UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

A CASE STUDY ABOUT CEDCO LTD- LESSONS LEARNED IN THE CONSTRUCTION INDUSTRY.

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DEDICATION

This final graduation project is dedicated to people pursuing professional and academic development while working and juggling the many challenges of life, work, family and the like for a better self and future. This project is a testament that anything is possible with God, determination, a sound support system and faith. "Success is not measured by what you accomplish, but by the opposition you have encountered, and the courage with which you have maintained the struggle against overwhelming odds." – Orison Swett Marden.

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"For surely I know the plans I have for you, says the LORD, plans to prosper you and not for harm, to give you a future with hope" Jeremiah 29:11. I thank the Almighty for His continuous guidance and strength, without Him none of this would be possible. To my parents, Theresa Martin and Carlton Culzac, your support and encouragement have always been pillars of my achievements. To my brother, Loic Martin and employer, Daniel Campbell, thank you for understanding when time off was needed to complete assignments.

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ABSTRACT

This project aims to develop a lesson-learned repository as part of the Organizational Process Assets for Project Management Plans for future construction projects by CEDCO Ltd. to manage project delays better. CEDCO Ltd., a consultancy firm in St. Vincent & the Grenadines, is faced with delays in its construction projects. These delays negatively impact the company's finances, reputation and relationship with stakeholders. An examination of the company's project management practices revealed that it does not practice retrospection, where it reviews its projects and documents the lessons learned. A learning culture enhances project outcomes and can reduce or better manage project delays.

The final product of this project is a case study of CEDCO Ltd. in relation to project delays using its three most recent residential projects. The final deliverables for this case study are identified causes for the delays, ranking of causes, the impacts of the delays, recommendations to resolve delays and a procedure to document and disseminate future lessons learned. An analytical and mixed methodology of qualitative and quantitative methods are used for this.

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ABBREVIATIONS AND ACRONYMS

AAR	After Action Review
CEDCO Ltd.	Caribbean Engineering and Design Consultants Limited
CSR	Corporate Social Responsibility
FGP	Final Graduation Project
GPM	Green Project Management
PMI	Project Management Institute
PMIS	Project Management Information Systems
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SVG	St. Vincent & the Grenadines
UN	United Nations
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

Delays in the construction industry are quite common (Haseeb et al., 2012; Fakunie & Fashina, 2020) and should, therefore, be addressed with solutions feasible to each company within the construction industry. The subject of the study was Caribbean Engineering and Design Consultants Limited (CEDCO Ltd.), a construction and engineering consultancy firm on the Small Island Developing State (SIDS) of St. Vincent & the Grenadines (SVG) located in the Caribbean. CEDCO Ltd. is a unique consultancy firm on the island of St. Vincent and the Grenadines. It is unique because it has a competitive advantage as it is the only firm offering services from the conceptualization phase to the end product. That is, the firm provides the opportunity to assist clients in purchasing property, designing the infrastructure and constructing and supervising works.

CEDCO Ltd.'s past and current residential projects were examined, and it was found that project delays are a recurrent occurrence that impacts its overall performance and reputation. Delays have negatively impacted the profit margin and client-contractor relationships, affecting the company's overall reputation. Observation of CEDCO Ltd.'s project management practices revealed that no lesson-learned repository was kept, so it could not be used as an organizational asset to provide input on the management plans. Utilizing lessons learned as a tool or input for project management plans has the following benefits: 1) historical data for new projects, 2) solutions to problems or risks that have the likelihood of recurring, 3) prevention of mistakes and 4) reduction in cost and planning time (Trevino & Anantatmula, 2008) with spill off effects such as increase in client satisfaction, and referrals, favourable cost and schedule performance indices, and increase profits. As such, this gap presented an opportunity for this study.

This Final Graduation Project general objective was to develop a lesson-learned repository as part of the Organizational Process Assets for Project Management Plans for future construction projects by CEDCO Ltd. to manage project delays better. The specific objectives of this project were: 1) to identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions; 2) to rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas; 3) to determine the impact of the delays and subsequently highlight known relationships among them to better understand the consequences of delays; 4) to identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions; and 5) to discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.

This project used analytical and mixed research methods, which entailed qualitative and quantitative methods, to achieve the objectives. Questionnaires and literature review were the main tools for gathering data while data analysis was used to interpret the questionnaire responses. Expert judgment using the knowledge gained from this Master's Program and the PMI texts were used to analyze the stakeholders and to recommend solutions to address the issues of delay in construction.

The main conclusions drawn from the Final Graduation Project were that delays are reoccurring issues in the construction industry that primarily cause cost and time overrun. However, there are other implications which were highlighted when investigating the causes of construction delays in CEDCO Ltd. projects. These implications included: quality issues, strained relationships, environmental, resource availability and wastage. In addition to this, it was concluded that the three major causes for construction delays in CEDCO Ltd. projects were low productivity, payment delay and ineffective communication. Having documented the lessons learned, it was recommended that the application of project management tools and techniques would make plausible solutions to reduce or eliminate the occurrence of delays and their implications.

1 INTRODUCTION

This Final Graduation Project was done in partial fulfillment of the requirements for the Master's in Project Management Degree. In the conceptualization phase of this project, much consideration was given to accessibility to information and problems within the researcher's employment industry. One of the significant problems that stood out within the Construction Industry was delays. D.W.M Chan & M.M Kumarasawamy's study, as cited in Haseeb et al. (2012, p.41), defines construction delay "as execute later than intended planned, or a particular period, or later than the specific time that all the concerned parties agreed for the construction project." Delays in the construction industry are quite common (Haseeb et al., 2012; Fakunie & Fashina, 2020) and should be addressed with solutions applicable to the country and at the entity's level. The subject of the study is CEDCO Ltd., a construction and engineering consultancy firm in the Small Island Developing State of St. Vincent & the Grenadines located in the Caribbean. Having observed the company's use of project management knowledge and skills, I noticed that the use of lessons learned as an organizational asset in the various management plans was absent from practice. It was this gap within the Project Management practice that led to the formulation of the topic, "A Case Study about CEDCO Ltd- Lessons Learned in the Construction Industry," a topic that is classified as "other specific topic" for the Final Graduation Project (FGP) topic.

The Final Graduation Project consists of seven sections: Introduction, Theoretical Framework, Methodological Framework, Results, Conclusion, Recommendation and Validation of the FGP in the field of Regenerative and Sustainable Development.

1.1. Background

CEDCO Ltd. is a unique consultancy firm within the Island of St. Vincent and the Grenadines. It is unique because it has a competitive advantage over its competitors by being the only firm that offers services from the conceptualization phase to the production of the end product. That is, the firm provides the opportunity to assist clients in purchasing property, designing the infrastructure and constructing and supervising works. Because St. Vincent and the Grenadines is a relatively small island, spanning 389 Km^2 across the Caribbean Sea, a company's reputation can be the determining factor that propels a company within the competitive construction industry to attain private works. Reputation, as defined in Fombrun's study as cited in Taghian et al. (2010), is "a perceptual representation of a company's past actions and future prospects that describe the firm's overall appeal of its key constituents when compared with other leading rivals.' The definition highlights that what a company did in its past affects how a potential customer views it compared to its competitors.

Studies have suggested a direct positive link between a company's reputation and financial performance. Findings in a study by Hall Jr. & Lee (2014) "indicate that firm reputation tends to have a positive impact on a firm's performance and that such a relationship is consistently strong across countries (U.S. and Japan)." The opposite can be inferred since past actions impact a company's reputation, so too does past performance impact the company's reputation. Key Performance Indicators (KPIs) are an excellent measure to determine how a company is performing. "Performance measurement reviews past and present functioning, derives strategies for

future endeavours, compares performance within and among the facilities, assesses the performance toward the organization's goals and provides needed direction to management for decision-making" (Lavy et al., 2014). In a study by Ali et al. (2013), the KPIs in the construction industry across multiple regions, notably the United Kingdom, Canada, Vietnam, Thailand, China and India, were listed. Common KPIs listed were client satisfaction, cost and time, all negatively affected by project delays.

Observation of CEDCO Ltd.'s performance revealed that project delays are a recurrent occurrence impacting its overall performance and reputation. CEDCO Ltd.'s project management process was examined to mitigate or eliminate some factors leading to project delays. Upon examination, it was noted that no lesson-learned repository was kept and, therefore, could not be used as an organizational asset for inputting management plans. As a result, the Final Graduation Project endeavours to document the lessons learned from previous projects and create a template for documenting new lessons learned going forward.

1.2. Statement of the problem

Project delays in the Construction Industry are a recurrent issue that primarily and negatively affects the client and contractor. As a result of these delays, financial costs are incurred, resulting in either net losses or a profit margin that is less than the optimum for the contractor. Examining CEDCO Ltd.'s past and current residential projects, delays have negatively impacted the profit margin and client-contractor relationships, affecting the

company's reputation. Literature provides numerous causes and, in some instances, in-depth analysis of the causes of delay within their geographical context. In a study in Bangladesh, some of the identified root causes of delay were Inaccurate cost estimation, Lack of proper management, Contractor's excessive workload and Escalation of resources price. In a literature review conducted by Mbala et al. (2019), 20 causes of project delays were identified, with the top ten being: 1) poor site management, 2) shortage of skilled labour, 3) unrealistic project schedule, 4) labour absenteeism, 5) design changes, 6) accidents due to poor site safety, 7) subcontractor delays, 8) shortage of materials on site, 9) late delivery of construction materials, and 10) effects of bad weather on construction site. Although the data for the literature review comes mainly from the Middle Eastern and Asian regions, the causes of construction delay are universal, although the ranking varies.

It was observed that some of these causes are repetitive and can be better managed to avoid or mitigate. A major gap was identified in the way construction projects are done at CEDCO Ltd. "Projects are an important source of expert know-how and organizational knowledge, but lessons-learned from them are not systematically incorporated into subsequent projects, evidencing a lack of knowledge management and learning culture in local construction companies" (Ferrada et al., 2016). Therefore, The solution to address the problems of delays and essentially reduce their associated impacts is to document the lessons learned and create a template for documenting future lessons learned to promote a learning culture.

1.3. Purpose

A study by Secchi et al. (1999), as cited in Carrillo et al. (2013), defines a lesson learned as "a knowledge or understanding gained by experience. The experience may be positive, as in a successful test or mission, or negative, as in a mishap or failure. Successes are also considered sources of lessons learned. A lesson must be significant in that it has a real or assumed impact on operations, valid in that it is factually and technically correct, and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps or reinforces a positive result." The term lesson learned was the outcome of After-Action Review, a military activity (Carrillo, 2005). The US Army in (1997) as cited in Carrillo, (2005) defined lesson learned as "validated knowledge and experience derived from observations and historical study of military training, exercises, and combat operations." When used as a review activity, the lesson learned seeks to answer the following questions: 1) What did we set out to do? 2) What actually happened? 3) Why did it happen? and 4) What are we going to do next time? Within the construction industry, project teams typically fail to follow through with the review process and move on to the next project. In instances where the review process does occur, there is a failure to document and disseminate the information, and when there is dissemination, there is a failure to apply. CEDCO Ltd. fell short at step one due to the lack of a review process. Utilizing lessons learned as a tool or input for Project Management Plans has the following benefits: 1) historical data for new projects, 2) solutions to problems or risks that have the likelihood of recurring, 3) prevention of mistakes and 4)

reduction in cost and planning time (Trevino & Anantatmula, 2008) with spill off effects such as increase in client satisfaction, and referrals, favourable cost and schedule performance indices, and increase profits.

Regarding historical data, documenting lessons learned will provide data such as the cost of resources, facilitating better estimations of future projects using the analogous cost-estimating technique. Furthermore, a series of data can be used to establish trends to determine future costs. One of the reasons cited for project delays is issues with the project budget. Therefore, a better estimate can allow for project finances to flow more efficiently. Some construction project problems reoccur because preventative measures were not implemented, such as the sub-contractor resigning without notice, which abruptly puts the project on hold. However, having them sign a legally binding contract that requires advance notice or incurs penalties is a preventative measure. Construction mistakes can be costly, but having reasonable estimates and learning from past errors reduces mistakes and saves money. Finally, having templates that work, such as schedules, budget estimates and models, reduces the time needed for planning. These are some of the expected benefits this Final Graduation Project is expected to bring. Because it was identified that there is no lesson learned repository and no process for documenting, disseminating and applying the lesson learned at CEDCO Ltd., this Final Graduation Project will investigate the lessons learned from previous projects as they relate to the causes of delay and document them; identify the impacts the delays had caused; suggest recommendations and; develop a procedure for documenting and disseminating future lessons learned to keep the repository relevant.

1.4. General objective

This project aims to develop a lesson-learned repository as part of the Organizational Process Assets for Project Management Plans for future construction projects by CEDCO Ltd. to manage project delays better.

1.5. Specific objectives

The Specific Objectives of this Project are:

1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.

2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.

3. To determine the impact of the delays and subsequently highlight known relationships among them to better understand the consequences of delays.

4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.

5. To discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

Originally named Caribbean Engineering and Design Consultants Ltd, CEDCO Ltd. is an architecture, engineering and construction company incorporated on January 14th, 2014, in St. Vincent and the Grenadines. Since then, CEDCO Ltd. has expanded to include CEDCO LLC to serve the North and Latin American Regions. The company is committed to infrastructure and development that is sustainable, mitigative and adaptive to climate change, low-carbon producing, net-zero and green (CEDCO Ltd, n.d.).

2.1.2 Mission and vision statements

Vision

"CEDCO Ltd.'s vision is to be a worldwide leader in affordable, resilient and sustainable environmental, housing and infrastructure development" (CEDCO Ltd, n.d.).

Mission

"Our mission is to catalyse positive change in the Architecture Engineering Construction (AEC) industry by providing innovative and sustainable solutions that address the challenges of climate change. We believe that by working together, we can create a future where our communities are resilient to climate impacts and our buildings and infrastructure are designed to minimize their environmental footprint" (CEDCO Ltd, n.d.).

In relation to the vision and the Final Graduation Project, overall, delays have a negative effect on the cost of construction projects. To become a leader in providing affordable housing, having a well-managed repository of lessons learned and applying them can be beneficial in managing delays and, hence, reducing costs. Likewise, because delays are inherent in the construction industry, the Final Graduation Project becomes a means by which the company can improve its performance as it strives to become a catalyst for change within the industry.

2.1.3 Organizational structure

CEDCO Ltd. is a small company comprised of a variety of consultants. It has four full-time employees: the Chief Executive Officer or Managing Director, Operations, Compliance and IT Consultants. Its composition at the third level, as shown in Figure 1. is the most dynamic level in the Organization. Based on the nature of the project, additional consultants are contracted to fulfil the project's requirements.

Figure 1

CEDCO Ltd. Organizational structure (CEDCO Business Plan: 2023)

Note. Copied from the *CEDCO Business Plan* (p.6), CEDCO Ltd., 2023, with authorization from the author. Own creation.

2.1.4 Products offered

CEDDCO Ltd. offers the following services:

- **Architectural and Engineering Design and Drawings, including 3D Modelling and Rendering**- Our Managing Director, who by profession is a civil engineer, has one-on-one sessions with the client(s), taking note of their ideas and bringing to life their concept in two-dimensional drawings which can also be done in the three-dimensions to give a more realistic perspective. The client(s) will have several opportunities to change the design until an agreement is reached.

- **Construction Supervision**- Clients who have already completed the design phase and are desirous of a company building their design are welcome to contract our construction supervision service. This entails drafting a Bill of Quantities and assisting the client in applying for financing and managing finances, resources, and design changes from start to finish of a construction project.

- **Environmental and Social Impact Assessments-** This entails assessing the impact of an infrastructural project on the surrounding environment and society. It can also entail evaluating the action of a natural phenomenon on the built environment.

- **Project Management**- We offer the option of managing projects from start to finish as the client's representative to ensure that projects are completed on budget and on time according to the scope of work of the contracts.

- **Quantity Surveying**- CEDCO Ltd. provides the service of creating Bills of Quantities for construction projects.

2.2 Project Management concepts

2.2.1 Project management principles

There are 12 project management principles. This section briefly discusses each of the principles.

1) **Stewardship-** According to PMI (2021, p.24), "stewards act responsibly to carry out activities with integrity, care, and trustworthiness while maintaining compliance with internal and external guidelines. They demonstrate a broad commitment to financial, social, and environmental impacts of the projects they support." Stewardship includes integrity, care, trustworthiness and compliance.

2) **Create a collaborative Project Team Environment- "**Project teams are made up of individuals who wield diverse skills, knowledge, and experience." (PMI, 2021, p.28) Collaboration among teams can lead to accomplishing shared objectives more effectively and efficiently.

3) **Optimize risk responses** – "A risk is an uncertain event or condition that, if it occurs, can have a positive or negative effect on one or more objectives" (PMI, 2021, p.53). Positive risks should be capitalized to realize maximum benefits, while exposure to negative risks or threats should be reduced. In responding to risks, the response should be appropriate for the significance of the risk, cost-effective, realistic within the project context, agreed to by relevant stakeholders, and owned by the responsible person (PMI, 2021). A risk impact matrix is often used to quantify the risks of a project and assign a cost.

4) **Effectively Engage with Stakeholders**- "Stakeholders can be individuals, groups, and/or organizations that may affect, be affected by, or perceive themselves to be

affected by a decision, activity, or outcome of a portfolio, program, or project." (PMI, 2021, p.31) Those with a high degree of influence and negative or natural views about the project must also be effectively engaged to increase the chances of the project having successful outcomes. The project team can be used to engage other stakeholders. Engagement with stakeholders can be measured using the frequency of communication and efficacy by means of attendance, feedback and completion of objectives made as a result of the engagement.

5) **Focus on Value-** Value is a subjective term and "is the worth, importance, or usefulness of something" (PMI, 2021, p.35). "Value focuses on the outcome of the deliverables." (PMI, 2021, p.34). The value indicates project success and can be defined quantitatively and/ or qualitatively. This can be a financial contribution or measure of a public good achieved, such as a social benefit or the customer's perceived benefit from the project result (PMI, 2021).

6) **Recognize, Evaluate, and Respond to System Interactions**- "A project is a system of interdependent and interacting domains of activity" (PMI, 2021, p. 37). A project works within other larger systems, and a project deliverable may become part of a more extensive system to realize benefits (PMI, 2021, p. 37). Understanding this nature of projects should lead to a holistic approach to how projects are carried out to affect project performance positively.

7) **Demonstrate leadership behaviours** – "Effective leadership promotes project success and contributes to positive project outcomes" (PMI, 2021, p.40). Effective leaders change their style based on the situation to support individual and team needs. One needs to be adaptable because of the dynamic nature of teams. Any team member can demonstrate leadership behaviour, which can be assessed through feedback surveys and KPIs such as team productivity.

8) **Navigate complexity-** "Complexity is a characteristic of a project or its environment that is difficult to manage due to human behaviour, system behaviour, and ambiguity (PMI, 2021, p.50). Although complexity can occur randomly, the project team can stay vigilant in recognizing various elements of uncertainty to mitigate the number of uncertainties that arise and their respective impact on the project. Concerning uncertainty, a scale can be created to measure the level of uncertainty of elements such as material deliveries.

9) **Embrace adaptability and resiliency –** "Adaptability refers to the ability to respond to changing conditions. Resiliency consists of two complementary traits: the ability to absorb impacts and the ability to recover quickly from setback or failure" (PMI, 2021, p.55). Because the unexpected can occur during the duration of a project, the organization and project team's approaches must promote and facilitate adaptability and resiliency to help the project accommodate change, recover from setbacks, and advance the project's work.

10) **Enable change to achieve the envisioned future state-** "Projects, by their very definition, create something new: they are agents of change" (PMI, 2021, p.58). Change is necessary to stay relevant, and the project manager's position enables them to prepare an organization for changes. Some stakeholders express reluctance to change; therefore, stakeholder engagement and motivational approaches become necessary to assist with the adoption of changes. "A structured approach to change helps individuals, groups, and the organization transition from the current state to a future desired state" (PMI, 2021, p.58). This is why implementing changes should not be done haphazardly nor rapidly to reduce opposition.

11) **Tailor based on context-** "Adapting to the unique objectives, stakeholder, and environment complexity contributes to project success. Tailoring is the deliberate adaptation of approach, governance, and processes to make them more suitable for the given environment and work at hand" (PMI, 2021, p.44). The concept of tailoring is based on the accepted notion that projects are unique; therefore, the approach to executing a project successfully should be carefully adapted to the uniqueness of each project.

12) **Build quality into processes and deliverables-** According to PMI (2021, p.47), "Quality is the degree to which a set of inherent characteristics of a product, service, or result fulfils the requirements." The requirements will be the acceptance criteria based on the stakeholders' expectations and project objectives. Quality, therefore, "focuses on

meeting acceptance criteria for deliverables" (PMI, 2021, p.47). Dimensions or criteria for quality include but are not limited to performance, conformity, reliability, resilience, satisfaction, uniformity, efficiency and sustainability. To better understand how these dimensions relate to quality PMI (2021) had these questions to ask:

- **Performance-** "Does the deliverable function as intended by the project team and other stakeholders?"
- **Conformity-** "Is the deliverable fit for use, and does it meet specification?"
- **Reliability-** "Does the deliverable produce consistent metrics each time it is performed or produced?"
- **Satisfaction-** "Does the deliverable elicit positive feedback from end users? This includes usability and user experience?"
- **Efficiency-** "Does the deliverable produce the greatest output with the least inputs and effort?"
- **Sustainability-** "Does the deliverable positively impact economic, social, and environmental parameters?"

2.2.2 Project management domains

Project Performance Domains

- **Stakeholder Performance Domain** "addresses activities and functions associated with stakeholders." (PMI, 2021, p.8) According to PMI (2021, p.8), a stakeholder is "an individual, group, or organization that may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project, program, or portfolio."

Effective execution of the Stakeholder Performance domain results in a productive working relationship with the stakeholders throughout the project, stakeholder agreement with project objectives and beneficiary stakeholders who are supportive and satisfied. In contrast, stakeholders who may oppose the project or its deliverables do not negatively impact project outcomes (PMI, 2021, p.8).

- **Team Performance** "addresses activities and functions associated with the people responsible for producing project deliverables that realize business outcomes." (PMI, 2021, p.16). According to PMI (2021, p.16), effective execution of the domain results in shared ownership, a high-performing team, applicable leadership and other interpersonal skills demonstrated by all team members. Key roles identified in the team are: 1) Project manager- "Te person assigned by the performing organization to lead the project team that is responsible for achieving the project objectives." (PMI, 2021, p.16) 2) Project Management Team- "The members of the project team who are directly involved in project management activities." (PMI, 2012, p.16) and; 3) Project Team- "A set of individuals performing the work of the project to achieve its objectives." (PMI, 2021, p.16).

- **Development Approach and Life Cycle** "addresses activities and functions associated with the development approach, cadence, and life cycle phases of the project." (PMI, 2021, p.32) The key terms for understanding the development approach and life cycle are deliverable, development approach, cadence, project phase and project life cycle.

Deliverable is “any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project.”

- **Planning** “addresses activities and functions associated with the initial, ongoing, and evolving organization and coordination necessary for delivering project deliverables and outcomes.” (PMI, 2021, p.51) This domain aims to “proactively develop an approach to create the project deliverables. The project deliverables drive the outcomes the project was undertaken to achieve. (PMI, 2021, p.51)

- **Project Work** “addresses activities and functions associated with establishing project processes, managing physical resources, and fostering a learning environment.” (PMI, 2021, p. 69) The domain is associated with establishing the processes and performing the work to enable the project team to deliver the expected deliverables and outcomes. Activities of this domain include but are not limited to managing the flow of existing work, new work, and changes to work; keeping the project team focused; establishing efficient project systems and processes; communicating with stakeholders; managing material, equipment, supplies, and logistics; working with contracting professionals and vendors to plan and manage procurement and contracts; monitoring changes that can affect the project; and enabling project learning and knowledge transfer.” (PMI, 2021, p.70)

- **Delivery** "addresses activities and functions associated with delivering the scope and quality that the project was undertaken to achieve." (PMI, 2021, p.80)

- **Measurement** "addresses activities and functions associated with assessing project performance and taking appropriate actions to maintain acceptable performance." (PMI, 2021, p.93). This domain evaluates the degree to which work done in the Delivery Performance Domain meets the metric identified in the Planning Performance Domain. Reasons for this domain include: "evaluating performance compared to work plan; tracking the utilization of resources, work completed, budget expended, etc.; demonstrating accountability; providing information to stakeholders; assessing whether project deliverables are on track to deliver planned benefits. Focusing conversations about trade-offs, threats, opportunities, and options; and ensuring the project deliverables meet customer acceptance criteria." (PMI, 2021, p. 94)

- **Uncertainty** "addresses activities and functions associated with risk and uncertainty." (PMI, 2021, p.116) PMI (2021) defines uncertainty as a "state of not knowing or unpredictability." Aspects that contribute to project uncertainty include but are not limited to economic factors such as volatility in prices, availability of resources, ability to borrow funds, and inflation/deflation; technical considerations such as new or emerging technology, complexity associated with systems, and interfaces; legal or legislative constraints or requirements; physical environment as t pertains to safety, weather, and working conditions; ambiguity related to current or future conditions social and market

influences shaped by opinion and media; and. Political influences, either external or internal to the organization." (PMI, 2021, p.118)

2.2.3 Predictive, adaptative and hybrid projects

Table 1

Main Features of Predictive, Adaptative and Hybrid Projects (PMI; 2021)

Predictive	**Adaptive**	**Hybrid**
Linear Method- one phase flows into the next. Known scope, time and costs at the beginning of the project.	Agile Methods- repetitive phases or cyclical with feedback loop Two types- Incremental and Iterative	Combination of Predictive and Adaptive
Managed changes- few variations	Flexible- Changes and feedback are incorporated.	Used in projects when there are known and unknown project elements
Value is in the end product.	Value is added in phases.	

2.2.4 Project management

2.2.5 Project management knowledge areas and processes

"A Project Management Process Group is a logical grouping of project management processes to achieve specific project objectives." (PMI, 2017, p.23) There are five process groups, which are described as follows:

- **Initiating Process Group-** "Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase." (PMI, 2017, p.23)

- **Planning Process Group-** "Those processes required to establish the scope of the project, refine objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve." (PMI, 2017, p.23)
- **Executing Process Group-** "Those processes performed to complete work defined in the project management plan to satisfy the project requirements." (PMI, 2017, p.23)
- **Monitoring and Controlling Process Group-** "Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the project are required; and initiate the corresponding changes." (PMI, 2017, p.23)
- **Closing Process Group-** "Those processes performed to formally complete or close the project, phase, or contract." (PMI, 2017, p.23)

Knowledge Areas

"Processes are also categorized by Knowledge Areas. A knowledge Area is an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques." (PMI, 2017, p.23) There are ten Knowledge Areas according to PMI Standards, which are described as follows:

1) **Project Integration Management** - "includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project

management activities within the Project Management Process Groups." (PMI, 2017, p.23)

2) **Project Scope Management-** "includes the processes required to ensure the project includes all the work required, and only the work required, to complete the project successfully." (PMI, 2017, p.23)
3) **Project Schedule Management-** "includes the processes required to manage the timely completion of the project." (PMI, 2017, p.24)
4) **Project Cost Management-** "includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so the project can be completed within the approved budget." (PMI, 2017. P.24)
5) **Project Quality Management**- "includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements to meet the stakeholders' expectations." (PMI, 2017, p.24)
6) **Project Resources Management-** "includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project." (PMI, 2017, p.24)
7) **Project Communications Management-** "includes the processes required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and ultimate disposition of project information." (PMI, 2017, p.24)

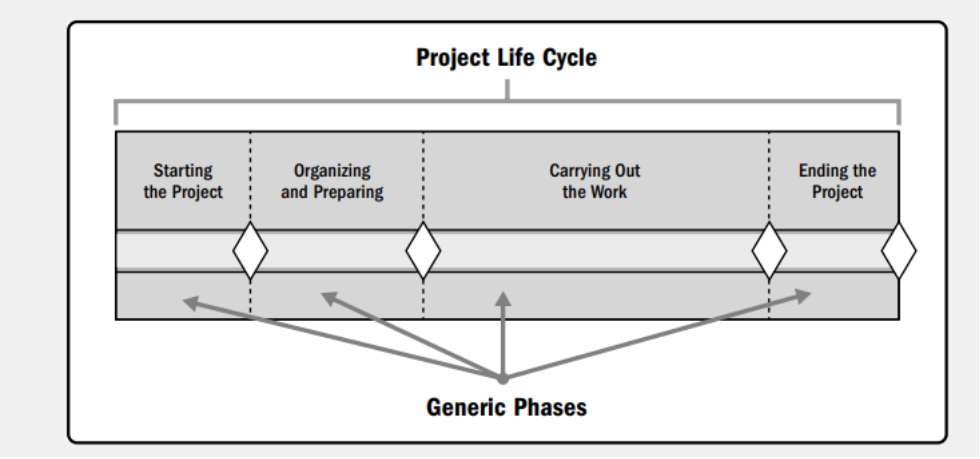
8) **Project Risk Management-** "includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project. (PMI, 2017, p.24)
9) **Project Procurement Management-** "includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team." (PMI, 2017, p.24)
10) **Project Stakeholders Management-** "includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution." (PMI, 2017, p.24)

2.2.6 Project life cycle

"A Project life cycle is the series of phases that a project passes through from start to completion. A project phase is a collection of logically related activities that culminate in completing one or more deliverables (PMI, 2017). An example of a generic project life cycle is shown in Figure, which consists of four phases: starting the project, organizing and preparing, carrying out the work, and ending the project. There are three main project life cycles. They are 1) Predictive Life Cycle, 2) Adaptive Life Cycle, and 3) Hybrid. There are two types of adaptive life cycles: iterative and incremental.

Figure 2

Generic Depiction of a Project Life Cycle (PMI:2021)



Note: Copied from the *PMBOK Guide (PMI))* (7th ed., p. 548), by Project Management Institute, 2021, PMI. Copyright 2021 by PMI.

Predictive or Waterfall Project Life Cycle is characterized by the following: project scope, time, and cost are determined in the early phases of the life cycle and changes to scope are managed (PMI, 2017, p.19).

The Iterative Project Life Cycle is characterized by the following: the project scope is typically determined in the early phases of the cycle; however cost and time estimates are modified as the team's understanding of the product increases; the product is developed through a series of repeated cycles, while increments successively ass to the functionality of the product (PMI, 2017, p.19).

The incremental Project Life Cycle is characterized by deliverables produced through iterations that successively add functionality within a predetermined timeframe, and deliverables are considered complete only after the final iteration (PMI, 2017, p.19).

Hybrid Project Life Cycle, as its name suggests, is a combination of the two main life cycle types: predictive and adaptive life cycles. The well-known project elements will utilize the predictive life cycle, while those not so well-defined will use the Adaptive Life Cycle (PMI, 2017, p.19).

Having defined each Project Life Cycle, it can be determined that the Predictive Life Cycle best corresponds to the Final Graduation Project. Because the FGP examines the lessons learned by CEDCO LTD in the Construction Industry, the characteristics of construction projects, such as known scope, time and cost estimates at the beginning of the projects with managed changes, are consistent with the Predictive Life Cycle.

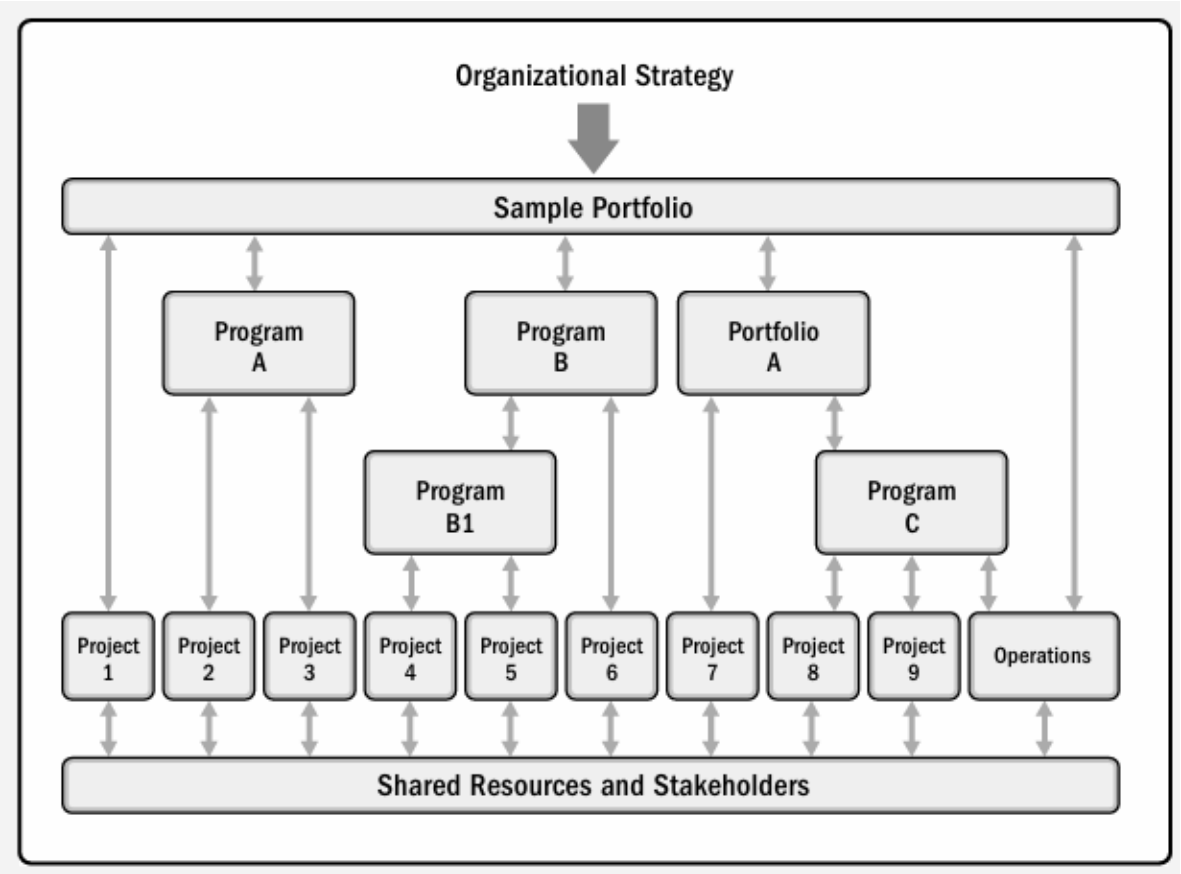
2.2.7 Company strategy, portfolios, programs and projects

"Strategy defines the company's distinctive approach to competing and the competitive advantages on which it will be based. A good competitive strategy is one that creates unique value for a particular set of customers" (Harvard Business School, 2020). The company strategy of CEDCO Ltd. is to be the primer architecture, engineering and construction company in St, Vincent & the Grenadines by taking a very unique niche within the industry. This unique and competitive niche entails being the only company that offers all the services that are involved with the conception to the actualization of a client's construction project, that is, the company designs, seeks approval, and supervises the construction. Eventually, the company aims to go beyond and offer loans for the construction of residential projects.

Portfolio refers to when “projects, programs, subsidiary portfolios, and operations are managed as a group to achieve strategic objectives” (PMI, 2017, p.714). “A program is defined as related projects, subsidiary programs, and program activities managed in a coordinated manner to obtain benefits not available from managing them individually” (PMI, 2021, p.543). “A project may be managed in three separate scenarios: as a stand-alone project (outside a portfolio or program); within a program; or within a portfolio. Project management has interactions with portfolio and program management when a project is within a portfolio or program” (PMI, 2017, p.543). This relationship is illustrated in Figure 3.

Figure 3.

Example of portfolio, program, and project management interfaces (PMI; 2017)



Note: Copied from the *PMBOK Guide (PMI))* (7th ed., p. 544), by Project Management Institute, 2021, PMI. Copyright 2021 by PMI.

2.3 Other applicable theories/concepts related to the project topic and context

An applicable concept to this project topic is "Lessons Learned." Research has noted that delays in construction projects are a reoccurring issue. It can therefore be inferred that project managers do not use the process of lessons learned as a possible method of

improving the short comings of the previous project or as a means of identifying the cause of the delay to improve on the next project. In analyzing the lessons learned, the researcher hopes that project managers can identify the necessary tools and techniques that can be applied as solutions. Rowe & Sikes (2006) defines lessons learned as "the documented information that reflects both the positive and negative experiences of a project." Lessons learned is a tool within itself that project managers can apply to other projects for improved success. Rowe & Sikes (2006) identifies these train of thoughts as a deterrent as to why project managers and teams do not utilize the tool:

- "Every project is different and learning from one project is not applicable to other projects.
- There is not enough time for learning. We have to complete the project.
- Nothing ever happens after lessons learned are captured."

2.3.1 Current situation of the problem or opportunity in study

Working directly in the construction industry has revealed a reoccurring problem that has inspired this Final Graduation Project. Construction delays, whether public or private are very common and concerning as they result in primarily cost and time overrun. CEDCO Ltd is no exception to such consequences but also because of the high competition in the construction industry and the small geographic size of the island, reputation is very important in gaining more private projects. As an employee of CEDCO Ltd, the opportunity to use the company's history as the basis for the Final Graduation Project presented itself as a means to apply what was learnt in this Master's Program. Since working with the company, all of the projects were completed after the completion date which concluded that intervention, or

recommendations were needed. The current situation is further discussed in a literature review presented conducted as one of the tools used to produce objective 1 deliverables.

3 METHODOLOGICAL FRAMEWORK

"Methodological framework is a set of procedures, methods, and tools that guide the research process in a systematic and structured manner. It provides a structure for conducting research, collecting and analyzing data, and drawing conclusions." (Hassan, 2022). This chapter discusses the information sources, research methods, tools, assumptions, and constraints and explains the deliverables. The importance of having a methodological framework lies in its benefits. McMeekin et al. (2020) list the benefits of using methodological frameworks, such as improving consistency, enhancing research quality, standardizing approaches, and maximizing the trustworthiness of findings.

3.1 Information sources

Huffman (2023) groups information sources into three types. The types identified are Primary, Secondary and Tertiary. For this Final Graduation Project, the focus will be on utilizing primary and secondary data sources, which will provide both qualitative and quantitative data to achieve the project's objectives.

3.1.1 Primary sources

Primary sources of information are firsthand accounts of research or an event, including original scholarly research results, raw data, testimony, speeches, historical objects or other evidence that provides unique and original information about a person or an event (Huffman, 2023; Huffman, 2023). Primary sources of information include letters, technical reports, correspondences, and photographs (Healey Library, 2019). To accomplish the objectives of this FGP, the primary sources of information are data from

logs, including communication, delivery, weather, complaints, financial reports, project documents, surveys, and questionnaires.

Each project would have data recorded regarding communication, site conditions, complaints, changes, spending, income and other project-related information that would be very useful in determining patterns and causes of delays. Surveys and questionnaires created by the researcher are

3.1.2 Secondary sources

Secondary sources analyze, synthesize, evaluate, and interpret primary sources (or other secondary sources). Secondary sources are created after an event and written by someone who did not experience or observe the event firsthand (Huffman, 2023). Secondary sources of information include books, analysis or interpretation of data, dissertations, scholarly articles and documentaries (Healey Library, 2019).

Table 2

Information sources for each of the project objectives (Culzac; 2024)

Objectives	**Information sources**	
	Primary	**Secondary**
1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	Data from logs (communication, delivery, weather, complaints, financial) and other project documents	Journal articles, case studies
2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.	Survey to collect feedback from stakeholders	Journal articles, case studies
3. To determine the impact of the causes identified and subsequently highlight known relationships among the causes.	Data from logs and project reports	Journal articles, case studies
4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.	Data from questionnaires completed by stakeholders	Journal articles, case studies Book

Table 2

Cont.

Objectives	Information sources	
	Primary	**Secondary**
5. To create a method for documenting and disseminating future lessons learned to further the repository.	Firsthand experience	Journal articles, case studies

3.2 Research methods

"Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create a better understanding of a topic" (University of Newcastle Library, 2023). There are several types of research methods, such as descriptive and analytical. Applied, Fundamental, Quantitative, Qualitative, Conceptual and Empirical (Rangaiah, 2021) are the methods the researcher can employ to gather the necessary data to achieve the project objectives. Analytical and mixed research methods were used in this FGP.

3.2.1 Analytical Method

"Analytical Research is a form of research where the researcher has to make do with the data and factual information available at their behest and interpret this information to undertake an acute evaluation of the data" (Rangaiah, 2021).

3.2.2 Mixed Method

Mixed methods research involves the use of both qualitative and quantitative methods. “Quantitative Research, as the name suggests, is based on measuring a particular amount or quantity of a particular phenomenon. It focuses on gathering and interpreting numerical data and can be adapted to discover averages or patterns or make predictions. Qualitative research can be defined as the study of the nature of phenomena and is especially appropriate for answering questions of why something is (not) observed, assessing complex multi-component interventions, and focusing on intervention improvement” (Busetto et al., 2020).

Table 3

Research methods for each of the project objectives (Culzac: 2024)

Objectives	**Research methods**	
	Analytical Research Method	**Mixed Method**
1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	Using secondary data analysis to review reports from previous and current projects.	Open-ended surveys were administered to stakeholders to collect their input on the causes.
2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.	Creating a metric system to score the causes and then using the average to rank the scores.	Questionnaire to rank the causes identified
3. To determine the impact of the causes identified and subsequently highlight known relationships among the causes.	Investigate the impact delays have had from project reports.	Use the causes identified and make inferences as to whether one will impact the other.

Table 3

Cont.

Objectives	**Research methods**	
	Analytical Research Method	**Mixed Method**
4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.	Using secondary data analysis to review the literature on what others have proposed.	N/A
5. To discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.	Research existing methods and adapt to CEDCO Ltd.	Create and disseminate a template created from adapting existing methods for user feedback to finalize the method.

3.3 Tools

"Research Tools" are vehicles that broadly facilitate research and related activities. "Research Tools" enable researchers to collect, organize, analyze, visualize and publicize research outputs" (Ale Ebrahim Nader, 2016).

Table 4

Tools for Each Project Objective (Culzac: 2024)

Objectives	**Tools**
1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	• Data gathering • Questionnaire • Checklists
2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.	• Data representation
3. To determine the impact of the causes identified and subsequently highlight known relationships among the causes.	• Data analysis
4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.	• Expert judgement • Document analysis
5. To discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.	• Information management

3.4 Assumptions and constraints

"Assumptions are, of course, those matters that are universally accepted or that have been sufficiently well demonstrated that the researcher can build on them" (Williams, 1980). Constraints, also referred to as restrictions or limitations, are "at the simplest level, the weaknesses of the study, based on factors that are often outside of your control as the researcher. These factors could include time, access to funding, equipment, data or participants" (Jansen, 2022).

Table 5

Assumptions and Constraints Associated with the Project Objectives (Culzac:2024)

Objectives	**Assumptions**	**Constraints**
1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	• No causes were omitted.	• Limited by the data available in secondary sources and what was logged by the company. • Confidentiality restrictions by stakeholders to discuss some aspects of the projects
2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.	• Results from questionnaires are objective.	• The sample population for the questionnaire is very small, so the ranking may not be representative of CEDCO Ltd.
3. To determine the impact of the causes identified and subsequently highlight known relationships among the causes.	• Association of the causes identified in the relationships does not equate to causations.	• Limited by the data available in secondary sources and what was logged by the company. • Confidentiality restrictions by stakeholders to discuss some aspects of the projects

Table 5

Cont.

Objectives	Assumptions	Constraints
4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.	• Recommendations are practical	• Recommendations are restricted by external and internal Enterprise Environmental Factors such as resource availability and financial policies.
5. To discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.	• Stakeholders are literate in software used to create the repository	• To add to the repository, stakeholders must have access to it • Cloud storage

3.5 Deliverables

PMI (2017) states, "A deliverable is defined as any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project. Deliverables may be tangible or intangible." The deliverables are directly linked to the objective - as a result of achieving the purpose or as required by the researcher to accomplish the objective, such as in the case of the questionnaire data that will be needed to complete the matrix to rank the causes of project delays. A summary of the deliverables is shown in Table 6.

Table 6

Deliverables for Each of the Project Objectives (Culzac: 2024)

Objectives	**Deliverables**
1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	• List of Causes • Questionnaire results • Stakeholder matrix
2. To rank the ten major causes of construction delay through stakeholder feedback to validate and determine high-priority areas.	• Questionnaire results • Graph of ranked causes
3. To determine the impact of delay associated with the causes identified and highlight known relationships among the impacts.	• Documentation of impacts • Matrix of causes of delay and associated implications
4. To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.	• A list of recommendations
5. To create a method for documenting and disseminating future lessons learned to further the repository.	• Procedure for documenting and sharing lessons-learned repository.

4 RESULTS

4.1. Causes for Delay in CEDCO Ltd. Construction Projects

Objective: To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.

A literature review was conducted to compile a list of major or significant causes for delays in construction projects. The primary causes identified by each study were selected and summarized in Table 7. The list was used to create a questionnaire that required respondents/ stakeholders to select ten causes that contributed to the delay in one or more of CEDCO Ltd.'s previous construction projects that the respondent was involved in. An option of other was provided in the questionnaire to allow the respondents to state a cause that was not presented in the list of options. The respondents comprised of four fulltime employees (FTE), one part-time employee (PTE), four subcontractors (SC) and three recent former clients (RCF), as shown summarized in Table 8.

In a study conducted by Assaf & Al-Heji (2006) on causes of construction delay in large projects, the 73 delay causes they identified were categorized into nine groups and ranked from the viewpoints of owners, contractors and consultants. All three parties agreed that change orders by the owner during construction were the most important cause of delay. In comparison, two of the three parties would have agreed that delay in progress payments by the owner, ineffective planning and scheduling of the project by the contractor, poor site management and supervision by the contractor, shortage of labourers

and difficulties financing the project by the contractor were identified as the most important causes of delay. While all three parties agreed that changes in government regulations and laws, traffic control and restrictions at job sites, the effect of social and cultural factors and accidents during construction were the least important (Assaf & Heji, 2006, p.354).

Sambasivan & Soon (2007, p.520) assessed "the perceptions of clients, consultants, and contractors on the relative importance of causes and effects of delay in the Malaysian construction industry." Unlike their counterparts, Assaf & Al-Heji (2006), the causes were grouped into eight categories. The common categories were: 1) client-related, 2) contractor-related, 3) consultant-related, 4) material-related, 5) labor and equipment-related, 6) contract-related factors and 7) external factor-related. Sambasivan & Soon (2007) included contract relationship-related factors that account for major disputes, inappropriate organizational structure, and lack of communication between parties. In contrast, Assaf & Heji (2006) categorized project-related and contractor-related to cover the previously mentioned causes and included design-related causes. Sambasivan & Soon (2007) ranked the four major causes of delay as 1) improper planning, 2) site management, 3) inadequate contractor experience and 4) finance and payments of completed work.

Al- Momani, A.H (2000) studied 130 public projects inclusive of "residential, office and administration buildings, school buildings, medical centers and communication facilities" in Jordan "to aid construction managers in establishing adequate evaluation before the contract award using quantitative data identified the major causes of project delay as: "poor design, change orders, weather, site conditions, late delivery, economic conditions and increase in quantity."

Shah, R K (2016) investigated the causes of construction delay in Ghana, Australia and Malaysia because the researcher noted that delay and cost overrun were fundamental problems in construction projects. Using a questionnaire administered in all three countries for comparative reasons, the researcher documented that the "key factors causing the project delay vary from one country to another" (Shah, RK, 2016). In Ghana, the most critical factors for delay were delay in payment and underestimation or project cost due to price inflation or unavailability of materials and time variation, which could affect prices. On the other hand, Australia and Malaysia had similar results, with the most critical factors being lack of planning and scheduling by contractors, which affected estimated targets within the agreed budget, poor site management, contractor's inexperience and finally, underestimation of the project's complexity.

El-Sayegh, M (2008) assessed the risks in the United Arab Emirates (UAE) construction industry and addressed their proper allocation. The researcher shared a list of significant delay causes similar to that of Shah, R.K (2016), who identified inflation, sudden price changes, and material and labor shortages as substantial economic risks. Owners' risks included unrealistic construction schedules, improper intervention and changes in design. The researcher found that political, social and cultural risks were insignificant.

Al et al. (2009) studied delays in construction projects in Al Zentan, Libya. The researchers would have used two categories to group the delays. These are non-excusable and excusable delays comprising non-compensable and compensable delays. Results showed that improper planning, lack of effective communication, shortage of supply and

design errors were the significant factors of delay, all non-excusable delays caused by contractors or suppliers.Faridi & El-Sayegh's study, as cited in Samarghandi et al. (2016), listed low productivity level of laborers, slow decision-making, delays in producing design documents and delays in reviewing and approving design documents by consultants and clients (preparation) as the most significant causes of delay in UAE.

Table 7

Summary of Major Causes of Construction Delay in Previous Studies (Culzac: 2024)

Citation	Country of Study	Major Causes Listed by Study
Assaf & Al-Heji (2006)	Saudi Arabia	Change orders by the owner during construction Delay in progress payment Ineffective planning and scheduling Labour shortage
El- Sayegh (2008)	UAE	Shortage in material and labour supply Unrealistic construction schedules Changes in design Inflation and sudden changes in prices
Sambasivan & Soon (2007)	Malaysia	Contractor's improper planning Contractor's poor site management Inadequate client finance and payments for completed work Inadequate contractor experience
Al-Momani, A.H (2000)	Jordan	Change orders Weather and site conditions Late deliveries Economic conditions

Note: Table is a compilation of a literature review.

Table 7

Cont.

Citation	Country of Study	Major Causes Listed by Study
Faridi & El-Sayegh (2006)	UAE	Slow preparation Lack of early planning Ineffective decision making Low productivity
Al et al. (2009)	Libya	Insufficient coordination Ineffective communication
Shah, RK (2016)	Australia, Malaysia & Ghana	Fast growth of inflation Contractor's poor site management Increase in material prices Delays caused by changes in design specifications and financial problems Underestimating project cost

A stakeholder is defined as "An individual, group, or organization that may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project, program, or portfolio." (PMI, 2017, p.250) Full-time and part-time employees, sub-contractors, and recent former clients were selected as participants in the questionnaire because each group would have affected the project's outcome in one form or another, and each would have a perception or reason for the delays. A Stakeholder Analysis, which is "A

method of systematically gathering and analyzing quantitative and qualitative information to determine whose interests should be taken into account through the project." (PMI, 2017 p.250), was performed on the participating groups. The type of Stakeholder Analysis selected was the Influence Impact Matrix, which identifies the stakeholders with the most influence and impact on project success. Results from the analysis presented in Figure 4. show that the subcontractors, full-time and recent former clients would have had a strong influence and impact on the project's success. This is a logical outcome because the full-time employees would be responsible for key knowledge areas of the project, such as schedule, cost, quality, procurement, resource, and stakeholder management. The subcontractors and their teams were responsible for masonry, carpentry, plumbing, electrical, painting and tiling. Therefore, their roles and decision-making would influence and impact on the project's success. The recent former clients also share the same level of influence and impact for two main reasons: 1) they were the main sources of change requests, and 2) they financed the projects through lending institutions or self-financing. ON the other hand, the part-time employee or consultant had a low influence and impact on the previous projects. Their role would have been limited to Occupational Health and Safety to monitor and reduce risks on the job site.

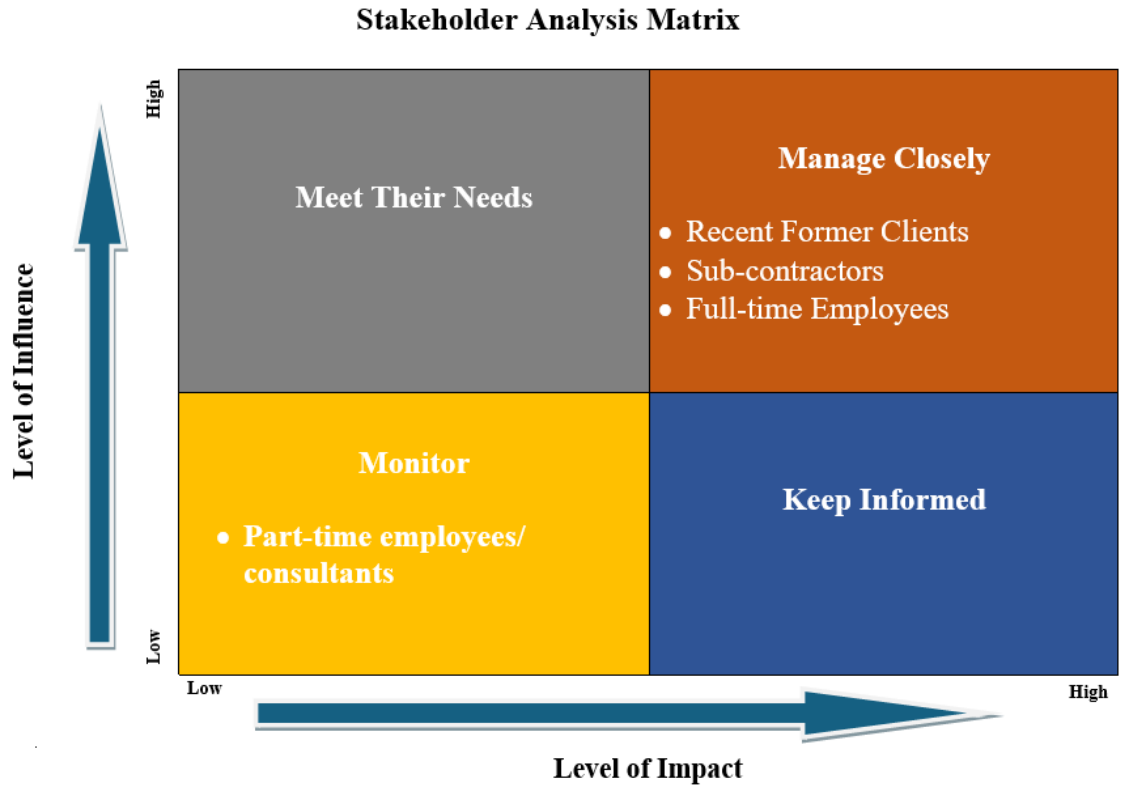
Table 8

Questionnaire Participant Stakeholder Profile (Culzac:2024)

Full-time Employees (FTE)	Part-time employees/ consultants (PTE)	Sub-Contractors (SC)	Recent former clients (RFC)	Total Respondents & Questionnaires
4	1	4	3	12

Figure 4

Influence Impact Grid for Stakeholder Analysis (Culzac: 2024)



The questionnaire results are summarized in Table 9. showing the scores each cause received. The "other" option in the questionnaire yielded four additional causes from full-time employees, subcontractors, and recent former clients. These additional causes were slow reporting of progress claims, slow resolutions to design and structural issues during construction, slow approval for utilities at the site and poor conflict resolution between client and contractor. The results revealed that the ten major causes for delay in previous CEDCO Ltd. Construction projects are: 1) slow preparation of drawings and approval, 2) change orders requested by the owner during construction, 3) insufficient coordination, 4) ineffective communication, 5) ineffective planning and scheduling, 6) payment delay, 7) poor workmanship, 8) low productivity, 9) underestimating project cost and, 10) other-slow reporting of progress for claims. The scores of the ten major causes are shown in Figure 5.

Table 9

Questionnaire results showing the scores of each cause of construction delay (Culzac: 2024)

	Causes for Construction Delay	**FTE**	**PTE**	**SC**	**RFC**	**Total**
1	Slow preparation of drawings and approval	1		2	3	6
2	Change orders requested by the owner during construction	4	1	4	3	12
3	Insufficient coordination		1	4	1	6
4	Ineffective communication	4	1	4	3	12
5	Ineffective planning and scheduling	3	1	1	3	8
6	Inflation and sudden changes in prices		1	4		5
7	Payment delay	4	1	4	3	12
8	Material shortage	2		3		5
9	Labour shortage					0
10	Poor workmanship	3	1	2	2	8
11	Weather and site conditions	2		2		4
12	Contractor’s poor site management	4	1			5
13	Low Productivity	4	1	2	3	10
14	Underestimating project cost	3	1	4		8
15	Other- Slow reporting of progress for claims	4		3	3	10
16	Other- Slow resolutions to design and structural issues during construction				2	2
17	Other- Slow approval for utilities at site				2	2
18	Other- Poor conflict resolution between client and contractor	2		1	2	5
	Total	40	10	40	30	120

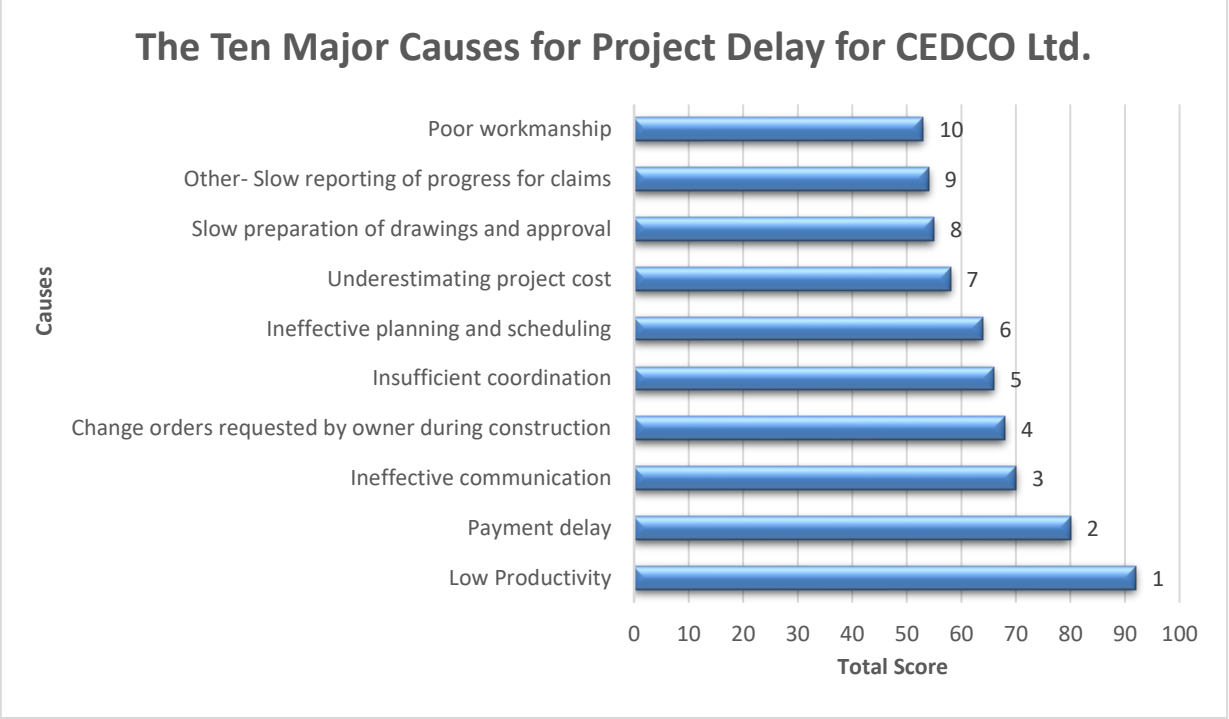
4.2. Ranked Causes of Delay in Previous CEDCO Ltd. Construction Projects

Objective: To rank the ten major causes of construction delay through stakeholder feedback to validate and determine high-priority areas.

A second questionnaire was administered to the same group, which listed the ten causes of construction delay that scored the highest in the previous questionnaire. Participants were then requested to rank the ten major causes. The ranking was done based on a scale of one to ten, with ten being the most significant cause for construction delays and one being the least of the causes. Results from the questionnaire are displayed in Figure 5. indicating that the greatest to the least of the causes are as follows: 1) low productivity, 2) payment delay, 3) Ineffective communication, 4) change orders requested by the owner during construction, 5) insufficient coordination, 6) ineffective planning and scheduling, 7) underestimating project cost, 8) slow preparation of drawings and approval, 9) other- slow reporting of progress for claims and 10) poor workmanship.

Figure 5

Ten Major Causes for Construction Delay in Previous CEDCO Ltd. Projects (Culzac: 2024)



Brief Description of the Causes for Construction Delay

1. Low productivity

Miller (2018) defines productivity as "the measure of output that you get against the effort (input, i.e. project resources) you put in to achieve it." Estimating activity duration, which is the "process of estimating the number of work periods needed to complete individual activities with estimated resources" (PMI, 2021, p.195), is a critical project management process under Project Schedule Management that affects productivity. In

accurately estimating the activity duration, the appropriate resources can be assigned to the activity in relation to resource skill level and quantities. If these resources are insufficient, output is negatively affected, thus affecting productivity. During this process, the following inputs must be taken into consideration: 1) project management plans- schedule management plan and scope baseline, 2)project documents- activity attributes, activity list, assumption log, lessons learned register, milestone list, project team assignments, resource breakdown structure, resource calendars, resource requirements and risk register, 3) enterprise environmental factors- productivity metric and location of team members and 4) organizational process assets- historical duration of information and lessons learned repository (PMI, 2021).

2. Payment delay

Payment delay is an external factor that originates from the client or their lending institution and becomes a known risk to the contractor.

3. Ineffective communication

To have effective communication, a strategy must be in place for communication among the project stakeholders, and the approach must be implemented. Often, ineffective communication comes from not planning, managing, and monitoring communications, which are project communications management processes. A communication management plan is frequently seen as the least important part of a residential construction project by the project manager/ contractor. However, misunderstandings, miscommunication, and

inappropriate communication channels have been shown to contribute to the delay in the project.

4. Change orders requested by the owner during construction

Change requests can affect the project's resource management plan, schedule, and cost baseline (PMI, 2012, p.358). These requests should, therefore, be assessed to determine their impact on the schedule and cost baseline (PMI, 2021, p. 115). If approved, “new or revised cost estimates, activity sequences, schedule dates, resource requirements, and/or analysis of risk response alternatives” (PMI, 2021, p.115) can be required. Monitoring communication can assist with documenting all change requests to ensure they are addressed and responses are shared with the team. Time, therefore, will be needed to process such requests by the owners, which contributes to the delay.

5. Insufficient coordination

Insufficient coordination results from ineffective or poor communication, which corresponds to a lack of a communication management plan or its implementation. The consequence of inadequate coordination stems from the shortcomings of the manage and monitoring processes in the project communication management plan. During the management process, information fails to be collected and distributed on time, while during the monitoring process, the information needs of the stakeholders are not met. This prevents the team from operating in harmony and allows misunderstandings and miscommunication to occur easily.

6. Ineffective planning and scheduling

Ineffective planning and scheduling mainly occur when the six processes of the schedule management plan are not correctly followed. Failure to plan how the project schedule is developed, managed, executed, and implemented; activities are defined; activities are sequenced; activity duration is estimated; and the schedule is developed and controlled will result in poor planning and scheduling. The communication management plan is also helpful in this cause for construction delay because information such as change requests that can affect the scope baseline and work performance data will be considered input into the various processes. This means that the project information needs to be current and shared in a timely manner since it affects other knowledge areas.

7. Underestimating project cost

Underestimating project costs occur due to errors made in the plan, and estimating costs and determining budget processes are part of the project cost management knowledge area. Using inappropriate tools and techniques, outdated costings, not correctly accounting for known risks with contingency reserves, unknown risks with a management reserve, and failure to include the schedule management plan, which would consist of the list of activities to assign a cost to, risk management plan, quality management plan and scope baseline can be contributing factors as to why the project cost was underestimated.

8. Slow preparation of drawings and approval

The time it takes to prepare drawings depends on the workload of the architect and engineer and the project's complexity. The greater their workload and the more complex the project is, the longer the drawings take to prepare. EEFs “refer to conditions, not under the project team's control, that influence, constrain, or direct the project. These conditions can be internal or external to the organization” (PMI, 2021, p.38). Approving drawings would be considered an Enterprise Environmental Factor (EEF). Because a government body, the Physical Planning Unit, approves drawings, the project team does not control this aspect.

9. Slow reporting of progress for claims Project communication and schedule

Progress reporting must be identified as an activity for the project and be incorporated into the project schedule so that reporting can be done promptly. The quantity surveyor who does the reporting should be identified as one of the stakeholders in the communication plan so that timely information and instructions can be shared with them. The slow reporting often comes due to late notice or when funds and the workload of the quantity surveyor.

10. Poor workmanship

In this context, poor workmanship refers to the failure of the quality of work done to meet the quality requirements of the stakeholders’ objectives and engineering and local building standards. The quality requirements, methods and criteria in which compliance with these standards will be tested, measured and accepted must be established. Quality

must then be managed and controlled with regular monitoring and assessment to ensure regular compliance with the accepted criteria during quality checks.

4.3. Implications of Delay

Objective: To discuss the implications associated with each major cause of delay to understand the risks better.

The common implications associated with the causes of delay are cost overrun, time overrun, quality issues, resource availability, material wastage and strained relationships. The implication of environmental factors was included to highlight how some delays can have an impact on the environment, given that one should be cognizant of the impact of human activities on planetary boundaries and the need to move towards regenerative development. A summary of the causes for delay and the associated implications are shown in Figure 6. At the end of the impact of delay are failed projects whereby the building fails to be completed and legal action brought against either party to settle disputes.

Figure 6

Implications associated with the causes for construction delay (Culzac:2024)

	Implications							
Causes for Construction Delay	**Cost overrun**	**Time overrun**	**Quality issues**	**Resource availability**	**Material wastage**	**Strained relationships**	**Environmental**	**Unemployment**
Slow preparation of drawings and approval								
Change orders requested by the owner during construction								
Insufficient coordination								
Ineffective communication								
Ineffective planning and scheduling								
Payment delay								
Poor workmanship								
Low Productivity								
Underestimating project cost								
Other- Slow reporting of progress for claims								

1) **Cause:** Low productivity

Implications

a) **Cost overrun-** Cost overrun occurs when the actual cost is less than the earned value to give a cost performance index of less than 1 (PMI, 2017, p.263). In the case of low productivity, because the output level is less than required to keep the project on schedule, the project duration will have to be extended to complete the objectives. This results in a longer employment period for the workers, which is a positive in their best interest, and an extended period of other operating costs such as utilities. However, overall, it causes the project to exceed the budget. Moreover, to rectify the delay, one option is to increase labor, which could result in a cost overrun.

b) **Time overrun-** Time overrun occurs when the planned value is less than the earned value to give a schedule performance index of less than 1 (PMI, 2017, p.263), that is, the amount of work expected to be completed according to the schedule is greater than what was actually completed. This results in the extended project duration, which will have cost and possibly legal implications. Depending on the conditions of the contract, financial penalties can be incurred if the contractor fails to deliver the project on schedule, which can lead to financial losses.

c) **Quality issues-** In some instances where tasks have to be completed in a specific time, and they fail to do so, quality is reduced. One such example is pouring concrete in one continuous operation to make a slab. Failure to complete results in a second pouring day, which reduces the structural integrity when the two batches of concrete would have cured. This also results in uniformity and poor bonding between layers. Additionally, specific quality-related tasks could be omitted when low productivity results from a low

labor force for the amount of work to be completed. Another example is the continuous use of a vibrator while pouring concrete to remove air pockets. If the project is behind schedule and there is a sudden increase in productivity, expeditious work could mean a lack of attention to or omission of quality checks and specifications agreed upon as part of the acceptance criteria for the project.

d) **Strained relationships-** Clients can become frustrated when it is observed that the project is not moving at the desired pace to keep on schedule. Questions are raised regarding the adequacy of funds if the cause of low productivity is a case where there are too few workers. Strained relations can be the contractor to a subcontractor when the output of subcontracted work is a cause for delay. This may result in the extreme repercussions of cutting any future partnership.

e) **Unemployment-** Unemployment is a possible implication for workers who, after evaluation, were not producing the necessary output for the project to keep on schedule. The contractor may overhaul the entire labor force and employ a new team or dismiss selective persons.

2) **Cause:** Payment delay

Implications

a) **Time overrun-** Finances are necessary to keep the project going. The payment delay could result in the contractor's inability to continue work or work at high productivity, especially if they do not have personal funds to continue until payment is received. A payment delay would mean workers cannot get paid and a procurement halt for materials, the two main factors necessary for productivity. If

these implications of payment delay were to occur frequently, the project's duration would be extended beyond its expected time.

b) **Resource availability-** Payments being delayed can result in the contractor's inability to acquire materials, rent machinery or equipment, and retain human resources, all of which are required to complete project work.

c) **Strained relationship-** Payment delays can frustrate all parties involved, including the client, contractor/ project manager, subcontractors, and suppliers. This is often reflected in numerous phone calls to the client for payments and calls to the contractor by subcontractors and suppliers. In cases where the contractor's credit limit has been reached until a payment has been made to suppliers, procurement for other projects would be negatively affected. Other than the disgruntled stakeholders, the client is now faced with the dilemma of their project being on hold.

d) **Unemployment-** Construction workers are typically paid fortnightly, that is, every two weeks unless it is a job work where they are paid by the milestone or after the job. Payment delays would strain the contractor's ability to pay fortnightly workers, which could lead to the contractor downsizing the labor force.

3) **Cause:** Ineffective communication

Implications

a) **Cost overrun-** ineffective communication can lead to costly errors during the project, such as site instructions and change requests not being shared on time and to all relevant parties before an action is taken, which results in costly corrective actions.

b) **Resource availability-** Moreover, resources such as materials would have been used to carry out an error, which impacts the material availability to complete or redo the task.

Ineffective communication can also lead to poor scheduling of human resources and rental of equipment.

c) **Material wastage-** Due to errors from ineffective communication, materials would have been wasted, with some being unable to be reused or recycled.

d) **Strained relationship-** Ineffective communication among stakeholders could strain the relationship, especially between contractor and client. When the client is not closely engaged, involved, updated and consulted regularly due to poor communication as a result of not following through with the communication plan or a lack thereof of such a plan, it can result in misunderstandings, the contractor making assumptions about the client's needs, lack of current information and feedback to meet the quality and approval required by the client.

e) **Environmental-** Wastage and fixing errors due to ineffective communication can increase the company's carbon footprint. Carbon footprint is the "amount of carbon dioxide emissions associated with all the activities of a person or other entity" (Selin, 2013). The increase in the carbon footprint can be attributed to additional work for transporting materials (deliveries) and workers, energy consumption, and waste disposal. Furthermore, excess waste material due to the error contributes to the reduction in landfill capacity.

4) **Cause:** Change orders requested by owner during construction

Implications

a) **Cost overrun-** Controlling the scope and change order requests is important as each change and addition to the scope will have a cost implication. Before satisfying the

client's requests, a cost should first be assigned to the shift. Failure to do so will result in an accumulation of changes over budget, causing cost overruns.

b) **Time overrun-** Investigating each change order request related to design feasibility, new material sourcing, new cost estimates, and any associated tasks with the request will require time to complete. Too many requests will affect the schedule and can cause a time overrun.

c) **Material wastage-** Change requests on work previously done that will require it to be demolished and redone will cause material wastage.

d) **Environmental-** Due to wastage and work to be redone, the carbon footprint increases, and discarded material contributes to the landfill.

e) **Strained relationship**- The inability to satisfy every change request order by the client can make the client feel displeased. Sometimes, the client becomes frustrated with the assumption that the contractor refuses to accommodate their requests because they believe it is extra work or the contractor lacks the skills to produce the change request. On the contractor's part, they can become irritated if the change orders are numerous, which often affects the progress of the project and the work completed, even if the client can finance the changes.

5) Cause: Insufficient coordination

Implications

a) Cost overrun- Poor coordination can lead to errors, some of which cost money. Improperly sequenced activities can lead to re-dos, time and material wastage, negatively impacting the budget.

b) **Resource availability-** Coordination is critical while scheduling so subcontractors can know when they are required to do tasks such as plumbing and electrical-related. Failure to do so could result in their unavailability for short-notice calls. Moreover, it is vital for the purchasing and delivery of materials. If the foreman fails to notify the project team of materials needed ahead of time, then time could be wasted while waiting for deliveries.

c) **Time overrun-** Lack of coordination to schedule activities and procure materials can cost the project valuable time. In the case of St. Vincent and the Grenadines, the application for electricity and water connection to a new site can take several weeks to months, depending on factors such as a site's proximity to an existing pole. An accumulation of delays from insufficient coordination can cause time overrun.

d) **Environmental-** Insufficient coordination can lead to multiple deliveries to the project site that are not at the truck's total capacity. This oversight leads to the unnecessary burning of fossil fuels for transportation, which increases the carbon footprint. Additionally, the potential for wastage exists if activities are not correctly sequenced.

6) **Cause:** Ineffective planning and scheduling

Implications

a) **Resource availability-** Failure to plan and schedule activities can affect resource management. This lack of planning could mean that the materials required for immediate, specific tasks are not available because funds were spent stockpiling other resources that are not immediately needed; workers are left idle because the materials to work with are insufficient or the number of workers exceeds the volume of work to be completed which means that the workers are underutilized and activities are not completed in a logical, sequential order which could mean some activities have to be redone.

b) Time overrun- The delay caused by ineffective planning and scheduling, which affects resource availability, can cause time overrun. Time can be spent idle waiting on materials or too much time on activities because of the lack of human resources assigned to those activities.

7) Cause: Underestimating project cost

Implications:

a) **Cost overrun-** Grossly underestimating the price of a project is one of the costliest errors that could be made because this would mean that the contractor would have to complete the project out of pocket based on the signed contract. Cost underestimation would, therefore, guarantee that cost overrun would occur since, initially, the funds were insufficient to see the project through to completion.

b) **Time overrun-** Due to the lack of finances, the contractor would continue the project on a "go slow" approach as they personally fund the continuation of the project until completion.

c) **Quality issues-** Specifications that the client and contractor would have agreed upon before the commencement of the project may have to be renegotiated on a lower budget so that the project can be completed. Additionally, some contractors might cut corners to cut costs, which could affect the quality of some aspects of the project.

d) **Resource availability-** The limited finance would limit the resources allocated to the project. It would also affect the type of resources intended for the project; for instance, a granite countertop would be substituted for a cheaper material, such as porcelain tiles.

e) **Unemployment-** Lack of funds for the project would mean that the labor force must be reduced to match the low budget. Work might be infrequent because of cash flow issues, which can result in unstable employment.

f) **Strained relationship-** Lack of finances on the part of an error made in cost estimation by the contractor creates hostility between the contractor and client because the project would have challenges in meeting the completion deadline and the agreed specifications. In cases such as these, the client may seek legal recourse.

8) Cause: Slow preparation of drawings and approval

Implications

a) Strained relationship- Depending on the architect and engineer's workload and the design's complexity, the final drawings can take some time to produce. Although approval depends on an external body, corrections are often needed for drawings upon their review. This process can take up to a few months overall, which can exceed the client's patience. This phase does not necessarily affect the project as the start date comes into effect when the contract is signed between the client and contractor, having received financing for which the approved drawings become necessary. However, this cause would have scored highly because of the clients' perception that this phase is why the loan approval process takes longer and, hence, their project starts later than they would have preferred.

9) Cause: Slow reporting of progress for claims

Implications

a) **Time overrun-** Several financial institutions require reports prepared by quantity surveyors to determine that the value of the works and material on site is equivalent to or

exceeds the value of the recent disbursement of funds. It is a good practice as this method provides security for the banks and clients to ensure that the funds borrowed are used to finance what is intended. However, some reports take a long time to produce depending on the quantity surveyor's availability and workload. This is why most contractors have developed the practice of requesting a site visit by the quantity surveyor in advance in anticipation that they would have completed the scheduled works amounting to the value of the disbursement. A delay in receiving the disbursement could mean that the project cannot continue because of the lack of funds, which could lead to time overrun if this repeatedly occurs for each disbursement.

b) **Resource availability-** The availability of resources is affected by the availability of funds, which depends on when the disbursement is received and, therefore, the time it takes for the report to be produced and submitted to the financial institution.

10) Cause: Poor workmanship

Implications

a) **Cost overrun-** A price will be associated with redoing any work concerning labour, materials, transport and other direct inputs. The risk of cost overrun increases with the extent to which the work was poorly done and the amount of work to be redone.

b) **Quality issues-** Poor workmanship will result in quality issues that must be rectified if proven unsatisfactory.

c) **Time overrun-** Time taken to correct quality issues due to poor workmanship can cause the project to fall behind schedule.

d) **Resource availability-** The activity or activities deemed poor workmanship would have utilized material that depletes the stock for redos. Therefore, new materials will have to be sourced.

e) **Material wastage-** If the client is unsatisfied with the work produced or if there are errors, they can request the work to be redone in consultation with the contractor/ project manager, which will lead to wasted materials.

f) **Environmental-** Materials that are wasted due to poor workmanship will be discarded in the landfill, and the carbon footprint of the company and project increases when delivering new material, operating equipment, discarding waste, and transporting workers.

g) **Unemployment-** Lack of experience and the necessary skills to produce quality work will lead to the dismissal of the employees.

4.4. Lessons learned and recommendations

Objective: To identify the areas of improvement as lessons learned for recommending project management tools and techniques as solutions.

Having successfully identified and ranked the causes of delay for previous CEDCO Ltd projects, objective 4 focuses on the lessons learned that would be identified as areas for improvement and recommends the appropriate use of tools and techniques from the various processes under the project management knowledge areas as solutions; a summary of which is displayed in Table 10. It is important to note that the solutions are not limited to the tools and techniques mentioned, nor are they expected to be used in isolation. Instead, a combination or integration of tools and techniques may be required to be more effective in solving the problem.

1) **Cause of Delay:** Low Productivity

Lessons learned:

I. **Get advance notice for material request-** An advance notice or request for materials from the project foreman to the project team will ensure that the necessary materials are available on-site for the scheduled activity. Low productivity will not be due to a lack of material. Advance notice also allows for better coordination of purchases and deliveries among the different project sites.

II. **Assess daily activity to determine the resources needed-** The project team can also assess daily activities in advance to determine if the project site has the necessary resources (humans, equipment, tools and materials) for the scheduled activities. If the

site is lacking, arrangements can be made to have the resources on-site to avoid any delay caused by low productivity.

Project Management Tools & Techniques Based Solutions:

I. **Trend analysis-** "As the project progresses, the project team may use trend analysis, based on current performance information, to determine the resources needed at upcoming stages of the project" (PMI, 2017, 356). The project team can also compare trends to previous projects of a similar nature to help determine what resources and how much will be needed.

II. **Problem-solving-** This technique may be required if resources are shared among sites and conflicting needs exist. The project team will need to decide which site has priority and devise a solution with the best outcome, preferably a win-win solution so that no project suffers from the other. Suggested solutions include renting equipment, shifting workers, and rescheduling an activity.

III. **Conflict Management**- Conflict management will be an essential technique or skill for the project team if conflicts arise, as every foreman might perceive their project as the highest priority when demanding or requesting resources, especially when limited.

IV. **Project Management Information System-** "can include resource management or scheduling software that can be used to monitor the resource utilization which helps to ensure that the right resources are working on the right activities at the right time and place" (PMI, 2017, p.357). It is also helpful in managing communications so that the project team can receive timely resource requests and feedback can be distributed promptly and even electronically to reduce paper usage for a greener operation.

2) **Cause of Delay:** Payment delay

Lessons learned:

I. **Consider payment delay as a high risk-** payment delay was considered the second major cause of delays. This could be a critical delay as funds are needed to supply the project with resources continuously. Therefore, consideration should be given to identifying it as a risk and placing this factor in the risk register. Because it is a threat and cannot be avoided most of the time, this risk should be mitigated to minimize its effects.

Project Management Tools & Techniques Based Solutions:

I. **Reserve analysis-** "Reserve analysis compares the amount of contingency reserves remaining to the amount of risks remaining at any time in the project to determine if the remaining reserve is adequate" (PMI, 2017, p.456). Arrangements can be made with the client for the project manager to hold a portion of the contingency fund. Because the contingency will account for the risk of payment delay, this amount can be used and replenished when the client makes the payment. This would mean that funds will be present if another payment delay occurs.

II. **Audits-** A risk audit can be conducted to ensure that the risk responses and their implementation measures effectively mitigate the effects of the payment delay. This can be conducted through monthly meetings.

3) **Cause of Delay:** Ineffective communication

Lessons learned:

I. **Communication is important-** Project information must be collected, documented, stored and disseminated efficiently and clearly to the relevant stakeholders. Communications, therefore, must be planned, managed and monitored to be more effective. Frequently, there is a slow relay of information among the project team, poor decision-making, collaboration and coordination and misunderstanding between client and subcontractor.

Project Management Tools & Techniques Based Solutions:

I. **Meetings-** Meetings can come in different modes, sizes, and durations and have different agendas. Meetings can be virtual or in person, with the client, suppliers, project team, workers or a combination of stakeholders, held for a short duration or up to an hour. Some of the various types of meetings that can be used regularly for more effective communication to reduce delays are:

    a) **Status meetings** "are when team members provide data that the project manager uses to review where the project is over a period of time" (Koeneke, 2023). Activities or milestones that were accomplished, pending and upcoming are discussed, as well as a review of the budget, assessment of risks, and scheduling of forthcoming meetings.

    b) **Change Control Board Meetings** are meetings "to review change requests that are happening a project." (Koeneke, 2023) The changes are evaluated and given approval, deferred or denied.

c) **Daily stand-up meetings,** which are generally brief, approximately 15 minutes, occur at the beginning of the day, at the same time and location and answer three questions: 1) What did you do yesterday? 2)What will you do today? 3) Are there any challenges to progress?

II. **Project Management Information System-** According to PMI (2017, p.392), PMIS "provides a set of standard tools for the project manager to capture, store, and distribute information to internal and external stakeholders with the information they need according to the communications plan, The information contained in the system is monitored to assess its validity and effectiveness."

III. **Communication Technology-** According to PMI (2017, p.370), the following should be considered when selecting an appropriate technology: the urgency of the need for information, availability and reliability of technology, ease of use, project environment and sensitivity and confidentiality of the information. St. Vincent and the Grenadines has relatively reliable internet connectivity and comprehensive coverage. Therefore, a real-time tool will be appropriate for CEDCO operations in conjunction with other means of communication, such as WhatsApp group chats. Other tools such as Trello can be used for information related to tasks and orders that need to be done, which are in the process of being done, and those that are completed and assign team members to the task**.**

4) **Cause of Delay:** Change orders requested by owner during construction

Lessons learned:

I. **Changes should be reviewed and assessed before approval, deferral or denial**- The project scope would have been established in the project charter, and the scope and cost baseline would have been agreed upon in the early stages of the project before the actual construction work commenced. Change requests can potentially impact other aspects of the project, such as cost and scope baseline. Although time will be needed to assess the change request, it is necessary to reflect on the effects on other aspects of the project, such as cost and scope baseline, which can overall affect quality. Scope creep should be avoided, and gold-plating scope creep "is the uncontrolled expansion to product or project scope without adjustments to time, cost, and resources" (PMI, 2017, p.168). Gold plating, on the other hand, "happens when the project team adds extra features that were not part of the original scope, usually as "freebies" for the client. Possible causes include:

- Going above and beyond: the project team thinks it will make the client happy.
- Showing off: team members want to demonstrate their abilities.
- Distracting from defects: an attempt to hide mistakes or deficiencies" (Aldrige, 2021).

Project Management Tools & Techniques Based Solutions:

I. **Data analysis (What-if scenario analysis)-** The What-if scenario analysis can be used to determine the effects of changes on the budget, schedule and any other correlated aspect. Sometimes, a cost-benefit analysis might be required to determine if the benefits outweigh the costs associated with increased budget and project duration, especially if the

construction project has social or financial benefits. Once the analysis is complete and all parties have discussed it, an informed decision can be made.

5) **Cause of Delay:** Insufficient coordination

Lessons learned:

I. **Follow up with project sites-** To ensure that the different project sites are not lacking in any material and that requests for materials, equipment and tools are fulfilled to avoid any delay, it would be a good practice to follow up with the different project sites.

Project Management Tools & Techniques Based Solutions:

I. **Decision making-** Based on available funds, demands or conflicting interests for resources, team members must be able to make the best decisions logistically, financially and environmentally.

II. **Negotiation-** Sometimes, team members may also need to negotiate to get additional resources or come to a compromise to deal with conflicts of interest.

6) **Cause of Delay:** Ineffective planning and scheduling

Lessons learned:

I. **Regularly update project schedule-** Ineffective planning and scheduling are primarily due to not controlling the schedule. Control schedule, according to PMI (2017, p.222), "is the process of monitoring the status project to update the project

schedule and managing changes to the schedule baseline.' If the schedule is not up to date, then the best decisions regarding planning and scheduling cannot be made.

Project Management Tools & Techniques Based Solutions:

I. **Performance reviews-** "Performance reviews measure, compare, and analyse schedule performance against the schedule baseline such as actual start and finish dates, per cent complete, and remaining duration for work in progress" (PMI, 2017, p.227). With the tool, the project team can make better-informed decisions to correct or prevent delays.

II. **Critical path method-** Is a method used to estimate the minimum project duration and determine the amount of schedule flexibility on the logical network paths within the schedule model" (PMI, 2017, p.210). This method identifies critical tasks for the project to finish on time. Project managers can, therefore, ensure that these particular tasks are completed on time by optimising resource allocation.

III. **Leads and lags-** "Leads and lags are refinements applied during network analysis to develop a viable schedule by adjusting the start time of the successor activities" (PMI, 2017, p.214). Leads are when the start times of the successor activities start before the predecessor is finished. This shortens the duration of the project. Lags are used to purposefully introduce a delay in the project, such as when time is needed for concrete to cure.

IV. **Schedule compression** techniques - "are used to shorten or accelerate the schedule duration without reducing the project scope to meet schedule constraints, imposed

dates, or other schedule activities" (PMI, 2017, p.215). They help get projects back on schedule.

a) **Fast-tracking-** Some activities can be done in parallel with each other instead of sequentially, although there is an increase in the risk of rework. However, this method requires more coordination.

b) **Crashing involves increasing** resources and working overtime or in shifts. Although this technique can help to get the project back on track, it can also cause cost overrun, especially as it relates to labour and risks lowering the quality of the project. This "crashing" is because people will eventually become tired after consistently working long hours and be prone to making errors or work becoming sloppy.

V. **Resource optimization techniques-** "These techniques involve the scheduling of activities and the resources required by those activities while considering both the resource availability and the project time" (PMI, 2017, p.227).

a) **Resource smoothing-** When there is a time constraint, this technique ensures that the project does not exceed its allocated resources by adhering to the project requirements.

7) **Cause of Delay:** Underestimating project cost

Lessons learned:

I. **Update pricelists before producing a BOQ**- Prices of goods and services tend to fluctuate for various reasons, such as supply and demand, inflation, conflicts in supplier countries, natural disasters, and more. More current pricing information will help increase project cost accuracy and include the necessary reserves.

Project Management Tools & Techniques Based Solutions:

I. **Analogous estimating** - is the use of a previous project of a similar nature as the basis for estimating a current project. This method can be used to identify the attributes that will need to be taken into account in the estimates. A review of the previous project estimates can also be used to identify attributes that should have been included but were overlooked and those that were grossly underestimated.

II. **Three-point estimating-** This technique's estimation accuracy is improved using three estimates. The first of the three estimates is "most likely" estimating, where the cost of the activity is based on a realistic effort assessment for the required work and any predicted expenses; therefore, an up-to-date price list will be helpful. The second is "optimistic" estimating, where the cost is based on an analysis of the best-case scenario for the activity. Third is pessimistic estimating, where the cost is based on an analysis of the worst-case scenario.

III. **Alternatives analysis-** "Alternative analysis is a technique used to evaluate identified options to select which options or approaches to use to execute and perform the project's work" (PMI, 2021, p.245). Although used to determine the project budget, if

the project cost was underestimated, alternative analysis could be used to determine options for the client within the underestimated budget.

8) **Cause of Delay:** Slow preparation of drawings and approval

Lessons learned:

I. **Be proactive-** Periodically check with the authority responsible for approving the drawings. The Physical Planning Unit will reduce delays caused by approved drawings waiting to be collected. Moreover, corrections are sometimes needed, and corrections can be made more promptly by checking regularly.

Project Management Tools & Techniques Based Solutions:

I. **Networking-** Having a relationship with persons in advantageous positions in the agency can assist with communicating updates to the organization. Employers with whom CEDCO has a relationship at the agency can inform the organization when approved drawings are ready for collection or corrections must be made.

9) **Cause of Delay:** Slow reporting of progress for claims

Lessons learned:

I. **Use the project schedule to plan in advance when claims will be submitted-** Using the schedule to help make projections of where the project is expected to be, and the expected earned value can assist with planning when to make claims. The quantity surveyor can be approached in advance and an appointment made.

The actual date may vary, but the variance should be low once the schedule and performance review are regularly updated and conducted.

Project Management Tools & Techniques Based Solutions:

I. **Project Management Information System**- The PMIS, such as Microsoft Project, will have the necessary project information once recorded as it relates to work completed, schedule, resource usage and earned value. This information can help make projections and carefully schedule the appropriate time to make claims.

10) **Cause of Delay:** Poor workmanship

Lessons learned:

I. **Neglecting quality management has a cost-** Failure to manage the quality of the deliverables regularly could result in costly rework and an unsatisfied client. Quality should be managed and controlled to reduce the cost and delays associated with poor workmanship.

Project Management Tools & Techniques Based Solutions:

I. **Inspection**- "An inspection is the examination of a work product to determine if it conforms to documented standards" (PMI, 2021, p.302). Inspection should occur regularly on a construction site since one incorrect or off-set element can affect the entire project. Unknowingly continuing with issues or faults can result in costly rework that could have been resolved if detected earlier.

II. **Performance reviews**- "Performance reviews measure, compare, and analyse the quality metrics defined by the Plan Quality Management process against the actual

results" (PMI, 2021, p.303). This review is beneficial for ensuring that measurements are correct and materials are tested, especially regarding concrete strength in conformance with the accepted criteria in the Quality Management Plan.

III. **Testing evaluations**- The frequency information and types of tests will be documented in the quality management plan. The contractor/ Project manager must ensure conformance with the testing schedule. Costs are associated with some tests and should be accounted for in the budget to avoid lack of funds being a reason for non-conformance.

IV. **Check sheets**- Check sheets help gather information regarding defects or incomplete work observed during inspection for correction. They are a simple method that can be employed to manage quality.

Table 10

Summary table of lessons learned and recommendations (Culzac: 2024)

Causes for Project Dealy	**Lessons learned**	**Recommendations- Tools & Techniques**
Low productivity	• Get advance notice for material requests • Assess daily activity to determine the resources needed.	• Trend analysis • Problem-Solving • Conflict management • PMIS
Payment delay	• Consider payment delay as a high risk.	• Reserve Analysis • Audits
Ineffective communication	• Communication that is clear, timely, and shared with relevant stakeholders is essential. •	• Meetings (Change control board meetings, Project status meetings, Daily stand up meetings) • PMIS • Communication technology

Table 10

Cont.

Causes for Project Dealy	**Lessons learned**	**Recommendations- Tools & Techniques**
Change orders requested by the owner during construction	• Changes should be reviewed and assessed before approval, deferral or denial.	• Data analysis (What-if scenario analysis, Cost-benefit analysis)
Insufficient coordination	• Follow up with project sites.	• Decision making • Negotiation
Ineffective planning and scheduling	• Regularly update the project schedule.	• Critical path method • Scheduling compression techniques (fast tracking, crashing) • Resource optimization (resource smoothing) • Leads and lags

Table 10

Cont.

Causes for Project Dealy	**Lessons learned**	**Recommendations- Tools & Techniques**
Underestimating project cost	• Update pricelists before producing a BOQ.	• Analogous estimating • Three-point estimating • Alternative analysis
Slow preparation of drawings and approval	• Be proactive.	• Networking
Slow reporting of progress for claims	• Use the project schedule to plan in advance when claims will be submitted.	• PMIS
Poor workmanship	Neglecting quality management has a cost.	Inspection Testing Performance reviews Check sheets

4.5. Lessons Learned Process

Objective: To discuss the lesson learned process for adaptation by CEDCO Ltd to create a method for documenting and disseminating future lessons learned to further the repository.

There are lessons to be learned from every project. These can include successes, shortcomings and areas of improvement. It is important the project teams develop the habit of identifying the lessons learned after a project is completed, documenting these lessons, analyzing to determine what lead to the success or shortcoming and what can be done differently to improve, storing to build a repository and retrieving for use in future projects. A summary of the lessons learned process is summarized below in Figure 7.

Figure 7

Lessons learned process (Rowe & Sikes, 2006)

The lessons learned repository can be used as an organizational asset as part of the input into the various management plans to help reduce or eliminate delays. It is

recommended that the following steps or process be taken when adopting a learning culture.

Step 1: Identify Lessons Learned

Conduct a closeout meeting at the end of the project for stakeholders to review the project. In this meeting the objective will be to answer the following questions:

1) What went right?
2) What went wrong?
3) What needs to be improved?

The meeting should be facilitated by the Project Manager.

Step 2: Document Lessons Learned

Once the information has been captured, in the template which could be done electronically for greener practices they can easily upload and shred with other stakeholders who were not able to contribute. This gives other stakeholders the opportunity to provide feedback. The meeting room selected for the review should have the necessary infrastructure to facilitate documenting and uploading the lessons learned electronically. The contribution by stakeholders within the template can be used to formulate one report from the project with the lessons learned.

Step 3: Analyze Lessons Learned

The purpose of analyzing the lessons learned is to examine the contributing factors that lead to the success or shortcomings, suggest recommendations and determine tis applicability to other projects.

Step 4: Store Lessons Learned

Shared cloud storage has become the common and ideal location for storing information that has to be accessed by members of an organization or team. The project team should consider which cloud storage provider is the best option as cloud storage can become costly. Security should also be taken into consideration especially if the reports and templates contain sensitive information. Lessons learned should be stored in an organized and manner with a standardized labelling that structure such as “Lesson learned category_project reference_close date.”

Step 5: Retrieve Lessons Learned

The purpose of creating the repository is not only to store the lessons learned but to be able to access them for use in current projects as input. Using key words in naming of the file allows for an easier search (Rowe & Sikes, 2006).

4.5.1. Proposed Documentary System

This section proposes a digital methodology for documenting and sharing the lessons learned for all projects. Digital was chosen as the main mode of documentation to promote green and environmentally friendly operations and it reduces the physical space needed to store all the paperwork associated with the process, printing and dissemination time and the costs of paper and ink. The process is summarized in six steps which is illustrated in Figure 8.

Step 1: Complete online form

At the end of a project during the closeout meeting, under the guidance of the project manager who, at his or her discretion can assign a team member the responsibility, an online form using Google Form or another effective software will be distributed to team members and stakeholders for their input on the lessons learned. This form will be used to capture the following: project name, a summary of the experience or observation, aspects that went right, wrong or needs improving, lesson learned, recommendations and Project Management Area of Knowledge the lesson learned is focused on.

Step 2: Log contribution in database

After the meeting, an assigned team member will log the responses from the online forms, preferably in tabular form in one database that is saved in cloud storage such as Dropbox, Google drive or Microsoft One drive. Pricing,

accessibility and limitations for the different cloud storage can be evaluated to determine the best option.

Step 3: Share repository link

A secured link giving access to the database will be shared with the members of the organization primarily through email.

Step 4: Solicit feedback

Members will be asked to peruse the database to ensure that their contribution was accurately recorded, the database is error free, and that the information presents a true reflection of what transpired during the project. Furthermore, this step allows for the discussion of recommendations.

Step 5: Update database

The team member with responsibilities of data entry will make the revisions to the database. Some software, such as Google sheets and Microsoft Excel allows for the locking of sheets which can done in this instance to prevent unauthorized persons from making unsanctioned edits.

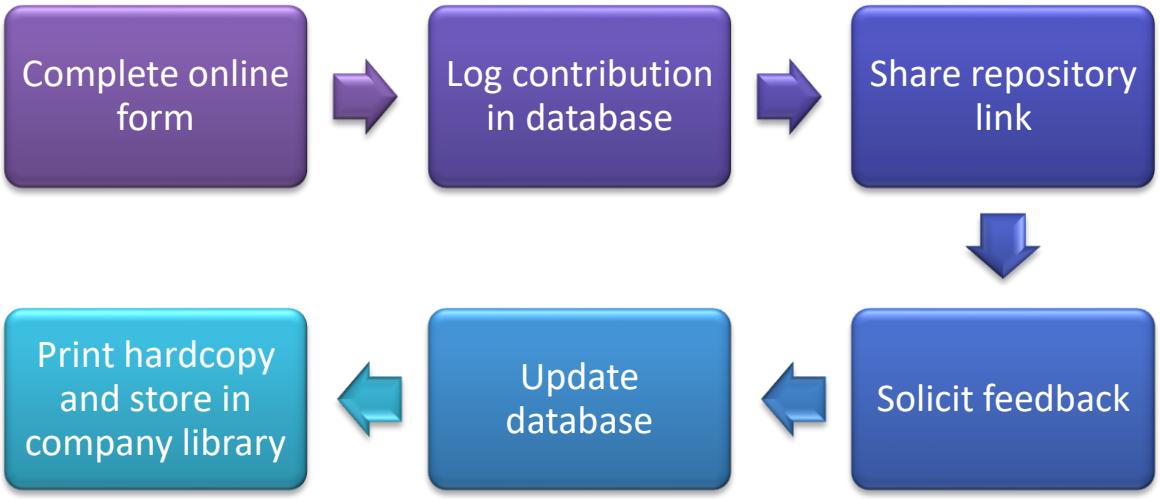
Step 6: Print hardcopy and store in company library

Once finalized, one copy can be printed and stored in the company library. This is useful in the event of poor internet connectivity which could make the digital

copy inaccessible and; the printed copy is less likely to be affected by corruption and unauthorized changes.

Figure 8

Proposed lessons learned documentary process (Culzac: 2024)



5 CONCLUSIONS

1) According to literature, delays in the Construction Industry are a recurrent issue that can cause cost and time overrun.
2) In reference to the influence and impact matrix, the stakeholders with the highest influence and impact are the recent former clients, subcontractors and full-time employees.
3) The ten major causes of delay identified for CEDCO Ltd ranked from one to ten were: 1) low productivity, 2) payment delay. 3) ineffective communication, 4) change orders requested by owner during construction, 5) insufficient coordination, 6) ineffective planning and scheduling, 7) underestimating project cost, 8) slow preparation of drawing and approval, 9) slow reporting of progress for claims and 10) poor workmanship.
4) The delays that scored the highest should be given the highest priority with reference to finding solutions.
5) Each of the ten causes for construction delay was analyzed to determine the implications which were summarized in Figure 6. The common implications for CEDCO Ltd., which are those that correspond to six or more of the causes of construction delays are: cost overrun, time overrun, resource availability and strained relationships.
6) Lessons learned for each of the delay were documented and appropriate Project Management tools and techniques were recommended as solutions as summarized in Table 10. The tools and techniques are not standalone solutions but can be used

in conjunction with other tools and techniques and the required input. Some of the tools and techniques repeat but their purpose are different based on the lesson learned.

7) Developing a learning culture where lessons learned are used as an organizational asset for the different Project Management Plan is a means by which project teams can improve their success rates and reduce project delays.
8) The lesson learned process involves five steps: identify, analyze, document, store, and retrieve. Lessons learned typically occur at the end of a project and the project manager has responsibilities of facilitating the process,

6 RECOMMENDATIONS

1) To reduce the implications of poor workmanship, the project team should do regular quality checks to reduce the chances of poor work quality advancing to the point where it becomes very costly to correct.
2) To reduce the implications of time overrun, the client should establish penalties in the form of a legally binding contract that prevents the contractor from completing the project beyond two months of the expected completion date. Extra time beyond the completion date should be given in case of long-term excusable delays.
3) To enhance coordination, communication, planning, and scheduling, the project team should implement Project Management Information Systems (PMIS) and other project management software tools, such as Trello and Wrike, which can aid information sharing.
4) To improve the cost estimation process, the project team should update material price lists regularly, especially before a bill of quantities (BOQ) is prepared for the client, including a contingency reserve. This update will assist with a more accurate estimate of cost.
5) It is recommended that when a change order request is being processed, a cost estimate be presented to the client and a report on how the change will affect the budget as well as any other aspect of the project before proceeding with the change to satisfy the needs of the client, in essence, the project team should conduct an integrated change control process.

6) To reduce the implications of slow approval, the project team should regularly check the Physical Planning Unit to collect the approved drawings. Moreover, the submission of drawings to be approved should be done in time for the Unit's monthly meeting to review development applications.
7) To improve communication and coordination, site instructions given by the contractor/ project manager and change order requests made by any stakeholder should be done in a formal written manner and disseminated to all the relevant stakeholders to keep everyone up to date.
8) Procurement should be properly coordinated among multiple sites to reduce the company's carbon footprint and capitalise on a full truckload delivery. This coordination minimises the number of trips and deliveries to be made, and it should be done systematically instead of haphazardly over a wide geographic area. Additionally, carpooling can be done for site visits, which should be coordinated in such a manner that all project sites in one geographic area are visited on one trip.
9) It is recommended that materials used for props, scaffolding, and decking be treated for termites or treated lumber and reused at different project sites to reduce material wastage and environmental degradation.
10) It is recommended that the project team make regular updates to the project schedule to improve scheduling and planning. These updates, along with regular monthly or bi-weekly financial reporting, can be used to determine the status of schedule and cost performance indices to indicate cost and time overrun. Early indications can signal early corrective or intervention measures.

11) It is recommended that the project team conduct bi-weekly or monthly progress meetings to check the status of current construction projects to improve planning and scheduling and determine if any intervention is needed.
12) To cultivate a learning culture from lessons learned, the project team should conduct closeout meetings to discuss and document areas of success and areas for improvement.
13) It is recommended that the system to capture, store and disseminate lessons learned be tested with a request for feedback from the users. Persons may have suggestions on how to enhance the system to increase effectiveness.

7 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

"Sustainable development is development which meets the needs of the present without compromising the ability of the future generations to meet their own needs" United Nations, 2023). Sustainable development focuses on three pillars: economic, environmental and social. Since the term was coined in the Brundtland Report in 1987, the United Nations has developed 17 Sustainable Development Goals to end poverty, protect the environment and improve the lives and prospects of everyone everywhere (United Nations, 2023) by 2030. However, issues persist as global sea temperatures continue to rise, ice caps are melting, extreme poverty exists, and the intensity of storms is increasing. Academics have been looking at systems and pillars in isolation, such as the case where black plastic balls were used in 2015 to combat the effects of increased evaporation of Silver Lake Reservoir. Later, in 2017, the balls were removed because the water became undrinkable. A paradigm shift was needed in the way solutions were created. The term "Regenerative Development", a reasonably new concept proposed in 1995 by Regenesis Group, a multidisciplinary team (Dias, 2018), is now being considered as the way forward which takes into account the interconnectedness of systems, its natural ability to regenerate itself, be resilient and create benefits. Regenerative development can be defined as "a systemic approach that sees, for example, global challenges as the climate change hypotheses, as an opportunity to develop co-agency among several cultures and fields, toward a shared purpose that can reconcile the fragmented relationship of human and natural systems and multiple problems within a place" (Dias, 2018). In the future, it is recommended that organizations be regenerative,

purposefully making communities both human and natural more viable and vital, which will subsequently lead to regenerative projects.

Although the project focuses on mitigating delays using a lesson-learned repository, this repository can be used to improve other aspects of project management overall. The relationship between the Regenerative development dimensions and the Final Graduation Project is summarized in Table 11.

Table 11

Relationship Between Regenerative Development Dimensions and Final Graduation Project (Culzac: 2024)

Regenerative Development Dimension	Relationship
Environmental	Construction projects can adversely affect the environment; by implementing a lesson learned repository, methods can become efficient such as deliveries, reduced material wastage, and unnecessary energy consumption.
Social	Having a lesson-learned repository considers stakeholders' feedback, which allows for participation and promotes inclusivity.
Economic	The lesson-learned repository is expected to promote better management of financial resources, which will allow for timely payment of suppliers and workers.

Table 11

Cont.

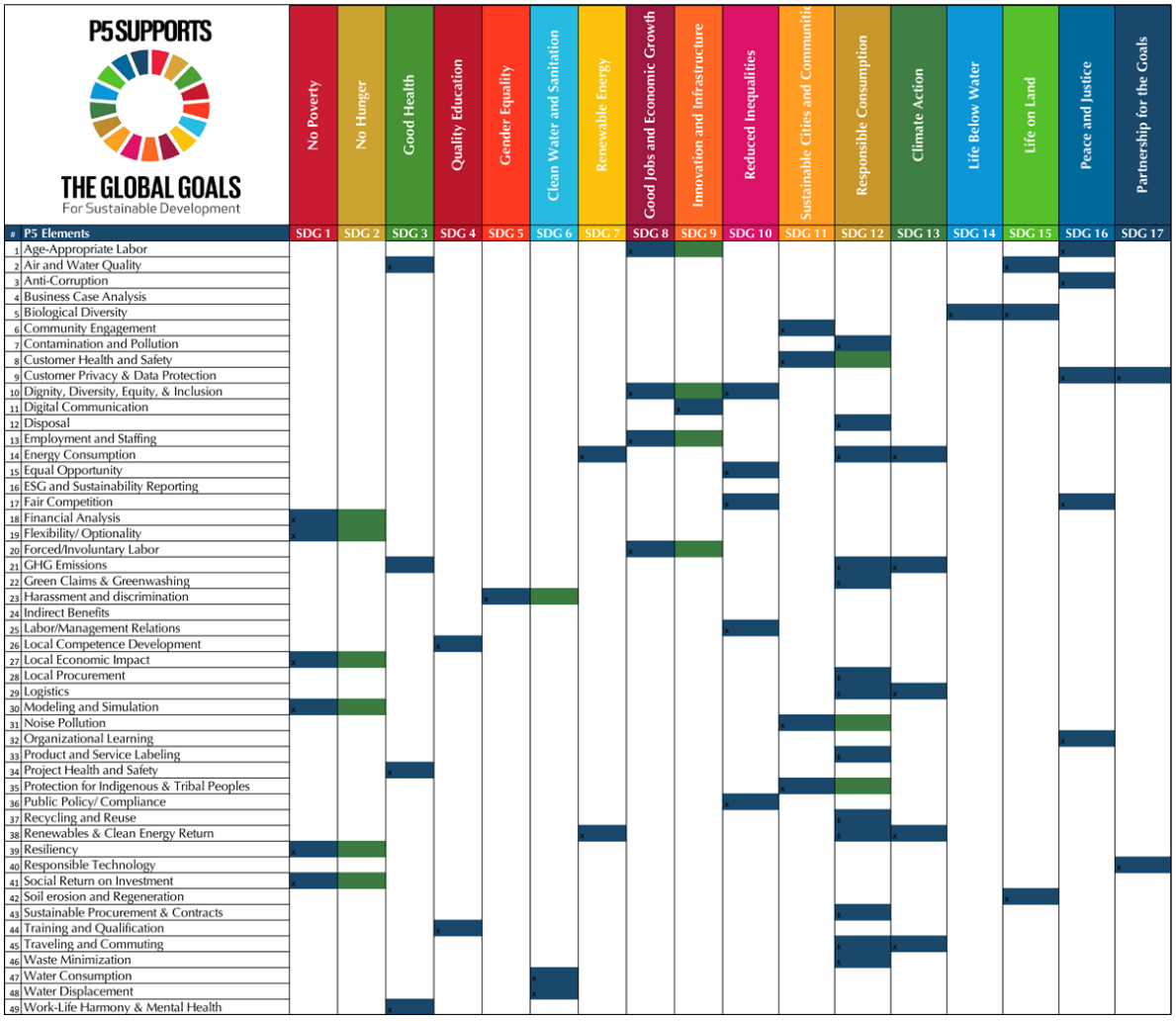
Regenerative Development Dimension	Relationship
Political	Whether good or bad, every team member's experience will be valued and consolidated into the repository. This means that everyone will participate in the decision-making process for future projects.
Cultural	The lesson-learned repository can be used to improve designs and construction processes that are greener (environmentally friendly). The success of these new designs and methods can be used as a template for other construction companies.
Spiritual	Having a lesson-learned repository and applying it is a conscious effort on the part of the project team to improve the overall operation and implementation of projects. This includes stakeholder well-being due to better schedule management, reduced pollution and wastage due to better resource management and increased financial gains to give back to social programs.

The P5 Impact Analysis is a tool that can be used to assess, measure and improve a project's team sustainability performance. The P5 Impact analysis will be used to evaluate sustainability performance for the Final Graduation Project. As a conscious effort to make projects more sustainable and regenerative and as part of the Corporate Social Responsibility of CEDCO Ltd., this tool will determine if the project will bring about positive change. The P5 Analysis elements integrate themselves with the 17 Sustainable Development Goals and, therefore, do not go contrary to what was developed before.

Figure 7. shows the relationship between the 17 Sustainable Development Goals and the elements of the P5 Analysis.

Figure 9

Relationship Between the Sustainable Development Goals and the Elements of the P5 Impact Analysis



Note. Copied from Green Project Management. (n.d.). The P5 Standard for Sustainability in Project Management. Greenprojectmanagement.org. https://greenprojectmanagement.org/gpm-standards/the-p5-standard-for-sustainability-in-project-management.

The figure shows a complete mapping of the P5 Ontology to the Sustainable Development Goals.

A summary of the potential impact of sustainability on prosperity, planet, and people is shown in Table 12. Further analysis will be conducted to determine the overall score.

Table 12

Potential Sustainability Impact of Final Graduation Project Using the P5 Impact Analysis Elements (Culzac: 2024)

Prosperity Impact	Potential Sustainability Impact
Category	Business Agility
Flexibility Optionality	Over time, the lesson-learned repository will have solutions to issues that may arise occasionally. These solutions can be adapted or adopted to solve current issues.
Resiliency	The lesson-learned repository will provide additional information pertaining to risks, which will help the company be better prepared.
Category	Market & Economic Stimulation
Local Economic Impact	Increased performance using the Lesson Learned repository will increase the number of signed contracts for construction projects. An increase in projects means that CEDCO Ltd. can employ more people.
Indirect Benefits	Better management of resources will reduce wastage and promote efficient delivery of material, which reduces pollution from trucks to give environmental benefits such as cleaner air and reduced land pollution.
Planet Impact	Potential Sustainability Impact
Category	Transport
Local Procurement	Purchasing goods and services from local suppliers will be improved through an improved ordering and delivery system enabling bulk delivery or no less than a truckload. This reduces the carbon footprint of delivery trucks and service providers travelling to the site.
Travelling and commuting	First preference will be given to employ persons within the community of projects, and when possible, commuting will be done together.
Logistics	Better scheduling of deliveries to reduce trucking costs and allow timely delivery.

Table 12

Cont.

Category	Energy
Energy Consumption	Efficient procurement management will see that sites are connected to electricity to avoid using generators during construction, which burn more fuel and require multiple fuel delivery trips.
GHG Emissions	More efficient delivery schedules and the reduction of energy consumption will lead to a reduction in GHG Emissions.
Category	Land, Air, & Water
Water consumption	The design of site sheds can include guttering to harvest water during the pre-dry season, which is typically an issue. Increased water storage not only offers security but also reduces consumption.
Noise Pollution	Maintaining equipment and using noise-cancelling accessories that come with some equipment can reduce construction noise. Also, wearing the appropriate PPE will help protect against the adverse effects of noise.
Category	Consumption
Recycling and Reuse	Reusing materials from one site, such as scaffolding, will reduce material wastage. Additionally, better procurement reduces the purchasing of unnecessary material and the exact lumber length, which negates the need for cutting and promotes waste among workers.
Disposal	Better site management will entail that waste is disposed of promptly in the landfill, and that packaging is not burnt on site or left to be dispersed by the wind.
People	Potential Sustainability Impact
Project Health and Safety	To reduce risks, employees and site visitors must wear the minimum PPE requirements, including a Hi-Vis Vest, Hard Hat and Closed shoes/ Steel tip.
Employment & Staffing	The necessary skilled and unskilled personnel will be employed for each site/ project.

BIBLIOGRAPHY

Abd El-Razek, M. E., Samy, M., & Abdel-Razek, M. A. (2008). Major causes of construction project delays: A comprehensive analysis. International Journal of Project Management, 26(1), 38-45.

Al, S., Tumi, H., Omran, A., Hamid, A., & Pakir, K. (2009). *CAUSES OF DELAY IN CONSTRUCTION INDUSTRY IN LIBYA*. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=6e71f468aadf9697a4d0dc3ff5b9b29e0253ee3d

Al-Momani, A. H. (2000). Construction delay: a quantitative analysis. *International Journal of Project Management*, *18*(1), 51–59. https://doi.org/10.1016/s0263-7863(98)00060-x

Alkass, S., Mazerolle, M., Tribaldos, E., & Harris, F. (1995). Computer aided construction delay analysis and claims preparation. *Construction Management and Economics*, *13*(4), 335–352. https://doi.org/10.1080/01446199500000038

Amri, T. A., & Marey-Pérez, M. (2020). Towards a sustainable construction industry: Delays and cost overrun causes in construction projects of Oman. *Journal of Project Management*, *5*(2), 87–102. https://doi.org/10.5267/j.jpm.2020.1.001

(2000). AACE international's risk management dictionary. Cost Engineering (Morgantown, West Virginia).

Barnes, M. (1988). Construction project management. *International Journal of Project Management*, *6*(2), 69–79. https://doi.org/10.1016/0263-7863(88)90028-2

CEDCO Ltd. (n.d.). *CEDCO - About Us*. Www.cedconsult.org. Retrieved June 11, 2024, from https://www.cedconsult.org/about-us

De la Garza, J. M., Prateapusanond, A., & Ambani, N. (2007). Preallocation of Total Float in the Application of a Critical Path Method Based Construction Contract. *Journal of Construction Engineering and Management*, *133*(11), 836–845. https://doi.org/10.1061/(asce)0733-9364(2007)133:11(836)

Egwim, C and Alaka, HA and Toriola-Coker, O and Balogun, H and Ajayi, SO and Oseghale, RO (2021) Extraction of Underlying Factors Causing Construction Projects Delay in Nigeria. Journal of Engineering, Design and Technology. ISSN 1726-0531 DOI: https://doi.org/10.1108/JEDT-04-2021- 0211

El-Sayegh SM. 2008. Risk assessment and allocation in the UAE construction industry. International Journal of Project Management. 26(4):431–438. https://doi.org/10.1016/j.ijproman.2007.07.004.

Fakunle, F. F., & Fashina, A. A. (2020). Major delays in construction projects: A global overview. *PM World J*, *9*, 1-15.

Faridi, A. S., & El-Sayegh, S. M. (2006). Significant factors causing delay in the UAE construction industry. *Construction Management and Economics*, *24*(11), 1167–1176. https://doi.org/10.1080/01446190600827033

Fashina, A. A., Fakunle, F. F., & Omar, M. A. (2020). A study on the effects of construction project delays in Somaliland construction industry. *J. Manag. Econ. Indust. Organ*.

Harvard Business School. (2020). *Strategy Explained - Institute For Strategy And Competitiveness - Harvard Business School*. Hbs.edu. https://www.isc.hbs.edu/strategy/pages/strategy-explained.aspx

Haseeb, M., Wong, S. Y., & Asif, M. (2011). An investigation into the factors causing delays in construction projects in Pakistan. International Journal of Construction Management, 11(2), 53-69.

Healy, P. (2007). Project management in construction. In Design and Construction. https://doi.org/10.4324/9780080491080

Keane, P. J., & Caletka, A. F. (2008). *Delay Analysis in Construction Contracts*. https://doi.org/10.1002/9781444301144

Latif, M., Saleem, M., & Cheema, S. M. (2023). Analyzing the Key Factors Contributing to Project Delays in the Construction Industry: A Comprehensive Study. *Journal of Development and Social Sciences*, *4*(3), 936-944.

Kikwasi, G. (2013). Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania. *Australasian Journal of Construction Economics and Building - Conference Series*, *1*(2), 52. https://doi.org/10.5130/ajceb-cs.v1i2.3166

Mbala, M., Aigbavboa, C., & Aliu, J. (2019). Causes of delay in various construction projects: a literature review. In Advances in Human Factors, Sustainable Urban Planning and Infrastructure: Proceedings of the AHFE 2018 International Conference on Human Factors, Sustainable Urban Planning and Infrastructure, July 21-25, 2018, Loews Sapphire Falls Resort at Universal Studios, Orlando, Florida, USA 9 (pp. 489-495). Springer International Publishing.

Miller, D. (2018, January 31). *Is Productivity Really Important in Project Management*. InGenium Web. https://www.ingeniumweb.com/blog/post/is-productivity-really-important-in-project-management/3737/

Rashid, Y. (2020). Analysis of delay factors and their effects on construction projects. *Management Science Letters*, *10*(6), 1197–1204. https://doi.org/10.5267/j.msl.2019.11.039

Ravisankar, K. L., Anandakumar, S., Krishnamoorthy, V. M., & M.Phill. (2014). Study on the Quantification of Delay Factors in Construction Industry. International Journal of Emerging Technology and Advanced Engineering.

Rowe, S. F., & Sikes, S. (2006). *Lessons learned*. Pmi.org. https://www.pmi.org/learning/library/lessons-learned-next-level-communicating-7991

Samarghandi, H., Tabatabaei, S. M. M., Taabayan, P., Hashemi, A. M., & Willoughby, K. (2016). Studying the Reasons for Delay and Cost Overrun in Construction Projects: The Case of Iran. *Journal of Construction in Developing Countries*, *21*(1), 51–84. https://doi.org/10.21315/jcdc2016.21.1.4

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, *25*(5), 517–526. https://doi.org/10.1016/j.ijproman.2006.11.007

Shah, RK (2016) An Exploration Of Causes For Delay And Cost Overrun In Construction Projects: A Case Study Of Australia, Malaysia & Ghana. Journal of Advanced College of Engineering and Management, 2 (1). pp. 41- 55. ISSN 2392-4853

APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)

1. Student name

Jenice Tiffany Culzac

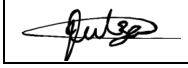
2. FGP name

A Case Study about CEDCO Ltd- Lessons Learned in the Construction Industry.

3. Application Area (Sector or activity)

Construction

4. Student signature



5. Name of the Graduation Seminar facilitator

Professor Róger Valverde Jiménez

6. Signature of the facilitator

7. Date of charter approval

8. Project start and finish date

January 2024	August 2024

9. Research question

What are the lessons learned by CEDCO Ltd as they relate to project delays in the construction industry to improve future projects?

10. Research hypothesis

It is possible to identify and document the lessons learned by CEDCO Ltd for use in future construction projects to manage or eliminate project delays.

11. General objective

General objective:

This project aims to develop a lesson-learned repository as part of the Organizational Process Assets for Project Management Plans for future construction projects by CEDCO Ltd. to manage project delays better.

12. Specific objectives

Specific objectives

1. To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.
2. To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.
3. To determine the impact of the delays and subsequently highlight known relationships among them to better understand the consequences of delays.
4. To suggest recommendations for managing the identified causes of delay to manage project delays of future construction projects better.
5. To create a method for documenting and disseminating future lessons learned to further the repository.

13. FGP purpose or justification

Project delays in the Construction Industry are a recurrent issue that primarily and negatively affects the client and contractor. As a result of these delays, financial costs are incurred, resulting in either net losses or a profit margin that is less than the optimum for the contractor. Besides this, relationships among the stakeholders become strained and exasperated, and sometimes, the relationship becomes antagonistic.

CEDCO Ltd., the subject of this Final Graduation Project, has approximately nine years of experience in the construction industry and is not exempt from delays and their effects. Although some delays are described as excusable, that is, beyond the control of the stakeholders, others need to be appropriately managed to maximize benefits. It was observed that CEDCO Ltd. has no documentation of lessons learned from previous projects, which can be utilized as input in preparing management plans for future construction projects.

The documentation of lessons learned would be considered an organizational asset for various management plans. The extent to which the application of this input is determined to be successful in managing delays can be measured using the company's and project's Key Performance Indicators (KPIs). Regarding the KPIs, some of the expected outcomes are an increase in client satisfaction, referrals, positive Cost and Schedule Performance Indices, and increased profits.

14. Work Breakdown Structure (WBS). In table form, describing the main deliverable as well as secondary products or services to be created by the FGP.

1. FGP- A Case Study About CEDCO Ltd.- Lessons Learned in the Construction Industry
    1.1 FGP profile
        1.1.1 Introduction
        1.1.2 Theoretical framework
        1.1.3 Methodological framework
        1.1.4 Preliminary bibliographical research
        1.1.5 Annexes (FGP schedule, FGP WBS, FGP Charter)
    1.2 FGP development
        1.2.1 **Objective 1: Causes of Delay**
            1.2.1.1 Document causes of delay from past projects
        1.2.2 **Objective 2: Ranked Causes of Delay**
            1.2.2.1 Design criteria and metrics to rank the causes of delay
            1.2.2.2 Develop matrix with scoring and ranking of causes
        1.2.3 **Objective 3: Impacts of the Delay**
            1.2.3.1 Report impacts from past projects and literature
            1.2.3.2 Identify relationships among impacts
        1.2.4 **Objective 4: Recommendations to Manage Causes of Delay**
            1.2.4.1 Document recommendations based on Knowledge Areas
        1.2.5 **Objective 5: Method for Documenting and Sharing Lessons Learned**
            1.2.5.1 Design template for documentation
            1.2.5.2 Design procedure for sharing Lessons Learned
        1.2.6 Conclusions
        1.2.7 Recommendations
        1.2.8 Reference lists
        1.2.9 Annexes
        1.3.0 Tutor approval for reading.
    1.3 Reader's review.
    1.4 Board of Examiners evaluation.

15. FGP budget

Category	Estimated Costs	
Internet Services	$	510.00
Electricity	$	600.00
Printing & Binding	$	300.00
Courier Service	$	300.00
Cloud storage space	$	160.20
Graduation Fee	$	272.34
Total Costs in Eastern Caribbean Dollars	**$**	**2,142.54**
Equivalent in United States Dollars	*$*	*808.51*

16. FGP planning and development assumptions

1) Information on past company projects is accessible electronically.
2) The Project can be completed within the allotted four months.
3) Mentors are able to provide timely feedback.
4) Participants will provide information that is true and accurate to the best of their knowledge.

17. FGP constraints

1) The Final Graduation Project must be completed within the allotted timeframe of three months after the Seminar.
2) The use of information from Government construction projects will be limited due to confidentiality clauses in some of the signed contracts.
3) The quality of the information documented by CEDCO Ltd will affect the extent to which analyses can be made.
4) Student is constrained by the rules and regulations of the Final Graduation Project.

18. FGP development risks

1) Information digitally stored about CEDCO Ltd.'s past projects could be corrupted, which could cause a delay in analysis.
2) If internet connectivity and/or hardware used to gather information and create FGP were to experience technical problems, a delay in meeting internal or final deadlines could arise.
3) Delays in responses by key stakeholders as part of the analysis could result in delays in the schedule.
4) Delayed feedback from a mentor or tutor due to unforeseen circumstances could delay the student's making corrections for deliverables development.

19. FGP main milestones

Milestones are related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS of section 14 of this Charter. At the same time, the deliverables are related to the specific objectives (in the case of the FGP, please include the times for the tutorship reviews as well as for the readership).

Deliverable	**Finish estimated date**
1.1 FGP profile	25th Feb 2024
1.1.1 Introduction	18th Feb 2024
1.1.2 Theoretical Framework	4th Feb 2024
1.1.3 Methodological framework	11th Feb 2024
1.1.4 Preliminary bibliographical research	15th Jan 2024
1.1.5 Annexes	25th Feb 2024
1.2 FGP development	9th June 2024
1.2.1 Objective 1: Causes of Delay	17th March 2024
1.2.2 Objective 2: Ranked Causes of Delay	24th March 2024
1.2.3 Objective 3: Impacts of Delay	7th April 2024
1.2.4 Objective 4: Recommendations to Manage Causes of Delay	21st April 2024
1.2.5 Objective 5: Method for Documenting and Sharing Lessons Learned	28th April 2024
1.2.6 Conclusions	12th May 2024
1.2.7 Recommendations	19th May 2024
1.2.8 Reference lists	26th May 2024
1.2.9 Annexes	26th May 2024
1.3.0 Tutor approval for reading	9th June 2024

1.3 Readers' review	30th June 2024
1.4 Board of Examiners Evaluation	28th July 2024

20. Theoretical framework

20.1 Estate of the "matter"

CEDCO Ltd. is a consultancy firm specialising in construction, supervision, design, project management, and engineering. It was observed that project delays were reoccurring issues the company faced in its residential construction projects, which, as a result, negatively impacted profit margins, company reputation and stakeholder relations. Literature has shown that this is a geographically wide reoccurring issue in the construction industry and is very much studied to mitigate. Within the context of CEDCO Ltd., examining its project management practices revealed that retrospection is not an activity the company undergoes after each project or deliverable completion. With retrospection, the company can document successes and failures and determine what works and how to improve so as not to repeat the failures. Identifying the causes is the first step to finding solutions to address project delay issues. Research has shown that delay causes are quite similar but ranked differently. These causes include poor site management, shortage of skilled labour, unrealistic project schedule, labour absenteeism, design changes, accidents due to poor site safety, subcontractor delays, shortage of materials on site, late delivery of construction materials, and effects of bad weather. Research has shown that researchers have looked at each case individually to derive feasible solutions, such as improved communication through regularly scheduled meetings and diversifying the supply chain to address supply issues.

20.2 Basic conceptual framework

The basic concepts included in the FGP are:

Project Management, Construction, Lesson Learned, Knowledge Areas, Processes, Project Life cycle, Organizational Assets, Sustainable Development, Regenerative Development, P5 Impact Analysis

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To identify the causes of delay in previous construction projects managed by CEDCO Ltd and recommend solutions.	List of Causes	**Primary** Data from logs (communication, delivery, weather, complaints, financial) and other project documents **Secondary** Journal articles, case studies	Analytical and Mixed Research Methods	Data gathering Data analysis- Root Cause, Document Checklists	Limited by the data available in secondary sources and what was logged by the company. Confidentiality restrictions by stakeholders to discuss some aspects of the projects

Objective	**Name of deliverable**	**Information sources**	**Research method**	**Tools**	**Restrictions**
To rank the causes of delay through stakeholder feedback as a means of validation and to determine high-priority areas.	Questionnaire results Matrix of ranked causes	**Primary** Survey to collect feedback from stakeholders **Secondary** Journal articles, case studies	Analytical and Mixed Research Methods	Data representation	The sample population for the questionnaire is very small, so the ranking may not be representative of CEDCO Ltd.

Objective	**Name of deliverable**	**Information sources**	**Research method**	**Tools**	**Restrictions**
To determine the impact of the causes identified and subsequently highlight known relationships among the causes.	Documentation of impacts Concept map showing relationships between or among impacts	**Primary** Data from logs and project reports **Secondary** Journal articles, case studies	Analytical and Mixed Research Methods	Data analysis	Limited by the data available in secondary sources and what was logged by the company Confidentiality restrictions by stakeholders to discuss some aspects of the projects

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To suggest recommendations for managing the identified causes of delay to manage project delays of future construction projects better.	A list of recommendations	**Primary** Data from questionnaires completed by stakeholders **Secondary** Journal articles, case studies	Analytical Research Method	Expert judgement Document analysis	Recommendations are restricted by external and internal Enterprise Environmental Factors such as resource availability and financial policies.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To create a method for documenting and disseminating future lessons learned to further the repository.	Procedure for documenting and sharing lessons learned repository.	**Primary** Firsthand experience **Secondary** Journal articles, case studies	Analytical and Mixed Research Methods	Information management	To add to the repository, stakeholders must have access to it Cloud storage

22. Validation of the work in the field of the regenerative and sustainable development.

"Sustainable development is development which meets the needs of the present without compromising the ability of the future generations to meet their own needs" United Nations, 2023). Sustainable development focuses on three pillars: economic, environmental and social. Regenerative development can be defined as "a systemic approach that sees, for example, global challenges as the climate change hypotheses, as an opportunity to develop co-agency among several cultures and fields, toward a shared purpose that can reconcile the fragmented relationship of human and natural systems and multiple problems within a place" (Dias, 2018).
The FGP considers the P5 Impact Analysis, which is based on Regenerative Development and has elements connected to the 17 Sustainable Development Goals that can be used to determine the project's impact on People, Prosperity and the Planet. This tool can be used to measure the overall impact of the project on these categories. A negative overall score will indicate that the project does not contribute to the sustainable and regenerative development. For elements that scored poorly, the project can be reassessed or redesigned to put measures in place to improve the outcome. On the other hand, a positive overall result shows that the project contributes to regenerative and sustainable development. Because this project focuses on lessons learned, the sole purpose of lessons learned is to improve project processes, outcomes and designs through experience. Therefore, improvements are expected to be brought to people, prosperity and the environment.

Potential indicators and ways to measure them include:

Water consumption- compare water consumption using utility bills of construction sites that practice rainwater harvesting with one of equal magnitude that does not.

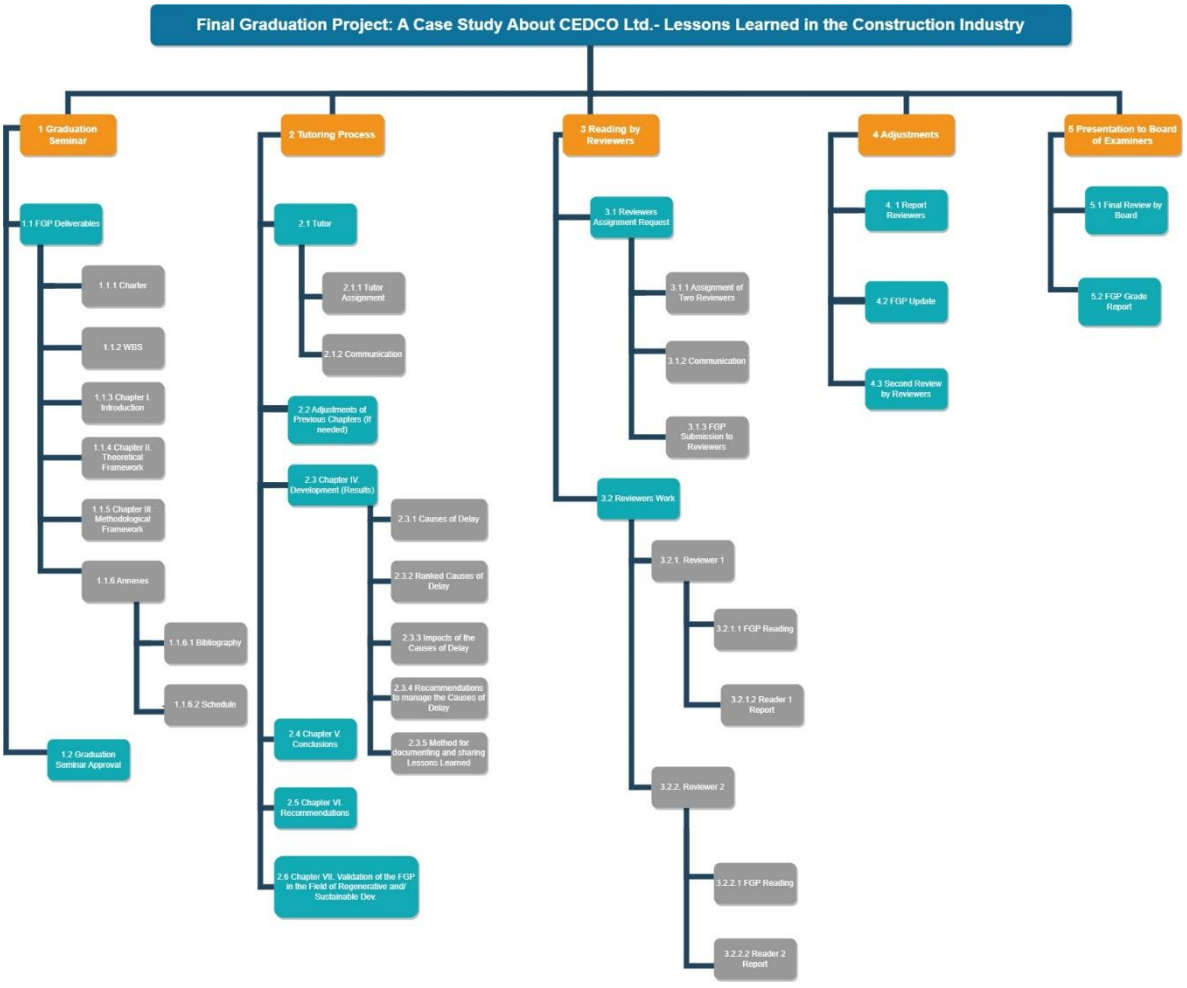
Waste disposal- observation of the cleanliness of the surroundings

Local Economic Impact- census on the number of persons employed due to the project

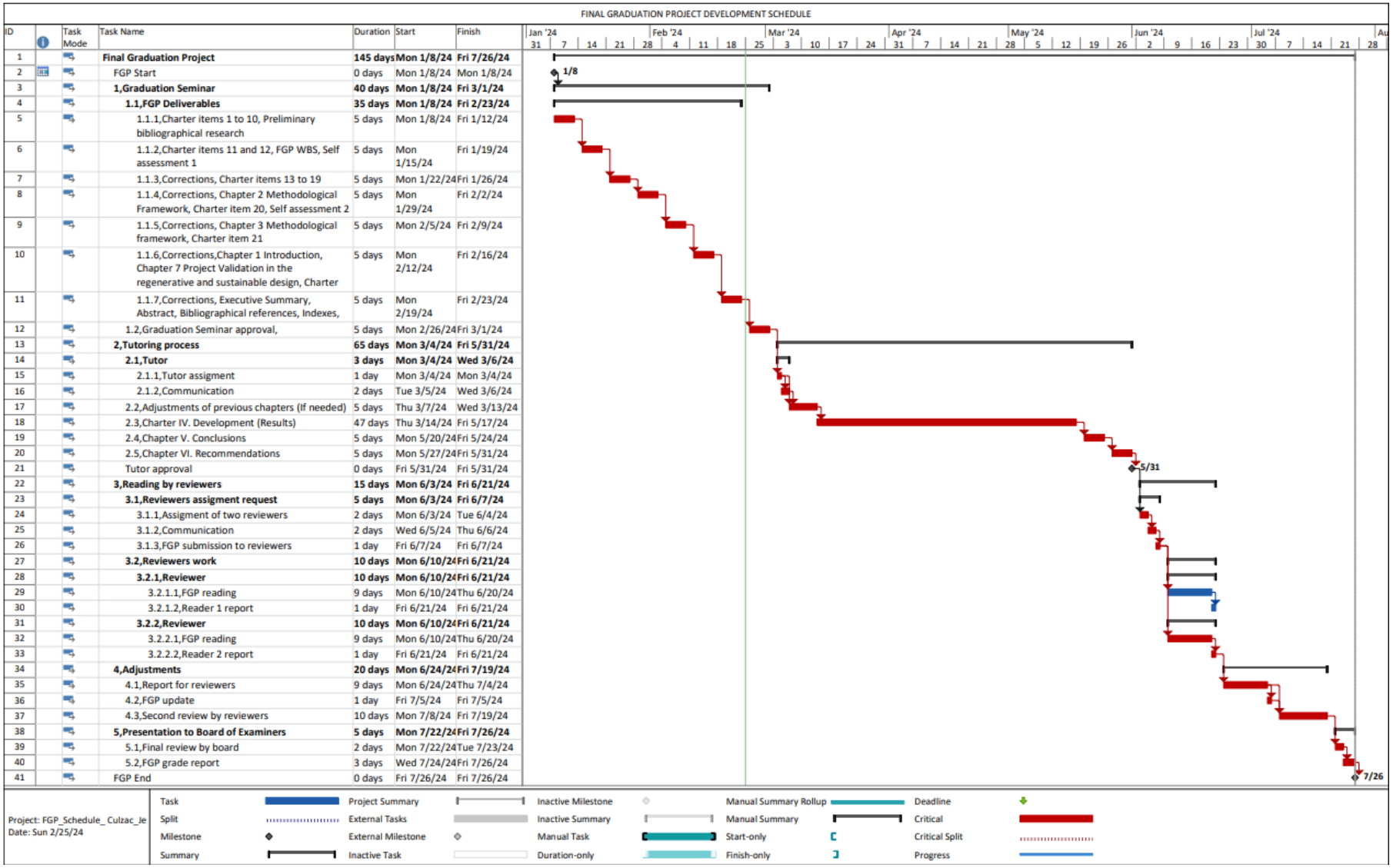
Public Policy and compliance- review records of social security payments of workers to ensure the employer is paying this as part of compliance

Local procurement- count and compare the number of local and foreign project suppliers.

Appendix 2: FGP WBS



Appendix 3: FGP Schedule



ID	Task Mode	Task Name	Duration	Start	Finish
1		**Final Graduation Project**	**145 days**	**Mon 1/8/24**	**Fri 7/26/24**
2		FGP Start	0 days	Mon 1/8/24	Mon 1/8/24
3		**1,Graduation Seminar**	**40 days**	**Mon 1/8/24**	**Fri 3/1/24**
4		**1.1,FGP Deliverables**	**35 days**	**Mon 1/8/24**	**Fri 2/23/24**
5		1.1.1,Charter items 1 to 10, Preliminary bibliographical research	5 days	Mon 1/8/24	Fri 1/12/24
6		1.1.2,Charter items 11 and 12, FGP WBS, Self assessment 1	5 days	Mon 1/15/24	Fri 1/19/24
7		1.1.3,Corrections, Charter items 13 to 19	5 days	Mon 1/22/24	Fri 1/26/24
8		1.1.4,Corrections, Chapter 2 Methodological Framework, Charter item 20, Self assessment 2	5 days	Mon 1/29/24	Fri 2/2/24
9		1.1.5,Corrections, Chapter 3 Methodological framework, Charter item 21	5 days	Mon 2/5/24	Fri 2/9/24
10		1.1.6,Corrections,Chapter 1 Introduction, Chapter 7 Project Validation in the regenerative and sustainable design, Charter	5 days	Mon 2/12/24	Fri 2/16/24
11		1.1.7,Corrections, Executive Summary, Abstract, Bibliographical references, Indexes,	5 days	Mon 2/19/24	Fri 2/23/24
12		1.2,Graduation Seminar approval,	5 days	Mon 2/26/24	Fri 3/1/24
13		**2,Tutoring process**	**65 days**	**Mon 3/4/24**	**Fri 5/31/24**
14		**2.1,Tutor**	**3 days**	**Mon 3/4/24**	**Wed 3/6/24**
15		2.1.1,Tutor assigment	1 day	Mon 3/4/24	Mon 3/4/24
16		2.1.2,Communication	2 days	Tue 3/5/24	Wed 3/6/24
17		2.2,Adjustments of previous chapters (If needed)	5 days	Thu 3/7/24	Wed 3/13/24
18		2.3,Charter IV. Development (Results)	47 days	Thu 3/14/24	Fri 5/17/24
19		2.4,Chapter V. Conclusions	5 days	Mon 5/20/24	Fri 5/24/24
20		2.5,Chapter VI. Recommendations	5 days	Mon 5/27/24	Fri 5/31/24
21		Tutor approval	0 days	Fri 5/31/24	Fri 5/31/24
22		**3,Reading by reviewers**	**15 days**	**Mon 6/3/24**	**Fri 6/21/24**
23		**3.1,Reviewers assigment request**	**5 days**	**Mon 6/3/24**	**Fri 6/7/24**
24		3.1.1,Assigment of two reviewers	2 days	Mon 6/3/24	Tue 6/4/24
25		3.1.2,Communication	2 days	Wed 6/5/24	Thu 6/6/24
26		3.1.3,FGP submission to reviewers	1 day	Fri 6/7/24	Fri 6/7/24
27		**3.2,Reviewers work**	**10 days**	**Mon 6/10/24**	**Fri 6/21/24**
28		**3.2.1,Reviewer**	**10 days**	**Mon 6/10/24**	**Fri 6/21/24**
29		3.2.1.1,FGP reading	9 days	Mon 6/10/24	Thu 6/20/24
30		3.2.1.2,Reader 1 report	1 day	Fri 6/21/24	Fri 6/21/24
31		**3.2.2,Reviewer**	**10 days**	**Mon 6/10/24**	**Fri 6/21/24**
32		3.2.2.1,FGP reading	9 days	Mon 6/10/24	Thu 6/20/24
33		3.2.2.2,Reader 2 report	1 day	Fri 6/21/24	Fri 6/21/24
34		**4,Adjustments**	**20 days**	**Mon 6/24/24**	**Fri 7/19/24**
35		4.1,Report for reviewers	9 days	Mon 6/24/24	Thu 7/4/24
36		4.2,FGP update	1 day	Fri 7/5/24	Fri 7/5/24
37		4.3,Second review by reviewers	10 days	Mon 7/8/24	Fri 7/19/24
38		**5,Presentation to Board of Examiners**	**5 days**	**Mon 7/22/24**	**Fri 7/26/24**
39		5.1,Final review by board	2 days	Mon 7/22/24	Tue 7/23/24
40		5.2,FGP grade report	3 days	Wed 7/24/24	Fri 7/26/24
41		FGP End	0 days	Fri 7/26/24	Fri 7/26/24

Appendix 3: Preliminary bibliographical research

Globally, delays in construction projects are one of the most common and costly problems encountered in the industry that are treated seriously (Fakunie & Fashina, 2020). In Keane and Caletka's study (as cited in Fakunie & Fashina, 2020), four types of delays were identified: Critical or Non-critical, Excusable or Non-excusable; Compensable or Non-compensable; and Concurrent or Non-concurrent. Non-excusable delay "is mostly common with contractors or their suppliers," while Excusable delay "is as a result of an unexpected event beyond the contractor or the subcontractor's control" (Fakunie & Fashina 2020). Non-compensable delay "is a type of delay where the contractor is not eligible for added compensation resulting from any excusable delay that may occur" (Ravisankar et al., 2014), while Compensable delay "allows the contractor to be eligible for a time extension as well as additional compensation" (Keane & Caletka, 2009). On the other hand, critical delays " prevent the contractor from concluding the work on the scheduled timeline agreed upon in the construction contract" (Alkass, Tribaldos, Mazerolle, & Harris, 1995). Non-critical delays are "delays that do not influence the project timeline but somehow affect the advancement of the work activities" (Barnes, 1988; Healy, 2007), while Concurrent delays occur when "Two or more delays that occur or overlap within the same period, either of which occurring alone would have affected the ultimate completion date" Association for the Advancement of Cost Engineering (AACE) (2000). Finally, Critical and Non-critical delay "often happens when one of the work activities requires more than the timeline to achieve such activities within the scheduled period "(De La Garza et al., 2007).

As a result of the delays, Construction projects suffer from several adverse effects, including but not limited to time and cost overruns, acceleration losses, low service quality, sudden contract termination and disputes among key construction stakeholders (Fakunie & Fashina, 2020). In Sambasivan and Soon's study (as cited in Fakuni et al., 2020), cash flow problems, disbelief, lawsuits and settlement of a dispute between parties to a contract by a neutral third party were identified as other negative effects of project delays. In Kiwasi's study (as cited in Fakunie et al., 2020), 14 delay effects were ranked based on an analysis

of the Construction Industry in Tanzania as follows from the most common to the least; “time and cost overrun, negative social impact, resources wastages, arbitration, disputes, lead client to return the loans, poor quality, delay in making a profit for the owner, bankruptcy, litigation, create stress on contractors, total abandonment and acceleration losses”. Most of these effects lead to financial loss as there is a direct link between delay and increase in project cost (Rashid, 2020).

This presents a viable argument for identifying the causes of delays in the construction industry to produce better outcomes. Rashid (2020), in his research model, categorized the causes as follows: Contractor-related factors, Client-related factors, Consultant-related factors, Materials-related factors, Equipment-related factors, Labor-related factors, and general equipment conditions. The study conducted by Rashid (2020) revealed that Client and Contractor-related causes played the most significant role in causing Project delays. However, Latif et al. (2023) noted that “different delay factors often interact with each other and amplify their effects.” Hence, the argument is made for one to understand the complex relationships so that delays can be adequately understood and managed. Latif et al. (2023) attribute delays in construction projects to poor Project management, which is supported by Kikwasi (2013) and suggests that “proactive application of project management techniques can considerably reduce issues associated with delays in various projects, particularly construction projects.” Abd El Razek et al. (2008) and Haseeb et al. (2011) agree that payment issues cause Project delays. “The ten most common causes for Construction Project Delays are weather and climate conditions, poor communication, lack of coordination and stakeholder conflicts, ineffective or inadequate planning, material shortages, financial problems, payment delays, equipment/ plant shortages, lack of experience/ project stakeholder skills/ competence among, lack of workforce and poor site management” Latif et al., (2023).

This preliminary bibliographic research highlights the effects of project delays in the Construction Industry. CEDCO Ltd., a consultancy firm within the Engineering and Construction Industry located in the Caribbean Island of St. Vincent & the Grenadines, is no exception to this problem and its effects. As a business operating in a small country, the

negative effects of project delays affect the company's reputation and, thus, its success and growth, as there is a heavy reliance on referrals to secure non-governmental construction projects. Therefore, identifying and documenting lessons learned becomes a significant input in the Knowledge Areas of Project Management to achieve more successful outcomes as Key Performance Indicators (KPIs).

Appendix 4: Philological Dictum

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21st June 2024

Academic Advisor

Master's Degree in Project Management (MPM)

Universidad para la Cooperacion Internacional (UCI)

Dear Academic Advisor

Re: Thorough Review and Proofreading of Final Graduation Project submitted by Jenice Culzac in partial fulfilment of the requirements for the Master's in Project Management (MPM) Degree

I hereby confirm that Jenice Culzac has made all the corrections to the Final Graduation Project document, as I advised. In my opinion, the document now meets the literary and linguistic standards expected of a student for a degree at the Master's level.

Athalie Caine-Soleyn (Mrs.)
EdD, PGDip, MAEd, PGCE, BA