cause the kind of issues that may result in project failure. On top of that, we have also been involved in demo meetings to get familiar with every expected problem that may arise during the meetings. Further to this, we have also applied agile methodologies that help encourage flexibility and responsiveness enabling the project management team to better deal with changes and unexpected challenges more effectively. These practices have proved to be highly effective in yielding positive outcomes because of the fruitful meetings. Moreover, we have conducted regular check-ins and kept implementing strategies to ensure we are on track and addressing any upcoming problems.

3- Quantitative Risk Analysis

In the larger context of quantitative risk management, quantitative risk analysis focuses on calculating risks on the basis of the collected data (McNeil, Frey, and Embrechts, 2015). Quantitative risk analysis seeks to provide a more detailed understanding of the financial implications of the risk on the business and the amount this impact will cause (McNeil, Frey, and Embrechts, 2015). Thus, employing existing knowledge helps in the prediction and estimation of the results (Andres, Otero, and Amavilah, 2021). In order to make the best use of data for quantitative risk analysis, it is essential to first conduct in-depth research and ensure that the information has already been applied to different situations. Let's say, that during the last five projects, category A equipment has failed after completing 7 hours of operation. Therefore, it can be concluded that if category A equipment is operated for 8 hours, it will definitely break down.

With their complex mathematical, statistical, and scientific frameworks, quantitative analysis techniques provide a detailed and accurate assessment of risk, which is vital for developing an effective response (Haimes, 2011). However, a project manager, when working on a construction project, cannot create an effective response strategy without detailed awareness of the size of the risk (Smith, Merna, and Jobling, 2014).

4- Qualitative Risk Analysis

Qualitative risk analysis refers to a method of assessing and categorizing an identified risk determined by the intensity and the possibility of its consequences (Rausand, 2013). In other words, qualitative risk analysis is also considered a primary shield against risks (Lyon, and Popov, 2020). The major agenda behind the use of qualitative risk analysis during this project was to develop a list of risks that must be given precedence over others. Moreover, it also helped filter out potential barriers to the project's success, involving the risks that were unlikely to cause major damage. When project managers addressed the most harmful risks first, it became easier for them to efficiently invest their time and effort to the right tasks, improving project management efficiency.

5- Risk Mitigation strategies

Risks can be addressed through the implementation of effective strategies and techniques that pave the way to the successful execution of a project. This way, the risk mitigation strategies used during the project are given below.

Risk Mitigation Strategies used during the project:

After assessing all the risks that might occur during the project, the next step is to develop risk management techniques. In other words, one may need to develop mitigation strategies that further lead to successful project monitoring. Some of these techniques used during the project for the LCB bank in the Ivory Coast are given below.

1. Risk assessment and prioritisation

After analyzing the potential risks, the project team focused on the ways that could help them better manage all the risks. The next step that has been followed during the project involves assessing and prioritizing the risks. Assessment of the risks mainly involves identifying the chances of the occurrence of those risks (Rausand, 2013). Moreover, it also involves evaluating the impact these risks could cause on the entire working of the project. This way, the project management team prioritized the implementation of strategies for those risks that could have hurt the project's success. In this case, the team conducted an in-depth risk assessment using historical data. On top of that, the project managers consulted experts in the field prior to project initiation concerning all those risks that were proving as a threat. These practices have helped them better deal with the consequences of those risks. In this way, the project managers allocated a risk score for each specified risk, depending on its chance of occurrence and impact. With the help of this scoring system, the project managers started prioritizing risks including the delayed deliveries of the material needed for construction, changes in the design of some floors, and last but not least labor shortages. Furthermore, labor shortages were considered as one of those risks that had a greater chance of occurrence and could have a potential impact on the project. Taking these circumstances into account, the project management team of the MBTP distributed resources and created contingency plans. Not only this, but the project managers applied preventive actions specifically designed to combat these critical risks. This approach has helped the project managers and the other stakeholders proactively deal with the risks and mitigate their impact, resulting in a more favorable project outcome.

2. Risk mitigation planning

Once the risks were identified, we planned to develop a complete risk management framework. This way, we created a set of actions and techniques to minimize the likelihood and consequences of specified risks. The major goal of the project managers was to actively manage potential issues and ensure the smoothness of the project, even when faced with unexpected challenges. In that regard, the project management team also identified the risk concerning the weather conditions during the scheduling process. By keeping in mind the risk mitigation strategies, the team created a kind of system that helped them track the weather conditions. Moreover, they also introduced techniques such as temporary weather barriers and flexible working hours to mitigate the interruptions caused by weather conditions. They incorporated contract clauses with their suppliers and subcontractors to address possible delays caused by adverse weather. These proactive approaches have helped the project management team at LCB Bank overcome the impact of weather-related issues, such as the risks caused by costly delays. This allowed the team to complete the project on time.

Brainstorming as a risk management technique

Brainstorming as a risk management technique encourages an open approach that motivates all team members to take part in the project (Chapman, 1998). This technique allows all the team members to manage the possible risks that may arise throughout the project’s timeline. The project managers involved in the MBTP tried to make the best use of the brainstorming technique. This is the reason, that the project for LCB Bank developed a higher sense of project risk monitoring and its control. The project managers play a key role in brainstorming for the purpose of innovating effective risk management techniques. During this project, an external facilitator was also appointed to avoid the risks because a mishandled brainstorming session is considered as a complete waste of time. In this manner, the external facilitator helped the project managers propose ideas and engage in the brainstorming activity. As far as teamwork and individual brainstorming are concerned, it has been stated that although teamwork increases the chances of improved understanding, it also gives rise to conflicts. Thus, some experts prefer brainstorming as a team and very few go for individual research (Wilson, C., 2013). However, this project for the LCB bank prioritized leveraging brainstorming as a team and thus, it led to problem-solving, encouraged unity, and boosted confidence among the team members.

A number of guidelines for the brainstorming activity were followed by the project managers of the MBTP. Firstly the project managers focused on brainstorming the opportunities, this happens because of the mind's tendency to concentrate on the risks leading to negative outcomes. Therefore, it is preferred to first talk about the positive opportunities to gain a more aligned assessment of opportunities and risks. Moreover, extracting opportunities from a related or previous project to brainstorm concepts for a new project has proven to be beneficial to this project's success. The record of the previous projects kept by the companies has allowed the project team to get familiar with the challenges and learn lessons beforehand. Further to this, additional brainstorming was carried out as part of the brainstorming process that continued after the risks and opportunities had been assessed. This way, the project managers tried their best to experience rare and unique project opportunities or risks that could help them bring about more innovative ideas. Thus, examining the possible opportunities to address various risks simultaneously highly benefited the project's progress. However, an additional opportunity always facilitates generating a greater number of opportunities.

3. Communication and collaboration

Whether it's a construction project or any other kind of project, it is important to maintain open communication and boost collaboration among all the stakeholders involved (Urbinati *et al.* 2021). Proper communication between all the project team members is also essential to ensure effective risk management. Consistent communication allows all the team members to become aware of every single detail of the project (Englund, and Graham, 2019). This further enables them to think and perform accordingly. The communication can be improved during project meetings such as formal and informal. Offering a platform to all the team members for addressing risks, updating about the progress, and sharing concerns they may encounter can be involved in formal and informal meetings. In that regard, the project manager conducted regular meetings with the engineers and architects to discuss the construction-related issues they may encounter. These meetings have helped the team members openly discuss the challenges they are encountering and get assistance with resolving those issues. During these meetings, the project management team encouraged all the stakeholders to provide their input while disclosing their encounters. This collaborative environment has enabled the team to analyze and address the potential risks early on. On top of that, this has allowed the team members to share effective approaches and collectively develop measures to reduce the impact of those risks. This proactive approach proved to be highly beneficial in the project costing process as it helped the team carefully meet budgetary objectives. This also contributed to fewer conflicts and ensured that the project progressed smoothly while achieving timeline objectives.

4. Continuous monitoring and review

Managing the risks in construction projects requires one to put in consistent effort and keep on reviewing the project's progress (Winch, 2012). Thus, it refers to continuously monitoring and identifying risks, assessing the impact of risk mitigation strategies, and recognizing the expected risks that might emerge during the project's lifecycle. This continuous monitoring of risks and their impact allows all the project team members to stay ahead of challenges and promptly act in order to minimize their effects. In this manner, the project managers have applied a robust risk-tracking and monitoring process for the LCB bank. In other words, they created a system to gather and examine data concerning the project risks. This system further had a positive impact on the project's functioning and risk monitoring. In addition to this, the systems have also facilitated the documentation of incidents, close calls, and modifications under the project conditions. Moreover, it helped all the team members to gain awareness regarding the trends, analyze the impact after applying the mitigation strategies, and carry out necessary changes accordingly. Furthermore, routine project status meetings were held during the project for the LCB bank. The purpose behind these meetings was to assess risk registers, update analysis, and consider any new risks or modifications in the project scope. This approach is the only reason that the project managers view this method as having a lasting influence on project planning and budgeting.

5. Contingency planning

Contingency plans are a real need to ensure effective risk management where uncertainties are inevitable (De Meyer, Loch, and Pich, 2002). As far as the project for the LCB bank is concerned, contingency planning was used to develop backup strategies, resources, and

action plans to reduce the impact of potential risks or unexpected incidents. Maintaining project momentum and being adequately prepared to manage unexpected outcomes is only possible when the project management team considers different scenarios and sets up plans for contingencies. During this project, the project management team came up with risks that could have caused the occurrence of unfavourable climate conditions resulting in interruptions in important activities. In order to deal with this risk, the team created a contingency plan that involved plans for speeding up work during favourable weather, re-shuffling activities, and distributing more resources if required. With the help of this plan, the team members were allowed to communicate with other stakeholders in case any readjustments were needed concerning weather-related challenges. Consequently, when sudden rainstorms affected certain construction activities, the team rapidly executed the contingency plan in order to ensure prompt completion. This approach resulted in increased productivity of all the team members.

6. Learning from past projects

Getting know-how about past projects within the same industry plays a vital role in getting familiar with past experiences. In this manner, the past delays depict budget overruns caused by unexpected ground conditions (Reichelt, and Lyneis, 1999). These lessons from the previous projects can be implemented in future projects. With the help of this regular identification of risks concerning ground conditions, the project management team has implemented the process of designing reinforced foundations to develop project duration and budgets accordingly.

In many areas, the project managers face issues with subcontractor performance and coordination. To gain proper experience, the project team enhanced its risk management approach with the help of a rigorous subcontractor assessment and selection process. This involves emphasizing the roles and responsibilities such as developing successful communication channels with subcontractors. By utilizing these lessons learned, the company can decrease the chances of subcontractor-related issues. Moreover, these lessons also help one ensure efficient delivery of the project tasks. This way, knowledge about past projects paved the way to defining the domains that needed improvements while working for the LCB bank. As a consequence, the project team refined their risk management techniques which led them to enhance and improve the overall project results. Thus, the client was so satisfied with the efforts put into the work that he called it an optimized project experience.

6- Risk tracking and management

The project management team allotted for the project of LCB Bank has applied a thorough approach to risk tracking and management in order to achieve project success. They started with addressing potential risks at the beginning of the project. Moreover, they carried initiatives that facilitated engagement between the stakeholders and team members to gain detailed awareness about the project. On top of that, the team also utilized project management software that helped them systematically log and monitor predicted risks, permitting real-time tracking and analyzing their possible impacts. By promoting transparency and nurturing open communication, the team succeeded in maintaining a strong risk management culture that enhanced their ability to navigate problems effectively.

Use of work breakdown structure:

Cost estimation refers to forecasting the project cost in order to accomplish specific goals (Mislick, and Nussbaum, 2015). To put it in another way, the cost estimation process needs to consider every element that is used for the successful accomplishment of project goals such as labor and materials. In that regard, a work breakdown structure is used to achieve a precise cost estimation process. A WBS allows dividing the tasks into smaller chunks called work packages (WPs). Each work package is assigned a team along with varied risks and costs. A work package enables easier and quicker detection of cost overruns concerning a specific task before it can have a negative impact on the project outcomes.

Creation of WBS for the LCB bank

During the project management for the LCB bank, a work breakdown structure (WBS) was designed to carefully manage different areas of the project. The team has divided WBS into three main groups, each assigned different duties. These groups include the construction team, the Design Group, and the Sanitary Management team.

Construction team

The construction team was assigned tasks regarding the construction of floors such as walls and ceilings. This group included six members:

Project Managers (2): There were two project managers assigned to supervise the entire construction procedure. They focused on ensuring that the project was completed on time and within the estimated budget.

Site Supervisor (1): The site supervisor managed daily activities on-site such as organizing tasks among all the workers. Moreover, he confirmed that all the safety requirements were met.

Construction Workers (3): Actively engaged in the actual construction of floors and walls. These construction activities mainly encompass tasks such as constructing a framework, pouring concrete, and fitting drywall.

Design Group

The design group centred around designing the ceilings and ensuring compliance with architectural standards. In this manner, the group was composed of five members:

- **Lead Architect (1):** Directed the design process, making every possible effort to make sure that the ceiling designs were aligned with the project's complete architectural vision.
- **Interior Designer (1):** Worked closely with the architect to construct aesthetically pleasing ceiling designs, balancing style and function.
- **Draftsperson (1):** Created intricate drawings and guidelines for the ceiling designs, ensuring precision for the construction team.
- **Quality Control Specialist (1):** Analyzed design plans to ensure compliance with regulatory guidelines and quality standards.
- **Management Engineer (1):** Managed everything related to costing and planning of the construction project.

Sanitary Management Team

The sanitary management team was responsible for managing all sanitary installations concerning the project for the LCB bank. However, the team was composed of five members and they are given as follows:

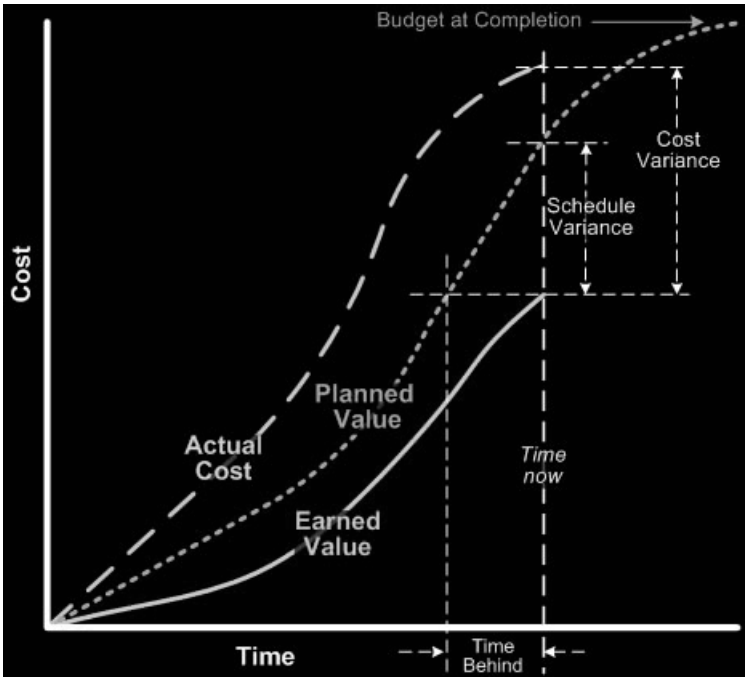
- **Sanitary Engineer (1):** Managed the design and installation of plumbing systems, guaranteeing that all sanitary requirements were met efficiently.
- **Plumber (2):** The plumbers designed the plumbing systems of the floors with the help of the installation of plumbing systems, encompassing pipes, fixtures, and fittings, guaranteeing effective sanitation and performance.
- **Health and Safety Officer (1):** The health and safety officer focused on ensuring sanitary installations meet health requirements and safety regulations.
- **Maintenance Technician (1):** The technician was responsible for regular maintenance and resolution of issues concerning the post-installation of the sanitary systems.

By organizing the project with the help of this work breakdown structure (WBS), the management team appointed to tackle the LCB Bank project succeeded in overcoming its complications. In addition to this, the team also ensured that each aspect is handled with the help of skilled professionals, who are committed to their duties. This structured approach not only resulted in efficient project functioning but also encouraged accountability and dedication among team members.

Tracking performance using Earned Value Management (EVM)

Earned value management (EVM) refers to measuring the performance of the tasks or work packages created using a work breakdown structure (Aminian *et al.* 2016). The project team utilized earned value management (EVM) to compare current performance with the planned performance. This technique is beneficial for managing and controlling the project but one must not completely rely on it as it carries sudden shifts. Measuring risks using EVM has helped the project team overcome the impact of potential risks by utilizing a contingency budget. However, earned value means the total budget that a project has successfully achieved based on the tasks that are accomplished.

For instance, the project budget was estimated at $20,000 and scheduled to be completed within a period of six months. Following a three-month duration, 50% of the work is completed and the current earned value totals $10,000. During this phase of the project, the project is estimated to have consumed about half of the budget. As a consequence, when the actual expenses begin to surpass the earned value, the project team needs to pause and analyze the cause of the cost overrun.



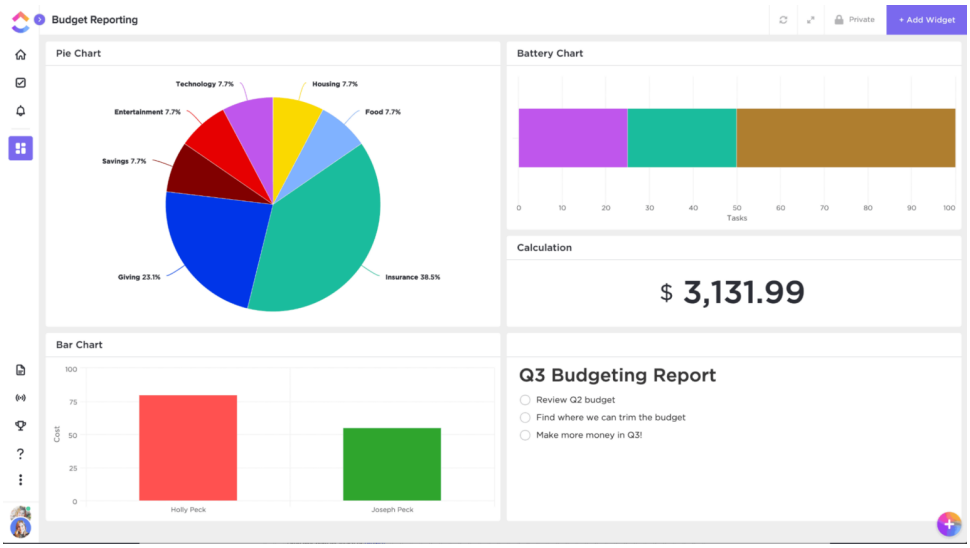
Via Planningengineer.net

Minimizing the changes to the project scope

Everyone is familiar with the fact that carrying out different changes within the project scope results in increased costs, therefore, it is important to minimize changes to the project scope. On the other side, clients and stakeholders usually require modifications at any stage of the project (Newcombe, 2003). Thus, these changes can sometimes significantly increase the costs or the timeline for completion. However, the project managers for the LCB bank dived deeper to analyze the changes that were too challenging to apply without additional funds. Thus, they tried their best to stick to the planned scope designed for the project. As a result, it helped them keep the budget and schedule as planned.

Use of project management software to monitor cost

The project was carried out with the help of project management software to frequently monitor and track the progress. These project management platforms are designed to offer several solutions for every area of the project. This way, ClickUp was used to offer a customizable solution to track and monitor different tasks individually. However, the budget template of the ClickUp named as the ClickUp's budget template is used for project risk management and facilitates tracking the budget of the project and identifying cost-related risks. Thus, the project management team benefitted from the advantages of this software leading them to save time and enhance communication.



Generating budget reports using Dashboards in ClickUp

Tracking the project costs throughout to keep them under control

The team focused on keeping the cost of all the resources under control. These resources include equipment and labor. On top of that, the team used project management software that enabled them to better manage the upcoming risks and control the project costs in advance. However, they still had to encounter challenges regarding the increase in the cost. On the other hand, the use of ClickUp resulted in a well-organized and perfectly managed budget for the project. Furthermore, it also facilitated them with real-time reports, coordination with team members from different groups, and much more.

Collecting project documentation and cost data

While talking about the CPM in project management of LCB Bank in the Côte d'Ivoire, it is easier to conclude that the team has put in a huge amount of effort to achieve effective project planning and cost management. As a consequence, these practices have helped them achieve project objectives likely the evaluation and enhancement of project planning and cost control methodologies. However, the collection of project documentation and cost data carries a systematic approach that provides a foundation for making informed decisions and distributing all the resources throughout the project.

The collection of project documentation and cost data for LCB Bank was conducted using a structured approach that comprised several key steps:

Identification of Documentation Requirements: The first and foremost step to the collection of project documents and cost data involves determining the types of documentation that are required for better project execution (Venkataraman, and Pinto, 2023). These documents during the project encompassed the project charters, project scope statements, work breakdown structures (WBS), and last but not least risk management plans. Thus, every single document played a significant part in determining the project's objectives, products, and possible risks.

Engagement of Stakeholders: All the stakeholders involved in the project, such as the project team members, client, and financial analysts, were engaged in collecting comprehensive data. For a fruitful accomplishment of the project, regular meetings were conducted and their major aim was to ensure that all the meaningful knowledge was acquired. Furthermore, the engagement also fostered alignment of the stakeholders' expectations with the project objectives.

Utilization of Project Management Software: The application of project management software, namely ClickUp, streamlined the collection and organization of data. With the help of this platform, real-time tracking was possible for the project managers which further resulted in project metrics. This facilitated the team to efficiently manage records and cost-related data. Tools like dashboards and configurable reports offered insights into budget discrepancies and resource allocation.

Cost Estimation and Budgeting: Cost estimation was considered one of the most critical components of the data collection process during this project. In this manner, the project team did in-depth research about the historical data as well as the market trends. This data was gathered to develop precise cost estimates for different project areas. The cost estimates involved two types such as direct costs and indirect costs. The direct costs included the labor and deliverables designated for the project. On the contrary, the indirect costs included overhead and backup reserves. Through the categorization of costs into non-variable and variable expenses, the team created a comprehensive budget that highlighted the financial needs of the project.

Monitoring and Reporting: Frequent monitoring of the costs in comparison to the budget was incorporated to guarantee financial control throughout the project. The regular financial statements were generated during the project in order to demonstrate any variances across budgeted and actual expenditures. Consequently, this paved the way for the identification of the areas that require adjustments for the purpose of making timely and informed decisions.

Regarding the management of project documentation and cost data, a documentation and cost data management system was utilized to enhance transparency and accountability among all group members, who were organized using a work breakdown structure (WBS).

Centralized Documentation Repository: Centralized documentation repository involves a system or a platform that manages and stores an organization's data or documents in one protected space (Amorim *et al.* 2017). This system acts as a centralized digital repository where all important files, records, and other data are easily stored and can be accessed. During the LCB bank project's execution, a centralized repository was created to store and protect all project-focused documents. Moreover, the team members were given access to the latest information, thereby decreasing the chances of misunderstandings and errors.

Regular Updates and Reviews: The project team tried to stay updated by conducting frequent audits of the documentation and cost data to verify that they were accurate and relevant. This repetitive cycle permitted the integration of updated details and corrections based on the project's new requirements.

Performance Metrics and Analysis: Performance metrics and analysis is a term used for the systematic assessment of quantifiable metrics that determine the effectiveness and overall success of a project's various operations (Cruz Villazón *et al.* 2020). In other words, these metrics act as the critical indicators that support project management teams as well as organizations in understanding and tracking their performance in different fields such as financial stability, operational productivity, client satisfaction, and employee productivity. While considering the adaptation of the performance metrics and analysis within this project, the project's key performance indicators (KPIs) were designed to examine the project's financial stability. In this context, metrics likely budget variance and schedule discrepancy provided clarity regarding the project's performance and pointed out areas for improvement.

Performing market research to gather cost information

1. Defining Research Objectives

The project management team started by clearly highlighting the focus of their research and the focus of the research mainly includes the research objectives such as the evaluation and improvement of project planning and cost control practices. This way, the team gathered accurate cost data that was needed for the construction materials, resources, labor costs, and other relevant financial expenses. As a result, the research became targeted and was aligned with the goals.

2. Utilizing Secondary Research

We conducted comprehensive secondary research in order to gather available data on market rates and trends. After reviewing industry reports, government-issued publications, and resources from trade organizations for the collection of data on regular expenses linked to banking-related projects in Brazzaville, we set a benchmark for expected costs.

3. Conducting Primary Research

In addition to secondary sources, we also happened to be involved in primary research. This encompassed:

- Surveys and Questionnaires: We distributed surveys among local vendors and

contractors to gather pricing proposals for materials and labor expenses. Consequently, this straightforward method offered up-to-date information that reflected the current market situation. Moreover, it also helped us close the deals with the most reasonable options available.

- Interviews: We conducted interviews with industry experts as well as local construction companies to gather insights about the pricing trends and potential undisclosed costs that were not evident from regular quotes.

4. Competitive Analysis

We also performed a competitive analysis and examined similar projects for the banks handled by construction companies in the Côte d'Ivoire. We analyzed their budgets and cost control mechanisms to gain awareness about how they managed every single expense of the project without exceeding the expected amount and the potential risks.

5. Engaging Local Stakeholders

Engaging with local stakeholders was an ultimate need in order to learn about the regional economic conditions. This way, we conducted talks with community leaders, government authorities, and business stakeholders to understand the details about labor availability, sourcing materials, and compliance costs that might affect the budget.

6. Market Trends Analysis

After working on its market trends and monitoring the data concerning the construction and banking industries in the Ivory Coast, we analyzed economic benchmarks like inflation rates, variations in exchange rates, and requirements for construction services to predict the factors that can affect expenses over time.

7. Cost-Benefit Analysis

Once we collected sufficient information, the entire team carried out a financial analysis to examine and compare different options related to the supplies and construction processes. This analysis helped us make strategic decisions about where to sensibly distribute while keeping the expenses under control.

8. Regular Assessment and Adjustment

During the entire project duration, we built a system that facilitated us to consistently review the collected data regarding the cost of the previous projects in a similar industry. This regular assessment paved the way to adjusting our budget estimations as the situation demands, maintaining financial control throughout the project's completion.

To broaden our analysis, we also performed a competitive analysis and studied banking-related infrastructure managed by construction firms in the Côte d'Ivoire. We reviewed their financial plans and cost control methods to learn how they manage expenses and potential challenges while staying within the expected budget. This comparative analysis gave us additional context and proven strategies to incorporate into our project.

Thus, the above techniques used during the project clearly demonstrate the team’s dedication and effort to bring the best results for the client named LCB Bank. In this way, the team has indulged in a deeper analysis and research which further helped them overcome the anticipated risks on time. However, they still had to address some risks that were likely to occur. The best part is that the team collaborated and discussed every possible scenario they believed needed to be addressed. Not only this, the team stayed in contact even through remote means. Thus, the Zoom meetings and Google Meet were their go-to mediums for discussing the project-related issues and challenges. Moreover, the team members were also allowed to give suggestions related to these circumstances based on their previous experiences. This initiative provoked a friendly environment among all the project members.

Data Analysis:

The planning and costing work for the LCB bank was tackled using careful measures. This way, the project’s preparatory work included a variety of tasks related to the site installation. These tasks involve delivering and collecting equipment, possible occupation of public space, development of material storage areas, site guarding, provision of temporary water and electricity, and installation of temporary site fencing. On top of that, a container was used for the Ens 1 control mission office. To ensure the security of the site surroundings, safety indicators, proper machine positioning during operations, signage, and day-and-night markings were used following EN 1,000.

On the other hand, demolition and evacuation processes carried out during the project include

the removal of door and window casings, along with grilles. Moreover, the project also carries the removal of existing false ceiling installation, removing roof frame and roofing panels, and demolition of all existing buildings such as the transportation of waste material to the public disposal site (with precautions for the nearby wall).

Moving forward, the earthwork cutting and excavation work included the excavations for the isolated footings and raft plates, with an additional 371 m³ of work, compacted backfill under paving totalling 92 m³, and consolidation for compaction of excavation bases amounting to 26 m³. The infrastructure works such as cleaning concrete dosed at 200 kg/m³ for footings and slabs totalling 41 m³, reinforced concrete dosed at 350 kg/m³ for insulated footings amounting to 14 m³, along with reinforced concrete mixed at 350 kg/m³ for underpinning walls totalling 18.3 m³, were performed. Moreover, the infrastructure work also encompassed reinforced concrete mixed at 350 kg/m³ for posts totalling 4.1 m³, 350 kg/m³ for the running sill amounting to 9.88 m³, and floor paving dosed at 150 kg/m³ totalling 24.81 m³. Furthermore, it included steel-reinforced concrete dosed at 350 kg/m³ for the slab plate totalling 27.88 m³, 350 kg/m³ for chaining and stiffeners on the ground floor amounting to 2 m³, and 80-micron polyane film under the floor paving covering 188 m².

While going through the superstructure works, it has been seen that the team used concrete dosed at 350 kg/m³ for walls totalling 50.1 m³, for ground floor posts amounting to 6 m³, for beams totalling 16.1 m³, and for the full slab adding up to 39.5 m³. Additionally, the reinforced concrete prepared at 350 kg/m³ for gutters, parapets, and strips totalling 31.16 m³ and 350 kg/m³ for stairs amounting to 3.1 m³. However, the project carries 350 kg/m³ for floor posts totalling 4 m³, 350 kg/m³ chaining and stiffeners at R+1 amounting to 1.4 m³, and 350 kg/m³ for the cage cover slab stair totalling 0.58 m³.

Further to this, the masonry consists of a hollow agglomeration of 15, joint with cement mortar, adding up to 311.00 m²; additionally, cement mortar coatings with a thickness of 2 cm, incorporating mesh at the joints of reinforced concrete (RC) masonry elements, covers an area of about 622 m², while mesh coatings on the BA wall at the ground floor encompass 285 m².

As far as the wall floor covering is concerned, the installation includes porcelain tiles on the floors covering an area of 488.63 m², and earthenware tiles used on the walls of wet rooms, covering a total of 105.52 m². However, ribbed porcelain stoneware tiles on the stairs added up to 18.43 m², and anti-slip porcelain stoneware tiles for the entrance hall and bathroom covered 28 m².

SEALING, THERMAL INSULATION, AND EVACUATION: The process involves the installation of a green multi-layered hyrene waterproofing membrane applied to the stare cage covering an area of 12 m² while the application of an aluminum pax membrane raised around assorted works and channels totalling 266 m².

In this way, the formation of a 2% slope in a 4 cm thick mortar covering an area of 239.87 m² for rainwater orientation, the installation of 8 stumps for EP removal, the installation of PVC ø110 over a length of 42.14 meters for rainwater drainage, the use of flashing installed around the channel head measuring 44.46 meters, the positioning of rock wool below the face of the cover covering 350 m², and the application of two layers of varnish-type bituminous emulsion on facade walls totalling 72 m² were all completed. All these details clearly depict that the data was gathered by carrying out correct measurements of the walls of the floors.

The budget for all these expenses was designed before its actual application. This made the execution smoother and hassle-free. However, the team was asked to carry out all the tasks within the budget that was already designed. Moreover, the team members also kept on communicating the issues that they encountered during the project. This regular collaboration and communication among all the stakeholders paved the way to managing the risks and quickly dealing with all the problems. Comprehensive planning and budgeting allowed the team to distribute the resources efficiently, assuring that each part of the project was adequately funded.

Not only were regular progress meetings held to check milestones and address any emerging delays, but this also encouraged a forward-thinking approach to project management. Moreover, the application of collaborative software solutions smoothed the process of getting real-time updates and records, boosting openness and collaboration among all team members.

As a consequence, it would not be wrong to say that the project not only met its deadlines but also maintained high-quality work throughout the execution phase.

As far as the supply and installation of 60x60 Armstrong slab false ceilings is concerned, its installation is on the specified support structure for both the ground floor and upper floor covers a total area of 405.19 m². Moreover, in the aluminum carpentry glazing, all glazed aluminum work features a clear glazing of 2x6mm with an interlayer film on a frame made of extruded aluminum, fabricated from Almag alloy si 0.5, lacking a thermal break.

The curtain wall assembly comprises type VEC glazing sized at 2x10mm and an interlayer film, backed by a durable extruded aluminum structure attached using Alti chemical dowels and screens, featuring the following fastening dimensions:

On the front facade:

- Ground floor: 3.45m x 2.62m, quantity: 1
- Upper floor: 7.72m x 2.62m, quantity: 1

On the right-side facade:

- Ground floor: 6.05m x 2.62m, quantity: 1
- Upper floor: 6.64m x 2.62m, quantity: 1

In addition, a pair of entrance doors consisted of three hinged doors with clear glass measuring 2x10mm and an interlayer film adhered to an aluminum frame, which included a security baton, a hydraulic door closer, and a branded lock, seized at 3.27m x 2.50m, quantity: 1. The supply and fitting of glazed aluminum windows for sun guardian premises feature the following dimensions: 1.27m x 2.00m, quantity: 1, and 1.50m x 2.00m, quantity: 1. Furthermore, a local DAB glass aluminum door was delivered and installed having dimensions of 1.09m x 2.20m, quantity: 1, comprising a police baton and a door closer with pressure adjustment. The supply and installation of glass aluminum doors for sun offices contained dimensions 0.90m x 2.40m, quantity: 4. A sliding door was installed in the bay windows allowing entry to the ticket office, measuring 1.20m x 2.20m, quantity: 1. At last, the office partition wall assembly was made of glass panels with dimensions of 2x6mm and dimensions of height 2.40m, which incorporated the given door dimensions: two doors measuring 2.00 m x 2.40 m, one door measuring 1.09 m x 2.40 m, and one door measuring 2.40 m x 2.40 m.

Retractable Rolling Metal Shutters: The furnishing and installation of retractable rolling metal shutters within the display window to the right of the main doorway openings, measuring 3.27 m x 2.50 m, is required for a total of one unit.

Metal Doors: The supply and installation of metal doors at the main doorway to the staircase and sun garage are outlined below. The sizes and numbers are as follows:

- 1.20 m x 2.20 m: 1 unit
- 3.15 m x 2.50 m: 1 unit

The assembly has a pre-painted finish such as its installation, sealing, and fixing prerequisites.

Bulletproof Door for Double Secure Area: The supply and setup of a shielded door for a double secure chamber are specified below. A double-skin door consists of the following characteristics:

- Two boxed faces composed of solid steel plate, at a thickness of 20/10th.
- A reinforcing core covering the entire surface of sheet steel that is fabricated from corrugated steel poles, measuring 10/10th omega, with thermal insulation

filling comprising rock wool. However, the core is supported by four anti-friction spring hinges fixed to the frame.
- The hinge side is secured with three anti-unsticking lugs as well as recessed high-security locks that incorporate a multi-point (3) locking system, a simple half-turn mechanism, and a double stand.
- Coated in LCB Bank color, measuring 0.90 m by 2.20 m (PAR).

Armored Door for DAB Machine Room: The installation and fitting of an armored door for the DAB machine room and related areas are highlighted. The door has a double skin design along with the given components:

- A flat iron pre-frame, 50/10th in thickness and 50 mm wide, installed with eight steel legs for anti-burglary sealing.
- A doorframe fabricated from folded steel sheet, having a thickness of 20/10th mm and a 1 cm overlap on three sides, each 100 mm wide.
- One leaf (opening) in a 60 mm box, with dimensions of 0.85 m x 2.20 m, in a total of two units.

Opening Grille: The installation of the opening grille for the LCB bank project includes construction using 40 square tubes and flat irons, and an inspection hatch measuring 0.80 m x 0.80 m is required in a quantity of one unit.

Fixed Ladder: The delivery and setup of a fixed ladder on walls for accessing a hatch is detailed in a quantity of one unit.

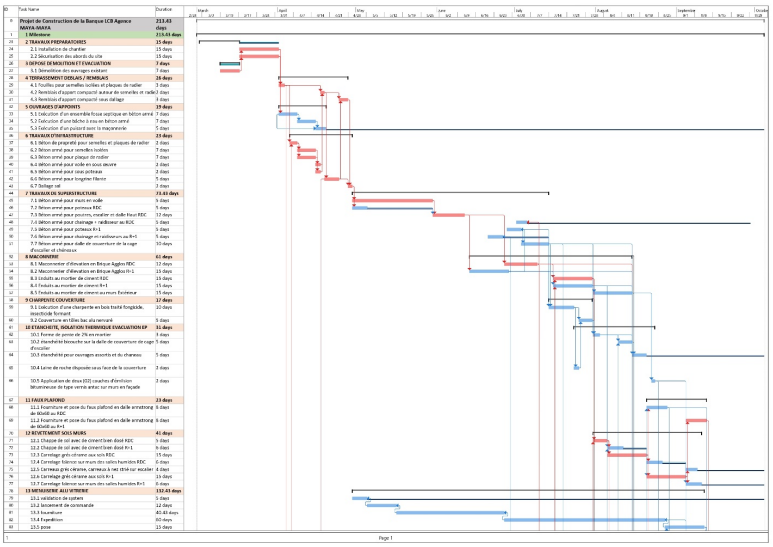
Sanitary Plumbing:
The sanitary plumbing system used for the construction work at the LCB bank promoted the installation of the entire EU, EV, and water drainage system on the first floor. The equipment contains the following elements:

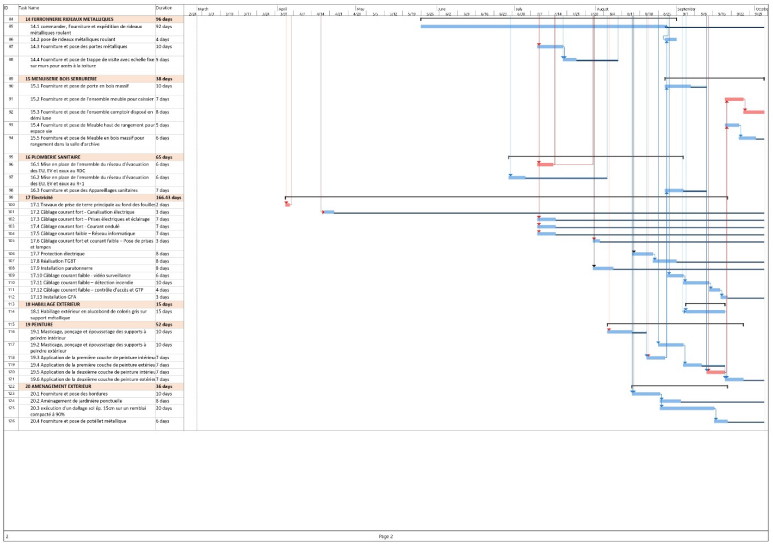
- 1 enamel sink bowl, 1 unit
- 5 chrome toilet paper holders
- 5 English toilets
- 5 Sinks
- 3-floor drains
- 5 units of sink mirrors

In addition to this, 5 stale air extractors were installed.

A pressurized water system equipped with a pressure booster (60 l/min) was installed, establishing a connection to the building's first-floor network. This installation greatly improved the water flow efficiency and sustained consistent pressure throughout the entire project’s execution. Regular maintenance was scheduled to achieve maximum efficiency and enhance the durability of the equipment.

Detailed project schedule and milestones:





Discussion of results

The findings of this research emphasize the essence and dynamics of the collaboration between MBTP and LCB Bank involved in a construction project focused on improving the bank's operations. Another important observation is that even though an estimated budget was defined, the project still exceeded its fixed budget a little bit. This result clearly depicts the challenges associated with controlling the costs for construction projects, particularly in remote settings where unexpected expenses may arise.

Cost estimates and budget breakdown:

N°	Désignation des ouvrages	P.T (HT)
1	TRAVAUX PREPARATOIRES Installation de chantier comprenant : Sécurisation des abords du site:	
SOUS TOTAL		3,158,298
2	DEPOSE DEMOLITION ET EVACUATION	
SOUS TOTAL		1,461,828
3	TERRASSEMENT DEBLAIS / REMBLAIS	
SOUS TOTAL		3,388,099
4	TRAVAUX D'INFRASTRUCTURE	
SOUS TOTAL		31,522,624
5	TRAVAUX DE SUPERSTRUCTURE	
SOUS TOTAL		47,582,279
6	MACONNERIE	
SOUS TOTAL		7,189,046
7	REVETEMENT SOLS MURS	
SOUS TOTAL		12,010,999
	CHARPENTE COUVERTURE	
SOUS TOTAL		9,584,144
9	ETANCHEITE, ISOLATION THERMIQUE EVACUATION EP	
SOUS TOTAL		7,577,507
10	FAUX PLAFOND	
SOUS TOTAL		5,120,791
11	MENUISERIE ALU VITRERIE	
SOUS TOTAL		23,105,006
12	FERRONNERIE RIDEAUX METALLIQUES	
SOUS TOTAL		5,433,268
13	PLOMBERIE SANITAIRE Appareillages	
SOUS TOTAL		7,848,202
14	MENUISERIE BOIS SERRURERIE	
SOUS TOTAL		5,462,545
15	CLIMATISATION	
SOUS TOTAL		
16	HABILLAGE EXTERIEUR ALUCOBOND	
SOUS TOTAL		8,968,412
17	OUVRAGES D'APPOINTS	
SOUS TOTAL		6,422,706
18	PEINTURE	
SOUS TOTAL		9,678,717
19	AMENAGEMENT EXTERIEUR	
SOUS TOTAL		4,485,529
SOUS TOTAL		
TOTAL HT		200,000,000

- Results of the market research and cost sheet creation.
- Evaluation of the client proposal preparation process.

Relation to Research Questions

The research questions posed at the outset of this study sought to explore how current project management techniques enhance the effectiveness of construction projects managed remotely, identify new strategies for improving planning and cost control, assess the impact of stakeholder engagement, and derive lessons from international practices applicable to the Ivory Coast.

1. Project Management Techniques: The analysis clearly demonstrates that proven project management practices involving comprehensive planning and stakeholder participation play a large part in enhancing project efficiency. Additionally, adopting the brainstorming methods contributed to more open communication of plans with clients, hence, boosting collaboration.
2. Strategies for Improvement: The above findings indicate that innovative techniques, such as task division among all the team members and encouraging timely completion, played a crucial role in managing costs and meeting deadlines. This resonates with modern research highlighting the essence of responsive methods in remote project management.
3. Stakeholder Engagement: The results indicate that active stakeholder engagement significantly contributes to project success. Maintaining frequent contact with clients helped stakeholders mitigate challenges related to project delays, supporting results from previous studies that highlight the influence of effective communication in construction management.
4. Lessons from Other Countries: Insights collected from impactful methods for remote planning and cost control applied across the globe propose that employing best practices designed for local contexts could improve project performance in the Côte d'Ivoire.

Comparison with Previous Research

The results of existing research on project management signify that cost control and schedule management serve as solid pillars for the successful execution and delivery of projects (Lavingia, 2003; Emhjellen et al., 2003). The focus on preventing delays aligns with Eden et al. (2005), who described how delays can exert pressure on both teams and investors. Over and above that, the initial need to address land issues reflects the usual challenges encountered in large-scale projects, as observed by Hormozi and Dube (1999).

Implications of Findings

The consequences of these results are multifaceted. They imply that although multiple techniques are available for improving project management, there is still an absence of standardized approaches across different types of construction projects. This variation demands extensive research into diverse approaches to confirm that they fulfil particular project needs. Significantly, the practices adopted by MBTP, such as forming groups and dividing tasks among all the group members and workers, proved to be highly beneficial in dealing with tight deadlines while keeping costs under control.

Limitations of the Study

Although this thesis paper offers enough insights regarding remote project management, project planning, and lastly cost control practices, it is crucial to acknowledge its limitations. The dependence on qualitative data may hinder the ability to apply findings more broadly across different industries. Furthermore, factors likely the changing market conditions and varying rates of technology adoption have the potential to affect project outcomes but were not extensively addressed in this thesis.

Future Research Directions

Future studies may concentrate on quantitative analyses to determine the impact of certain project management practices related to cost control, as well as the effectiveness of construction projects. However, examining the impact of advanced technologies for better communication and monitoring may offer a deeper understanding of the refinement of remote project management methodologies.

Conclusion:

The thesis has explained every other detail that needs to be encountered while talking about the MBTP collaboration with the LCB bank. This collaboration is all about a construction project governed by MBTP to facilitate the LCB bank. An estimated budget was created for this project but it still slightly exceeded the fixed budget. The brainstorming method that has been used during the project has also been clearly explained in the above thesis. The brainstorming method is one of the most effective ways to share your plans with the clients. This helps the clients get a better understanding of how their project is going to proceed. According to this method, every single detail of the project needs to be discussed with the client. MBTP has aimed to fulfil every single requirement of this project that was requested by the LCB bank. Moreover, the project management team also ensured the client that the materials used during their services were of top-notch quality.

During this research, we also considered discussing the potential regulatory costs and any unanticipated finances that might have a large impact on the project budget. By communicating with local stakeholders such as community leaders, government authorities, and business owners, we discovered important insights about workforce supply, material acquisition, and regional economic factors.

To further expand our research process, we carried out secondary research as well as primary research. The secondary research was performed to gather available data on market rates and trends. After reviewing all the reports gathered from the industries, government-issued publications, and trade organizations concerning expenses linked to banking-related projects in Brazaville, we established a standard for expected costs. On the contrary, the primary research involved surveys and questionnaires that were distributed among local sellers and contractors to collect cost estimates for materials and labor. As a result, this straightforward method gave us an up-to-date information that emphasized the current market situation.

We conducted talks with community leaders and business professionals to learn about labor

supply, material sourcing, and other expenses for meeting requirements that could impact the budget amount. A work breakdown structure (WBS) was designed to carefully supervise different aspects of the project. We divided WBS into three main groups, each assigned different duties. These groups include the construction team, the Design Group, and the Sanitary Management team. A construction team included two project managers, one site supervisor, and three construction workers. The design group encompassed a lead architect, interior designer, draftsperson, quality control specialist and a management engineer. Moreover, a sanitary management team had a sanitary engineer, health safety officer, maintenance technician, and two plumbers. By utilizing this work breakdown structure (WBS) throughout the project, the management team successfully managed the challenges and complications of the project. In addition to this, the team also ensured that every project member shows full dedication and commitment toward their duties. This structured approach not only helped us efficiently execute the project but also boosted accountability and dedication among all team members. On the other hand, we used earned value management (EVM) to track the performance of the tasks or work packages created using a work breakdown structure. In conclusion, the thesis aims to shed light on every other aspect that needed to be discussed when dealing with the project planning and cost control mechanisms.

References:

Abou-Ibrahim, H., Hamzeh, F., Zankoul, E., Munch Lindhard, S., & Rizk, L. (2019). Understanding the planner's role in lookahead construction planning. Production Planning and Control, 30(4), 271–284.

https://doi.org/10.1080/09537287.2018.1524163

Adafin, J., Rotimi, J. O. B., and Wilkinson, S. (2016). "Determining Significant Risks in the Variability between Design-Stage Elemental Cost Plan and Final Tender Sum." Journal of Management in Engineering, American Society of Civil Engineers (ASCE), 32(6).

Akintoye, A.S. and MacLeod, M.J., 1997. Risk analysis and management in construction. *International journal of project management*, *15*(1), pp.31-38.

Albadvi, A., & Hosseini, M. (2011).Mapping B2B value exchange in marketing relationships: a systematic approach. Journal of Business & Industrial Marketing, 26(7), 503 - 513.

AlNasseri, H., & Aulin, R. (2015). Assessing understanding of planning and scheduling theory and practice on construction projects. EMJ – Engineering Management Journal, 27(2), 58–72. https://doi.org/10.1080/10429247.2015.1035963

Alroomi, A., David Jeong, H., and Oberlender, G. D. (2016). "Evaluation of Methods to Retain Cost Estimating Competencies Using Structural Equation Modeling." Journal of Management in Engineering, 32(1), 04015026.

Aminian, V., Nejad, A., Mortaji, S. and Bagherpour, M., 2016. A modified earned value management using activity based costing. *Journal of project management*, *1*(2), pp.41-54.

American Association of State Highway and Transportation Officials (AASHTO). 2013. Practical Guide to Cost Estimating, First Edition, American Association of State Highway and Transportation Officials Washington, DC.

Amorim, R.C., Castro, J.A., Rocha da Silva, J. and Ribeiro, C., 2017. A comparison of research data management platforms: architecture, flexible metadata and interoperability. *Universal access in the information society*, *16*, pp.851-862.

Anderson, S.W., 2006. Managing costs and cost structure throughout the value chain: research on strategic cost management. *Handbooks of Management Accounting Research*, *2*, pp.481-506.

Andres, A.R., Otero, A. and Amavilah, V.H., 2021. Using deep learning neural networks to predict the knowledge economy index for developing and emerging economies. *Expert*

Systems with Applications, *184*, p.115514.

Assaf, S.A. and Al-Hejji, S., 2006. Causes of delay in large construction projects. *International journal of project management*, *24*(4), pp.349-357.

Atkinson, R., Crawford, L. and Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. *International journal of project management*, *24*(8), pp.687-698.

Aven, T., 2015. *Risk analysis*. John Wiley & Sons.

Aven, T., 2016. Risk assessment and risk management: Review of recent advances on their foundation. *European journal of operational research*, *253*(1), pp.1-13.

Ayorinde, T., Osarenren Osasrere, A., & Ademola Adeniran, A. (2015). Costing Techniques and Pricing Decisions of Manufacturing Companies in Ogun State. International Journal of Humanities and Social Science, 5(12). Available at http://www.ijhssnet.com/view.php?u=https:www.ijhssnet.com/journals/Vol/_5/_No/_12/_December/_2015/20.pdf.

Aziz, A. and Kumar, S., 2019, March. Financial and work management analysis for residential construction: A case study. In *International Conference on Advances in Civil Engineering (ICACE-2019)* (Vol. 21, p. 23).

Bakry, I., Moselhi, O., & Zayed, T. (2016). Optimized scheduling and buering of repetitive construction projects under uncertainty. Engineering, Construction and Architectural Management, 23(6), 782–800. https://doi.org/10.1108/ECAM-05-2014-0069

Ballesteros-Pérez, P., Cerezo-Narváez, A., Otero-Mateo, M., Pastor-Fernández, A., Zhang, J. and Vanhoucke, M., 2020. Forecasting the project duration average and standard deviation from deterministic schedule information. *Applied Sciences*, *10*(2), p.654.

Ballesteros-Pérez, P., González-Cruz, M.C., Fernández-Diego, M. and Pellicer, E., 2014. Estimating future bidding performance of competitor bidders in capped tenders. *Journal of civil engineering and management*, *20*(5), pp.702-713.

Ballesteros-Perez, P., González-Cruz, M.C. and Canavate-Grimal, A., 2012. Mathematical relationships between scoring parameters in capped tendering. *International journal of project management*, *30*(7), pp.850-862.

Ballesteros-Pérez, P., del Campo-Hitschfeld, M.L., Mora-Melià, D. and Domínguez, D., 2015. Modeling bidding competitiveness and position performance in multi-attribute construction auctions. *Operations Research Perspectives*, *2*, pp.24-35.

Ballesteros-Pérez, P., González-Cruz, M.C., Fernández-Diego, M. and Pellicer, E., 2014. Estimating future bidding performance of competitor bidders in capped tenders. *Journal of civil engineering and management*, *20*(5), pp.702-713.

Barazza, G.A. and Bueno, R.A. (2007), “Probabilistic control of project performance using control limit curves”, Journal of Construction Engineering and Management, Vol. 133 No. 12, pp. 957-964.

Barghi, B., 2020. Qualitative and quantitative project risk assessment using a hybrid PMBOK model developed under uncertainty conditions. *Heliyon*, *6*(1).

Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure

factors in projects. International journal of project management, 14(3), 141 - 151.

Bensalah, M., Elouadi, A. and Mharzi, H., 2019. Overview: the opportunity of BIM in railway. *Smart and Sustainable Built Environment*, *8*(2), pp.103-116.

Bent, K., & Caplan, D. (2017). Lattice allocations: A bet-ter way to do cost allocations.Advances in Accounting, incor-porating Advances in International Accounting, 38(1), 99-105.

Buchtik, L., 2013, October. Secrets to Mastering the WBS. Project Management Institute.

Burke, R., 2013. *Project management: planning and control techniques*. John Wiley & Sons.

Burga, R. and Rezania, D., 2017. Project accountability: An exploratory case study using actor–network theory. *International journal of project management*, *35*(6), pp.1024-1036.

Cacciattolo, K., 2015. Defining organisational communication. European Scientific Journal, 11(20).

Cavka, H.B., Staub-French, S. and Pottinger, R., 2015. Evaluating the alignment of organizational and project contexts for BIM adoption: a case study of a large owner organization. *Buildings*, *5*(4), pp.1265-1300.

Chan, G., Li, H., Skitmore, M., & Huang, T. (2015). A 4D automatic simulation tool for construction resource planning: A case study. Engineering, Construction and Architectural Management, 22(5), 536–550.

Chang, A.S.T. and Tsai, Y.W., 2003. Engineering information classification system. *Journal of construction engineering and management*, *129*(4), pp.454-460.

Chapman, R.J., 1998. The effectiveness of working group risk identification and assessment techniques. *International Journal of Project Management*, *16*(6), pp.333-343.

Chin, L.S. and Hamid, A.R.A., 2015. The practice of time management on construction project. *Procedia Engineering*, *125*, pp.32-39.

Cho, K., Hong, T. and Hyun, C., 2010. Integrated schedule and cost model for repetitive construction process. *Journal of management in engineering*, *26*(2), pp.78-88.

Choudhry, R. M., Aslam, M. A., & Arain, F. M. (2014). Cost and schedule risk analysis of bridge construction in Pakistan: Establishing risk guidelines. Journal of Construction Engineering and Management, 140(7), 04014020. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000857

Cooper, R. and Kaplan, R.S., 1988. Measure costs right: make the right decisions. *Harvard business review*, *66*(5), pp.96-103.

Council of Development Housing Territorial Planning and Tourism of the Regional Government of Extremadura (2019) *Construction Pricing Base of the Regional Government of Extremadura*. Available online: http://baseprecioconstruccion.gobex.es/ (accessed: 30 December 2019).

Construction 2000 Classification Committee (2000) TALO 2000: Construction Classification. Helsinki: Building Information Foundation. ISBN 978-9516829480.

Construction Technology Institute of Catalonia (ITEC) (2019) *BEDEC DataBase*. Available online: https://metabase.itec.cat/vide/es/bedec (accessed: 30 December 2019).

Construction Specifications Institute, 2010. Uniformat: A uniform classification of construction systems and assemblies.

Council for Development and Housing of the Regional Government of Andalusia, University of Seville, School of Building Engineering of Seville and Official Association of Quantity Surveyors and Technical Architects of Seville (2019) *Andalusian Construction Cost Base (BCCA)*. Available online: https://www.juntadeandalucia.es/organismos/fomentoinfraestructurasyordenaciondelterritorio/areas/vivienda-rehabilitacion/planes-instrumentos/paginas/vivienda-bcca.html (accessed: 30 December 2019).

Cruz Villazón, C., Sastoque Pinilla, L., Otegi Olaso, J.R., Toledo Gandarias, N. and López de Lacalle, N., 2020. Identification of key performance indicators in project-based organisations through the lean approach. *Sustainability*, *12*(15), p.5977.

CYPE Arquimedes (2019) Available online: http://arquimedes.cype.es/ (accessed: 30 December 2019).

Damjanovski, S. (2013). Aplication of activity based costing and related management tools: The case of IPKO tele-communication llc. PhD diss. Ljubljana University, Faculty of Economics.

De Meyer, A., Loch, C.H. and Pich, M.T., 2002. Managing project uncertainty: from variation to chaos. *MIT Sloan management review*, *43*(2), p.60.

Ding, L.Y., Zhou, Y., Luo, H.B. and Wu, X.G., 2012. Using nD technology to develop an integrated construction management system for city rail transit construction. *Automation in Construction*, *21*, pp.64-73.

Directorate General of Housing and Rehabilitation of the Community of Madrid (2019) *Construction Database of the Community of Madrid*. Available online: http://www.madrid.org/bdccm/index.html (accessed: 30 December 2019).

Dorey, L., 2013. Preliminary Project Scope Statement.

Eden, C., Ackerman, F. and Williams, T. (2005), “The amoebic growth of project costs”, Project Management Journal, Vol. 36 No. 1, pp. 15-27.

Engineering Advancement Association of Japan (2017) A Guidebook of Project & Program Management for Enterprise Innovation. 3rd edn. Tokyo, Japan: Project Management Association of Japan (PMAJ). ISBN 978-4908520204.

Englund, R. and Graham, R.J., 2019. *Creating an environment for successful projects*. Berrett-Koehler Publishers.

Everaert, P., Bruggeman, W., Sarens, G., Anderson, S.R. and Levant, Y., 2008. Cost modeling in logistics using time-driven ABC: Experiences from a wholesaler. *International Journal of Physical Distribution & Logistics Management*, *38*(3), pp.172-191.

Fageha, M.K. and Aibinu, A.A., 2014. Prioritising project scope definition elements in public building project. *Australasian Journal of Construction Economics and Building, The*, *14*(3), pp.18-33.

Fan, S.L., Chong, H.Y., Hung, T.W. and Wang, Y.C., 2016. Cost-based scheduling method using object-oriented approach. *Automation in Construction*, *65*, pp.65-77.

Garcia-Fornieles, J.M., Fan, I.S., Perez, A., Wainwright, C. and Sehdev, K., 2003. A work breakdown structure that integrates different views in aircraft modification projects.

Concurrent Engineering, *11*(1), pp.47-54.

Ghoddousi, P., Ansari, R., & Makui, A. (2017). An improved robust buer allocation method for the project scheduling problem. Engineering Optimization, 49(4), 718–731. https://doi.org/10.1080/0305215X.2016.1206534

Gómez-Senent Martinez, E., 1997. El proyecto. Diseño en ingeniería. *Colección Académica. Editorial UPV*.

Haimes, Y.Y., 2011. *Risk modeling, assessment, and management*. John Wiley & Sons.

Harper, C. M., Molenaar, K. R., Anderson, S., and Schexnayder, C. (2014). "Synthesis of Performance Measures for Highway Cost Estimating." Journal of Management in Engineering, 30(3), 04014005.

Hartley, S., 2020. *Project Management: A practical guide to planning and managing projects*. Routledge.

Harrison, F. and Lock, D., 2017. *Advanced project management: a structured approach*. Routledge.

Hendrickson, C. and Au, T., 1989. *Project management for construction: Fundamental concepts for owners, engineers, architects, and builders*. Chris Hendrickson.

Hubbard, D.W., 2020. *The failure of risk management: Why it's broken and how to fix it*. John Wiley & Sons.

Hughes, W., Champion, R. and Murdoch, J., 2015. *Construction contracts: law and management*. Routledge.

HUSSEN, A., 2022. *CASH FLOW MANAGEMENT CHALLENGES AND THE ROLE OF COMMERCIAL BANKS IN CONSTRUCTION SECTOR* (Doctoral dissertation, ST. MARY'S UNIVERSITY).

Ilbeigi, M., Ashuri, B., and Joukar, A. (2017). "Time-Series Analysis for Forecasting Asphalt- Cement Price." Journal of Management in Engineering, 33(1), 04016030.

International Federation of Consulting Engineers Which FIDIC Contract Should I Use? Availableonline: **http://fidic.org/bookshop/about-bookshop/which-fidic-contract-should-i-use**.

International Project Management Association, 2015. *Individual Competence Baseline for Programme Management*. International Project Management Association.

In Zimina, D., Glenn, B., & Pasquire, C. (2012). Target value design: using collaboration and a lean approach to reduce construction cost. Construction Management and Economics,30(5), 383-398. https://doi.org/10.1080/01446193.2012.

IPMA, I., 2015. Individual competence baseline for project, programme & portfolio management. *International Project Management Association*, *4*.

ISO (2015) ISO 12006-2:2015 Building Construction - Organization of Information about Construction Works - Part 2: Framework for Classification. Geneva: International Organization for Standardization.

International Organization for Standardization, 2015. ISO 12006-2: 2015. Building Construction. Organization of Information about Construction Works. Part 2: Framework for Classification of Information.

ISO (2018) ISO 81346-12:2018 Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 12: Construction works and building services. Geneva: International Organization for Standardization.

Ibrahim, Y.M., Kaka, A.P., Trucco, E., Kagioglou, M. and Ghassan, A., 2007, March. Semi-automatic development of the work breakdown structure (WBS) for construction projects. In *Proceedings of the 4th International SCRI Research Symposium, Salford, UK* (pp. 133-145).

Iyer, K. and Jha, K. (2005), "Factors affecting cost performance: evidence from Indian construction projects", International Journal of Project Management, Vol. 23 No. 4, pp. 283-295.

Jaafari, A., 2001. Management of risks, uncertainties and opportunities on projects: time for a fundamental shift. *International journal of project management*, *19*(2), pp.89-101.

Jaya, NM., Pathirage, CP., & Sutrisna, M. (2010). A critical review on application of activity-based costing in the construction industry. In: CIB World Congress, the Lowry, Salford Quays, United Kingdom.

Jaya, M. (2013). An activity based cost construction model for improving the management of construction project overheads. PhD thesis. University of Salford, UK. Available at http://usir.salford.ac.uk/id/eprint/30758/.

Johnson, R.W., 2004. Masterformat 2004 Edition: Master List of Numbers and Titles for the Construction Industry. *Alexandria, Va.: The Construction Specifications Institute*.

Jusohb, R., & Baharudina, N. (2015). Target Cost Management (TCM): a case study of an automotive company. Procedia - Social and Behavioral Sciences, 172, 525-532.

Kang, L.S. and Paulson, B.C., 1997. Adaptability of information classification systems for civil works. *Journal of construction engineering and management*, *123*(4), pp.419-426.

Kaplan, R.S. and Anderson, S.R., 2007. *Time-driven activity-based costing: a simpler and more powerful path to higher profits*. Harvard business press.

Kaplan, R.S. and Cooper, R., 1998. *Cost & effect: using integrated cost systems to drive profitability and performance*. Harvard Business Press.

Kerzner, B. (2009). Clinical investigation of feeding difficulties in young children: a practical approach. Clinical pediatrics, 48(9), 960 - 965.

Kerzner, H., 2016. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling, WPLS Student Package*. John Wiley & Sons.

Larsen, J. K., Shen, G. Q., Lindhard, S. M., & Brunoe, T. D. (2016). Factors aecting schedule delay, cost overrun, and quality level in public construction projects. Journal of Management in Engineering, 32(1), 04015032. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000391

Leach, L. (2003), "Schedule and cost buffer sizing : how to account for the bias between project performance and your model", Project Management Journal, Vol. 34 No. 2, pp. 34-47.

Lee, J.H., Lee, S.W. and Kim, T.Y., 2019. A development of unified and consistent BIM database for integrated use of BIM-based quantities, process, and construction costs in civil engineering. *Journal of the Korea society of computer and information*, *24*(2), pp.127-137.

Lekshmi, S. A., & Unnikrishnan, V. (2018). Planning and delay analysis of a residential complex: A case study. International Journal of Civil Engineering and Technology, 9(6), 1191–1201.

Lines, B. C., Sullivan, K. T., Hurtado, K. C., & Savicky, J. (2015). Planning in construction: Longitudinal study of pre-contract planning model demonstrates reduction in project cost and schedule growth. International Journal of Construction Education and Research, 11(1), 21–39.
https://doi.org/10.1080/15578771.2013.872733

Liu, D., Keesing, J. K., Dong, Z., Zhen, Y., Di, B., Shi, Y. & Shi, P. (2010). Recurrence of the world's largest green - tide in 2009 in Yellow Sea, China: Porphyra yezoensis aquaculture rafts confirmed as nursery for macroalgal blooms. Marine Pollution Bulletin, 60(9), 1423 - 1432.

Liu, D., Xuan, P., Li, S., & Huang, P. (2015). Schedule risk analysis for TBM tunneling based on adaptive CYCLONE simulation in a geologic uncertainty-aware context. Journal of Computing in Civil Engineering, 29(6), 04014103.
https://doi.org/10.1061/(ASCE)CP.1943-5487.0000441

Liu, H., Lu, M. and Al-Hussein, M., 2014. BIM-based integrated framework for detailed cost estimation and schedule planning of construction projects. In *ISARC. Proceedings of the International Symposium on Automation and Robotics in Construction* (Vol. 31, p. 1). IAARC Publications.

Luu, V. T., Kim, S. Y., Tuan, N. V., & Ogunlana, S. O. (2009). Quantifying schedule risk in construction projects using Bayesian belief networks. International Journal of Project Management, 27(1), 39–50.
https://doi.org/10.1016/j.ijproman.2008.03.003.

López Paredes, A., Pajares Gutierrez, J. and Iglesias Sanzo, M., 2013. Certificación IPMA-4LC. *Manual de Preparación*, pp.978-8461640324.

Lyon, B.K. and Popov, G., 2020. Managing risk through layers of control. *Professional Safety*, *65*(04), pp.25-35.

Marsh, P., 2017. *Contracting for engineering and construction projects*. Routledge.

McNeil, A.J., Frey, R. and Embrechts, P., 2015. *Quantitative risk management: concepts, techniques and tools-revised edition*. Princeton university press.

Mêda, P. and Sousa, H., 2014. Information consistency on construction–Case study of correlation between classification systems for construction types. *eWork and eBusiness in Architecture, Engineering and Construction: ECPPM 2014*, p.309.

Melo, R.S.S., & Granja, A. D. (2017). Guidelines for target costing adoption in the development of products for the residential real estate market. Ambiente Construído, 17(3), 153-165.
http://dx.doi.org/10.1590/s1678-86212017000300168.

Memon, A.H., Rahman, I.A. and Azis, A.A.A., 2011. Preliminary study on causative factors leading to construction cost overrun. *International Journal of Sustainable Construction Engineering and Technology*, *2*(1).

Meredith, J.R., Shafer, S.M. and Mantel Jr, S.J., 2017. *Project management: a strategic managerial approach*. John Wiley & Sons.

Mislick, G.K. and Nussbaum, D.A., 2015. *Cost estimation: Methods and tools*. John Wiley & Sons.

Mohammadi, A., Tavakolan, M. and Khosravi, Y., 2018. Factors influencing safety performance on construction projects: A review. *Safety science*, *109*, pp.382-397.

Molio (2019) Generel information. Available at: https://ccs.molio.dk/ (Accessed: 30 December 2019).

Morrison-Smith, S. and Ruiz, J., 2020. Challenges and barriers in virtual teams: a literature review. *SN Applied Sciences*, *2*(6), pp.1-33.

Murray, A., 2009. Managing successful projects with PRINCE2.

Murphy, C.N., 2006. *The United Nations development programme: A better way?*. Cambridge University Press.

Naderi, F., Manteghi, M. & Safaei Moghaddam, A. (2014) 'Risk identification and analysis of the fourth-generation engine project based on the PMBOK standard', *Journal of Management Improvement*, 8(23), pp. 107-128.

Nam, J.Y., Jo, C.W. and Park, S.H., 2017. A study on applying information framework for BIM based WBS-Focusing on civil construction. *Journal of the Korea Academia-Industrial cooperation Society*, *18*(11), pp.770-777.

Namazi, M., & Shamsodini, K. (2016). The Investigation of the Impact of Learning on the Performance Focused Activity Based Costing (PFABC). Management Accounting, 9(29),73-87.

Newcombe, R., 2003. From client to project stakeholders: a stakeholder mapping approach. *Construction management and economics*, *21*(8), pp.841-848.

NBS (2019) UniClass 2015. Available at: https://www.thenbs.com/our-tools/uniclass-2015 (Accessed: 30 December 2019).

Norman, E.S., Brotherton, S.A. and Fried, R.T., 2008. *Work breakdown structures: the foundation for project management excellence*. John Wiley & Sons.

Office, T.S., 2017. *Managing successful projects with PRINCE2*. The Stationery Office.

Olawale, Y. and Sun, M. (2013), “PCIM: project controls and inhibiting-factors management model”, Journal of Management in Engineering, pp. 60-70.

OmniClass, C.S.I., 2010. OmniClass: A strategy for classifying the built environment.

Otley, D., 1999. Performance management: a framework for management control systems research. *Management accounting research*, *10*(4), pp.363-382.

Pagell, M., Wu, Z. and Murthy, N.N., 2007. The supply chain implications of recycling. *Business Horizons*, *50*(2), pp.133-143.

Paquin, J.P., Morin, P.P., Lambert, A. and Koplyay, T., 2022. Assessing project contingency reserves with the expected cost overrun risk measure. *Journal of Construction Engineering and Management*, *148*(10), p.04022102.

Park, H.T. and Lee, B.H., 2011. EVMS Database System Implementation for interworking of WBS & CBS based management in Construction Works. *Journal of the Korea Academia-Industrial cooperation Society*, *12*(6), pp.2851-2858.

Park, J. and Cai, H., 2017. WBS-based dynamic multi-dimensional BIM database for total construction as-built documentation. *Automation in Construction*, *77*, pp.15-23.

Park, I.J., Jin, R.Z., Yang, H.J. and Hyun, C.T., 2011, November. A support tool for cost and schedule integration by connecting PMIS & PgMIS. In *2011 2nd International Conference on Engineering and Industries (ICEI)* (pp. 1-5). IEEE.

Patanakul, P. and Shenhar, A.J., 2012. What project strategy really is: The fundamental building block in strategic project management. *Project Management Journal*, *43*(1), pp.4-20.

Pellerin, R. and Perrier, N., 2019. A review of methods, techniques and tools for project planning and control. *International Journal of Production Research*, *57*(7), pp.2160-2178.

Pennanen, A., Ballard, G., & Haahtela, Y. (2011). Target costing and designing to targets in construction. Journal of Financial Management of Property and Construction, 16(1),52-63. https://doi.org/10.1108/13664381111116089.

Pinto, J.K. and Slevin, D.P., 1989. Critical success factors in R&D projects. *Research-technology management*, *32*(1), pp.31-35.

Poshdar, M., González, V. A., Raery, G. M., Orozco, F., & Ca-brera-Guerrero, G. G. (2018). A multi-objective probabilis-tic-based method to determine optimum allocation of time buer in construction schedules. Automation in Construction, 92, 46–58. https://doi.org/10.1016/j.autcon.2018.03.025.

Poshdar, M., González, V. A., Raery, G. M., Orozco, F., Ro-meo,J. S., & Forcael, E. (2016). A probabilistic-based method to determine optimum size of project buer in construction schedules. Journal of Construction Engineering and Management, 142(10), 04016046. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001158.

PREOC Premeti (2019) Available online: http://www.preoc.es/#!129000001 (accessed: 30 December 2019).

Project Management Institute, 2000. A guide to the project management body of knowledge (PMBOK Guide). Project Management Institute.

PROSOFT Menfis (2019) Available online: https://prosoft.es/productos/menfis (accessed: 30 December 2019).

Rasdorf, W.J. and Abudayyeh, O.Y., 1991. Cost-and schedule-control integration: Issues and needs. *Journal of construction engineering and management*, *117*(3), pp.486-502.

Rausand, M., 2013. *Risk assessment: theory, methods, and applications* (Vol. 115). John Wiley & Sons.

Raz, T., Shenhar, A.J. and Dvir, D., 2002. Risk management, project success, and technological uncertainty. *R&d Management*, *32*(2), pp.101-109.

Reichelt, K. and Lyneis, J., 1999. The dynamics of project performance: benchmarking the drivers of cost and schedule overrun. *European management journal*, *17*(2), pp.135-150.

Rose, K.H., 2013. A guide to the project management body of knowledge (PMBOK guide). *Project management journal*, *44*(3), pp.e1-e1.

Rosenau, M.D. and Githens, G.D., 2011. *Successful project management: a step-by-step approach with practical examples*. John Wiley & Sons.

Russell, M. M., Howell, G., Hsiang, S. M., & Liu, M. (2013). Application of time buers to construction project task durations. Journal of Construction Engineering and Management, 139(10), 04013008. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000735

Russell, M. M., Hsiang, S. M., Liu, M., & Wambeke, B. (2014). Causes of time buer and duration variation in construction project tasks: Comparison of perception to reality. Journal of Construction Engineering and Management, 140(6), 04014016. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000819.

Sattineni, A. and Bradford, R.H., 2011. Estimating with BIM: A survey of US construction companies. *Proceedings of the 28th ISARC, Seoul, Korea*, *564*, p.569.

See-Lian, O., Muse, A., O'Sullivan, G., Aronsohn, A., Baharuddin, D., Chatzisymeon, T., Fadason, R., Green, A., Horner, M., Howes, R. and Leung, F., 2019. International Construction Measurement Standards: Global Consistency in Presenting Construction and Other Life Cycle Costs.

Shahandashti, S. M., and Ashuri, B. (2016). "Highway Construction Cost Forecasting Using Vector Error Correction Models." Journal of Management in Engineering, 32(2), 04015040.

Shen, Q., Xue, F., Li, Z., Luo, L., Xu, X., & Sommer, L. (2017). Schedule risk modeling in prefabrication housing production. Journal of Cleaner Production, 153, 692–706. https://doi.org/10.1016/j.jclepro.2016.11.028

Sharafoddin, S. (2016). The Utilization of Target Costing and its Implementation Method in Iran. Procedia Economics and Finance, 36, 123-127.https://doi.org/10.1016/S2212-5671(16)30023-5.

Sinesilassie, E. G., Tabish, S. Z. S., & Jha, K. N. (2017). Critical factors aecting schedule performance: A case of Ethiopian public construction projects - Engineers' perspective. Engineering, Construction and Architectural Management, 24(5), 757–773. https://doi.org/10.1108/ECAM-03-2016-0062

Singh, A., & Taam, T. (2008). Techniques for Calculating Unabsorbed Overhead. School of the Built Environment. In: Proceedings from International Conference on Building Education and Research (BEAR), University of Salford, UK, 113-124.

Smith, N.J., Merna, T. and Jobling, P., 2014. *Managing risk in construction projects*. John Wiley & Sons.

Soto Ramírez, D., Rivera Cadavid, L., Orobio Quiñones, A., & Cuadros López, A. J. (2018). Evaluation of the impact of schedule risks in a road infrastructure project. Espacios, 39(47).

Steffens, W., Martinsuo, M. and Artto, K., 2007. Change decisions in product development projects. *International Journal of Project Management*, *25*(7), pp.702-713.

Stellingwerf, R. and Zandhuis, A., 2013. *ISO 21500 Guidance on project management–A Pocket Guide*. Van Haren.

Stoy, C. and Wright, M., 2007. The ceec code for cost planning: Introduction and practical application. *The Journal of Cost Analysis & Management*, *9*(1), pp.37-54.

Subramani, T. and Sivakumar, P., 2018. Analysis Cost Overruns, Delays and Risk Involved in Construction Management Using Primavera. *Int. J. Eng. Technol*, *7*, p.160.

Sun, C., Man, Q. and Wang, Y., 2015. Study on BIM-based construction project cost and schedule risk early warning. *Journal of Intelligent & Fuzzy Systems*, *29*(2), pp.469-477.

Swedish Building Centre (2018) *Industry Practices for Application of CoClass in Software*. Stockholm: Swedish Building Centre.

Tang, J., Zhang, M., Tang, H., & Chen, Y. (2015). Research on Cost Management of Construction Project based on Activity-based Costing.

Teicholz, P.M., 1987, June. Current needs for cost control systems. In *Project controls: needs and solutions* (pp. 47-57). ASCE.

Terreno, S., Asadi, S. and Anumba, C., 2019. An exploration of synergies between lean concepts and BIM in FM: A review and directions for future research. *Buildings*, *9*(6), p.147.

Thamhain, H., 2013. Managing risks in complex projects. *Project management journal*, *44*(2), pp.20-35.

Thøger Christensen, L., 2002. Corporate communication: The challenge of transparency. *Corporate communications: an international journal*, *7*(3), pp.162-168.

Toffano Seidel Calazans, A. and Dias Kosloski, R.A., 2012. O gerenciamento da alteração de escopo na contratação externa de serviços de desenvolvimento/manutenção de software. In *XIII Argentine Symposium on Software Engineering (ASSE 2012)(XLII JAIIO, La Plata, 27 al 31 de agosto de 2012)*.

Toosi, H.N., Sebt, M.H. & Maknoon, R. (2014). A dynamic model for adjusting contemporary construction projects behaviors in today changeable environments. International Journal of Civil Engineering. 12 (4 A), 466-480.

Tsai, W.H., 1998. Quality cost measurement under activity-based costing. *International Journal of Quality & Reliability Management*, *15*(7), pp.719-752.

Urbinati, A., Landoni, P., Cococcioni, F. and De Giudici, L., 2021. Stakeholder management in open innovation projects: a multiple case study analysis. *European Journal of innovation management*, *24*(5), pp.1595-1624.

Venkataraman, R.R. and Pinto, J.K., 2023. *Cost and value management in projects*. John Wiley & Sons.

Verčič, A.T., 2021. The impact of employee engagement, organisational support and employer branding on internal communication satisfaction. Public Relations Review, 47(1), p.102009.

Villena Manzanares, F., García Segura, T., Ballesteros-Pérez, P. and Pellicer Armiñana, E., 2019, July. Influence of bim in construction companies innovation. In *Proceedings of the 23rd International Congress on Project Management and Engineering, Malaga, Spain* (pp. 10-12).

Wang, Y.R., 2008. A Study of Preproject Planning and Project Success Using ANN and Regression Models/Yu-Ren Wang, G. Edward Gibson Jr. In *The 25th International Symposium on Automation and Robotics in Construction.–Vilnius: Vilnius Gediminas Technical University* (pp. 688-695).

Westland, J., 2006. *The project management life cycle: a complete step-by-step methodology*

for initiating, planning, executing & closing a project successfully. Kogan Page Limited.

Winch, G.M., 2012. *Managing construction projects*. John Wiley & Sons.

Wilson, C., 2013. *Brainstorming and beyond: a user-centered design method*. Newnes.

Yang, H.J., Jin, R.Z., Park, I.J. and Hyun, C.T., 2012. Development of a Support Tool for Cost and Schedule Integration Managment at Program Level. *International Journal of Civil and Environmental Engineering*, *6*(2), pp.203-210.

Yuksel Pazarceviren, S., & Dede, B. (2015). Life cycle costing model based on target and activity based costing method and a model proposal. European Scientific Journal, August, 121-138.

Young-Bae, C., 2002. An Aplication Model to Ensure Practical Usage in Construction Management. In *Proceedings of the Korean Institute Of Construction Engineering and Management* (pp. 401-404). Korea Institute of Construction Engineering and Management.

Zwikael, O. and Sadeh, A., 2007. Planning effort as an effective risk management tool. *Journal of operations management*, *25*(4), pp.755-767.