UNIVERSIDAD PARA LA COOPERACIÓN INTERNACIONAL
(UCI)

A PROJECT MANAGEMENT PLAN FOR THE CONSTRUCTION OF A SOLAR-POWERED SEA MOSS AGRO-PROCESSING PLANT AT THE CASTRIES FISHERIES COMPLEX IN SAINT LUCIA

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DEDICATION

I dedicate this final graduation project to my deceased father, John Garnet Husbands, who passed away on February 13, 2022, during my MPM graduate studies. He represented a blanket of support, resilience, perseverance, strength to endure, and creativity in managing constraints, while facing challenges head-on. Continuous learning and self-abnegation in order to obtain higher education were always encouraged by him. Thus, may the completion of this FGP bring him continued peace and satisfaction.

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My sincerest gratitude to the Almighty God, my colleagues, family, and friends who supported me throughout my studies, encouraging me to endure till the end. I am also grateful for the invaluable contributions of all the lecturers and FGP reviewers in this program who were all very patient, understanding, and knowledgeable. They empowered and equipped me with 21st-century project management good practices and skillsets for transference into my environment. I am also grateful to the University of International Cooperation (UCI) for the scholarship award and for providing the relevant resources necessary to engender a successful outcome of attaining a Master's in Project Management (MPM).

ABSTRACT

The objective of this document is to develop a project management plan for the construction of a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia, based on the Project Management Institute principles and good practices in project management, also taking into account the relevant construction and national regulatory requirements. This initiative aligns with some of the earlier investments by the Government of Saint Lucia geared at fostering further potential in the sea moss industry and promoting the development and advancement of local producers and their respective microenterprises.

Additionally, it provides an opportunity for long-term investment in sustainable sea-moss agro-processing, providing numerous opportunities for operational and financial efficiencies which include but are not limited to the empowerment of sustainable livelihoods in sea moss farming, production and diversification in export products, reduction in import bill, yielding reduced energy cost and reliability in energy supply, and contribution to environmental social governance (SDG1, 7, 9,11,12).

The product of this FGP, which is a project management plan with all the subsidiary plans, including the validation of sustainable and regenerative development, will be executed within the constraints of schedule, budget, resources, quality, scope, risks, and customer satisfaction and improve avenues of communication for continuous improvement while adhering to national regulatory standards and international agreements (sustainable development goals) for sustained growth and organizational success.

INDEX OF CONTENTS

INDEX OF FIGURES 8
INDEX OF CHARTS 9
EXECUTIVE SUMMARY 12
1 INTRODUCTION 14
1.1. Background 14
1.2. Statement of the problem 14
1.3. Purpose 16
1.4. General objective 16
1.5. Specific objectives 16
2 THEORETICAL FRAMEWORK 18
2.1 Company/Enterprise framework 18
2.2 Project Management Concepts 20
2.3 Other applicable theory/concepts related to the project topic and context. 34
3 METHODOLOGICAL FRAMEWORK 44
3.1 Information sources 44
3.2 Research Methods 49
3.3 Tools 54
3.4 Assumptions and Constraints 57
3.5 Deliverables 60
4 RESULTS 64
4.1 Project Charter 64
4.2 Scope Management Plan 74
4.3 Schedule Management Plan 110
4.4 Cost Management Plan 140
4.5 Quality Management Plan 145
4.6 Resource Management Plan 157
4.7 Risk Management Plan 188
4.8 Procurement Management Plan 214

4.9 Stakeholder Management Plan 228
4.10 Communication Management Plan..235
5 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT..241
5.1 Validation of Regenerative Development...241
5.2 Key Performance Indicators 243
5.3 P5 Analysis 245
6 CONCLUSIONS 253
7 RECOMMENDATIONS..258
8 BIBLIOGRAPHY..261
9 APPENDICES 270
Appendix 1: FGP Charter 270
Appendix 2: FGP WBS...289
Appendix 3: FGP Schedule...290
Appendix 4: Preliminary bibliographical research 294
Appendix 5: Solar-powered Sea Moss Agro-processing Plant Design 303
Appendix 6: Lessons Learned Template 305
Appendix 7: Revision Dictum 306

INDEX OF FIGURES

Figure 1 *Principles: Sustainable Development Goals (Source: JH Consultancy and Management Services, 2022)* 15
Figure 2 *Organizational structure (Source: JH Consultancy and Management Services, 2022)* 19
Figure 3 *PMBOK® Guide details 12 principles of project management (Source: PMI, 2021, p.24 - 59)* 21
Figure 4 *PMBOK® Guide details 12 principles of project management (Source: PMI, 2021, p.24 - 59)* 22
Figure 5 *Development Approaches Diagram (Source: PMI, 2021, p.35)* 24
Figure 6 *Predictive life cycle (Source: PMI, 2021, p.43):* 25
Figure 7 *Adaptive Development Approach (Source: PMI, 2023, p.45):* 26
Figure 8 *The Hybrid Project Portfolio Management Approach (Source: Egeland, 2019, p.1)* 27
Figure 9 *Project Management Knowledge Areas (Source: Agile Practice Guide, 2017, p.90)* 30
Figure 10 *Project Management Life Cycle Phases (Source: Guru99, 2023, p.1)* 31
Figure 11 *Portfolio, Program and Project Interfaces (Source: Monday.com, 2022, p.1)* 33
Figure 12 *Work Breakdown Structure (WBS). Source: (J. Husbands, June 2023)* 87
Figure 13 *Schedule Network Diagram. Source (J. Husbands, June 2023)* 124
Figure 14 *Project Schedule. Source (J. Husbands, June 2023)* 138
Figure 15 *Stakeholder Power/Interest Grid. Source (Joanne Husbands, June 2023)* 232

INDEX OF CHARTS

Chart 1.Information sources (Source: J. Husbands, January 2023) 45
Chart 2 Research Methods (Source: J. Husbands, January 2023) 50
Chart 3 Tools (Source: J. Husbands, January 2023) 54
Chart 4 Assumptions and Constraints (Source: J. Husbands, January 2023) 57
Chart 5 Deliverables (Source: J. Husbands, January 2023) 61
Chart 6 Project Charter (Source: J. Husbands, June 2023) 64
Chart 7 Roles and Responsibilities (Source: J. Husbands, June 2023) 74
Chart 8 Requirements (Source: J. Husbands, June 2023) 77
Chart 9 Requirements Traceability Matrix (Source: J. Husbands, June 2023) 80
Chart 10 Project Scope Statement (Source: J Husbands, June 2023) 84
Chart 11 WBS Dictionary (Source: J. Husbands, June 2023) 88
Chart 12 Evaluation Checklist (Source: J. Husbands, June 2023) 102
Chart 13 Activity List. Source (J. Husbands, June 2023) 111
Chart 14 Estimated Activity Duration and Resource Assignment. Source (J. Husbands, June 2023) 125
Chart 15 Budget for Solar-powered Sea Moss Agro-Processing Plant. Source (Joanne Husbands, June 2023) 142
Chart 16 Key Quality Control Metrics. Source (Adapted from Rayneau Construction & Industrial Products by J. Husbands, June 2023) 149
Chart 17 Roles and Responsibilities. Source (J. Husbands, June 2023) 158
Chart 18 RACI Chart. Source (J. Husbands, June 2023) 176
Chart 19 Installation of 100kW AC PV Solar System with (2 hour) Battery Storage. Source (J. Husbands, June 2023) 180
Chart 20 Installation of Sea moss Agro-Processing Plant - Bill of quantities. Source (J. Husbands, June 2023) 183
Chart 21 Summary of Resources for Seamoss Processing Plant. Source (J. Husbands, June 2023) 188
Chart 22 Risk Breakdown Structure (RBS). Source (J. Husbands, June 2023) 189

Chart 23 Probability and Impact Scale. Source (J. Husbands, June 2023)........................192
Chart 24 Probability and Impact Matrix. Source (J. Husbands, June 2023)......................193
Chart 25 Risk Register. Source (J. Husbands, June 2023) 194
Chart 26 Procurement Items and Services. Source (J. Husbands, June 2023) 215
Chart 27 Procurement item justification for the installation of a 100 kW AC PV solar system with (2 hour) battery storage. Source (J. Husbands, June 2023) 217
Chart 28 Procurement item justification for the construction of sea moss- agro processing plant. Source (J. Husbands, June 2023) 220
Chart 29 Stakeholder Register Matrix. Source (J. Husbands, June 2023)........................229
Chart 30 Stakeholders Engagement Assessment Matrix. Source (J.Husbands,June 2023)233
Chart 31 Project Communication Matrix. Source (J. Husbands, June 2023) 236
Chart 33 FGP and Regenerative Development (Source: J. Husbands, January 2023) 241
Chart 34 Key Performance Indicators. (Source: J. Husbands, January 2023)....................243
Chart 35 P5 Standard Impact Analysis (Source: J. Husbands, January 2023) 246

ABBREVIATIONS AND ACRONYMS

ESG	Environmental Social Governance
GEF	Global Environment Facility- Small Grants Program – United Nations Development Program
GPM	Global Project Management
LUCELEC	Saint Lucia Electricity Services Limited
NURC	National Utilities Regulatory Commission
OECS	Organization of Eastern Caribbean States
PMI	Project Management Institute
RBS	Risk Breakdown Structure
SASB	Sustainability Accounting Standard
SLASPA	Saint Lucia Air and Sea Ports Authority
XCD	Eastern Caribbean Dollar
WBS	Work Breakdown Structure
WORLD BANK	The World Bank Organization (World Bank)

EXECUTIVE SUMMARY

In the Caribbean, sea moss, a type of seaweed, also known as an algae and Irish Moss, has long been a staple in handmade and commercially blended juices, with many claiming energy-boosting properties and various health advantages. Research conducted by Lomartire, et al (2021, p.24) states that "Seaweed is a great food source with bioactive components that promote a healthy diet with the advantage to exhibit anticancer, antiviral, antifungal, antidiabetic, antihypertensive, immunomodulatory, anticoagulant, anti-inflammatory, antioxidant, UV-protective, and neuroprotective properties after assimilation. Its low-fat content makes it especially appealing to the health-conscious and it is a key part of many diets. Brown seaweed is among the most exploited, with red algae being widely used in the food, nutraceutical, pharmaceutical and cosmetic industries. Unfortunately, not all types of seaweed are considered safe for human consumption. Seaweeds tend to accumulate heavy metals and minerals which could be detrimental to animal and human health if consumed in large quantities as food or drugs. Nonetheless, the use of the bioactive compounds found in seaweed in biotechnological and industrial applications promotes a healthier lifestyle in a sustainable way.

In 2018, the sea moss industry in Saint Lucia garnered much interest and popularity as a sustainable livelihood (farming and production) due to its value-added economic benefits and export potential worldwide. The Government of Saint Lucia provided XCD 500,000.00 to Export Saint Lucia to support developments within the sea moss industry. This contribution facilitated the employment of a Food Scientist/ Technologist (Consultant) to advise on natural organic preservatives to develop world-class, value-added sea moss products such as gels, drinks and powders; advisory services on standards for entry of products into international markets, branding, audits of sea moss facilities to provide training and certification where necessary and staging an expo in the year 2020 in Dubai. Recorded as a notable success, Saint Lucia's sundried sea moss was one of several products that were completely sold out within Saint Lucia's pavilion. (Govt, 2022)

JH Consultancy and Management Services is a small but growing consultancy management services company located in Saint Lucia. It was established in 2021 and has a complement of three consultants. The company's primary consultancy services are in the social, economic, environmental, infrastructure and youth development sectors. For the Final Graduation Project, the company has decided to undertake the elaboration of a project management plan for the construction of a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex given that there are no existing plans to do so. The plant will be constructed as an extension to the current Fisheries Complex structure in Castries. This can boost the manufacturing potential of the sea moss sector while supporting sustainable livelihoods in farming in the Castries basin. Thus, the problem was thoroughly investigated, and a solution was provided through a detailed proposal of a project management plan for the construction of a solar- powered sea moss agro-processing facility to be used as a template to guide all critical aspects of the project's life cycle and other relevant project management plans going forward, for assured growth and innovation within the sector.

The general objective was to develop a project management plan for the construction of a solar-powered sea moss agro-processing plant at the Castries fisheries complex in Saint

Lucia. The specific objectives of the project were to develop a project charter to guide the project requirements for implementation by the project manager, to achieve project outcomes, to develop a scope management plan to ensure that the scope of the project is executed as planned, to achieve the project objectives, to develop the schedule management plan to ensure that the project is completed on time, to develop a cost management plan to ensure that the project is completed within budget, to develop a quality management plan to ensure that the project is in compliance with and meets project quality standards, to develop a resource management plan to ensure that there are adequate resources to support project implementation, to develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process, to develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at various stages of the process, to develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution, and to develop a communications management plan to organize and document the processes, types and expectations of communication to internal and external stakeholders.

An analytical methodology was used for this research using qualitative data gathered from A Guide to the Project Management Body of Knowledge (PMBOK ® Guide) Sixth & Seventh Editions, as well as interviews from subject matter experts and the internet. The information was synthesized to develop the project management plan and its subcomponents for the construction of a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia.

In order to develop a project management plan for this FGP, the project team members should refer to the project charter to ensure alignment and adherence to the project's original goals and objectives. This can help streamline the planning and implementation processes, to better navigate uncertainties and challenges with resilience. In addition, regularly monitoring and adapting stakeholder engagement strategies will ensure ongoing alignment with stakeholder needs and foster a positive project environment.

It is therefore recommended that JH Consultancy & Management Services considers setting up a Microsoft Teams channel to support not only communications management plans activities but also cost management for value engineering. Furthermore, JH Consultancy & Management Services should regularly review and update the scope management plan throughout the project life cycle. As new information becomes available or project requirements change, the plan should reflect the current project scope. Lastly, JH Consultancy & Management Services should support ethical and sustainable project management practices by incorporating a sustainability criterion into supplier selection and contract evaluation. Green Project Management credentials can be included in requirements as a value add. This is a step in the right direction in encouraging more mindful environmental and sustainable practices in project implementation and to include as deliverables to subcontractors: a maintenance, asset and sustainability management plan, post implementation for continual benefits.

1 INTRODUCTION

1.1. Background

JH Consultancy and Management Services, established in 2021, is a trusted consultancy management services company located in Saint Lucia. At its core is a competent, agile team of experienced individuals motivated to deliver satisfaction at the highest quality standards, in line with customer requirements. The company's primary consultancy service areas are in the social, economic, environment, infrastructure, and youth development sectors. To support the author's final graduation project, the company has assumed the assignment of creating a project management plan for the construction of a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia. The project management plan for this legacy initiative can be used as a template to guide all critical aspects of the project's life cycle and serve as an input to other relevant project management plans for continuous future development and innovation within the sector.

1.2. Statement of the problem

In 2018, the sea moss industry in Saint Lucia garnered popular interest as a sustainable livelihood (farming and production) due to its value-added economic benefits and export potential worldwide. Presently, the Castries Fisheries Complex in Saint Lucia is not operational and there are no existing initiatives in the pipeline for its immediate recommissioning. The problem was investigated, and an extension to the structure which currently houses the Castries Fisheries Complex was deemed a feasible solution; its location being ideal to support the construction of the solar- powered sea moss agro-processing plant.

This enhances national contributions to signed international agreements (SDG 1, 7, 9,11,12), previous government investments, future local manufacturing potential and sustainable transformational development and livelihoods in the sea moss sector. As a solution, a project management plan for the construction of a solar- powered sea moss agro-processing plant is presented, with the aspiration to be used as a template to guide all critical aspects of the project's life cycle for assured successful outcomes. The project management plan will help to better coordinate and manage the construction project within schedule, budget, scope, resources, quality, risks, communication, and stakeholders in a safe, efficient, and streamlined manner.

Figure 1 *Principles: Sustainable Development Goals (Source: JH Consultancy and Management Services, 2022)*

Note: Figure developed based on a discussion with, and with authorization from the principal consultant and founder of JH Consultancy & Management Services, 2022. Own creation

1.3. Purpose

McKnight (2020) cites "Solar energy for agro-processing plants helps to provide a reliable electricity supply in order to meet demand at peak processing times and hedge against volatile electricity prices". As such, to increase value-added economic benefits from the sustainability of agro-processing sea-moss in Castries, efficiencies in utility costs and support of sustainable livelihoods in the sea moss sector, JH Consultancy and Management Services will develop a project management plan for the construction of a solar- powered sea moss agro-processing facility at the Castries Fisheries Complex in Saint Lucia. The company will cover all critical aspects of the project for strategic coordination and guidance on project execution within the Project Management Institute requirements on integration, scope, time, cost, quality, resources, communication, risk, procurement, and stakeholder management plans.

1.4. General objective

To develop a project management plan for the construction of a solar-powered sea moss agro-processing plant, as an extension to the existing infrastructure at the Castries Fisheries Complex in Saint Lucia, within requirements of the Project Management Institute standards and guidelines.

1.5. Specific objectives

1. To develop a project charter to guide the project requirements for implementation by the project manager, to achieve project outcomes.

2. To develop a scope management plan to ensure that the scope of the project is executed as planned, to achieve the project objectives.
3. To develop the schedule management plan to ensure that the project is completed on time.
4. To develop a cost management plan to ensure that the project is completed within budget.
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.
6. To develop a resource management plan to ensure that there are adequate resources to support project implementation.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at various stages of the process.
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.
10. To develop a communications management plan to organize and document the processes, types, and expectations of communication to internal and external stakeholders.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

JH Consultancy and Management Services is a consultancy management services company located in Saint Lucia. It was established in 2021 and has a complement of fifteen consultants inclusive of the principal consultant (managing director and founder). Collectively, the consulting team has over 20 years industry experience and its primary consultancy services been in the social, economic, environment, infrastructure, and youth development sectors. The company exists to deliver high quality, reliable services in an agile environment, to support customers' needs and ensure satisfaction in the achievement of the outlined deliverables and associated requirements, using 21st century project management, governance, and effective consulting service management principles.

2.1.2 Mission and vision statements

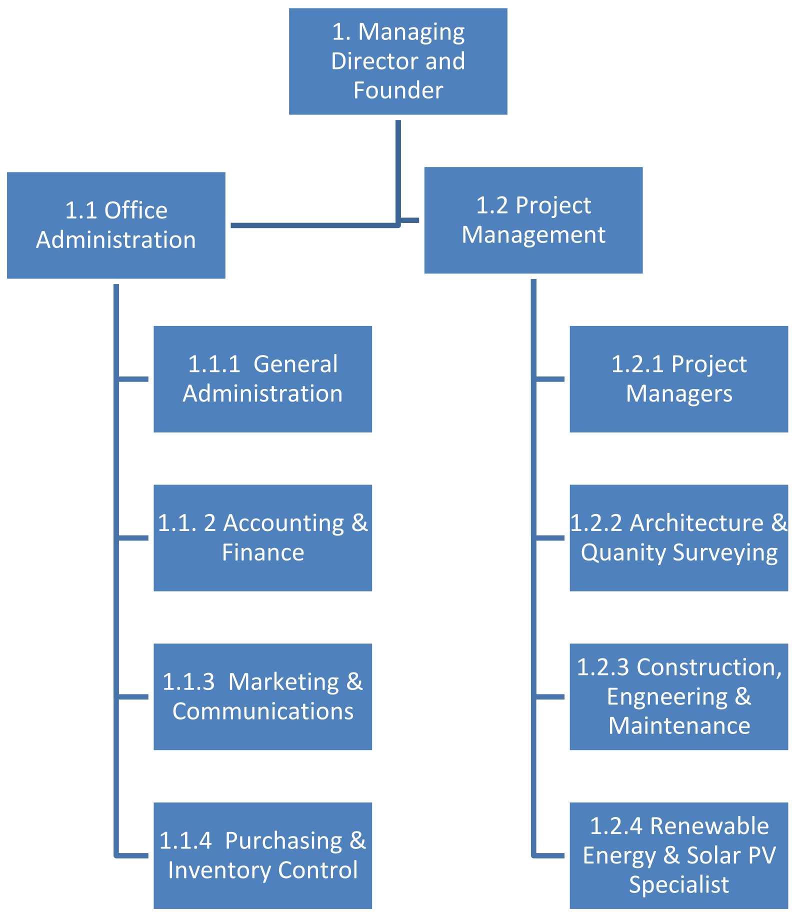
JH Consultancy and Management Services vision is to "Lead and be a chosen solution for steering customers' strategic business success" (JH Consultancy and Management Services, 2021).

Its mission is to "Enable and facilitate strategic business success through consultancy services near to customer's core" (JH Consultancy and Management Services, 2021).

2.1.3 Organizational structure

PMI (2017) defines organizational structure as "any arrangement of or relation between the elements of project work and organizational process based on roles, functions, or authority. They can be defined as being external to the project, tailored to fit the project context, or newly designed to meet a unique project need" (p.29). Figure.1 shows the organizational structure of JH Consultancy & Management Services.

Figure 2 *Organizational structure (Source: JH Consultancy and Management Services, 2022)*



Note: Figure developed based on a discussion with, and with authorization from the principal consultant and founder of JH Consultancy & Management Services, 2022. Own creation.

JH Consultancy and Management Services is composed of twelve (12) Consultants: the managing director and founder, and eleven other technical consultants, who report directly to the managing director and founder (principal consultant) based on the chain of command (relationship dependencies). Each consultant, based on their scope of work within the organization, will provide technical project management services to support the activities and overall deliverables under the project.

2.1.4 Products Offered.

The products provided by JH Consultancy and Management Services are strategies, operations, human resources, project management, construction, and infrastructure renovation consulting services. The latter includes the development of project plans which aid in the fulfillment and support of this FGP and its related objectives.

2.2 Project Management Concepts

The Project Management Institute developed A Guide to the Project Management Body of Knowledge (PMBOK® Guide), which sets the foundation of principles, skills, methodologies, policies, procedures, tools, techniques, and life cycle required for good practice in project management. Thus, this FGP is guided by the above-mentioned professional standards and methodologies.

2.2.1 Project Management Principles

PMI (2021) describes project management as “the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Underscored is that project management guides project work to deliver the intended outcomes and project teams can achieve the outcomes using a broad range of approaches (e.g., predictive, hybrid and adaptive)” (p.4).

The PMBOK® Guide details 12 principles of project management. The principles in project management serve as a foundational foot stool for strategy, decision making, problem solving, and overall governance of projects. According to PMI (2021, p.23), these may include but are not limited to: stewardship, team, stakeholders, value, systems thinking, leadership, tailoring, quality, complexity, risk adaptability and resiliency and lastly, change.

Figure 3 *PMBOK® Guide details 12 principles of project management (Source: PMI, 2021, p.24 - 59)*

Note: Reprinted from the book, *12 principles of project management, A Guide to the Project Management Body of Knowledge (PMBOK® Guide*) (7th edition, PMI, 2021, p.24 - 59), by PMI, 2021. Copyright 2021, Project Management Institute, Inc. All rights reserved.

2.2.2 Project Management Domains

PMI (2021) explains that “performance domains are a group of related activities which represents a project management system of interactive, interrelated, and interdependent management capabilities that work in unison to achieve desired project outcomes. Tailoring is the deliberate adaptation of the project management approach, governance, and processes to make them more suitable for the given environment and the work at hand and driven by the organizational values, culture, and project management principles.” (p.6)

The Standard for Project Management and the PMBOK® Guide present eight project performance domains that are pivotal for effectively delivering project outcomes. The project management performance domains are stakeholders, team development approach, life cycle, planning, project work, delivery, measurement, and uncertainty. These will guide the FGP in its planning and execution to achieve successful project outcomes.

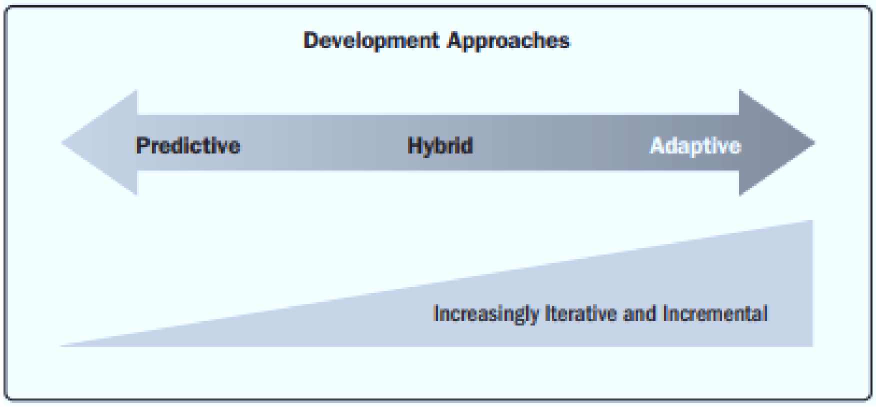
Figure 4 *PMBOK® Guide details 12 principles of project management (Source: PMI, 2021, p.24 - 59)*

Note: Reprinted from the book, *project management performance domains diagram A Guide to the Project Management Body of Knowledge (PMBOK® Guide*) (7th edition, p.5), by PMI, 2021. Copyright 2021, Project Management Institute, Inc. All rights reserved.

2.2.3 Predictive, Adaptive and Hybrid Projects

Development approaches are used to develop a product, service, or result throughout the project life cycle. The development approach used to create this FGP project management plan during its project life cycle is a hybrid project management approach. This approach includes both development approaches: predictive and adaptive. The following figure shows the development approaches diagram.

Figure 5 *Development Approaches Diagram (Source: PMI, 2021, p.35)*



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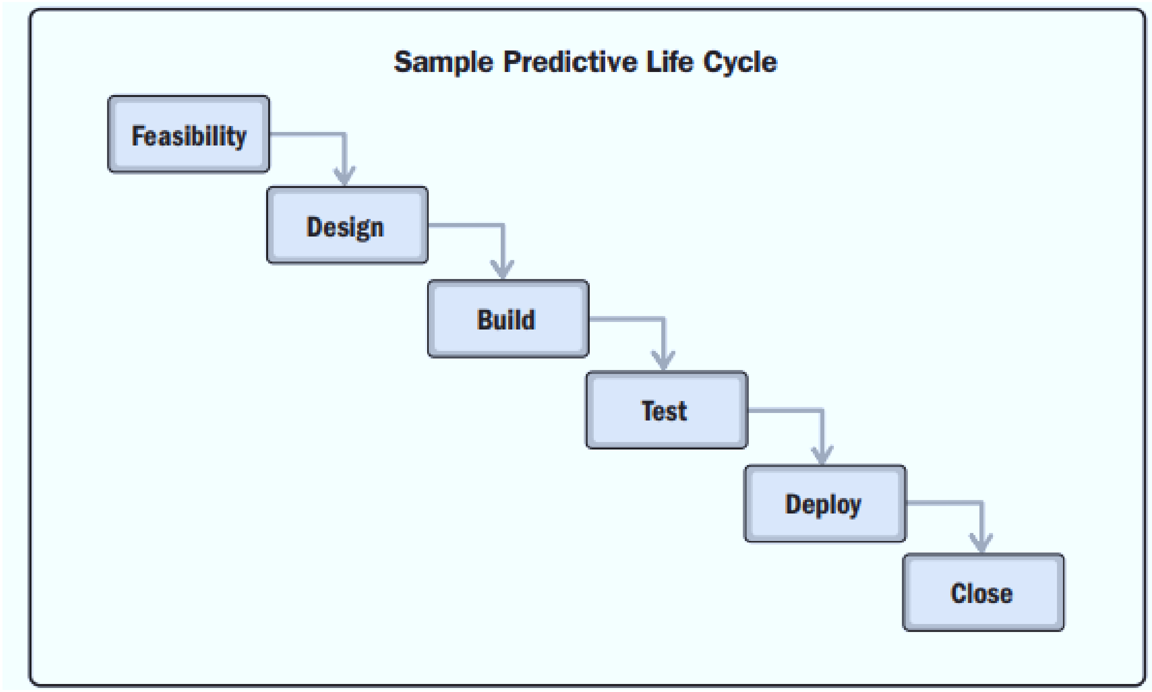
The predictive approach is useful when the project requirements are "defined, collected, and analyzed at the start of the project and it is often used if there is a high investment involved. Thus, a high level of risk may require frequent reviews, change control mechanisms, and replanning between development phases. Therefore, to reduce the levels of uncertainty early on, project planning is done upfront so that the majority of the project work follows plans that were developed near the start of the project. Furthermore, they use proof of concept to explore options and as a result, templates from previous, similar projects are often used." (PMI, 2021, p.35). The following figure shows the predictive life cycle.

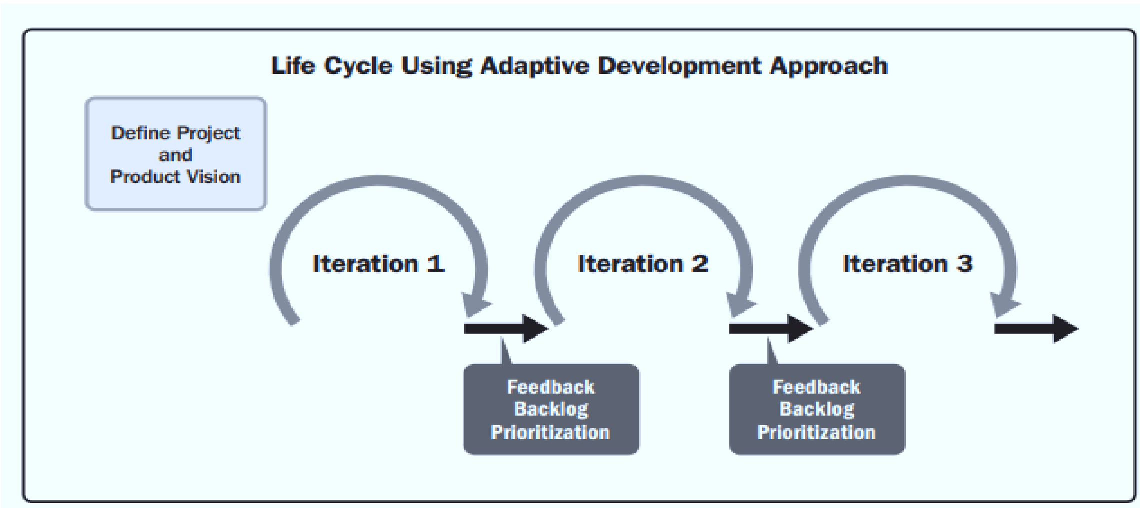
Figure 6 *Predictive life cycle (Source: PMI, 2021, p.43):*



Note: Reprinted from book, *Predictive Life cycle -A Guide to the Project Management Body of Knowledge (PMBOK® Guide*) (7th edition, p.43), by PMI, 2021. Copyright 2021, Project Management Institute, Inc. All rights reserved.

On the contrary, adaptive approaches are often used when there is a "high level of uncertainty and volatility (changes) expected throughout the project. Although a clear vision is established at the beginning of the project, the initial requirements are often refined or replaced in line with user feedback, the environment, or unexpected events. This approach uses both iterative and incremental approaches, although iterations tend to get shorter, and the product is more likely to evolve based on stakeholder feedback. The project team is engaged with planning for each iteration and will determine the scope they can achieve based on a prioritized backlog, estimate of work involved, collaboratively throughout the iteration to develop the scope" (PMI, 2021. p.38). Figure 4 shows the adaptive life cycle.

Figure 7 *Adaptive Development Approach (Source: PMI, 2023, p.45):*



Note: Reprinted from book, *Lifecycle with Adaptive Development Approach - A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (7th edition, p.45), by PMI, 2021. Copyright 2021, Project Management Institute, Inc. All rights reserved.

On the other hand, PMI (2021) notes that the hybrid approach tends to be more adaptive than predictive and has the following characteristics which explains its suitability for this FGP project. The hybrid approach is a combination of predictive, iterative, incremental, and/or agile approaches and is best used when there is uncertainty, complexity, and risk in the development portion of the project that would benefit from an agile approach, followed by a defined, repeatable, rollout phase that is appropriate to undertake in a predictive way, perhaps by a different team (PMI, 2021, p.36).

Therefore, this approach will produce business value in the best possible way given the environment. It will also produce feedback for the team as needed, to produce value in increments, and to manage risks in an iterative way. Figure 8 shows the Hybrid Project Portfolio Management Approach.

Figure 8 *The Hybrid Project Portfolio Management Approach (Source: Egeland, 2019, p.1)*

Notes. Copied from website, *The Hybrid Project Portfolio Management Approach* by Brad *Egeland, 2019,* Bradegeland. Copyright 2019 Bradegelan. All rights reserved.

2.2.4 Project Management

PMI (2021) defines project management as the “application of knowledge, skills, tools, and techniques to project activities to meet project requirements” (p.4). Therefore, utilizing the project management principles, a project manager and his/her team can guide the project work to deliver intended outcomes to meet requirements using a broad range of approaches (e.g., predictive, hybrid and adaptive). Project administration, on the other hand, guides the operations of the project and stresses more on the planning and organization function of the project (Surbhi, 2021). Project direction, on the contrary, is concerned with influencing to guide project team for expected high levels of performance to complete project activities. (Guru, 2021). Therefore, effective project management, direction and administration will aid in meeting the requirements of this FGP.

2.2.5 Project Management Knowledge Areas and Processes

The project management knowledge areas and process will guide the development of this FGP project management plan. Thus, as explained by PMI (2021), “the knowledge areas are as follows, integration, scope, schedule, cost, quality, resources, communications, risk, procurement, and stakeholders” (p. xiii). The validation of sustainable development and regenerative analysis will also be provided and explicitly elaborated.

Project management processes are sorted into logical groupings of project management inputs, tools and techniques, and outputs; all of which are tailored to meet the needs of the organization, stakeholders, and the project (PMI, 2021, p. 170). It is imperative that the project manager and project team establish periodic reviews of processes that the project team uses to conduct the project work. The PMI (2021) places the project management process into the following five Project Management Process Groups:

1. Initiating Process Group: Those processes are performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase (PMI., 2021, p.170).
2. Planning Process Group: Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve (PMI., 2021, p.170).
3. Executing Process Group: Those processes are performed to complete the work defined in the project management plan to satisfy the project requirements (PMI., 2021, p.170).
4. 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 plan are required; and initiate the corresponding changes (PMI., 2021, p.170).
5. Closing Process Group: Those processes are performed to formally complete or close the project, phase, or contract (PMI., 2021, p.170).

The following figure shows the project management knowledge areas.

Figure 9 *Project Management Knowledge Areas (Source: Agile Practice Guide, 2017, p.90)*

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	**Planning Process Group**	**Executing Process Group**	**Monitoring and Controlling Process Group**	**Closing Process Group**
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Monitor Stakeholder Engagement	

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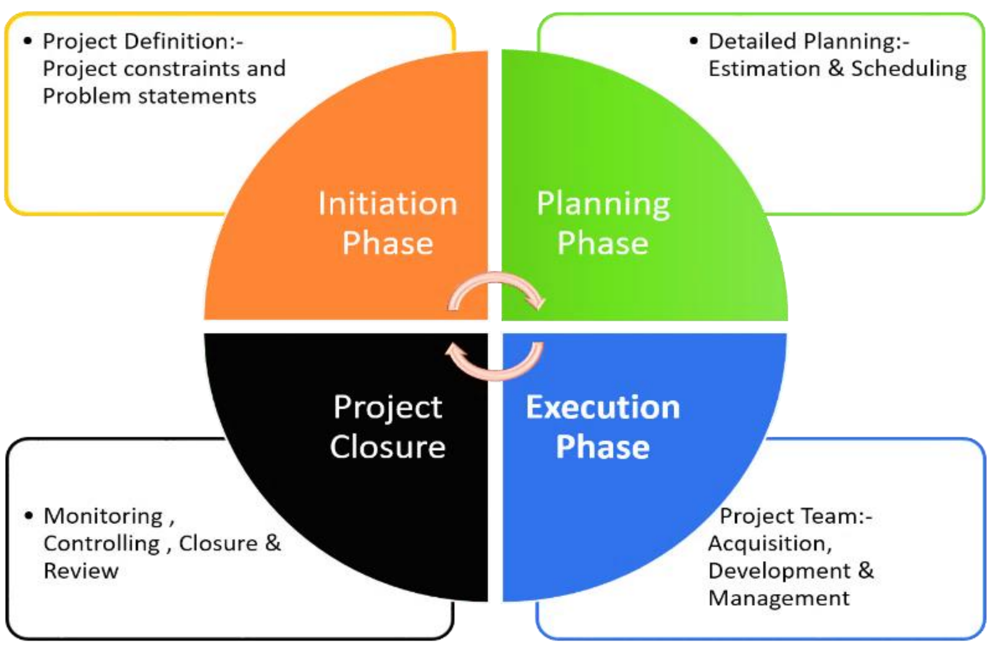
2.2.6 Project life cycle

PMI (2021) states that a project life cycle "consists of phases that connect the delivery of business and stakeholder value from the beginning to the end of the project" (p.245). Furthermore, Adeaca (2020) highlights that the project life cycle "is a sequence of phases through which a project progresses". However, the number of phases and sequence of the cycle may change based on the organization and the type of project. While Miller (2023) explains that project life cycles "are also known as project management life cycles and refers to all the phases and actions necessary to fulfill a project's goals and objectives successfully. It includes five stages: initiation, planning, execution, monitoring and closing" (p. 1). Figure 10 shows the Project Management Life Cycle Phases.

Figure 10 *Project Management Life Cycle Phases (Source: Guru99, 2023, p.1)*



Notes. Copied from a website. *Project Management Life Cycle Phases: What are the stages? by* M. Martin, *2023*, Guru99. Copyright 2023 Guru. All rights reserved.

2.2.7 Company Strategy, Portfolios, Programs, and Projects

PMI (2021) highlights that business strategy “is the reason for the project and all needs are related to the strategy to achieve” (p. 35).

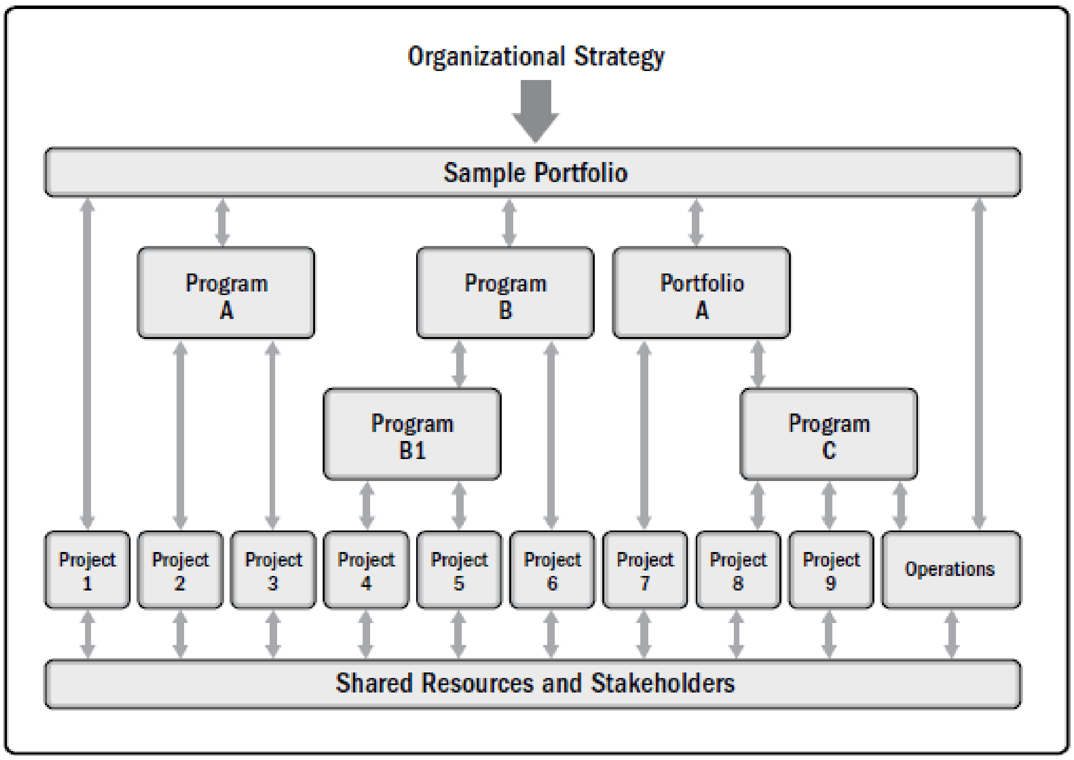
PMI (2021) further defines a project as “a temporary endeavor undertaken to create a unique product, service, result and indicates a beginning and an end to the project work or phase of project work” (p. 4). Projects may be stand alone or part of a program or portfolio. A program is related projects, subsidiary programs and program activities that are managed in a coordinated manner to obtain benefits not available from managing them individually (PMI, 2021, p.4). Finally, portfolios are projects, programs, subsidiary portfolios, and operations managed as a group to achieve strategic objectives. All the previously mentioned are part of an organization’s system for value delivery. (PMI, 2021, p.4)

Similarly, Żurawiecki (2022) defines portfolios, programs and projects using analogous terms, adding that the management of portfolios “provides a big picture of the organization’s projects and programs, as well as supports the managers to analyze and make the right decisions. Program management on the one hand, allows organizations to have the ability to align multiple projects for optimized or integrated costs, schedule, effort, and benefits, as well as helps the manager to determine the optimal approach for managing project interdependencies” (p. 2).

In summary, a project is a temporary venture, focused on creating a unique product, service, or result; whereas a program is a collection of projects that need to be managed and coordinated together. A portfolio, on the other hand, is a collection of projects and programs that are managed as a group to achieve strategic goals and business value (Żurawiecki, 2022).

This FGP belongs to the project category, which supports the overall objectives and alignment of the business strategy of the company. Figure 8 illustrates the Portfolio, Program and Project Interfaces.

Figure 11 ***Portfolio, Program and Project Interfaces (Source: Monday.com, 2022, p.1)***



Note: Copied from website, *why creating a strategic plan is worth your time.* Monday.com, 2022. Copyright 2022 Monday.com. All rights reserved.

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

2.3.1 Current situation of the problem or opportunity in study

The Central Statistical Office of Saint Lucia (2022) reports that in 2020, the unemployment rate of youth was nine thousand eight hundred and forty-four (9844) and in 2022 (last reported April - June) the rates declined by 29.4%, seven thousand three hundred and twenty-one (7321) to be exact. The highest ratings appeared to be consistently recorded among the following age ranges: 20-24, 25-29 and 15-19 for periods 2018 - 2022.

The total unemployment rate in Castries city was 18.96 % and 17.92% in rural Castries. Of the mentioned ratings, 22.27 % were males and 16.97% were females from Castries city while 15.26% were males and 20.60 % were females from rural Castries. In 2018, the sea moss industry in Saint Lucia garnered popular interest as a sustainable livelihood (farming and production) due its value-added economic benefits and export potential worldwide (overused sentence/repetitive).

Based on information obtained from a telephone interview with the head of the Aquaculture Unit of the Department of Fisheries, at present, there are thirty (30) registered sea moss farmers in the Castries basin. Twenty-three (23) of which are males while seven (07) are females. To date, the Castries Fisheries Complex in Saint Lucia is not operational and there are no existing initiatives in the pipeline for its immediate recommissioning. The problem was investigated, and an extension to the existing structure currently housing the Castries Fisheries Complex was deemed ideal to support the construction of a solar- powered sea moss agro-processing plant.

This presents an opportunity to enhance national contributions to signed international agreements (SDGs 1,7,9,11,12), previous government investments and future local manufacturing potential and sustainable transformational development and livelihoods in the sea moss sector. As a solution, a project management plan for the construction of a solar-powered sea moss agro-processing plant is presented with the aspiration to be used as a template to guide all critical aspects of the project's life cycle for assured successful outcomes.

2.3.2 Previous research done for the topic in study.

Limited research has been done for this topic of study in Saint Lucia; however, some work has been done to support the operationalization of a sea moss processing plant in Praslin, Micoud, Saint Lucia. Caribbean Aqua-Terrestrial Solutions (article 20230) notes that "Praslin is situated in the area with the second highest level of poverty in Saint Lucia. Prior to the decline of the banana industry, the majority of the community members were either banana farmers or paid farm workers. Many of the farms were subsequently abandoned. Consequently, the level of unemployment has steadily increased significantly over the years. GIZ CATS supported the GEF Small Grants Program project in Praslin by financing solar energy equipment (25.000US$) for the sea moss processing plant to substitute fossil fuel usage, thus reducing its carbon footprint. The project aimed to grow and diversify a community sea moss enterprise, thereby converting it into a sustainable national industry with export capacity in the village of Praslin, Saint Lucia. In that way, it targeted poverty reduction in the community as well as environmental protection, including the biodiversity of the Praslin Bay".

The relevant lessons learned from the above-mentioned project can be used as an input for the FGP's project management plan.

2.3.3 Other theory related to the topic in study.

2.3.3.1 Sustainable Blue Economy

"Sustainable use of ocean resources as the basis for the development of economies has been on the international policy agenda since the Rio Conference in 1992. Chapter 17 of Agenda 21 (UN, 1992) is devoted to the protection of the ocean, seas, and coastal areas, as well as the protection, rational use, and development of their living resources. More recently, the Sustainable Development Goals (SDGs), adopted as part of the 2030 Agenda for Sustainable Development (UN, 2015), highlights in its Goal 14 "Life below water", the need to conserve and sustainably use the ocean, seas, and marine resources for sustainable development. In a broader context, the sustainable development of the ocean economy is linked to all the other SDGs, most notably Goal 1. No poverty, Goal 7. Affordable and clean energy, Goal 9. Industry, innovation and infrastructure, Goal 12. Responsible consumption and production, Goal 13. Climate action and Goal 15. Life on land.

In the policy context of Saint Lucia, in an article posted by OECS (2021n, p.1), it states "A National Ocean Policy (NOP) framework is being formulated for integrated marine planning and management of Saint Lucia's marine space and the activities that occur within it from 2020 until 2035. All relevant planning, authorization or enforcement decisions, or development of government policy, will take account of this NOP and the supporting Strategic Action Plan" (SAP).

On the same token, in the policy context of Trinidad and Tobago, while no formal document on the sustainable Blue Economy exists, the Vision 2030 National Development Strategy of Trinidad and Tobago 2016-2030 (Government of the Republic of Trinidad and Tobago, 2016) outlines five themes which are relevant for a sustainable Blue Economy: 1) Putting People First: Nurturing Our Greatest Asset, 2) Delivering Good Governance and Service Excellence, 3) Improving Productivity Through Quality Infrastructure and Transportation; 4) Plant Globally Competitive Businesses, 5) Placing the Environment at the Centre of Social and Economic Development" (UNESCO, 2021, p.9-10).

Furthermore, OECD (2017, p.8, 10,13) notes in a report entitled 'Improving energy efficiency in the agro-processing chain' that "Energy is crucial for economic growth and a critical component in the ability of the agro-food sector to improve productivity, competitiveness, and sustainability. Improving the efficiency of energy use – using less energy to provide the same level of output and service – is an important tool that policy makers can use to ensure a number of positive outcomes that can deliver several government priorities, from economic growth to greenhouse gas reduction to energy security and food security." Available empirical studies – mainly on EU countries and the United States – suggest that the food system accounts for as much as 20% of total energy use in some OECD countries. At the farm level, energy is consumed both directly – as fuel or electricity to power farm activities – and indirectly – in the form of fertilizers and chemicals produced off-farm.

In the OECD area, on average, direct energy use by agriculture represents only 2% of total energy consumption. Moreover, energy accounts for an important and highly variable share of food costs. Despite existing efforts, market failures, policy-induced market distortions, and financial, organizational, and behavioral barriers all combine to impede the private sector's energy-efficiency initiatives. Food businesses are calling for a clear, consistent, regulatory environment that supports energy-efficient gains, and within which the private sector can thrive.

Overall, OECD governments are becoming increasingly aware of the need to improve energy efficiency through addressing policy failures and by encouraging public-private partnerships. Increasing dependence on energy usage (mainly fossil fuels) throughout the entire food chain raises concerns about the impact of high or variable energy prices on production costs, competitiveness, the final price of food for the consumer, as well as concerns about energy security. In addition to these concerns, the use of energy in the food chain can also have environmental impacts, such as greenhouse gas (GHG) emissions. While progress has been made, the private and government sectors can do more to ensure that the full energy efficiency potential of the food system is materialized" (OECD (2017, p.8, 10,13).

Improving the efficiency of energy use – using less energy to provide the same level of output and service – is widely recognized by many governments around the world as the most cost-effective and readily available means to address numerous energy-related issues, including energy security, the social and economic impacts of high energy prices and concerns about climate change. (IEA, 2014a) 3 At the same time, energy efficiency increases business competitiveness and promotes consumer welfare.

Successful energy efficiency projects can bring multiple additional advantages which extend far beyond the reduction of energy bills or emissions. Several authors have found that technologies which increase energy efficiency can also bring improvements to the production process, such as lower operational and maintenance costs, increased production yield, open outlets in new food markets that require certification of sustainability or energy performance and safer working conditions, all of which increase the productivity, overall efficiency, and profitability of a firm (Worrell et al., 2001; IEA, 2014a; OECD, 2015b).

In addition, Caribbean News Editor (2022, p. 1) reports “The Food and Agriculture Organization of the United Nations (FAO) and the Ministry of the Blue and Green Economy, Agriculture and National Food Security of Dominica have collaborated to develop a sustainable and resilient sea moss industry in Dominica. This supports the promotion of sustainable and resilient value chains in the Caribbean and a blue transformation of aquatic food systems.

Improving Dominica’s sea moss value chain would also support efforts to reduce the Caribbean Community’s (CARICOM) food import bill by 25% by 2025 while maximizing the sector’s contribution to the country’s Gross Domestic Product (GDP) and contributing to the country’s attainment of the Sustainable Development Goals (SDGs). Most importantly, it will increase the revenues of sea moss farmers who are predominantly women. In addition, it will assist in improving production, the environment, and the quality of life for several Dominican families and communities, and it will ensure a more robust and sustainable sea moss value chain that supports social, environmental, and economic sustainability. This program is a component of the FAO Subregional Office for the Caribbean Value Chain Development Program and is aimed primarily at the sustainable development of resilient value chains and the implementation of the CARICOM COVID-19 Agri-Food Recovery Plan".

The above theories align with the research to support the FGP's study. It gives rise to more focus on sustainable development and regenerative aspects of the project management plan. Some of the conclusions derived from "Sustainable Project Management Under the Light of ESG Criteria: A Theoretical Approach" study also supports this notion. The aforementioned research states "Sustainability defines criteria for the proper use of resources and the assessment of outputs in terms of economic, social, and environmental impacts. The traditional project management approach allocates and exploits resources, seeking the optimal combination of time, cost, and quality performance to maximize stakeholder benefits. This approach does not consider wider social and environmental issues, which are the challenges of sustainability. In addition, there is often an assessment mismatch between project success and project management success that limits the actual integration of sustainability issues (Kyriakogkonas, P., 2022, p.10).

Sustainability, as a field of study, can offer project management various new perspectives, supporting project managers in making decisions about the planning, management and control of resources allocated to the project, considering economic, social, and environmental impacts not only during the life cycle of the project but also during the life cycle of the resulting products of the project. The aim would be to ensure that the decisions taken are in the best interest of the customers, but without harming society and the environment (Kyriakogkonas, P., 2022, p.10).

Projects are a means of effecting change, delivering new products and services. Projects and project management help our society achieve the Sustainable Development Goals. Sustainability in projects should not just be an afterthought but rather, one of the goals of the project. Thus, project management must consider sustainability as one of, if not the most important success factor (Kyriakogkonas, P., 2022, p.10).

2.3.3.2 Regenerative Development

Project management methodologies can be used in the implementation of regenerative development initiatives. The scope of regenerative development can be implemented through a holistic approach to the individual FGP context (Müller, E. (2017):

1) regeneration of functional landscapes, where we produce and conserve, maximizing ecosystem function.
2) social strengthening by community organization and development, to cope with adaptation to climate change and reduce sumptuous consumption patterns.
3) a new paradigm for economic development where people matter more than markets and money, measured according to the well-being of humans and all life forms.
4) conservation and valuation of living culture which is the necessary bond for community life, where local knowledge, values and traditions are shared within family, friends, and the community, giving meaning to these terms.

5) rethinking and redesigning current political structures so they reflect true participatory democracy without the influence of money and power and especially fostering long term vision and actions that seek increased livelihoods and happiness and not only gross income.
6) Most importantly, fostering deep spiritual and value structures based on ethics, transparency, and global well-being allows humanity to live in peace with itself and Mother Earth.

The Project Management Institute's Construction Extension to the PMBOK Guide is used to improve the efficiency and effectiveness of the management of this FGP using tools, techniques, procedures, processes, and lessons learned which are applicable to the construction industry. Therefore, by using the Construction Extension to the PMBOK Guide, the project's health, safety, security, environmental and financials can be strategically managed using construction-specific practices whilst adhering to regulations and jurisdictional requirements.

Adherence to regulations and jurisdictional (local, global, or industry-specific) requirements where the product will be constructed, for example, civic laws and building codes is pivotal. Improving the social, economic, and environmental factors of sustainability, reliability, and the welfare of the affected communities should also be at the core of the construction projects.

Often, when a construction project starts, complexity might not be immediately apparent. As such, before making commitments for the project's scope, time, quality, safety, and cost, the development team should carefully examine the project to understand the complexities of stakeholder impact and any potential project ambiguity (such as the possibility of emergent issues or situations due to feedback and characteristics of stakeholder interrelationships). Therefore, to reduce effects and increase chances of success, the analysis should incorporate risk management. If not, a project might have an unclear scope of work, use an inappropriate construction methodology, create an unclear environment, and fall short of its deadline and financial projections.

Moreover, as more emphasis is placed on constructability, sustainability, and reliability of both the finished product and the means and methods to get there, as well as improved project governance from beginning of the project in the engineering and design phase are one of the factors that lead to construction projects failing.

3 METHODOLOGICAL FRAMEWORK

3.1 Information sources

An information source is a person, thing, or place from which information comes, arises, or is obtained. Information can be obtained from primary sources or secondary sources (Suresh M., 2020).

3.1.1 Primary sources

Primary sources provide raw information and first-hand evidence in the form of interview transcripts, statistical data, and works of art and gives you direct access to the subject of your research. Limited primary sources of information were required to obtain the information necessary for this FGP (Streefkerk R., 2023, p.1).

3.1.2 Secondary sources

Secondary sources provide second-hand information and commentary from other researchers and may include journal articles, reviews, and academic books, which describe, interpret, or synthesize (a) primary source (s) (Streefkerk R., 2023, p.1). Chart 1 details the sources included in this FGP.

Chart 1.Information sources (Source: J. Husbands, January 2023)

Objectives	Information Sources	
	Primary	**Secondary**
1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the project manager to achieve project outcomes.	▪ Interviews with Mr. Lovence Hilton – Consultant, Sol-lucian, and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. ▪ Review of mandates, regulatory requirements from the NURC and LUCELEC. ▪ Reports and existing plans and designs for the Castries Fisheries Complex.	▪ PMBOK® Guide 7th edition (2021) ▪ Journal articles ▪ Web research ▪ Lecture presentation notes
2. To develop a scope management plan to ensure that the scope of the project is executed as planned to achieve the project objectives.	▪ Interviews with Mr. Lovence Hilton Consultant, Sol-lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. ▪ Email ▪ Lessons learned from similar projects.	▪ Lecture presentation notes ▪ Textbooks ▪ Journal Articles from the PMI ▪ Web research ▪ PMBOK® Guide 7th edition (2021)

Objectives	Information Sources	
	Primary	**Secondary**
3. To develop the schedule management plan to ensure that the project is completed on time.	▪ Interview with Mr. Carl Bruce, Project Manager ▪ Project charter ▪ Email ▪ Lessons learned from similar projects.	▪ PMBOK® Guide 7th edition (2021) ▪ Practice standard for scheduling 3rd edition (2019) ▪ Lecture presentation notes ▪ Textbooks ▪ Journal articles from the PMI ▪ Web research
4. To develop a cost management plan to ensure the project is completed within budget.	▪ Interviews with Mr. Lovence Hilton – Consultant, Sol-lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. ▪ Mr. James Hamilton-Quantity Surveyor. ▪ Email ▪ Lessons learned from similar projects.	▪ PMBOK® Guide 7th edition (2021) ▪ Practice Standard for project estimating, PMI (2019) ▪ The Standard for Earned Value Management, PMI (2019) ▪ Lecture presentation notes ▪ Textbooks ▪ Journal Articles from the PMI ▪ Web research

Objectives	Information Sources	
	Primary	Secondary
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.	▪ Interviews with Mr. Lovence Hilton – Consultant, Sol-lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. ▪ Lessons learned from similar projects	▪ PMBOK® Guide 7th edition (2021) ▪ Journal Articles.
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.	▪ Interviews with Mr. Carl Bruce-Project Manager & Mr. James Hamilton- Quantity Surveyor, ▪ Interviews ▪ Meetings ▪ Email ▪ Lessons learned register from similar projects.	▪ Articles from the PMI on resource management ▪ PMBOK® Guide 7th edition (2021)
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.	▪ Interview with Mr. Carl Bruce, Project Manager ▪ Articles from the PMI on risk management. ▪ Email ▪ Lessons learned register from similar projects.	▪ Articles from the PMI ▪ PMBOK® Guide 7th edition (2021) ▪ The Standard for Risk Management in Portfolios, Programs, and Projects (2019) ▪ Web research ▪ Journal articles

Objectives	Information Sources	
	Primary	**Secondary**
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at various stages of the process.	▪ Interview with Ms. Kay Marion, Procurement, Purchasing & Inventory Control Specialist ▪ Lessons learned register from similar projects. ▪ Email.	▪ Articles from the PMI on procurement management ▪ PMBOK® Guide 7th edition (2021) ▪ Web research ▪ Journal articles
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.	▪ Interview with Mr. Carl Bruce, Project Manager ▪ Email	▪ Articles from the PMI on stakeholder management. ▪ Journal articles ▪ Web research

Objectives	Information Sources	
	Primary	**Secondary**
10. To develop a communications management plan to organize and document the communication processes, the types of communication, and expectations of communication to internal and external stakeholders.	▪ Interviews with Mr. Carl Bruce- Project Manager, ▪ Email ▪ Lessons learned from similar projects.	▪ Articles from the PMI on communications management ▪ Journal articles ▪ Web research ▪ PMBOK® Guide 7th edition

3.2 Research Methods

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis, to uncover new information or create better understanding of a topic (University of Newcastle Library guides, 2020).

3.2.1 Analytical Method

Analytical research is a specific type of research that involves critical thinking skills and the evaluation of facts and information relative to the research being conducted. From analytical research, a person finds out critical details to add new ideas to the material being produced (Sharma T., 2017).

3.2.2 Qualitative Research Method

Qualitative research involves collecting and analyzing non-numerical data (e.g., text, video, or audio) to explicitly deduce concepts, opinions, experiences, and in-depth insights into a problem, or to generate new ideas which can be compiled for research. It is the opposite of quantitative research, which involves collecting and analyzing numerical data for statistical analysis (Bhandari, P., 2023).

Chart 2 Research Methods (Source: J. Husbands, January 2023)

Objectives	Research Methods	
	Qualitative	Mixed Method
1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the project manager to achieve project outcomes.	▪ Available information from the PMBOK® Guide 6th and 7th edition, were used to make decisions is used in the elaboration of the project charter.	▪ Gathered information from the experts and historical data, etc.
2. To develop a scope management plan to ensure that the scope of the project is executed as planned to achieve the project objectives.	▪ Available data and information from primary and secondary sources were used to accurately elaborate scope baseline.	▪ An application of the deductive approach, gathering general data (primary and secondary) and obtaining a specific solution to the proposed hypothesis in terms of requirements for the

Objectives	Research Methods	
	Qualitative	Mixed Method
		specific scope of work required.
3. To develop the schedule management plan to ensure that the project is completed on time.	▪ Available information from the secondary sources was used to make evaluations and decisions used in the elaboration of this plan.	▪ Gathered information from the experts and historical data which were used to sequence activities, estimate activity durations, and develop the schedule.
4. To develop a cost management plan to ensure the project is completed within budget.	▪ Available information from the PMBOK® Guide 6th and 7th edition, as well as data from other similar projects were evaluated and used to make decisions for the cost management plan.	▪ The qualitative method, employing the deductive approach was used to gather information pertaining to the budget of the FGP to plan the project cost.
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.	▪ Facts and information were used from various sources to determine the quality management plan that meets the international standards and the	▪ Valid data, collected using the appropriate data collection tools, was analyzed, and used to determine the required quality of the project.

Objectives	Research Methods	
	Qualitative	Mixed Method
	requirements of the stakeholders.	
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.	▪ Facts and information from the PMBOK® Guide (edition 6 and 7) such as tools and techniques, primary data from the previous sections such as the WBS, were used in the creation of the components of the resource management plan.	▪ Valid data collected using the appropriate data collection tools will be analyzed and used to determine the resources required to carry out the project.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.	▪ Literature on effective communication including tools and techniques from PMBOK® Guide were used for the analytical approach in the development of the communication management plan.	▪ Valid data, collected using the appropriate data collection tools, will be analyzed and used to determine the appropriate communication models, methods, and technologies for the effective flow of information.

Objectives	Research Methods	
	Qualitative	Mixed Method
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at various stages of the process.	▪ Facts and information from reliable sources were assessed and used in the identification, categorization, and planning of risk responses.	▪ Qualitative method was used in the risk management plan by gathering opinions and experiences from experts and using appropriate tools to analyze risk, and plan risk responses.
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.	▪ Historical information from project documents was used in the preparation of statements of work, as well as in the assessment of market conditions which can impact procurements.	▪ Valid data collected using the appropriate data collection tools were analyzed and used to identify reliable sellers.

Objectives	Research Methods	
	Qualitative	Mixed Method
10. To develop a communications management plan to organize and document the communication processes, the types of communication, and expectations of communication to internal and external stakeholders.	▪ Available information from the PMBOK® Guide 6th and 7th edition, journal articles, and other sources were used to make decisions in the identification and engagement strategies elaborated in the stakeholder management plan.	▪ Data was collected using secondary resources to develop plan stakeholder engagement.

3.3 Tools

Project management tools are used by project teams to plan, track, and manage projects to achieve project goals within schedule (Zoho Projects, 2023). In addition, a data collection tool or research tool is any tool used to measure a variable, or to collect the information needed to answer a research question (CIKD, 2019). The tools used to gather information on each objective are listed in chart 3.

Chart 3 Tools (Source: J. Husbands, January 2023)

Objectives	Tools
1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals, ▪ Charter template

Objectives	Tools
project manager to achieve project outcomes.	
2. To develop a scope management plan to ensure that the scope of the project is executed as planned to achieve the project objectives.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals ▪ Observation ▪ Work breakdown structure template ▪ Work breakdown structure dictionary template.
3. To develop the schedule management plan to ensure that the project is completed on time.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals ▪ Microsoft Project ▪ WBS Schedule Pro
4. To develop a cost management plan to ensure the project is completed within budget.	▪ Interviews ▪ Expert judgement ▪ Tools for data analysis: Microsoft excel, Microsoft project.
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals ▪ Check list. ▪ Benchmarking ▪ Cost benefit analysis.

Objectives	Tools
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals ▪ Hierarchical charts ▪ Bottom-up estimating.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at various stages of the process.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals ▪ P x I template ▪ Risk register template.
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals
10. To develop a communications management plan to organize and document the communication processes, the types of communication, and expectations of communication to internal and external stakeholders.	▪ Microsoft Word & Excel ▪ Expert judgement ▪ Journals

3.4 Assumptions and Constraints

PMI (2021) defines an assumption as “a factor in the planning process that is considered to be true, real or certain, without proof or demonstration” (p.174). Knowledge of the assumptions for any project is of paramount importance, and according to William M. (2022), “an assumption in project management can be an event or circumstance that one expects to happen over the life cycle of the project. The more reasonable those assumptions, the better the project.”

A constraint is defined as a “limiting factor that affects the execution of a project, program, portfolio, or process” (PMI, 2021, p. 174). In this FGP, the identification of assumptions and constraints will be displayed alongside each objective.

Chart 4 Assumptions and Constraints (Source: J. Husbands, January 2023)

Objectives	Assumptions	Constraints
1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the project manager to achieve project outcomes.	▪ The charter will be correctly developed within the allotted time.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.
2. To develop a scope management plan to ensure that the scope of the project is executed as	▪ Experts will be willing to provide expert judgement and guidance.	▪ There is a lack of historical data as this is the first project of its

Objectives	Assumptions	Constraints
planned to achieve the project objectives.	▪ Timely feedback will be given by the tutor for timely completion of the plan.	kind undertaken by the organization.
3. To develop the schedule management plan to ensure that the project is completed on time.	▪ The researcher will have all the resources and tools needed to adequately create the schedule management plan.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization. ▪ The project is operating within a fixed timeframe or deadline, and as such the project team must complete all tasks and deliverables within the designated time frame.
4. To develop a cost management plan to ensure the project is completed within budget.	▪ Expert judgement will be readily accessible to the researcher for compiling the plan. ▪ The "3%" contingency or "5%" management reserve is assumed based on previous project experience or historical information.	▪ The researcher must gather information after work hours, and this may pose schedule constraints for the FGP. Thus, the project team needs to manage resources efficiently to deliver the required

Objectives	Assumptions	Constraints
		outcomes within the allocated budget.
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.	▪ Expert judgement is available for gathering information for the plan.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.	▪ The researcher will be able to complete the resource management plan within the specified time frame.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.	▪ Expert judgement and other information to develop the plan will be readily available.	▪ The organization lacks historical data on risk identification.
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization's expectations for input at	▪ Expert judgement and other information to develop the procurement plan will be readily available.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.

Objectives	Assumptions	Constraints
various stages of the process.		
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.	▪ Artifacts, journals, and expert judgement will be readily available.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.
10. To develop a communications management plan to organize and document the communication processes, the types of communication, and expectations of communication to internal and external stakeholders.	▪ Minutes of meetings are readily available to the researcher to determine accurately the communication needs of the stakeholders.	▪ There is a lack of historical data as this is the first project of its kind undertaken by the organization.

3.5 Deliverables

A deliverable is often defined as “an interim or final product, service or result from a project or initiative and is essentially the outcome the project was undertaken to create” (PMI, 2021, p.82). The major deliverable of this project is a project management plan for the construction of a solar-powered sea moss agro-processing plant. The deliverable for each of the objectives of this project is identified in chart 5.

Chart 5 Deliverables (Source: J. Husbands, January 2023)

Objectives	Tools
1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the project manager to achieve project outcomes.	▪ A project charter which validates the existence of the project and provides the project manager with the authority to carry out the project.
2. To develop a scope management plan to ensure that the scope of the project is executed as planned to achieve the project objectives.	▪ A scope management plan which includes the requirements traceability matrix. WBS, WBS dictionary, scope statement.
3. To develop the schedule management plan to ensure that the project is completed on time.	▪ A schedule management plan which includes the activity list, sequence of activities, activity durations, schedule model, schedule baseline.
4. To develop a cost management plan to ensure the project is completed within budget.	▪ A cost management plan which includes the cost baseline, an estimate of costs and the project budget.
5. To develop a quality management plan to ensure that the project is in compliance with and meets project quality standards.	▪ A quality management plan that ensures quality in relation to requirements is an integral part of the project, and how it is managed and controlled.

Objectives	Tools
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.	▪ A resource management plan that ensures all project resources are efficiently allocated, managed, and controlled for the successful completion of the project within the required scope, time, and quality.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.	▪ A risk management plan that includes the identification of risks, qualitative analysis of those risks, and the associated risk responses.
8. To develop a procurement management plan to ensure that project planning stays on track and within budget while ensuring that stakeholders know the procuring organization’s expectations for input at various stages of the process.	▪ A procurement management plan that includes procurement activities, stays on track and is monitored and controlled to ensure that project planning stays on track and within budget while ensuring stakeholders know the procuring organization’s expectations for input at various stages of the process.
9. To develop a stakeholder management plan to ensure that stakeholders are effectively involved in project decisions and execution.	▪ A stakeholder management plan that includes the identification of stakeholders and the development of approaches to effectively engage them based on their needs, expectations, interests, and the impact they may have on the execution of the project.

Objectives	Tools
10. To develop a communications management plan to organize and document the communication processes, the types of communication, and expectations of communication to internal and external stakeholders.	▪ A communications management plan that includes the formulation of an appropriate approach and plan for stakeholders, and project needs.

4 RESULTS

4.1 Project Charter

PMI (2021, p.184)) states that a project charter “is a document issued by the project initiator or sponsor that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities.” The project charter is the first step in the integration management for development of a project management plan for the project.

For this FGP, through information gathered from interviews, this project charter formally grants Ms. Jasmine Hutchinson, Managing Director and Founder of JH Management & Consultancy Services, the authority to apply organizational resources, as the principal consultant to the project, to produce the project management plan for the development of “A Project Management Plan for the Construction of a Solar-Powered Sea Moss Agro-Processing Plant at the Castries Fisheries Complex in Saint Lucia”.

Chart 6 Project Charter (Source: J. Husbands, June 2023)

PROJECT CHARTER
Project Name
A Project Management Plan for the construction of a Solar-Powered Sea Moss Agro-Processing Plant at The Castries Fisheries Complex in Saint Lucia
Project Purpose/Justification
McKnight (2020) asserts that “Solar energy for agro-processing plants helps to provide a reliable electricity supply in order to meet demand at peak processing times and hedge against volatile electricity prices.” As such, to increase value-added economic benefits from the sustainability of an agro-processing sea moss plant in Castries, efficiencies in utility costs and support of sustainable livelihoods in the sea moss sector, JH Consultancy and Management Services will develop a project management plan for the construction of

a solar-powered sea moss agro-processing facility at the Castries Fisheries Complex in Saint Lucia. The company will cover all critical aspects of the project for strategic coordination and guidance on project execution within the Project Management Institute requirements on integration, scope, time, cost, quality, resources, communication, risk, procurement, and stakeholder management plans.

Business Objectives

The following business objectives have been established to develop a project management plan for the construction of a solar-powered sea moss agro-processing plant, as an extension to the existing infrastructure at the Castries Fisheries Complex in Saint Lucia, within requirements of the Project Management Institute standards and guidelines:

1 To determine the feasibility and impact through a site environmental social impact survey for a solar powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia to determine whether the project should be considered.

2 To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.

3 To clear and prepare project site and structural steel as built in drawings for construction.

4 To complete seamoss agro-processing plant at the Castries Fisheries Complex in Saint Lucia of the highest quality possible within scope, budget, schedule, and customer requirements.

5 To hand over the completed solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia to the customer, signaling the close of the project.

Project Description

Stakeholders

JH Management & Consultancy Services

- Managing Director and Founder
- Office Administrator
- Office Assistant
- Accounts and Finance Specialists

- Marketing and Communications Specialists
- Procurement, Purchasing & Inventory Control Specialists
- Project Managers
- Architect
- Quantity Surveyor
- Construction, Mechanical and Structural Engineers
- Renewable Energy & Solar PV Specialist

Subcontractors:

- Rayneau Construction & Industrial Products
- Sol-Lucian
- ECMC
- ESBI

Government Agencies:

- Fisheries Department - Ministry of Agriculture, Fisheries, Food Security and Rural Development
- Ministry of Sustainable Development, Energy Science and Technology
- Ministry of Infrastructure, Port Services and Transport
- Ministry of Finance, Economic Development, and the Youth Economy
- Ministry of Health, Wellness and Elderly Affairs

Private Sector & Regulatory Bodies:

- Saint Lucia Electricity Services Limited (LUCELEC)
- National Utility Regulatory Commission (NURC)
- Export Saint Lucia
- Saint Lucia National Conservation Fund (SLUNF)
- Rubis Caribbean
- Saint Lucia National Association of Fisherman/'s Co-operative Ltd.
- Saint Lucia Air and Sea Ports Authority (SLASPA)
- Saint Lucia Bureau of Standards

Residents of Castries

Sea moss farmers in Castries

Fishermen Motorists Boat and cruise ship operators Donor Agencies ▪ Caribbean Development Bank (CDB) ▪ The World Bank Organization (World Bank) ▪ Global Environment Facility- Small Grants Program – United Nations Development Program (GEF SGP UNDP Saint Lucia)
Measurable Project Objectives and Success Criteria
Requirements
▪ The solar-powered sea moss agro-processing plant is to be constructed within smart quality requirements to withstand natural disasters inclusive of flooding, and hurricanes stronger than category 5. ▪ The solar-powered sea moss agro-processing plant is to be constructed within quality requirements to withstand earthquakes stronger than 7 on the Richter Scale. ▪ The solar-powered sea moss agro-processing plant is to be constructed so that all concrete block walls and concrete floors are reinforced with steel. ▪ The solar-powered sea moss agro-processing plant is to be constructed so that there is adequate lighting and fresh air ventilation for the people occupying the plant. ▪ The solar-powered sea moss agro-processing plant is to be constructed with adequate security, safety equipment and signage, as well as emergency exits. ▪ The solar-powered sea moss agro-processing plant is to be constructed so that there is a fire suppression system installed. ▪ The solar-powered sea moss agro-processing plant is to be constructed within scope, occupational health, and safety requirements to accommodate persons with disabilities/ handicapped persons. ▪ The solar-powered sea moss agro-processing plant is to be constructed within solar PV with battery storage which meets industry and scope requirements.

▪ The solar-powered sea moss agro-processing plant is to be constructed within occupational health and safety requirements and industry best practices for a sea moss agro-processing plant. ▪ The solar-powered sea moss agro-processing plant is to be constructed within procurement and resource requirements.
Constraints
▪ The project should not exceed three million, two hundred and fifty-five thousand (3,255,000.00) Eastern Caribbean dollars. ▪ The project duration should not exceed 24 months.
Assumptions
▪ It is assumed that sufficient skilled workers will be available for the duration of the project. ▪ It is assumed that all social and environmental impact assessments and approvals necessary to begin construction will be approved by all regulatory agencies. ▪ It is assumed that no national disaster and/or state of emergencies resulting in national shutdowns will occur for the duration of the project. ▪ It is assumed that the customer is sufficiently funded to sponsor the entire project and timely disbursements will be made to execute project deliverables. ▪ It is assumed that the sponsor and JH Consultancy & Management Services will be responsive to all queries for good governance and strategic management of the project. ▪ It is assumed that resources are within cost requirements for the construction of the solar-powered agro-processing plant.
Preliminary Scope
The preliminary project scope is as follows: a. **Foundation** – see scope management plan for specifications. b. **Ground Floor** – see scope management plan for specifications. c. **Roof** – see scope management plan for specifications. d. **Equipment Procurement and Installation** – see scope management plan for specifications.

e. **Furniture Procurement and Installation** – see scope management plan for specifications	
Risks	
▪ If there are natural disasters (e.g., hurricanes) occurring during construction, then the project schedule may be delayed, project material may be damaged, and procurement may also be delayed. ▪ If workers are injured on the job site, then this may delay the project schedule and more human resources will have to be found to replace the injured workers. ▪ If there are shortages or delays in shipment of the necessary materials, tools and equipment then the project schedule will be delayed, perhaps warranting replanning or the consideration of viable alternatives. ▪ If equipment malfunctions during construction, they will have to be replaced, which may delay the project schedule. ▪ If errors are made during material fabrication, the project schedule will be delayed as time would be wasted waiting for the correct material(s) to arrive. ▪ If materials are damaged during shipment, the project schedule may be delayed as it would be necessary to order new materials. ▪ If materials are damaged on-site, they would need to be replaced, which would result in an increase in project costs. ▪ If the cost of materials increases during construction, the project budget will have to be adjusted accordingly. ▪ Delayed engagement of key resources on the project may result in schedule creep. ▪ If concrete fails compression testing, the areas already built with that concrete will have to be redone, causing a delay in the project schedule and an increase in project costs. ▪ If the customer changes project requirements during construction, there will be a delay in the project schedule and an increase in project costs as more work would need to be done than previously agreed upon. ▪ Limited stakeholders buy-in due to misalignment to existing strategy and work programs.	

- Poor quality implementation by sub-contractor which does not meet customer requirements may result in scope creep.

Project Deliverables

1. Feasibility report & environmental social impact assessment
2. Solar powered sea moss agro-processing plant design
3. Cleared project site and structural steel as built drawings.
4. Completed solar-powered sea moss agro-processing plant.
5. Completed plant handover.

Summary Milestone Schedule

Milestone	End Date
1. Project initiation/Kick-off	June 30, 2023
2. Completion of Feasibility report & environmental social impact assessment	August 30, 2023
3. Solar powered sea moss agro-processing plant design	September 30, 2023
4. Cleared project site and structural steel as built drawings	October 15, 2023
5. Ground-breaking ceremony	October 31, 2023
6. Construction of the sea moss agro-processing plant	October 31, 2024
7. Installation of solar-powered system with battery storage and charge controllers	October 31, 2024
8. Permit Approvals and Grid Interconnection	Dec 31, 2024
9. Plant handover	June 30, 2025

Project Budget

Item	Costs
Salaries	1,257,904.02
Construction and Administration	$1,555,644.43
Vendors	$150,000.00
Permits	$50,000.00
Contingency (3%)	$51,169.33
Management Reserve (5%)	$85,282.22
Grand Total	**$3,150,000.00**

Project Approval	
To gain project approval, the solar-powered sea moss agro-processing plant must be delivered by June 30, 2025, with all the details agreed upon in the project scope. **Project Manager** Mr. Carl Bruce, Project Manager and Ms. Jasmine Hutchinson, Managing Director and Founder of JH Management & Consultancy Services are the principal consultants and project managers for this project and work meticulously to support the coordination and overall planning, implementation, and closure of the project according to scope, quality, budget, resource, risk schedule, customer, regulatory and construction requirements.	
Authorization	
Approved by:	**Date:**

4.1.1 Project Management Plan

The second step in integration management, the development of a project management plan for the project, considers the following processes: change control, lessons learned and project closure.

4.1.1.1 Change Control Process

PMI (2021, p.236) states that change control "is a process whereby modifications to documents, deliverables or baselines associated with the project are identified, documented, approved, or rejected. If any changes to the project scope must be made, then this process will be completed through integrated change control via the change control board, "a chartered group responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, and for recording and communicating such decisions." Thus, the project change control process is as follows:

a. Any member of the project team or any stakeholder may make a request for a change, and this is done by completing a change order request.

b. The member should submit the “change order request” to the principal consultant, JH Consultancy & Management Services.

c. The principal consultant, JH Consultancy and Management Services will review the “change order request” and will decide whether to approve it or not.

d. If the principal consultant, JH Consultancy and Management Services accepts it, he will then present it to Project Manager Mr. Carl Bruce - JH Consultancy and Management Services and the project sponsor.

e. If the change order is accepted by Mr. Carl Bruce, project manager and project sponsor, then the change order will be formally accepted and signed by both parties.

f. The principal consultant, JH Consultancy and Management Services will update all project documents and communicate the change to all project team members and stakeholders through a change directive.

4.1.1.2 Lessons Learned

PMI (2017, p. 242) defines the lessons learned as “The knowledge gained during a project, which shows how project events were addressed or should be addressed in the future, for the purpose of improving future performance. A lessons learned register is used to document and record knowledge gained during a project, phase, or iteration so that it can be used to improve future performance for the team and the organization.” The documentation of the lessons learned will consider the following process:

a. Retrospective meetings will be held at the end of each project phase, allowing for in-depth analysis of all completed work, examining the processes involved in the execution of each task.

b. Identified comments, recommendations and actions which could be valuable for future projects, as well as challenges, problems, realized risks and opportunities will all be documented as well as their respective impacts.

c. Based on this, appropriate actions will be taken to minimize or neutralize any negative impact, as well as to increase the likelihood of a positive impact.

d. In the meantime, the document should also be stored in a repository so that it can be readily retrieved and used in the implementation of existing and/or future projects.

A template of how to document the lessons learned is shown in Appendix 6.

4.1.1.3 Project Closure

PMI (2021, p. 237) posits that project closure is “Those processes performed to formally complete or close a project phase or contract.” Therefore, once the project has been completed, the principal consultant will go through all the closing processes to formally close the solar-powered sea moss agro-processing plant project. The following activities will be undertaken to ensure the successful closure of this project:

a. The principal consultant, the project manager, and the project sponsor will carry out a final inspection of the plant to confirm that all agreed work has been completed to an acceptable standard.

b. If there are any notes from the inspection, the principal consultant will complete these punch list items and reschedule another final inspection, as well as provide close out documentation and reports.

c. Once all work has been approved, the project sponsor will complete the deliverable acceptance form and it will be signed by the project sponsor, the principal consultant, and the project manager.

d. The keys to the plant will then be handed over to the project sponsor.

4.2 Scope Management Plan

PMI (2021, p. 249) states that a scope management plan is a "component of the project or program management plan that describes how the scope will be defined, developed, monitored, controlled, and validated." In this plan, the roles and responsibilities of the project team as it relates to the project scope, scope definition, verification, change control measures, and the work breakdown structure will be defined.

4.2.1 Roles and Responsibilities

The project team will all play key roles in managing the scope of the project. Chart 7 defines the roles and responsibilities of the project team for the scope management of this project.

Chart 7 Roles and Responsibilities (Source: J. Husbands, June 2023)

Name	Role	Responsibilities
Fisheries Department	Project Sponsor	• Approve or deny change order requests. • Accept or decline project deliverables. • Propose scope changes.
Jasmine Hutchinson	Director, founder, and principal consultant - JH Consultancy and Management Services	• Verify project scope. • Evaluate change order requests. • Evaluate impact of scope changes. • Organize change control meetings. • Communicate change directives. • Update project documents upon approval of change order requests. • Propose scope changes.

Name	Role	Responsibilities
Carlos Bruce Bella St. Rose	Project manager, - JH Consultancy and Management Services	• Evaluate change order requests. • Propose scope changes.
Stephen Booker Bill Ferguson Jim Carter Kay Marion Morris Charles Gary Gamble Ian Cotter Phil Lo Sharon Gabriel Bethany Joseph Kate Son Sky Yarde Denver Jackson	▪ Engineers - mechanical, electrical, structural, construction & maintenance ▪ Procurement, Purchasing & Inventory Control Specialists ▪ Architect, ▪ Quantity Surveyor, ▪ Renewable Energy & Solar PV Specialist ▪ Office Administrator ▪ Office Assistant ▪ Accounting and Finance Specialist ▪ Marketing and Communications Specialists	• Participate in change control meetings. • Communicate change control requests to the project managers. • Propose scope changes.

Name	Role	Responsibilities
Stakeholders	Subcontractors and Site Workers Sea moss Farmers	• Propose scope changes. • Execute change directives. • Propose scope changes for maximum benefits to be derived from the plant.

4.2.2 Scope Management Approach

The director, founder and principal consultant of JH Consultancy and Management Services will be the advocate or owner for scope management. Proposed changes to the scope can be made by any member of the project team or any of the stakeholders as described in section 4.1.1.1 Change Control Process.

The scope statement, work breakdown structure (WBS), and work breakdown structure dictionary are what define the scope for this project. Requirements become the foundation of the WBS, cost, schedule, quality planning, and procurement (PMI, 2017, p. 140). The project's requirements are detailed below.

Chart 8 Requirements (Source: J. Husbands, June 2023)

Customer Needs	Deliverable	Functional Requirements	Technical Requirements	Priority	Raised by
Use existing property.	Solar powered sea moss agro-processing plant design	Quantity Surveyor to provide boundary drawing to architect, principal consultant, and project sponsor.	Plant must be within property boundaries.	High	Project sponsor
Plant laid out to efficiently use available property area (3,616.40 sq. ft.)	Solar powered sea moss agro-processing plant design	Use boundary drawing to design and produce architectural site plan.	Site plan to indicate proposed location of plant on site area.	High	Project sponsor
Plant must be constructed with materials which support structural integrity and standards for a high quality solar-powered sea moss agro-processing plant (3,616.40 sq. ft.)	Completed solar-powered seamoss agro-processing plant	Send out invitations to tender for the construction of the solar-powered sea moss agro-processing plant	Construction materials, tools and equipment required by structural design.	High	Procurement, purchasing & inventory control specialist

Customer Needs	Deliverable	Functional Requirements	Technical Requirements	Priority	Raised by
Plant must be structurally sound.	Feasibility report environmental social impact assessment	Consultation and approval should be done by a registered professional structural and construction engineer.	Plant should adhere to local plant codes and industry standards solar PV and battery storage standards.	High	Project sponsor
Plant must have electricity.	Feasibility report environmental social impact assessment	Consultation and approval should be done by a registered professional electrical engineer.	All electrical design should be based on the expected electrical load, based on equipment and use of the plant.	High	Project sponsor
Plant must have running water.	Feasibility report environmental social impact assessment	Consultation and approval should be done by a registered professional mechanical engineer.	All plumbing should be designed based on the plant use for supply, waste, and ventilation.	High	Project sponsor

Customer Needs	Deliverable	Functional Requirements	Technical Requirements	Priority	Raised by
Plant must have wastewater treatment capabilities.	Feasibility report environmental social impact assessment	Consultation and approval should be done by a registered professional environmental engineer.	Wastewater treatment should be designed based on expected load from plant.	High	Local plant code
Plant must be adequately sized to allow for plant machinery.	Solar powered sea moss agro-processing plant design	Architect to design plant based on equipment necessary based on industry standards.	Plant should have enough room for equipment installation and maintenance.	High	Industry standard
Plant must have access and facilities for handicapped.	Solar powered sea moss agro-processing plant design	Architect to design plant to accommodate differently abled persons.	Having a disability should not stop you from accessing and operating comfortably in the plant.	High	Project sponsor
The processing plant must have adequate security and fire equipment, as well as emergency exits.	Solar powered sea moss agro-processing plant design	Architect to design plant to support occupational health, safety, and security standards.	Plant should be safe to work to minimize occupational hazards	High	Project sponsor

4.2.2.1 Requirements Traceability Matrix

The requirements traceability matrix provides a means to track requirements throughout the project life cycle and a structure for managing changes to the product scope (PMI, 2017, p.148). The requirements traceability matrix is depicted in the following chart.

Chart 9 Requirements Traceability Matrix (Source: J. Husbands, June 2023)

Customer Needs	Functional Requirements	Technical Requirements	Priority	Project Objective	WBS ID	Work package
Use existing property.	Quantity surveyor to provide boundary drawing to architect and project sponsor.	Plant must be within property boundaries.	High	To determine the feasibility and impact through a site survey for a solar powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia to determine whether the project should be considered.	2.1.3	Architectural design
Plant laid out to efficiently use available property area.	Use boundary drawing to design and produce architectural site plan.	Site plan to indicate proposed location of plant on site area.	High	To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.	2.1.3	Architectural design

Customer Needs	Functional Requirements	Technical Requirements	Priority	Project Objective	WBS ID	Work package
Plant must be constructed with materials to support structural integrity and standards for a high quality solar-powered sea moss agro-processing plant.	Send out invitations to tender to construct solar-powered sea moss agro-processing plant	Construction materials, tools and equipment required by structural design.	High	To clear and prepare project site and structural steel as built in drawings for construction.	2.1.8	Site preparation for commencement of construction
Plant must be structurally sound.	Consultation and approval should be done by a registered professional structural and construction engineer.	Plant should adhere to local plant codes and industry standards solar PV and battery storage standards.	High	To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.	2.1.8	Architectural design

Customer Needs	Functional Requirements	Technical Requirements	Priority	Project Objective	WBS ID	Work package
Plant must have electricity.	Consultation and approval should be done by a registered professional electrical engineer.	All electrical design should be based on the expected electrical load, based on equipment and use of the plant.	High	To complete seamoss agro-processing plant at the Castries Fisheries Complex in Saint Lucia of the highest quality possible within scope, budget, schedule, and customer requirements.	4.1.6	Architectural design
Plant must have running water.	Consultation and approval should be done by a registered professional mechanical engineer.	All plumbing should be designed based on the plant use for supply, waste, and ventilation.	High	To complete seamoss agro-processing plant at the Castries Fisheries Complex in Saint Lucia of the highest quality possible within scope, budget, schedule, and customer requirements.	4.1.7	Architectural design.
Plant must have wastewater treatment capabilities.	Consultation and approval should be done by a registered professional environmental engineer.	Wastewater treatment should be designed based on expected load from plant.	High	To complete seamoss agro-processing plant at the Castries Fisheries Complex in Saint Lucia of the highest quality possible within scope, budget, schedule, and customer requirements.	4.1.7	Architectural design

Customer Needs	Functional Requirements	Technical Requirements	Priority	Project Objective	WBS ID	Work package
Plant must be adequately sized to allow for plant machinery.	Architect to design plant based on equipment necessary, based on industry standards.	Plant should have enough room for equipment installation and maintenance.	High	To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.	2.1.6	Architectural drawings
Plant must have access and facilities for handicapped persons.	Architect to design plant to accommodate differently abled persons.	Having a disability should not prevent you from accessing and operating comfortably in the plant.	High	To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.	2.1.6	Architectural drawings
Plant must have adequate security and fire equipment, as well as emergency exits.	Architect to design plant to support occupational health, safety, and security standards.	Plant should be safe to work to minimize occupational hazards	High	To design a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex in Saint Lucia that is well prepared for construction and to verify that the structural materials for the plant are designed and manufactured to the specifications necessary to ensure safety and high-quality standards.	2.1.6	Architectural drawings

4.2.3 Scope Definition

The scope for this project was defined through a comprehensive requirements collection process.

This process began with a thorough analysis of the owner's objectives, plant codes, and documentation relative to industry standards. Secondly, the input from the architect, design engineer, and fabricators was also analyzed. The principal consultant and project managers of JH Consultancy & Management Services developed the requirements management plan, requirements documentation, and requirements traceability matrix for the plant specifications.

4.2.4 Project Scope Statement

The scope statement contains only the work that should be performed. Any work outside of the scope statement should not be performed. The following chart details the project scope statement.

Chart 10 Project Scope Statement (Source: J Husbands, June 2023)

Project Name
A Project Management Plan for the Construction of a Solar-Powered Sea Moss Agro-processing Plant at the Castries Fisheries Market.
Product Scope Description
The product of this endeavor is the construction of a solar-powered sea moss agro-processing plant at the Castries Fisheries Market. This project is being undertaken by JH Management and Consultancy Services as a means of expanding their business portfolio and enhances national contributions to signed international agreements (SDG1, 7, 9,11,12). The sea moss agro-processing plant will allow the Fisheries Department to produce more value-added sea moss products locally to improve the export potential of the sea moss, support previous government investments and future local manufacturing potential, sustainable transformational development, and livelihoods in the sea moss sector in the Castries basin.

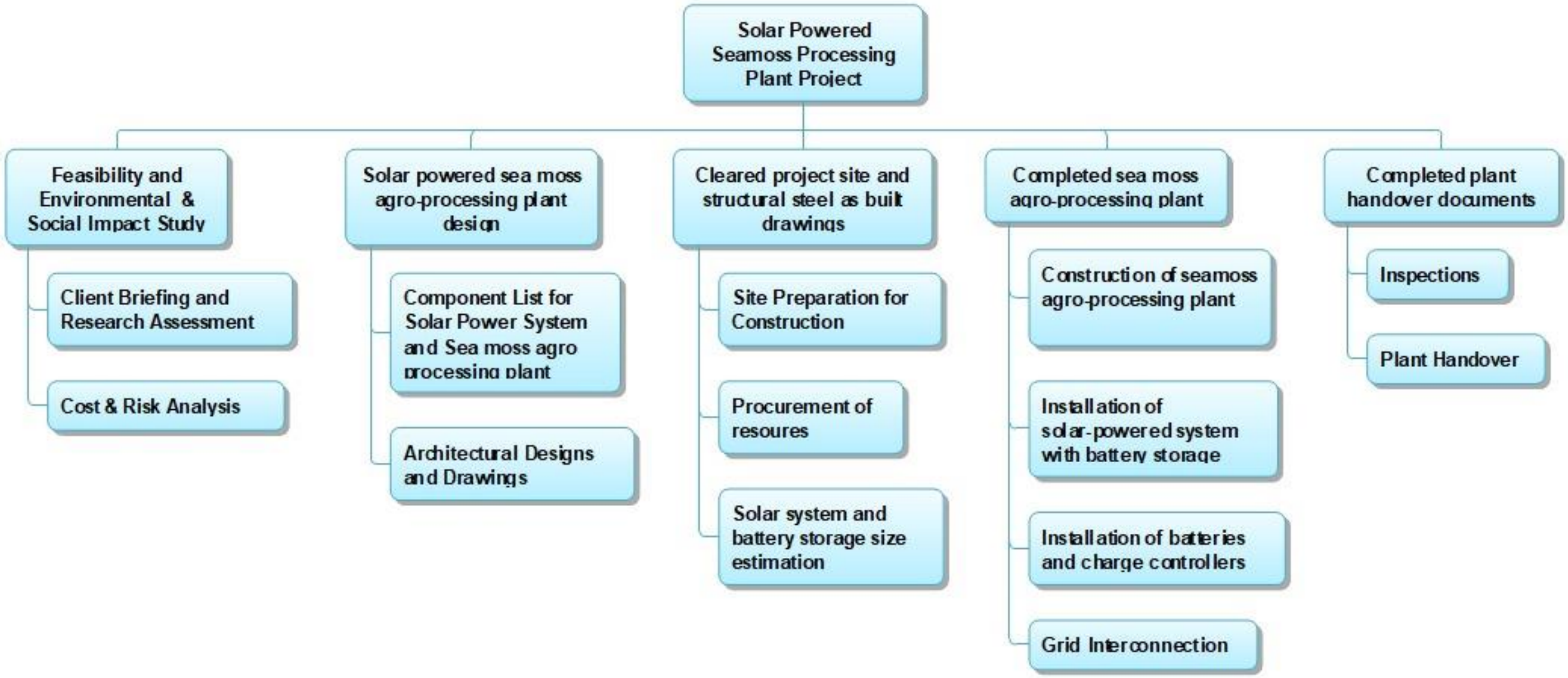
Project Deliverables	
Feasibility report and environmental social impact assessment	▪ Typed in size 12 font with 1.5 spacing and justified.
Solar powered sea moss agro-processing plant design	▪ Foundation – All columns and deep strip footing will be constructed using reinforced bars and ready-mix concrete. The steel columns are to be erected once the foundation is complete and the inside of the plant has been filled and compacted to the required level with 4-inch marl. ▪ Ground floor – The finished floor height will be 150 meters with the manufacturing equipment and solar power battery storage rooms having a finished floor height of 92.20 meters from sea level. ▪ Roof – Fabricator to provide structural steel for rafters, as well as framing, purlins, and sheeting. Figure 4 shows the roof framing for the solar-powered sea moss agro-processing plant.
Cleared project site and structural steel as built in drawings	▪ Saved as a dwg file as well as a pdf.
Completed sea moss agro-processing plant	▪ Compliance with the design, construction, and equipment standards ▪ The plant will be composed of a steel structure with reinforced concrete foundation and floors with reinforced concrete block walls.
Completed plant handover documents	▪ Typed in size 12 font with 1.5 spacing and justified. ▪ Saved as a dwg file as well as a pdf. ▪ All original documents
(*) Appendix 4 shows the architectural drawings for the solar-powered sea moss agro-processing plant.	

Project Exclusions
Items Excluded a. None
Project Constraints
1. The project should not exceed three million, two hundred and fifty-five thousand (3,255,000.00) Eastern Caribbean dollars. 2. The project duration should not exceed 24 months.
Assumptions
▪ It is assumed that sufficient skilled workers will be available for the duration of the project. ▪ It is assumed that all social and environmental impact assessments and approvals necessary to begin construction will be approved by all regulatory agencies. ▪ It is assumed that no natural disasters and/or state of emergencies resulting in national shutdowns will occur for the duration of the project. ▪ It is assumed that the customer is sufficiently funded to sponsor the entire project and timely disbursements will be made to execute project deliverables. ▪ It is assumed that the sponsor and JH Consultancy & Management Services will be responsive to all queries for good governance and strategic management of the project. ▪ It is assumed that resources are within cost requirements for the construction of the solar-powered agro-processing plant.

4.2.5 Work Breakdown Structure (WBS)

The WBS is a hierarchical decomposition of the total scope of work approved in the project scope statement (PMI, 2017, p. 156-157). The project is broken down into deliverables. Each of these deliverables is then further subdivided into work packages. Figure 9 shows the WBS for the solar-powered sea moss agro-processing plant.

Figure 12 *Work Breakdown Structure (WBS). Source: (J. Husbands, June 2023)*



PMI (2017) defines the WBS dictionary as "a document that provides detailed deliverable activity and scheduling information about each component in the WBS" (p. 162). The project team will use the WBS Dictionary as a statement of work for each WBS element. Chart 11 shows the WBS Dictionary.

Chart 11 WBS Dictionary (Source: J. Husbands, June 2023)

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
1	**1**	**Feasibility report and environmental social impact assessment**	**Commencement of conceptualization**	**-**	**40,000.00**	**-**
2	1.1	Client briefing and research assessment	Briefing on the project with the architect and other consultants and them doing research on standards to be used on the project.	Customer directive	$10,000.00	Computer Plant codes Solar PV requirements and Battery storage industry standards
2	1.1.1	Collect customer and regulatory requirements	Meetings held to ascertain customer and regulatory needs for the project.	Initial requirements documentation	$5,000.00	
2	1.1.2	Conduct and develop environmental social impact assessment and statement	The keys stages of the environmental social impact assessment is performed, to inform the development of a statement and feasibility report.	Environmental social impact statement and Feasibility report	$5,000.00	
2	1.2	Cost and risk analysis	Calculating the financial commitment needed from the project sponsor based on the customer requirements.	Cost evaluation	$10,000.00	Project scope

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	1.2.1	Determine preliminary budget	Preliminary financial commitment is determined for the project based on the customer requirements.	Initial budget	N/A	Project scope and requirements
2	1.2.2	Final budget and risk analysis report	Final financial commitment and risk analysis are determined for the project based on the customer requirements.	Final budget and risk analysis report	N/A	Project scope and requirements
1	**2**	**Solar powered sea moss agro-processing plant design**	**Collaborative efforts of consultants**		**$15,000.00**	
2	2.1	Component List for Solar Power System and Sea moss agro-processing plant	List of components required for Solar Power System	-	N/A	Architectural sketches Project scope
2	2.1.1	Request for bill of quantities for Solar powered sea moss agro-processing plant design	-	-	N/A	
2	2.1.2	Receipt and acceptance of bill of quantities for Solar powered sea moss agro-processing plant design	-	-	N/A	

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	2.2	Architectural designs and drawings				
2	2.2.1	Drawing preparation for solar power system and agro-process plant	Graphical representation of customer requirements	-	N/A	Computer AutoCAD software
2	2.2.2	Structural, Mechanical and Electrical Engineers Building Design	Construction and structural engineers and steel fabricator's plant design.	-	N/A	
2	2.2.3	Approval of solar power system and agro-process plant design	-	-	N/A	-
1	**3**	**Cleared project site and structural steel as built in drawings**	Collaborative efforts of subcontractors	-	**$50,000.00**	-
2	**3.1**	**Site preparation for construction**	Site is made ready for construction to begin. ▪ Land clearing ▪ Internal roads ▪ Fencing (temporary fixture) ▪ Sizing of solar panels ▪ Arranging solar panels. ▪ Sizing of bank of batteries ▪ Arranging of batteries	-	**-**	**-**

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	3.1.1	Retrieval of documents required for permit requests	The process of applying for the necessary permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs ▪ Department of Fisheries	Permits to proceed	$50,000.00	Architectural drawings
3	3.1.2	Permits and approval	Permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs ▪ Department of Fisheries	Permits to proceed	-	Permits

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	**3.2**	**Procurement of resources**	Procurement of resources required for the project	Procured required project items and services	-	Procurement, Purchasing & Inventory control Specialists
3	3.2.1	Preparation and dissemination of procurement packages	Resources required for procurement are documented and prepared for purchase.	-	-	-
3	3.2.2	Engagement of resources	-		-	-
3	3.2.3	Steel frame fabrication	Structural systems contracted to produce steel structure based on structural design.	Steel structure	$100,000.00	Structural drawings
3	3.2.4	Mobilization	Preparing project site for construction to begin.	Installation of the following items: *Hoarding *Control points *Datum lines *Site office *Bathrooms *Temporary power *Water Site is made ready for	$30,000.00	Crane, concrete truck, tractor with auger, total station, electronic level

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
				construction to begin. *Land clearing *Internal roads *Fencing (temporary fixture)		
2	3.2.5	Excavation and backfilling	Bringing project site to desired elevation with compacted marl fill.		$20,000.00	Excavators, dump trucks, rollers, tractors
2	**3.3**	**Solar system and battery storage size estimation**				
3	3.3.1	Sizing of solar panels	Panels are sized to ensure compliance with correct requirements.			Sol-Lucian, renewable energy & solar PV specialist
3	3.3.2	Arranging solar panels	Arrangement of solar panels according to site and systems plan.			Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	3.3.3	Sizing of bank of batteries	Batteries are sized to support appropriate storage for solar capacities.			Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	3.3.4	Arranging of batteries	Arranging batteries according to site and systems plan			Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
1	**4**	**Completed sea moss agro-processing plant**			**$474,644.43**	
2	**4.1**	**Construction of sea moss agro-processing plant**				
2	4.1.1	Foundation	*Layout *Concrete Blinding *Column Footing and Strip Footing *Blockwork *Steel column bolts *Reinforced concrete capping beam *Backfill	Completed plant foundation.	$16,111.20	Total station, boxing, carpenters, masons, laborers, concrete, concrete truck, rebar, steel benders, scaffolding
2	4.1.2	Steel frame	Erection of steel structure.	Completed and plumbed steel structure	$50,153.29	Crane, structural steel, and bolts
2	4.1.3	Walls	Perimeter and internal blockwork and capping beams.	Completed perimeter and interior walls.	$25,909.60	Concrete blocks, cement mixer, sand, masons, and laborers
2	4.1.4	Roof	Installation of roof panels and guttering.	Completed roof and guttering.	$62,205.99	Loadall, roof panels, guttering

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	4.1.5	Floor	Pouring of reinforced concrete floor slab.	Completed floor slab.	$48,298.74	Concrete, rebar, masons, carpenters, insulation
2	4.1.6	Electrical	*Installing conduit *Running cable *Installing plug and IT boxes *Installing lighting	Completed electrical work.	$25,000.00	Subcontractors
2	4.1.7	Plumbing	*Installing pipework *Installing floor drains *Installing sinks *Installing toilets	Completed plumbing work.	$35,200.00	Subcontractors
2	4.1.8	Air-conditioning	*Installing units *Gassing units	Completed air-conditioning work.	$12,300.00	Subcontractors
2	4.1.9	Finishes	*Plastering and painting walls *Installation of runners and ceiling tiles *Tiling floors *Installation of doors *Installation of windows *Installation of signage		$30,000.00	Cement mixer, cement, sand, ceiling tiles, doors, windows, signs
2	4.1.10	Fencing (Final Fixture)	Installation of Fencing (Final Fixture)	Completed Fencing (Final Fixture)	9,465.61	Subcontractors

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	4.1.11	Security Surveillance and Alarm System	Installation of Security Surveillance and Alarm System	Completed Security Surveillance and Alarm System	$10,000.00	Subcontractors
2	4.1.12	Equipment procurement and installation	Installation of Equipment procurement and installation	Completed Equipment procurement and installation	75,000.00	Subcontractors
2	4.1.13	Furniture Procurement & Installation	Installation of Furniture Procurement & Installation	Completed Furniture Procurement & Installation	75,000.00	Vendors
2	**4.2**	**Installation of solar-powered system with battery storage**	**Installation of solar panels, Control room, Inverter room and trenching**		**$336,300.00**	**Subcontractors**
3	4.2.1	Control rooms	Installation of control rooms	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.2	Inverter rooms	Installation of inverter rooms	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	4.2.3	Trenching	Installation of trenching	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.4	Racking system	Installation of racking system	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.5	Wiring of solar panels	Installation and wiring of solar panels	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.6	Inverter (micro)	Installation of inverter (micro).	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.6	AC and DC switches	Installation of AC and DC switches	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	4.2.7	Monitoring (Kwh Meter)	Installation of Monitoring (Kwh Meter)	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.2.8	AC and DC isolators	Installation of AC and DC isolators	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
2	**4.3**	**Installation of batteries and charge controllers**	**-**	**-**	**$573,600.00**	**Subcontractors**
3	4.3.1	Installation of battery bank	Installed battery bank	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.3.2	Install and wire inverter	Installed and wired inverter	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	4.3.3	Install charge controller	Installed charge controller	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.3.4	Installation of accessories (labels, wiring, clips etc.)	Installed accessories (labels, wiring, clips etc.)	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
2	**4.4**	**Grid Interconnection**		-	$15,000.00	Subcontractors
3	4.4.1	Request to integrate power supply to company power supply system. *Request to interconnect solar pv system to the grid.	Certification from Electrical inspectors and submission of request to Electric Utility Company (LUCELEC)			Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3	4.4.2	Electric Utility company tests for compliance based on its grid interconnection requirements.	Grid Interconnection	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
3	4.4.3	Signing of an agreement (interconnection agreement with electric utility company)	Grid Interconnection	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
		Billing and metering change	Grid Interconnection	-	-	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
1	**5**	**Completed plant handover documents**	**The completion of the project and the handover of the solar-powered sea moss agro-processing plant.**		**N/A**	**Project manager**
2	**5.1.**	**Inspections**	**Plant inspection performed by Town and Country Planning, the Ministry of Health, and the principal consultant.**	**Quality checklist requirements document**	**N/A**	**Project manager, principal consultant and project sponsor**
3	5.1.1	Final inspection	Plant Inspection performed by the Ministries of Health and Infrastructure, and the principal consultant.	-		Project manager, principal consultant and project sponsor
3	5.1.2	Reports and meetings	Final report and team retrospective meetings	-	N/A	JH Consultancy and Management Services and subcontractors

Level	WBS Code	Deliverables	Description of Work	Outcome	Budget	Resources
2	**5.2.**	**Plant handover**	**Handover of the solar-powered sea moss agro-processing plant to the project sponsor.**	**-**	**N/A**	**Project manager and principal consultant**
3	5.2.1	Plant walkthrough and sign off	Plant walkthrough and inspection with a health officer from the Ministry of Health, the Ministry of Infrastructure and sponsor.	Plant approval from the Ministry of Health and the Ministry of Infrastructure.	N/A	Project sponsor, principal consultant, project manager
3	5.2.2	Plant handover meeting	Meeting with the project sponsor to complete paperwork to officially close project.	Plant handover presentation, report, updated project management plan and close out documents	N/A	Principal consultant, project manager, project sponsor

4.2.6 Scope Verification

Prior to the official project kick-off, the principal consultant will validate that all project requirements and deliverables have been addressed by the project scope and that no extra work has been included. Thereafter, the principal consultant will meet with the project sponsor to receive formal acceptance. Once the project scope has been formally accepted, this establishes the project baseline.

The project manager will track the progress of the project's activities daily using a report of work performance information which will be submitted to the principal consultant. These reports will be used to track the overall progress of the project. Chart 12 shows the evaluation checklist that can be used as acceptance criteria for the customer.

Chart 12 Evaluation Checklist (Source: J. Husbands, June 2023)

Evaluation Criteria	Yes	No	Remarks
Customer Needs			
▪ Traffic management			
▪ Access to water			
▪ Access to electrical connection			
Occupational health, safety, and security requirements:			
▪ Proper ventilation			
▪ Access for handicapped			
▪ Adequate drainage			
▪ Adequate lighting			
▪ Emergency exits			
▪ Fire suppression			
▪ Adequate & disability-friendly restroom facilities			

Evaluation Criteria	Yes	No	Remarks
▪ Safety signage which is disability-friendly ▪ Provision of protective equipment (PPE), fire extinguishers, first aid kits, and other safety gear as per safety regulations in accordance with the Construction extension to the PMBOK Guide. ▪ Implementation of safety protocols and measures to protect workers and visitors during the construction phase. ▪ Compliance with construction safety regulations and provision of appropriate safety equipment and signage. ▪ Installation of surveillance cameras, alarms, access control systems, and related equipment based on the facility's security needs. ▪ Insulation materials for walls and proper ventilation systems based on the facility's size and processing needs. ▪ Record the number of incidents, accidents, and other safety violations as a measure of safety performance.			
Technical Requirements			
Good workmanship from skilled and qualified workers for proper installation within construction requirements: ▪ Layout ▪ Concrete ▪ Blinding ▪ Column			

Evaluation Criteria	Yes	No	Remarks
▪ Footing ▪ Strip footing ▪ Blockwork ▪ Steel column ▪ Bolts ▪ Reinforced ▪ Concrete ▪ Capping beam ▪ Backfill			
<u>Field weld inspection:</u> ▪ Adequate workmanship			
<u>Design and engineering inspection</u>: ▪ Engage qualified architects and engineers to develop a design that meets functional requirements, safety standards, and regulatory guidelines. <u>Structural steel inspection</u>: ▪ Adequate workmanship and quality materials within standards are used to ensure the plant structure is robust, stable, and able to withstand environmental conditions.			
<u>Plumbing inspection</u> Good workmanship from skilled and qualified plumbers: ▪ Installing pipework ▪ Installing floor drains ▪ Installing sinks ▪ Installing toilets			
<u>Air- conditioning inspection</u>			

Evaluation Criteria	Yes	No	Remarks
Good workmanship within industry requirements from skilled and qualified AC technicians: ▪ Installing units ▪ Gassing units			
Solar panel and battery, and charger controller systems: ▪ Adequate workmanship, materials, and equipment within requirements.			
Consultancy services: ▪ Engagement of reputable Professional services which meet the requirement of the project’s scope, resource and quality standards and are within the industry standards.			
Construction Requirements			
Design and engineering inspection: ▪ Design optimizes space utilization, workflow efficiency, and equipment placement.			
▪ Plant must adhere to local plant code construction, occupational health, solar PV and battery storage requirements and industry standards.			
▪ Plant must be able to withstand a category five (5) hurricane and an earthquake of over 7 on the Richter scale.			
▪ All concrete block walls and concrete floors should be reinforced with steel.			
Foundation Drying and Curing:			

Evaluation Criteria	Yes	No	Remarks
▪ Adequate drying and curing process of the foundation concrete. ▪ Acceptable industry curing methods are followed to achieve the desired strength and durability.			
Reinforcement placement: ▪ Adequate positioning and alignment of reinforcement bars within the foundation. ▪ Adequate measured clearance between the reinforcement and the formwork to ensure proper concrete cover.			
Structural integrity: ▪ Building structure is robust, stable, and able to withstand environmental conditions. ▪ The foundation during and after construction ensures stability and prevent settlement or structural issues.			
High strength bolting inspection: ▪ Proper bolt torque to ensure the plant structure is robust, stable, and able to withstand environmental conditions. ▪ Inspect installation of anchor bolts and other embedment in the foundation. ▪ Anchor bolts are properly aligned, levelled, and securely embedded in the concrete.			
Waterproofing and drainage: ▪ Installation of waterproofing membranes or coatings to protect the foundation from			

Evaluation Criteria	Yes	No	Remarks
water infiltration within industry standards. ▪ Placement of drainage systems, such as weep holes or drainage pipes, to prevent water accumulation around the foundation within industry standards.			
Field weld inspection: ▪ Adequate workmanship and quality materials within industry standards are used to ensure the plant structure is robust, stable, and able to withstand environmental conditions. - Equally distributed - No waste - Zero porosity - Tight weld - Required strength.			
Concrete compression testing of concrete cubes: ▪ 4500 psi compressive strength at 28 days that meet relevant standards and specifications. ▪ Good quality of concrete mix design, including the proportions of cement, aggregates, and water. ▪ Slump tests to check the consistency of the concrete during pouring conducted. ▪ Inspect pouring process to ensure proper placement and consolidation of concrete.			
Plumbing inspection:			

Evaluation Criteria	Yes	No	Remarks
▪ Good quality plumbing materials and fixtures to ensure proper water supply and drainage. ▪ Tested and verified the functionality of plumbing systems to prevent leaks or contamination risks.			
<u>Solar panel and battery, and charger controller systems:</u> ▪ Source materials from reputable suppliers and verify their compliance with quality requirements.			
<u>Documentation and records:</u> ▪ Maintain accurate records of construction activities, including plans, permits, inspections, and test reports. This includes records of foundation inspections, including photographs, measurements, and test results. ▪ Records of quality control measures implemented throughout the construction process. ▪ Document any non-conformities, deviations, or corrective actions taken during the inspection process.			
<u>Waste management systems:</u> ▪ Recycling bins, waste containers, and disposal methods suitable for waste management needs.			
<u>Water treatment systems:</u>			

Evaluation Criteria	Yes	No	Remarks
▪ Filtration systems and equipment based on the water quality requirements for sea moss processing.			
Permits and regulatory compliance: ▪ Budget and other associated requirements with obtaining permits ensures compliance are within local regulations.			
Furniture and fixtures: ▪ Furnishings and equipment required for the plant are sourced from reputable suppliers which meet industry quality requirements.			
Sea moss plant agro- processing equipment: ▪ Equipment is within sea moss agro-processing requirements and sourced from reputable suppliers which meets industry quality requirements.			

4.2.7 Scope Control

The project team will make sure that only formally accepted /approved work from the project's scope is performed. If any changes to the project scope are required, this process will be completed through integrated change control via a change request. Any member of the project team or any stakeholder may make a request for a scope change by completing a change request/ change order form and submitting it to the principal consultant.

Thereafter, the principal consultant will review the submitted change order request and if accepted, will then present it to the project manager from JH Consultancy & Management Services and the project sponsor. If formally approved, the change order will then be signed by both parties and the principal consultant will update all project documents and communicate the scope changes to all project team members and stakeholders.

4.3 Schedule Management Plan

PMI (2017) defines plan schedule management as “the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule” (p. 179).

4.3.1 Schedule Management Approach

The project schedule will be created using Microsoft Project 2019 and WBS Schedule Pro.

4.3.2 Roles and Responsibilities

The principal consultant will be responsible for decomposing the work packages into activities that will provide a basis for sequencing and estimating duration with the project team. The project manager will create the project schedule using Microsoft Project 2019, as well as WBS Schedule Pro and the schedule will be validated with the project team and the stakeholders. The principal consultant will obtain schedule approval from the project sponsor.

4.3.3 Activity List

An activity list contains all schedule activities required on the project, which are to be estimated. Dependences and other constraints for these activities can influence the duration estimates. The following chart details the activity list of the project.

Chart 13 Activity List. Source (J. Husbands, June 2023)

Activity ID Number	Activity Name	Description of Work	Responsibility
Deliverable 1: Feasibility report and environmental social impact assessment			
1.1 CLIENT BRIEFING AND RESEARCH ASSESSMENT			
1.1.1	Collect customer and regulatory requirements	Meetings held to ascertain customer and regulatory needs for the project.	Principal consultant, project manager
1.1.2	Meet customer	Meeting with customer/ project sponsor	Architect, principal consultant, project manager
1.1.3	Identify industry requirements	Conducting research on solar-powered sea moss agro-processing plant industry to identify minimum requirements.	Architect, ECMC, ESBI, renewable energy & solar PV specialist
1.1.4	Conduct plant code research	Conducting research on local plant codes and relevant industry standards to determine minimum requirements.	Architect, ECMC, ESBI, project manager- JH Consultancy & Management Services
1.1.5	Design considerations and restrictions	Identifying any other considerations and restrictions with regards to the plant design.	Architect, ECMC, ESBI
1.1.6	Scoping Assessment and evaluation	Identifying which potential impacts are relevant to assess and identifying alternative solutions to avoid, mitigate or compensate adverse impacts on biodiversity.	Principal consultant

Activity ID Number	Activity Name	Description of Work	Responsibility
1.1.7	Provide final report on environmental and social impact assessment	Writing the Environmental Impact Assessment.	Principal consultant
1.2 COST AND RISK ANALYSIS			
1.2.1	Determine preliminary budget	Preliminary financial commitment determined for the project based on the customer requirements.	Project scope and requirements
1.2.2	Perform parametric cost estimation	Estimating using information of known construction rates.	Quantity surveyor
1.2.3	Provide final budget determination and risk analysis report	Final financial commitment and risk analysis determined for the project based on the customer requirements.	Principal consultant
Deliverable 2: Solar powered sea moss agro-processing plant design			
2.1 COMPONENT LIST FOR SOLAR POWER SYSTEM AND SEA MOSS AGRO-PROCESSING PLANT			
2.1.1	Request for bill of quantities for Solar powered sea moss agro-processing plant design	-	Quantity Surveyor
2.1.2	Receipt and acceptance of bill of quantities for Solar powered sea moss agro-processing plant design	-	Quantity Surveyor

Activity ID Number	Activity Name	Description of Work	Responsibility
2.2 ARCHITECTURAL DESIGN DRAWINGS			
2.2.1	Drawing preparation for solar power system and agro-process plant	Graphical representation of customer requirements	Computer AutoCAD software
2.2.2	Provide structural, Mechanical and Electrical Engineers Building Design	Construction and structural, mechanical and electrical engineers and steel fabricator's plant design.	Construction and structural, mechanical engineer, and electrical engineer- JH Consultancy & Management Services
2.2.3	Provide structural design based on architect's conceptual design	Structural design of plant.	Architect, Construction, and structural engineer
2.2.4	Provide steel frame design based on requirements	Design of structural steel.	Architect, Steel fabricator-Rayneau Construction & Industrial Products
2.2.5	Provide plumbing design	Location and type of all plumbing in the plant.	Architect, Mechanical engineer - JH Consultancy & Management Services
2.2.6	Provide electrical design	Location and type of all electrical elements in the plant.	Architect, Electrical engineer - JH Consultancy & Management Services
2.2.7	Provide air-conditioning design	Location and size of all units in the plant.	Architect, Mechanical engineer - JH Consultancy & Management Services.
2.2.8	Approval of solar power system and agro-process plant design	Review and approval of plant designs	Engineers, architect, principal consultant, project manager

Activity ID Number	Activity Name	Description of Work	Responsibility
Deliverable 3: Cleared project site and structural steel as built in drawings			
3.1 SITE PREPARATION FOR CONSTRUCTION			
3.1.1	Retrieval of documents required for permit requests	The process of applying for the necessary permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs ▪ Department of Fisheries	Architectural drawings
3.1.2	Submission of design documents to Ministry of Infrastructure and Department of Planning for permission to construct a plant.	Applying for permit to begin construction.	Principal Consultant
3.1.3	Permits and approval	Permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs ▪ Department of Fisheries	Principal consultant

Activity ID Number	Activity Name	Description of Work	Responsibility
3.1.4	Plant permit issued	Permit extended to begin construction.	Principal consultant
3.2 PROCUREMENT OF RESOURCES			
3.2.1	Preparation and dissemination of procurement packages	Resources required for procurement are documented and prepared for purchase.	-
3.2.2	Engagement of resources	-	-
3.2.3	Steel frame fabrication	Structural systems contracted to produce steel structure based on structural design.	Structural drawings
3.2.3.1	Steel frame shipment	Shipping the steel to Saint Lucia.	Steel fabricator - Rayneau Construction & Industrial Products
3.2.3.2	Steel frame delivered to site	Clearing the steel from the port and delivering it to site.	Principal consultant
3.2.4	Mobilization	Preparing project site for construction to begin.	Crane, concrete truck, tractor with auger, total station, electronic level
3.2.4.1	Site boundary layout	Layout of the site boundary.	Quantity surveyor
3.2.4.2	Hoarding erection	Erecting the hoarding on the boundary of the project site.	Project manager, Rayneau Construction & Industrial Products
3.2.4.3	Site offices, bathrooms, and containers delivery on site	Delivery of container offices and bathrooms to project site.	Project manager, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Description of Work	Responsibility
3.2.4.4	Delivery of construction equipment to site	Movement of equipment from previous project site to current project site.	Project manager, Rayneau Construction & Industrial Products
3.2.4.5	Land clearing	Clearance of land to support the start of construction.	Rayneau Construction & Industrial Products
3.2.4.6	Internal roads	Provision of additional internal roads at the plant.	Rayneau Construction & Industrial Products
3.2.4.7	Fencing (temporary fixture)	Installation of temporary perimeter fence at plant site to cordon off construction area.	Rayneau Construction & Industrial Products
3.2.5	Excavation and backfilling	Bringing project site to desired elevation with compacted marl fill.	Excavators, dump trucks, rollers, tractors
3.2.5.1	Backfilling and compacting with marl.	Putting down marl to required elevation.	Rayneau Construction & Industrial Products
3.3 SOLAR SYSTEM AND BATTERY STORAGE SIZE ESTIMATION			
3.3.1	Sizing of solar panels	Panels are sized to ensure compliance with correct requirements.	Sol-Lucian, renewable energy & solar PV specialist
3.3.2	Arranging solar panels	Arrangement of solar panels according to site and systems plan.	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Description of Work	Responsibility
3.3.3	Sizing of bank of batteries	Batteries are sized to support appropriate storage for solar capacities.	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3.3.4	Arranging of batteries	Arranging batteries according to site and systems plan	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
Deliverable 4: Completed Sea moss agro-processing plant			
4.1 CONSTRUCTION OF SEA MOSS AGRO-PROCESSING PLANT			
4.1.1	Installation of Foundation	*Layout *Concrete Blinding *Column Footing and Strip Footing *Blockwork *Steel column bolts *Reinforced concrete capping beam *Backfill	Total station, boxing, carpenters, masons, laborers, concrete, concrete truck, rebar, steel benders, scaffolding
4.1.2	Install Steel frame	Erection of steel structure.	Crane, structural steel, and bolts
4.1.3	Install walls	Perimeter and internal blockwork and capping beams.	Concrete blocks, cement mixer, sand, masons, and laborers
4.1.4	Install roof	Installation of roof panels and guttering.	Loadall, roof panels, guttering
4.1.5	Install flooring	Pouring of reinforced concrete floor slab.	Concrete, rebar, masons, carpenters, insulation

Activity ID Number	Activity Name	Description of Work	Responsibility
4.1.6	Install electrical	*Installing conduit *Running cable *Installing plug and IT boxes *Installing lighting	Subcontractors
4.1.7	Install plumbing	*Installing pipework *Installing floor drains *Installing sinks *Installing toilets	Subcontractors
4.1.8	Install air-conditioning	*Installing units *Gassing units	Subcontractors
4.1.9	Install finishes	*Plastering and painting walls *Installation of runners and ceiling tiles *Tiling floors *Installation of doors *Installation of windows *Installation of signage	Cement mixer, cement, sand, ceiling tiles, doors, windows, signs
4.1.10	Install fencing (Final Fixture)	Installation of Fencing (Final Fixture)	Subcontractors
4.1.11	Install security Surveillance and Alarm System	Installation of Security Surveillance and Alarm System	Subcontractors
4.1.12	Perform equipment procurement and installation	Installation of Equipment procurement and installation	Subcontractors
4.1.13	Perform furniture Procurement & Installation	Installation of Furniture Procurement & Installation	Vendors

Activity ID Number	Activity Name	Description of Work	Responsibility
4.2 INSTALLATION OF SOLAR-POWERED SYSTEM WITH BATTERY STORAGE			
4.2.1	Install control rooms	Installation of control rooms	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.2	Install inverter rooms	Installation of inverter rooms	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.3	Trenching	Installation of trenching	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.4	Racking system	Installation of racking system	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.5	Wiring of solar panels	Installation and wiring of solar panels	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.6	Install inverter (micro)	Installation of inverter (micro).	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Description of Work	Responsibility
4.2.7	Install AC and DC switches	Installation of AC and DC switches	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.8	Monitoring (Kwh Meter)	Installation of Monitoring (Kwh Meter)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.9	Install AC and DC isolators	Installation of AC and DC isolators	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3 INSTALLATION OF BATTERIES AND CHARGE CONTROLLERS			
4.3.1	Installation of battery bank	Installed battery bank	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3.2	Installation and wiring of inverter	Installed and wired inverter	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3.3	Installation of charge controller	Installed charge controller	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Description of Work	Responsibility
4.3.4	Installation of accessories (labels, wiring, clips etc.)	Installed accessories (labels, wiring, clips etc.)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4 GRID INTERCONNECTION			
4.4.1	Integrating power supply to company power supply system. *Request to interconnect solar pv system to the grid (Certification from Electrical inspectors and submission of request to Electric Utility Company (LUCELEC)	Grid Interconnection Certification from Electrical inspectors and submission of request to Electric Utility Company (LUCELEC)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4.2	Testing by Electric Utility company for compliance based on its grid interconnection requirements	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4.3	Signing of an agreement (interconnection agreement with electric utility company)	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
	Billing and metering change	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Description of Work	Responsibility
Deliverable 5: Completed plant handover documents			
5.1. INSPECTIONS			
5.1.1	Final inspection	Plant Inspection performed by the Ministries of Health and Infrastructure, and the principal consultant.	Project manager, principal consultant and project sponsor
5.1.2	Application for final inspection.	Applying for the final plant inspection to the Ministries of Health and Infrastructure.	Project manager
5.1.3	Reports and meetings	Final report and team retrospective meetings	JH Consultancy and Management Services and subcontractors
5.2. PLANT HANDOVER			
5.2.1	Conduct plant walkthrough and sign off	Plant walkthrough and inspection with a health officer from the Ministry of Health, the Ministry of Infrastructure and sponsor.	Project sponsor, principal consultant, project manager
5.2.2	Plant sign-off	Plant approval from the Ministry of Health and the Ministry of Infrastructure.	Project sponsor, principal consultant, project manager
5.2.3	Conduct plant handover meeting	Meeting with the project sponsor to complete paperwork to officially close project.	Principal consultant, project manager, project sponsor

Activity ID Number	Activity Name	Description of Work	Responsibility
5.2.4	Plant handover presentation, report, updated project management plan and close out documents	Presenting the keys for the plant to the project sponsor.	Principal consultant, project manager, project sponsor

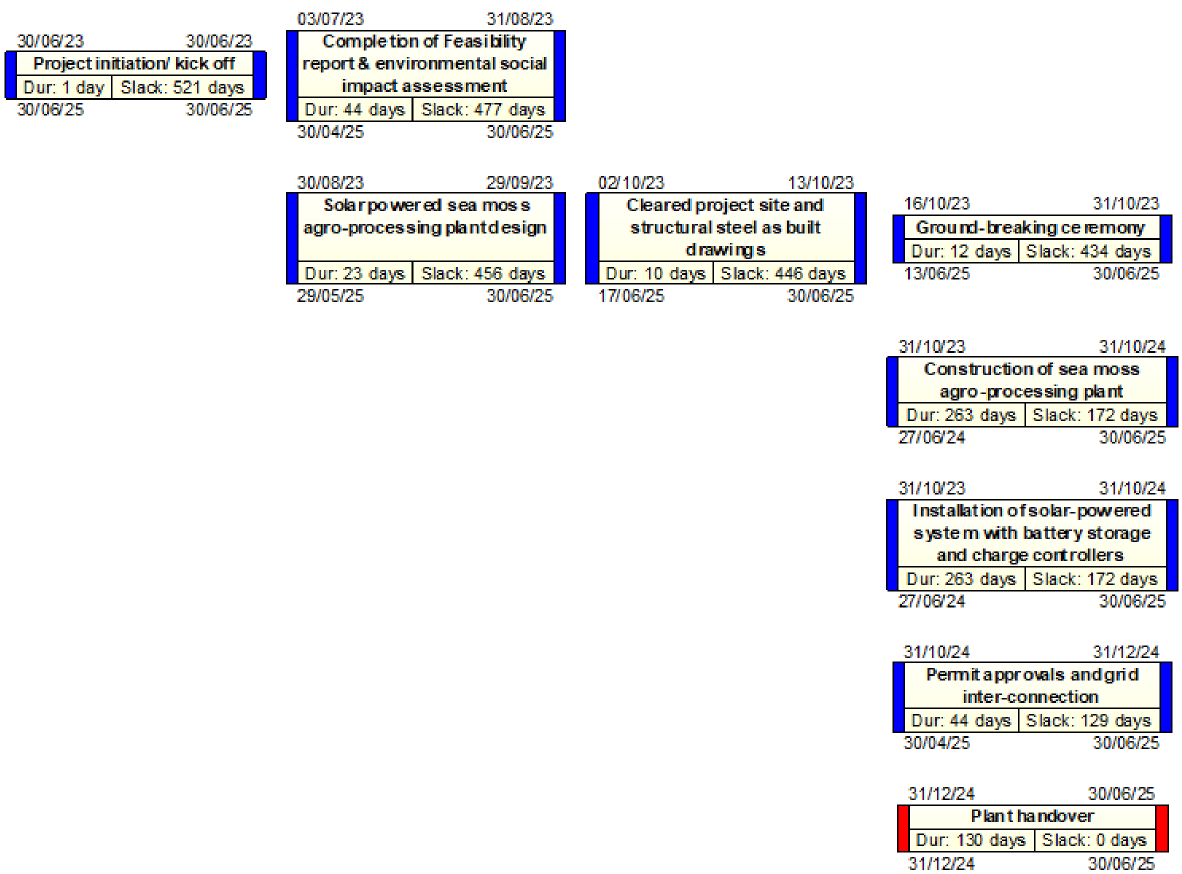
The following were designated as milestones for the project:

1. Project initiation/Kick-off
2. Completion of Feasibility report & environmental social impact assessment
3. Solar powered sea moss agro-processing plant design
4. Cleared project site and structural steel as built drawings.
5. Ground-breaking ceremony
6. Construction of the sea moss agro-processing plant
7. Installation of solar-powered system with battery storage and charge controllers
8. Permit Approvals and Grid Interconnection
9. Plant handover

4.3.4 Schedule Network Diagram

A schedule network diagrams are “commonly presented in the activity-on-node diagram format showing activities and relationships without a time scale” (PMI ,2017, p. 218). The diagram, with activity date information, shows the project network logic, the project’s critical path and schedule activities. Figure 10 shows the schedule network diagram for this project.

Figure 13 *Schedule Network Diagram. Source (J. Husbands, June 2023)*



4.3.5 Estimating Activity Durations

PMI (2017) defines estimate activity durations as “the process of estimating the number of work periods needed to complete the individual activities with estimated resources” (p. 195-196). For this FGP, the project team used parametric estimating to estimate the duration for each activity. The following chart details the duration of each activity.

Chart 14 Estimated Activity Duration and Resource Assignment. Source (J. Husbands, June 2023)

Activity ID Number	Activity Name	Duration (Days)	Responsibility
1.0 SOLAR POWERED SEA MOSS AGRO-PROCESSING PLANT PROJECT		**644**	
Deliverable 1: Feasibility report and environmental social impact assessment		**44**	
1.1 CLIENT BRIEFING AND RESEARCH ASSESSMENT			
1.1.1	Collect customer and regulatory requirements	-	Principal consultant, project manager
1.1.1.1	Meet customer	-	Architect, principal consultant, project manager
1.1.1.2	Identify industry requirements	-	Architect, ECMC, ESBI, renewable energy & solar PV specialist
1.1.1.3	Conduct plant code research	-	Architect, ECMC, ESBI, project manager- JH Consultancy & Management Services

Activity ID Number	Activity Name	Duration (Days)	Responsibility
1.1.1.4	Design considerations and restrictions	-	Architect, ECMC, ESBI
1.1.1.5	Scoping Assessment and evaluation	-	Principal consultant
1.1.1.6	Provide final report on environmental and social impact assessment	-	Principal consultant
1.2 COST AND RISK ANALYSIS			
1.2.1	Determine preliminary budget	-	Project scope and requirements
1.2.2	Perform parametric cost estimation	-	Quantity surveyor
1.2.3	Provide final budget determination and risk analysis report	-	Principal consultant
Deliverable 2: Solar powered sea moss agro-processing plant design		**22**	
2.1 COMPONENT LIST FOR SOLAR POWER SYSTEM AND SEA MOSS AGRO-PROCESSING PLANT			
2.1.1	Request for bill of quantities for Solar powered sea moss agro-processing plant design	-	Quantity Surveyor
2.1.2	Receipt and acceptance of bill of quantities for Solar powered sea moss agro-processing plant design	-	Quantity Surveyor

Activity ID Number	Activity Name	Duration (Days)	Responsibility
2.2 ARCHITECTURAL DESIGN DRAWINGS			
2.2.1	Drawing preparation for solar power system and agro-process plant	-	Computer AutoCAD software
2.2.2	Provide structural, Mechanical and Electrical Engineers Building Design	-	Construction and structural, mechanical engineer, and electrical engineer- JH Consultancy & Management Services
2.2.2.1	Provide structural design based on architect’s conceptual design	-	Architect, Construction, and structural engineer
2.2.2.2	Provide steel frame design based on requirements	-	Architect, Steel fabricator-Rayneau Construction & Industrial Products
2.2.2.3	Provide plumbing design	-	Architect, Mechanical engineer - JH Consultancy & Management Services
2.2.2.4	Provide electrical design	Location and type of all electrical elements in the plant.	Architect, Electrical engineer - JH Consultancy & Management Services
2.2.2.5	Provide air-conditioning design	Location and size of all units in the plant.	Architect, Mechanical engineer - JH Consultancy & Management Services.
2.2.3	Approval of solar power system and agro-process plant design	Review and approval of plant designs	Engineers, architect, principal consultant, project manager

Activity ID Number	Activity Name	Duration (Days)	Responsibility
Deliverable 3: Cleared project site and structural steel as built in drawings		**23**	
3.1 SITE PREPARATION FOR CONSTRUCTION			
3.1.1	Retrieval of documents required for permit requests	The process of applying for the necessary permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs ▪ Department of Fisheries	Architectural drawings
3.1.1.1	Submission of design documents to Ministry of Infrastructure and Department of Planning for permission to construct a plant.	Applying for permit to begin construction.	Principal Consultant
3.1.2	Permits and approval	Permits from the following public offices: ▪ Physical Planning Section- Ministry of Physical Development ▪ Ministry of Infrastructure, Port Services and Transport ▪ Ministry of Health and Wellness, and Elderly Affairs	Principal consultant

Activity ID Number	Activity Name	Duration (Days)	Responsibility
		▪ Department of Fisheries	
3.1.2.1	Plant permit issued	Permit extended to begin construction.	Principal consultant
3.2 PROCUREMENT OF RESOURCES			
3.2.1	Preparation and dissemination of procurement packages	Resources required for procurement are documented and prepared for purchase.	-
3.2.2	Engagement of resources	-	-
3.2.3	Steel frame fabrication	Structural systems contracted to produce steel structure based on structural design.	Structural drawings
3.2.3.1	Steel frame shipment	Shipping the steel to Saint Lucia.	Steel fabricator - Rayneau Construction & Industrial Products
3.2.3.2	Steel frame delivered to site	Clearing the steel from the port and delivering it to site.	Principal consultant
3.2.4	Mobilization	Preparing project site for construction to begin.	Crane, concrete truck, tractor with auger, total station, electronic level
3.2.4.1	Site boundary layout	Layout of the site boundary.	Quantity surveyor
3.2.4.2	Hoarding erection	Erecting the hoarding on the boundary of the project site.	Project manager, Rayneau Construction & Industrial Products
3.2.4.3	Site offices, bathrooms, and containers delivery on site	Delivery of container offices and bathrooms to project site.	Project manager, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Duration (Days)	Responsibility
3.2.4.4	Delivery of construction equipment to site	Movement of equipment from previous project site to current project site.	Project manager, Rayneau Construction & Industrial Products
3.2.4.5	Land clearing	Clearance of land to support the start of construction.	Rayneau Construction & Industrial Products
3.2.4.6	Internal roads	Provision of additional internal roads at the plant.	Rayneau Construction & Industrial Products
3.2.4.7	Fencing (temporary fixture)	Installation of temporary perimeter fence at plant site to cordon off construction area.	Rayneau Construction & Industrial Products
3.2.5	Excavation and backfilling	Bringing project site to desired elevation with compacted marl fill.	Excavators, dump trucks, rollers, tractors
3.2.5.1	Backfilling and compacting with marl.	Putting down marl to required elevation.	Rayneau Construction & Industrial Products
3.3 SOLAR SYSTEM AND BATTERY STORAGE SIZE ESTIMATION			
3.3.1	Sizing of solar panels	Panels are sized to ensure compliance with correct requirements.	Sol-Lucian, renewable energy & solar PV specialist
3.3.2	Arranging solar panels	Arrangement of solar panels according to site and systems plan.	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Duration (Days)	Responsibility
3.3.3	Sizing of bank of batteries	Batteries are sized to support appropriate storage for solar capacities.	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
3.3.4	Arranging of batteries	Arranging batteries according to site and systems plan	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
Deliverable 4: Completed Sea moss agro-processing plant		**263**	
4.1 CONSTRUCTION OF SEA MOSS AGRO-PROCESSING PLANT			
4.1.1	Installation of Foundation	*Layout *Concrete Blinding *Column Footing and Strip Footing *Blockwork *Steel column bolts *Reinforced concrete capping beam *Backfill	Total station, boxing, carpenters, masons, laborers, concrete, concrete truck, rebar, steel benders, scaffolding
4.1.2	Install Steel frame	Erection of steel structure.	Crane, structural steel, and bolts
4.1.3	Install walls	Perimeter and internal blockwork and capping beams.	Concrete blocks, cement mixer, sand, masons, and laborers
4.1.4	Install roof	Installation of roof panels and guttering.	Loadall, roof panels, guttering
4.1.5	Install flooring	Pouring of reinforced concrete floor slab.	Concrete, rebar, masons, carpenters, insulation

Activity ID Number	Activity Name	Duration (Days)	Responsibility
4.1.6	Install electrical	*Installing conduit *Running cable *Installing plug and IT boxes *Installing lighting	Subcontractors
4.1.7	Install plumbing	*Installing pipework *Installing floor drains *Installing sinks *Installing toilets	Subcontractors
4.1.8	Install air-conditioning	*Installing units *Gassing units	Subcontractors
4.1.9	Install finishes	*Plastering and painting walls *Installation of runners and ceiling tiles *Tiling floors *Installation of doors *Installation of windows *Installation of signage	Cement mixer, cement, sand, ceiling tiles, doors, windows, signs
4.1.10	Install fencing (Final Fixture)	Installation of Fencing (Final Fixture)	Subcontractors
4.1.11	Install security Surveillance and Alarm System	Installation of Security Surveillance and Alarm System	Subcontractors
4.1.12	Perform equipment procurement and installation	Installation of Equipment procurement and installation	Subcontractors
4.1.13	Perform furniture Procurement & Installation	Installation of Furniture Procurement & Installation	Vendors

Activity ID Number	Activity Name	Duration (Days)	Responsibility
4.2 INSTALLATION OF SOLAR-POWERED SYSTEM WITH BATTERY STORAGE			
4.2.1	Install control rooms	Installation of control rooms	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.2	Install inverter rooms	Installation of inverter rooms	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.3	Trenching	Installation of trenching	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.4	Racking system	Installation of racking system	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.5	Wiring of solar panels	Installation and wiring of solar panels	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.6	Install inverter (micro)	Installation of inverter (micro).	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Duration (Days)	Responsibility
4.2.6	Install AC and DC switches	Installation of AC and DC switches	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.7	Monitoring (Kwh Meter)	Installation of Monitoring (Kwh Meter)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.2.8	Install AC and DC isolators	Installation of AC and DC isolators	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3 INSTALLATION OF BATTERIES AND CHARGE CONTROLLERS			
4.3.1	Installation of battery bank	Installed battery bank	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3.2	Installation and wiring of inverter	Installed and wired inverter	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.3.3	Installation of charge controller	Installed charge controller	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

Activity ID Number	Activity Name	Duration (Days)	Responsibility
4.3.4	Installation of accessories (labels, wiring, clips etc.)	Installed accessories (labels, wiring, clips etc.)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4 GRID INTERCONNECTION			
4.4.1	Integrating power supply to company power supply system. *Request to interconnect solar pv system to the grid (Certification from Electrical inspectors and submission of request to Electric Utility Company (LUCELEC)	Grid Interconnection Certification from Electrical inspectors and submission of request to Electric Utility Company (LUCELEC)	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4.2	Testing by Electric Utility company for compliance based on its grid interconnection requirements	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
4.4.3	Signing of an agreement (interconnection agreement with electric utility company)	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products
	Billing and metering change	Grid Interconnection	Sol-Lucian, renewable energy & solar PV specialist, Rayneau Construction & Industrial Products

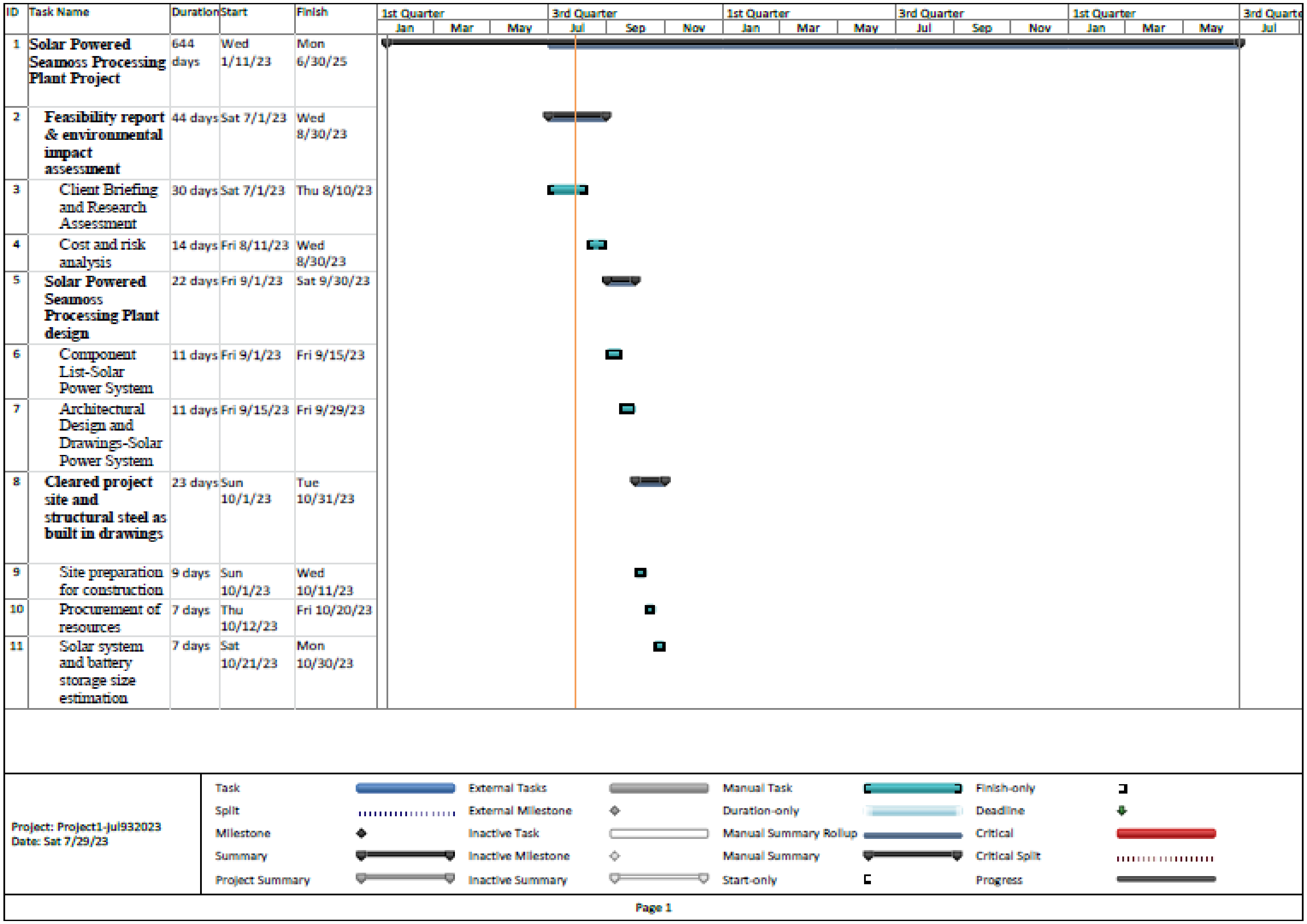
Activity ID Number	Activity Name	Duration (Days)	Responsibility
Deliverable 5: Completed plant handover documents		**129**	
5.1. INSPECTIONS			
5.1.1	Final inspection	Plant Inspection performed by the Ministries of Health and Infrastructure, and the principal consultant.	Project manager, principal consultant and project sponsor
5.1.1.1	Application for final inspection.	Applying for the final plant inspection to the Ministries of Health and Infrastructure.	Project manager
5.1.2	Reports and meetings	Final report and team retrospective meetings	JH Consultancy and Management Services and subcontractors
5.2. PLANT HANDOVER			
5.2.1	Conduct plant walkthrough and sign off	Plant walkthrough and inspection with a health officer from the Ministry of Health, the Ministry of Infrastructure and sponsor.	Project sponsor, principal consultant, project manager
5.2.1.1	Plant sign-off	Plant approval from the Ministry of Health and the Ministry of Infrastructure.	Project sponsor, principal consultant, project manager
5.2.2	Conduct plant handover meeting	Meeting with the project sponsor to complete paperwork to officially close project.	Principal consultant, project manager, project sponsor

Activity ID Number	Activity Name	Duration (Days)	Responsibility
5.2.2.1	Plant handover presentation, report, updated project management plan and close out documents	Presenting the keys for the plant to the project sponsor.	Principal consultant, project manager, project sponsor

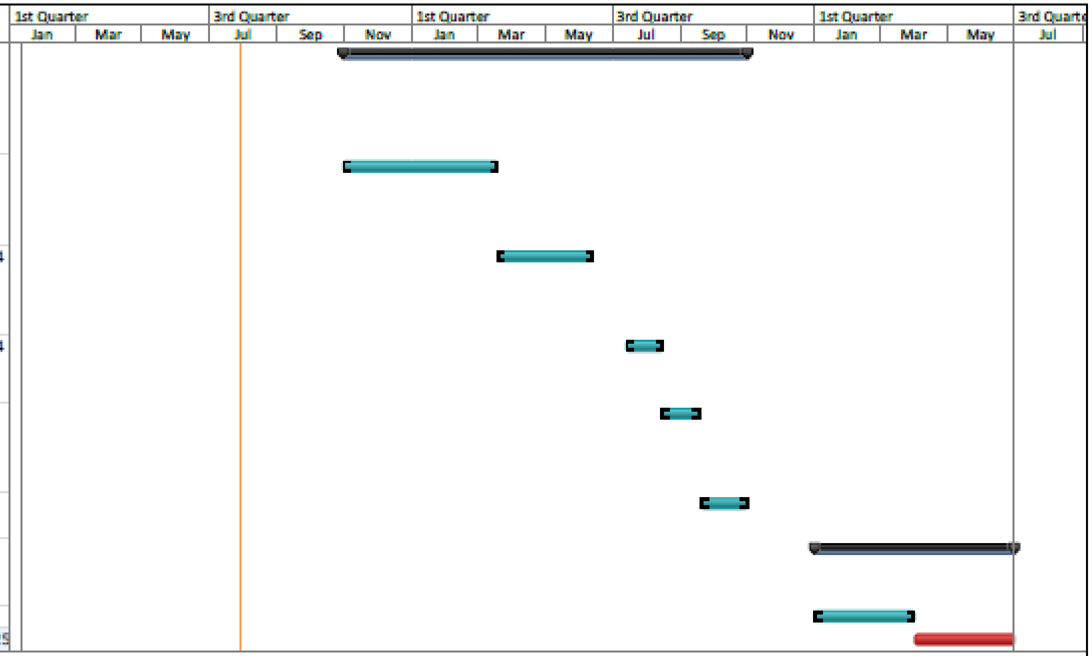
4.3.1 Development of Project Schedule

To complete the development of the Project Schedule, the inputs used were the schedule management plan, activity list, project schedule network diagram, and estimated activity durations. The tools used to develop the project schedule were schedule network analysis and Microsoft Project 2019. Figure 11 shows the project schedule.

Figure 14 *Project Schedule. Source (J. Husbands, June 2023)*



ID	Task Name	Duration	Start	Finish
12	**Completed solar-powered sea moss agro-processing plant**	263 days	Tue 10/31/23	Thu 10/31/24
13	Construction of Seamoss Agro-Processing Plant	100 days	Tue 10/31/23	Mon 3/18/24
14	Installation of solar-powered system with battery storage	63 days	Tue 3/19/24	Thu 6/13/24
15	Installation of the Solar System	25 days	Sun 7/14/24	Thu 8/15/24
16	Installation of Batteries and Charge Controllers	25 days	Thu 8/15/24	Wed 9/18/24
17	Grid Interconnection	30 days	Fri 9/20/24	Thu 10/31/24
18	**Completed plant handover documents**	129 days	Wed 1/1/25	Mon 6/30/25
19	Inspections	64.5 da	Wed 1/1/25	Tue 4/1/25
20	Plant Handover	64 days	Wed 4/2/25	Mon 6/30/25



Project: Project1-Jul932023
Date: Sat 7/29/23

Task	External Tasks	Manual Task	Finish-only
Split	External Milestone	Duration-only	Deadline
Milestone	Inactive Task	Manual Summary Rollup	Critical
Summary	Inactive Milestone	Manual Summary	Critical Split
Project Summary	Inactive Summary	Start-only	Progress

4.4 Cost Management Plan

PMI (2017) defines Project Cost Management as "the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget" (p. 231).

4.4.1 Plan Cost Management

The accounts and finance specialists will be responsible for managing and reporting on the project's budget throughout the duration of the project and making available progress and status reports to the principal consultant. A reviewed report will be made available by the principal consultant to the project sponsor and other relevant stakeholders. In addition, updates will be presented in the bi-monthly progress meeting by the accounts and finance specialists and principal consultant on the previous month's cost performance to relevant stakeholders (project sponsor, project team and others as needed).

Cost performance will be measured using earned value management (EVM). EVM develops the following three dimensions for each work package and control account (PMI, 2017, p. 261,704):

1. Planned value (PV) – the authorized budget assigned to scheduled work.
2. Earned value (EV) – the measure of work performed expressed in terms of the budget authorized for that work.
3. Actual cost (AC) – the realized cost incurred for the work performed on an activity during a specific time.

Earned value calculations for the control accounts (CA), created at the second level of the WBS, will measure and manage the financial performance of the project. Milestones will be weighed and credit for completed activities will be assigned at the work package level. The percentage of credit granted to each work package will be calculated based on the amount of work completed at the given time of the evaluation as compared to the total cost required to complete the work package.

Moreover, cost variance (CV) is defined as the amount of budget deficit or surplus at a given point in time, expressed as the difference between earned value and actual cost. It is equal to the EV minus the AC. The cost performance index (CPI) is a measure of the cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost. A CPI value of less than 1.0 indicates a cost overrun for work completed and a CPI value greater than **1.0** indicates a cost underrun of performance to date. CPI is equal to the ratio of the EV to the AC; Equation: **CPI= EV/AC**, (PMI, 2017, p.262-263).

In the case of this project, a CPI change of -0.1 will change the status of the control account to cautionary, where this control account should be monitored more closely to see if it changes further. A CPI change of -0.2 will change the status of the control account to a critical below plan alert, where recommendations, decisions and corrective action will be needed to bring the control account back to cautionary status at the minimum and/or at or above target.

The principal consultant will present the project sponsor with options for corrective action and the project sponsor will select a corrective action for implementation. A formal corrective action plan will be developed detailing all the actions to be employed to bring the project back within budget requirements and is implemented post-approval by the project sponsor. To propose changes to the cost baseline, this request can be submitted by internal or external stakeholders, as described in section 4.1.1.1 Change Control Process.

4.4.2 Estimate Project Costs

PMI (2017, p.240) states that "estimate costs is the process of developing an approximation of the cost of resources needed to complete project work". Parametric estimating was used to determine the cost of each work package, given that historical data on costs per task, related to each activity for each work package, was already available. Additionally, the cost estimate included a contingency reserve of 3%.

4.4.3 Determine Project Budget

An aggregation of the estimated costs for each work package or individual work packages are computed to establish an authorised cost baseline, within which the project performance can be monitored and controlled (PMI, 2017, p.248). The following chart details the budget of the project.

Chart 15 Budget for Solar-powered Sea Moss Agro-Processing Plant. Source (Joanne Husbands, June 2023)

Expense	Quantity	Unit Cost (XCD)	Total Cost (XCD)
Feasibility report and environmental social impact assessment	**1**	**40,000.00**	**40,000.00**
Solar powered sea moss agro-processing plant design	**1**	**15,000.00**	**15,000.00**
Cleared project site and structural steel as built in drawings	**1**	**50,000.00**	**50,000.00**
Construction/Subcontractors	4		**1,555,644.43**
Rayneau Construction & Industrial Products	***41***		***448,710.43***
Carpenters	5	9,119.55	9,119.55
Masons	5	9,119.55	9,119.55
Laborers	5	13,632.00	13,632.00

Expense	Quantity	Unit Cost (XCD)	Total Cost (XCD)
Feasibility report and environmental social impact assessment	**1**	**40,000.00**	**40,000.00**
Solar powered sea moss agro-processing plant design	**1**	**15,000.00**	**15,000.00**
Cleared project site and structural steel as built in drawings	**1**	**50,000.00**	**50,000.00**
Welders	2	7,695.07	7,695.07
Operators	2	9,119.55	9,119.55
Mixer operators	2	9,119.55	9,119.55
Steel benders	2	20,000.00	20,000.00
Steel fabricators	2	27,695.07	27,695.07
Foremen	3	9,119.55	9,119.55
Crane & structural systems operators	3	9,119.55	9,119.55
Excavation/Backfilling	2	9,119.55	9,119.55
Plumbers	2	35,200.00	35,200.00
Electricians	2	11,500.00	25,000.00
Loadall operator	1	9,119.55	9,119.55
Structural steel erection	1	27,695.07	27,695.07
Air-conditioning technicians	2	12,300.00	12,300.00
Tilers	5	12,260.90	12,260.90
Painters	5	12,260.90	12,260.90
Storeroom clerk	1	20,000.00	20,000.00
Site engineer	1	44,521.80	44,521.80
Materials, tools, and equipment		44,208.34	44,208.34
Execution of activities and sundry items		73,284.88	73,284.88
Sol - Lucian	4	1,0810,000.00	1,0810,000.00
Subcontractors- consulting agencies	2		60,000.00
ESBI	1	30,000.00	30,000.00
ECMC	1	30,000.00	30,000.00
JH Consultancy & Management Services	***15***		***1,257,904.02***
Project management	***6***		***1,257,904.02***

Expense	Quantity	Unit Cost (XCD)	Total Cost (XCD)
Feasibility report and environmental social impact assessment	**1**	**40,000.00**	**40,000.00**
Solar powered sea moss agro-processing plant design	**1**	**15,000.00**	**15,000.00**
Cleared project site and structural steel as built in drawings	**1**	**50,000.00**	**50,000.00**
Principal consultant	1	150,000.00	150,000.00
Project managers	2	100,000.00	200,000.00
Quantity surveyor	1	70,000.00	70,000.00
Architect	1	70,000.00	70,000.00
Engineers - mechanical, electrical, mechanical, structural, construction & maintenance	3	90,000.00	270,000.00
Renewable energy & solar PV specialist	1	70,000.00	70,000.00
Office administration	**6**		***575,000.00***
Office administrator	1	67,904.02	67,904.02
Office assistant	1	60,000.00	60,000.00
Accounts and finance specialists	1	75,000.00	75,000.00
Marketing & communications specialist	1	75,000.00	75,000.00
Procurement, purchasing & inventory control specialists	2	75,000.00	150,000.00
Vendors	***2***		***150,000.00***
Commercial Supplies Limited (furniture and agro-processing equipment)	1	50,000.00	50,000.00
B & B Money Saver Inc.	1	50,000.00	50,000.00
Permits	4	50,000.00	50,000.00
Contingency (3%)	1	51,169.33	51,169.33
Management reserve (5%)	1	85,282.22	85,282.22
TOTAL			**3,255,000.00**

4.4.4 Control Costs

The project status will be closely monitored and updates to the project cost will be managed within the cost baseline and its associated requirements.

4.5 Quality Management Plan

The quality management plan will verify that the processes and materials used during the project meets customer, product, process, and project requirements.

4.5.1 Quality Management Approach

In order to meet the project's quality objectives, an integrated quality approach to define quality standards, quality metrics, and how to continuously improve quality is provided. Product and process quality for the construction of the solar-powered sea moss agro-processing plant will be defined by Rayneau Construction & Industrial Products, current standards for construction, as well as industry standards identified during research for A Solar-powered Sea Moss Agro-processing Plant. As a reputable company that has successfully completed construction projects before, Rayneau Construction & Industrial Products quality standards track record speaks for itself. The principal consultant will define and document all organizational and project specific process and product standards. In addition, all quality documentation will become part of the project management plan.

The principal consultant will be responsible for working with the project manager, and engineers to define the quality metrics that will be used to measure quality throughout the project life cycle. Any project team member may identify ways in which quality can be improved. Each submitted recommendation will be reviewed to determine its impact on the project budget and the current processes used. If implemented, the project manager will subsequently update all project documentation to include the quality improvement as well as applicable quality standards, regulations, and certifications that the plant needs to comply with, such as ISO standards, local building codes, and food safety regulations.

4.5.2 Quality Standards

4.5.2.1 Product Quality

Product quality for a solar-powered sea moss agro-processing plant refers to the characteristics, standards, and specifications that determine the excellence and reliability of the sea moss products produced within the plant. The product quality standards and requirements will be determined by the principal consultant and is based on the construction standards set by Rayneau Construction & Industrial Products. The principal consultant and engineers will use the findings from feasibility environmental social impact assessment, as well as their expert judgement to document the company standards, given that they were not previously documented. In addition to the company standards, there will be industry specific product standards identified from research that will be added to the quality standards for this project. The change control process identified in chapter 4.1.1.1 will be used to make any additions to the quality standards for the product.

4.5.2.2 Process Quality

The process quality standards and requirements will be determined by the principal consultant. These standards will be based on the construction standards set by Rayneau Construction & Industrial Products. These standards were not previously documented so the project manager will use his expert judgement to document the company's standards. The change control process identified in chapter 4.1.1.1 will be used to make any additions to the quality standards for the product.

4.5.3 Quality Assurance

The quality assurance of the construction of the solar-powered sea moss agro-processing plant focuses on the processes used in the construction of the plant. It supports the creation and maintenance of the quality system and using project processes effectively.

The principal consultant and project manager will perform assessments at planned intervals throughout the project to ensure all processes are being correctly implemented and executed. Most importantly, quality assurance processes will be related to the structural engineer and related engineers' inspection of the placement of all steel reinforcement of columns, beams, or floors before they are poured. The concrete will be poured only after the placement has been approved.

Moreover, the project team will provide day-to-day quality management, conduct internal process audits on a weekly basis, monitor process performance metrics, and assess the effectiveness of all processes for compliance with project standards. If areas for improvement are identified, they are to be corrected as quickly and efficiently as possible under the supervision of the principal consultant.

The project manager will schedule bi-annual project management reviews by an external auditor (third-party project management office), to provide an independent assessment of quality management practices and project management processes being implemented. When all quality assurance documentation is reviewed, the results should be used to improve project processes, as a process improvement, given that it is an important aspect of quality assurance. All process improvements should be documented and communicated to all stakeholders.

4.5.4 Quality Control

The quality control of the construction of the solar-powered sea moss agro-processing plant focuses on identifying and correcting any defects found during the construction of the plant. The process involves monitoring and recording results of the execution quality management activities to assess performance and ensure the project outputs are complete, correct and meet customer expectations. It determines if the project outputs do what they were intended to do. The process should be performed throughout the project to formally demonstrate, with reliable data, that the customer's acceptance criteria have been met (PMI 2017, p. 298, 299). Checklists and inspection forms will be used to document findings and identify non-conformities. The Key Quality Control Metrics are detailed below.

Chart 16 Key Quality Control Metrics. Source (Adapted from Rayneau Construction & Industrial Products by J. Husbands, June 2023)

Process Action	Acceptable Process Standard	Assessment Interval
Foundation inspection	▪ Good workmanship from skilled and qualified workers for proper installation within construction requirements: Layout, Concrete, Blinding, Column, Footing, Strip footing, Blockwork, Steel column, Bolts, Reinforced, Concrete, Capping beam and backfill. ▪ Foundation Drying and Curing: ▪ Adequate drying and curing process of the foundation concrete. ▪ Acceptable industry curing methods are followed to achieve the desired strength and durability. ▪ Foundation Excavation: ▪ Adequate measurement of depth, width, and alignment of the excavated foundation trench. ▪ Excavation meets the specified dimensions and alignment as per the design. ▪ Reinforcement placement: ▪ Adequate positioning and alignment of reinforcement bars within the foundation. ▪ Adequate measured clearance between the reinforcement and the formwork to ensure proper concrete cover.	During and after installation

Process Action	Acceptable Process Standard	Assessment Interval
Design and engineering inspection	▪ Engage qualified architects and engineers to develop a design that meets functional requirements, safety standards, and regulatory guidelines. The architect must have a Bachelor of Architecture (B.Arch) or a Master of Architecture (M.Arch) with a focus on building science, and construction technology. Design expertise in AutoCAD and a good understanding of building codes, zoning regulations, and other legal requirements to ensure that their designs comply with local laws and regulations. The Engineers must possess a bachelor's degree in engineering, such as Civil Engineering, Mechanical Engineering, Electrical Engineering, or Structural Engineering. ▪ Design optimizes space utilization, workflow efficiency, and equipment placement (3,616.40 sq.ft)	Once
Structural integrity	▪ Building structure is robust, stable, and able to withstand environmental conditions. The concrete has 4500 psi compressive strength at 28 days that meet relevant standards and specifications. The building beams are 250 kN·m and the maximum shear force is 50 kN. ▪ The foundation during and after construction ensures stability and prevent settlement or structural issues.	During and after installation
Structural steel inspection	▪ Adequate workmanship and quality materials within local and industry building code standards are used to ensure the plant structure is robust, stable, and able to withstand environmental conditions. The yield strength of steel (250 MPa) is well above the	During and after installation

Process Action	Acceptable Process Standard	Assessment Interval
	maximum bending stress (1.25 MPa), ensuring the structural integrity of the building under bending loads.	
High strength bolting inspection	▪ Bolt torque tolerance of +/-10% with ISO 16047:2005(en) standards to ensure the plant structure is robust, stable, and able to withstand environmental conditions. ▪ Inspect installation of anchor bolts and other embedments in the foundation. ▪ Anchor bolts are properly aligned, levelled, and securely embedded in the concrete.	Every connection
Waterproofing and drainage:	▪ Installation of waterproofing membranes or coatings to protect the foundation from water infiltration within industry standards. ▪ Placement of drainage systems, such as weep holes or drainage pipes, to prevent water accumulation around the foundation within industry standards.	During and after installation
Field weld inspection	▪ Adequate workmanship and quality materials within industry standards are used to ensure the plant structure is robust, stable, and able to withstand environmental conditions (Equally distributed, No waste, Zero porosity, Tight weld and Required strength)	During and after every weld
Concrete compression testing of concrete cubes	▪ 4500 psi compressive strength at 28 days that meet relevant standards and specifications. ▪ Good quality of concrete mix design, including the proportions of cement, aggregates, and water. ▪ Slump tests to check the consistency of the concrete during pouring conducted. ▪ Inspect pouring process to ensure proper placement and consolidation of concrete.	Every concrete pour of column, beam, or floor

Process Action	Acceptable Process Standard	Assessment Interval
Electrical inspection	▪ Engage qualified electricians to perform installations and inspections. ▪ Good workmanship from skilled and qualified electricians to install electrical systems, wiring, and equipment according to industry standards and safety guidelines (Installing conduit, running cable, installing plug and IT boxes and Installing lighting) ▪ Energy-efficient LED lights for indoor and outdoor lighting based on the facility's lighting requirements.	Every connection
Plumbing inspection	▪ Good quality plumbing materials and fixtures to ensure proper water supply and drainage. ▪ Good workmanship from skilled and qualified plumbers: Installing pipework, installing floor drains, installing sinks and Installing toilets. ▪ Tested and verified the functionality of plumbing systems to prevent leaks or contamination risks.	Every connection
Air-conditioning inspection	▪ Good workmanship within industry requirements from skilled and qualified AC technicians: Installing units and Gassing units.	Every connection
Safety inspection	▪ Provision of protective equipment (PPE), fire extinguishers, first aid kits, and other safety gear as per safety regulations. ▪ Implementation of safety protocols and measures to protect workers and visitors during the construction phase.	Throughout the project

Process Action	Acceptable Process Standard	Assessment Interval
	▪ Compliance with construction safety regulations and provision of appropriate safety equipment and signage. ▪ Installation of surveillance cameras, alarms, access control systems, and related equipment based on the facility's security needs. ▪ Insulation materials for walls and proper ventilation systems based on the facility's size and processing needs. ▪ Record the number of incidents, accidents, and other safety violations.	
Solar panel and battery, and charger controller systems	▪ Adequate workmanship, materials, and equipment within requirements. ▪ Source materials from reputable suppliers and verify their compliance with quality requirements. <u>Batteries:</u> ▪ Quantity: Sizing depends on energy storage capacity required during non-sunny periods ▪ Calculation of the total storage capacity based on energy demand and expected duration of non-sunny periods. <u>Mounting Structures:</u>	Once

Process Action	Acceptable Process Standard	Assessment Interval
	▪ Quantity: Sufficient racks or frames to accommodate the chosen number of solar panels. ▪ Design and specifications support the type of solar panels and installation layout. <u>Solar Panels:</u> ▪ Quantity: Based on energy requirements and panel efficiency; assuming 300W panels ▪ Calculation of the total wattage needed by considering the plant's energy consumption and desired solar energy offset. <u>Inverters:</u> ▪ Quantity: Based on the number of solar panels and their electrical output. ▪ Appropriately sized inverters based on the total power output of the panels.	
Documentation and records	▪ Maintain accurate records of construction activities, including plans, permits, inspections, and test reports. This includes records of foundation inspections, including photographs, measurements, and test results. ▪ Records of quality control measures implemented throughout the construction process. ▪ Document any non-conformities, deviations, or corrective actions taken during the inspection process.	Quarterly

Process Action	Acceptable Process Standard	Assessment Interval
Waste management systems:	▪ Recycling bins, waste containers, and disposal methods suitable for waste management needs.	Once
Water treatment systems	▪ Filtration systems and equipment based on the water quality requirements for sea moss processing.	Once
Permits and regulatory compliance	▪ Budget and other associated requirements with obtaining permits ensures compliance are within local regulations.	Quarterly
Furniture and fixtures	▪ Furnishings and equipment required for the plant are sourced from reputable suppliers which meet industry quality requirements.	Once
Sea moss plant agro-processing equipment	▪ Equipment is within sea moss agro-processing requirements and sourced from reputable suppliers which meets industry quality requirements.	Once
Consultancy services	▪ Engagement of reputable professional construction and solar power pv installation services of experts with skills, technical expertise and track record in the field for over	Once

Process Action	Acceptable Process Standard	Assessment Interval
	ten years, delivering to requirements within scope, resource and quality and industry standards.	

In addition, day-to-day inspections of the project work will be conducted by the principal consultant, project manager, engineers, and site engineers to ensure all project work is completed to the highest standard possible.

4.6 Resource Management Plan

The resource management plan will aid in defining how to estimate, acquire, manage, and use physical and team resources throughout the project until its closure (PMI, 2017, p.307- 308). The resource management plan will include:

- Human Resources (Roles and responsibilities)
- Project organisation charts
- Staffing management plan
- Physical resources

4.6.1 Human Resources

4.6.1.1 Roles and Responsibilities

For the construction of the solar-powered sea moss agro-processing plant to be successful as a project, the project team must clearly understand each of their roles and responsibilities within scope requirements. This enables the successful completion of their portion of the project work based on their defined roles, responsibilities, and core deliverables. For this project, the following roles and responsibilities were established.

Chart 17 Roles and Responsibilities. Source (J. Husbands, June 2023)

Role	Responsibility
Architects (A)	▪ Responsible for the development and refinement of the project's design. They collaborate closely with clients, understanding their requirements and translating them into architectural solutions and provide further guidance and coordination to ensure the project's design intent is maintained throughout the process. ▪ They ensure that the design meets all relevant building codes and regulations while incorporating appropriate structural, electrical, and mechanical systems.
Quantity surveyor (QS)	▪ Responsible for estimating the costs involved in a construction project. They analyze project specifications, drawings, and other relevant documents to determine the quantities of materials, labor, and equipment required. They use this information to prepare detailed cost estimates and budgets.
Principal consultant (PC)	▪ Responsible for the overall success of the project, providing leadership and strategic direction to the project team. ▪ Oversees and coordinates the project's overall planning, execution, and delivery, ensuring that it aligns with the customers objectives and meets quality standards.

Role	Responsibility
	▪ Ensures effective communication and collaboration with the project team, sponsor, and all relevant stakeholders in accordance with the communications plan. ▪ Authorizes and approves all project expenditures within cost baseline and associated requirements.
Project manager (PM)	▪ Responsible for creating project planning documents, engaging with project stakeholders, and managing expectations and collaboration. ▪ Provides leadership to the project team, assists with risk management to minimize risk, and ensure project success. ▪ Oversees the project closure phase, ensuring that all project deliverables are completed, approved, and handed over to the client or stakeholders. ▪ He/she conducts a project evaluation to assess its success, identify lessons learned, and make recommendations for future projects.
Site engineer (SE)	▪ Responsible for the laying out of all elements of the plant, finding any clashes between the structural and architectural drawings, doing any calculations necessary, and providing as-built drawings to the architect. ▪ The SE is also responsible for explaining any details to the subcontractors or project team members about what needs to be done to complete the task, as well as, providing datum lines where necessary.

Role	Responsibility
Office administrator (OA)	▪ Responsible for managing the day-to-day operations of the project office. This includes maintaining office supplies, equipment, and facilities, and ensuring a clean and organized workspace. Documentation and filing, correspondence, and communication both internal and external. Scheduling and calendar management, providing support for project meetings which includes preparing meeting agendas, taking minutes, and documenting action items. ▪ He/she may also assist in preparing presentations, collating reports, and distributing meeting materials to attendees.
Office administrator (OA)	▪ Maintains project-related databases and information systems, ensuring accurate and up-to-date data entry and retrieval. ▪ Provides administrative support to the project team members as needed; this may include arranging team events or celebrations, assisting with onboarding new team members, and coordinating project-related training or professional development activities.
Office assistant (OAA)	▪ Provides administrative support, document management, data entry and reporting assistance, meeting support, assistance with communication and correspondence, travel and logistics, data and information

Role	Responsibility
	management and general office assistance such as answering phone calls, greeting visitors, maintaining office supplies, and assisting other office staff members as needed.
Market & communications specialist (MS)	▪ Provides market research, analyzes market data, and provides insights to inform on best marketing strategies as well as to guide decision-making. Collaborates with cross-functional teams to develop marketing strategies that align with the organization's goals. ▪ Defines target audiences, positioning, messaging, and promotional tactics to effectively reach and engage stakeholders. ▪ Manages the organization's brand identity and ensures consistency across all marketing and communication channels. Develops brand guidelines, monitors brand performance, and implements strategies to enhance brand awareness and perception. Provides content creation and social media management. ▪ Develops and maintains relationships with media outlets, journalists, and industry influencers. ▪ Responsible for writing press releases, coordinating media interviews, and managing media inquiries to generate positive media coverage for the organization.

Role	Responsibility
	▪ Develops and implements internal communication strategies to ensure consistent messaging and alignment within the organization. Creates employee newsletters, organizes town hall meetings, and facilitates internal communication channels to keep employees informed and engaged.
Procurement, purchasing & inventory control specialist (PPS)	▪ Develops procurement strategies and policies that align with the organization's goals and project requirements. This involves analyzing project needs, identifying suitable suppliers, and determining the most effective procurement methods. Supports supplier selection and management, request for proposal (RFP), purchasing and order management, contract management, and inventory control. ▪ Monitors and controls project procurement costs; this includes tracking project expenditures, analyzing supplier pricing, negotiating favorable terms, and identifying opportunities for cost savings or value-added services. ▪ Collaborates with project teams and suppliers to ensure that procured materials and equipment meet quality standards and specifications. ▪ Conducts quality inspections, reviews product documentation, and addresses any quality issues or non-compliance. Identifies and mitigates procurement-related risks.

Role	Responsibility
	▪ Collaborates and communicates effectively with internal project teams, suppliers, and other stakeholders to ensure alignment. Addresses concerns and facilitates smooth procurement processes. ▪ Ensures procurement activities adhere to legal and ethical standards, including compliance with relevant regulations and organizational policies. Ensures transparency and fairness in supplier selection, bidding processes, and contract management.
Renewable energy & solar PV specialist (RS):	▪ Collaborates with project teams to assess the feasibility and viability of renewable energy projects, particularly solar PV (Photovoltaic) systems. This involves conducting site assessments, evaluating energy needs, and designing appropriate solar PV solutions. Supports the design of solar PV systems that meet project requirements, considering factors such as available space, energy demand, and system efficiency; this includes designing the layout, selecting appropriate PV panels, inverters, and balance of system components, and ensuring compliance with relevant codes and standards. Evaluates and selects the most suitable solar PV technologies and equipment for the project, considering factors such as efficiency, durability, cost-effectiveness, and environmental impact. ▪ Performs energy modelling and analysis to estimate the energy production potential of solar PV systems.

Role	Responsibility
	▪ Assesses the economic viability and return on investment (ROI) of solar PV projects through energy yield calculations, financial modelling, and cost-benefit analysis. Ensures compliance with local, regional, and national regulations, permits, and codes related to renewable energy and solar PV installations. Facilitates the permitting process, coordinating with regulatory authorities, and obtaining necessary approvals for project implementation. Oversees the implementation and construction of solar PV systems. ▪ Collaborates with contractors, suppliers, and installation teams to ensure proper installation, equipment commissioning, and quality control. ▪ Conducts site visits and inspections to monitor progress and address any technical issues. ▪ Monitors the performance of installed solar PV systems to ensure optimal energy generation. Implements monitoring systems and analyzes data to identify and address any performance issues. Develops and implements preventive and corrective maintenance plans for ongoing system maintenance and optimization. ▪ Engages with project stakeholders, including clients, communities, and regulatory bodies, to address concerns, provide project updates, and promote the benefits of renewable energy and solar PV

Role	Responsibility
	technologies. Participates in public outreach activities, workshops, and educational initiatives. Identifies potential risks and uncertainties associated with solar PV projects and develops strategies to mitigate them. ▪ Promotes sustainable practices and environmentally responsible approaches throughout the project life cycle. Considers the environmental impact of solar PV systems and identifies strategies for resource conservation, waste management, and carbon footprint reduction.
Foremen (F)	▪ Responsible for supervising and directing a team of workers on the job site. They provide guidance, instruction, and support to ensure that tasks are performed correctly, efficiently, and safely. They are involved in planning and organizing work activities. They coordinate with project managers or superintendents to develop work schedules, assign tasks to team members, and ensure that resources and materials are available as needed.
Accounts & finance specialist (AC)	▪ Responsible for all financial reporting, systems and processes, transactions, budgeting and forecasting, accounts payable and receivable, general ledger management, financial analysis, tax compliance, finance planning and strategy, and cash flow management. ▪ Ensures adherence to financial policies, procedures, and guidelines. ▪ Provides guidance and training to ensure compliance across the organization.

Role	Responsibility
	▪ Stays updated on accounting principles, financial regulations, and compliance requirements relevant to the industry and interacts with internal and external stakeholders regarding financial matters. ▪ Collaborates with management, department heads, auditors, banks, and other financial partners. Builds relationships and effectively communicates financial information and insights.
Electrical engineer (EE), (1 position)	▪ Responsible for ensuring that the plant operates at an optimum and efficient electrical capacity. The EE is also responsible for supporting the design of the electrical systems and components for projects, including power distribution systems, lighting systems, control systems, and wiring layouts. He/she ensures compliance with relevant codes, standards, and project requirements. ▪ Conducts electrical testing, troubleshooting, and commissioning activities to ensure proper functioning and performance of electrical systems. He/she is also responsible for verifying compliance with quality standards, safety regulations, and project specifications, as well as ensuring electrical safety on the project site by adhering to relevant safety regulations, codes, and standards. He/she identifies and mitigates electrical hazards, promotes safe work practices, and conducts inspections to ensure compliance. ▪ The electrical engineer also collaborates with multidisciplinary teams, including architects, engineers, contractors, and project managers, to ensure effective coordination and integration of electrical systems

Role	Responsibility
	with other project components. Attends project meetings, provides updates, and contributes to decision-making. ▪ He/she monitors electrical project costs and ensures adherence to budgetary constraints, identifies cost-saving opportunities, proposes value engineering solutions, manages change orders related to electrical scope, maintains accurate project documentation, including progress reports, technical memos, and as-built drawings. ▪ He/she generates project-related reports and communicates project status, risks, and issues to relevant stakeholders
Structural engineer (SE):	▪ Collaborates with project teams to develop project plans and design concepts for construction and structural elements. ▪ Reviews project requirements, analyzes site conditions, and provides input on construction methodologies and structural systems. ▪ Conducts structural analysis to determine the strength, stability, and integrity of proposed structures. ▪ Designs structural components, including beams, columns, foundations, and load-bearing elements, ensuring compliance with relevant codes, regulations, and safety standards.

Role	Responsibility
	▪ Prepares construction drawings, specifications, and other technical documentation detailing the structural components and requirements of the project. ▪ Ensures accuracy, clarity, and completeness of documentation to facilitate construction activities. Provides technical oversight during the construction phase of the project. ▪ Collaborates with contractors, subcontractors, and construction teams to ensure that structural elements are built according to design specifications and industry standards. ▪ Conducts site visits and inspections to monitor progress and quality of construction. Ensures the structural integrity and safety of the project throughout its life cycle. ▪ Performs structural assessments, reviews design changes, and addresses any structural concerns or issues that arise during construction. Adheres to safety regulations and promotes safe work practices on the construction site. ▪ Collaborates with multidisciplinary project teams, including architects, engineers, contractors, and project managers, to ensure effective coordination and integration of construction and structural elements. Attends project meetings, provides technical input, and contributes to decision-making. ▪ Identifies opportunities for value engineering to optimize construction and structural design.

Role	Responsibility
	▪ Proposes cost-effective solutions, alternative materials, or construction methods that maintain or enhance the project's performance and quality while achieving cost savings. Identifies potential risks and hazards associated with construction and structural aspects of the project. ▪ Develops risk mitigation strategies and collaborates with project teams to implement measures that minimize risks and ensure a safe working environment. ▪ Maintains accurate project documentation, including progress reports, design change orders, and as-built drawings. ▪ Generates reports on construction and structural activities, providing updates on project status, issues, and risks to relevant stakeholders. Monitors construction and structural costs and ensures adherence to budgetary constraints. ▪ Collaborates with project managers to track project expenditures, manage change orders, and identify cost-saving opportunities.
Mechanical engineer (ME)	▪ Collaborates with project teams to develop project plans and design concepts for mechanical systems and components.

Role	Responsibility
	▪ Reviews project requirements, analyzes technical specifications, and provides input on mechanical design considerations. Supports design and selects mechanical systems and components for the project, including HVAC systems, plumbing systems, fire protection systems, and other mechanical equipment. ▪ Ensures compliance with applicable codes, regulations, and industry standards. ▪ Prepares technical documentation, including mechanical drawings, specifications, and equipment schedules. ▪ Ensures accuracy and completeness of documentation to facilitate construction, installation, and maintenance activities. ▪ Provides technical oversight during the construction phase of the project. ▪ Coordinates with contractors, subcontractors, and construction teams to ensure proper installation of mechanical systems and equipment. ▪ Conducts site visits and inspections to monitor progress and quality of construction. Selects appropriate mechanical equipment, devices, and materials based on project requirements and technical specifications. ▪ Collaborates with vendors and suppliers to procure necessary equipment and materials within budget and timeline constraints.

Role	Responsibility
	▪ Conducts testing, troubleshooting, and commissioning activities to ensure proper functioning and performance of mechanical systems. Verifies compliance with quality standards, safety regulations, and project specifications. Addresses any issues or deficiencies that arise during testing and commissioning. ▪ Incorporates energy-efficient and sustainable design principles into mechanical systems. Provides technical guidance and support to project teams, contractors, and other stakeholders. ▪ Addresses mechanical-related queries, resolves technical issues, and offers recommendations for improvement or optimization. ▪ Monitors mechanical project costs and ensures adherence to budgetary constraints. Identifies cost-saving opportunities, proposes value engineering solutions, and manages change orders related to mechanical scope. ▪ Collaborates with multidisciplinary project teams, including architects, engineers, contractors, and project managers, to ensure effective coordination and integration of mechanical systems with other project components. Attends project meetings, provides updates, and contributes to decision-making.
Electrical subcontractor (ES)	▪ Responsible for installing all plant and site electrical elements as per electrical and site layouts and schedules.

Role	Responsibility
Plumbing subcontractor (PS):	▪ Responsible for installing all plant and site plumbing elements as per mechanical drawings and schedules.
Air-condition technician - subcontractor (ACS)	▪ Responsible for installing all air-condition elements as per mechanical drawings and schedules.
Steel bending subcontractor (SBS), (1 position):	▪ Responsible for cutting, bending, and placing all reinforced steel as required by the structural drawings.
Excavation/backfilling subcontractor (EBS), (1 position)	▪ Responsible for removing and adding required material in all locations specified by the structural drawings.
Tilers - subcontractor (TS):	▪ Responsible for installing tiles as per layouts and in accordance with acceptable industry standards.

Role	Responsibility
Structural steel erection - subcontractor (SSES)	▪ Responsible for the erection and plumbing of the structural steel based on the structural drawings.
Crane & structural system operator – subcontractor (CS)	▪ Responsible for assisting the SSES with the erection of the structural steel.
Painters - subcontractor (PS)	▪ Responsible for all painting necessary for the project.
Loadall operator – subcontractor	▪ Operates the loadall machine according to manufacturer's guidelines, industry best practices, and relevant safety regulations, to lift, move, and position loads of various sizes and weights.
Steel fabricator – subcontractor	▪ Interpret engineering drawings, blueprints, and specifications to understand the required dimensions, shapes, and materials for the fabrication. Works with steel materials to create and assemble metal structures and components. Collaborates with project managers, engineers, and other team members to coordinate fabrication activities and ensure project requirements are met. Communicates effectively regarding progress, challenges, and any design or fabrication issues which may arise.

Role	Responsibility
Steel bender – subcontractor	▪ Interprets engineering drawings, blueprints, and specifications to understand the required dimensions, shapes, and placement of steel reinforcement bars. Shapes and bends steel reinforcement bars for use in the construction project.
Mixer operators – subcontractor	▪ Operates concrete mixers or other mixing equipment to prepare batches of concrete or construction materials according to project specifications. Follows established procedures for loading materials, mixing ratios, and operating controls.
Welders – subcontractor	▪ They perform welding operations using various techniques such as MIG (Metal Inert Gas), TIG (Tungsten Inert Gas), or ARC welding and follow welding procedures and specifications to ensure proper joining and fabrication of metal components, within industry requirements.
Laborers – subcontractor	▪ Provide physical support and assistance in various tasks on the construction site. They assist in site preparation activities, including clearing debris, digging trenches, and setting up temporary structures or barriers. They also transport construction materials, tools, and equipment to the work area and also load and unload materials from trucks or storage areas using appropriate lifting and carrying techniques. ▪ They operate basic construction tools and equipment under supervision, such as shovels, wheelbarrows, rakes, and jackhammers, following all safety guidelines and instructions provided by experienced

Role	Responsibility
	operators. It is their responsibility to sort and dispose of debris or salvageable materials appropriately as well as to assist with concrete-related tasks, such as pouring, spreading, and finishing. Finally, they help in the installation of concrete forms, reinforcing bars, or concrete blocks.
Masons – subcontractor	▪ Construct walls, foundations, floors, and other structures using bricks, blocks, stones, or other masonry materials and lay out structures according to blueprints, drawings, or specifications, ensuring accuracy and alignment.
Carpenters	▪ Construct and install wooden frameworks, walls, floors, roofs, and other structural components based on architectural plans, blueprints, or project specifications.

4.6.1.2 Project Organisational Charts

The following chart shows the RACI chart for the Construction of the Solar-powered Sea moss Agro-processing Plant Project.

Chart 18 RACI Chart. Source (J. Husbands, June 2023)

Activity	Principal Consultant	Engineers	Quantity Surveyor	Project Manager	Marketing & Communications Specialist	Procurement, Purchasing & Inventory Control Specialists	Accounts and Finance Specialists	Architect	Subcontractors	Project Sponsor	Renewable Energy & Solar PV Specialist	Office Administrator	Vendors	Stakeholders
Requirements gathering	A	I	R	A	I	I	I	R	R	C	A	I		I
Plant design	A	R	R	A	I	I	I	R		C	R	I		I
Change requests	R	C	I	C	I	I	I	I	I	C	I	I		I
Site survey	R	C	I	R	I	I	I	I	R	C	A	I		I
Feasibility study	R	C	I	R	I	I	I	I	R	C	A	I		I
Contract administration	R	I	I	A	I	A	I	I	I	C	I			
Site preparation	R	C	I	R	I	I	I	I	R	C	A	I		I
Site management	A	A	I	A	I	I	I	I	R	I	I	I		I
Permits/approvals	R	I	A	A	I	I	I	I	R	I	A	I		I
Project scope	R	I	I	A	I	I	I	I	I	I	I	I		I

Activity	Principal Consultant	Engineers	Quantity Surveyor	Project Manager	Marketing & Communications Specialist	Procurement, Purchasing & Inventory Control Specialists	Accounts and Finance Specialists	Architect	Subcontractors	Project Sponsor	Renewable Energy & Solar PV Specialist	Office Administrator	Vendors	Stakeholders
Project communications	R	I	I	A	R	I	I	I	I	I	I	I		I
Construction: Sea moss processing plant	A	A	A	A	I	I	I	I	R	C	A	I		1
Construction: Solar power system	A	A	I	A	I	A	I	A	R	I	A	I		I
Data, information management and filing	A	A	I	A	I	A	I	A	R	I	A	R		I
Project quality	R	C	A	A	I	A	I	A	A	I	A	I	A	I
Stakeholder management	R	I	I	A	I	I	I	I	A	I	A	I		I
Finance and accounting	A	A	I	A	I	A	R	A	A	I	A	I		I
Status reports	A	I	I	A	I	I	I	I	I	I	I	I		I
Procurements	A	I	I	A	I	R	I	I	A	I	I	I	A	I
Occupational health, safety and security	A	A	I	A	I	I	I	I	R	I	A	I	I	I
Risk management	R	A	I	A	I	I	I	I	A	I	A	I	I	I

R: Responsible for completing the work, A: Accountable for ensuring task completion, C: Consulted before any decisions are made, I: Informed when a decision has been made.

4.6.1.3 Staff Acquisition

For the construction of the solar-powered sea moss agro-processing plant, the project staff will consist of a JH Consultancy and Management Services project team (internal resources) and subcontractors (external sources). The previously mentioned internal and external project resources will form part of procurements plan. The subcontractors' base will be at their main office. The project management staff and subcontractors will be required to be on site, when necessary, to complete their deliverables in relation to project scope requirements.

4.6.1.4 Training

There will be no formal training provided to the Rayneau Construction & Industrial Products team. The customers' requirements and expectations were reiterated through discussions upon engagement with the subcontractors who were hired based on competency in meeting all requirements within their scope of duties.

4.6.1.5 Performance Reviews

The principal consultant will review the overall performance of the project during the project life cycle. At the inception of the project, the principal consultant will communicate with the project manager, and engineers to inform them of all expectations of the work to be completed.

It is the site engineer's - Rayneau Construction & Industrial Products, responsibility to manage and evaluate each site worker's performance and judge how effectively they are completing their assigned work. On the other hand, it is the principal consultant's responsibility to evaluate each of the project management team members, and judge how effectively they are completing the work assigned.

At the end of every month, the principal consultant will meet with the project management team and subcontractors to provide feedback on employee and project performance. In turn, the project manager will meet with the management of Rayneau Construction & Industrial Products to formally review the performance of each site worker. All formal documents will be archived at the JH Consultancy and Management Services project office.

4.6.2 Physical Resources

Charts 19 and 20 shows the estimated physical resources needed to successfully complete the project. Based on the evaluation of the data received from the electric utility company (LUCELEC), the average monthly consumption of the Castries Fisheries Complex in 2021 was 47.56 kWh. A 100 kW AC PV solar system is recommended to zero the Electricity Bills at the Castries Fisheries Complex in saint Lucia every month. The formula used is System Size = (Average Monthly Consumption (kWh) / Average Peak sun hours) X Panel efficiency factor.

Chart 19 Installation of 100kW AC PV Solar System with (2 hour) Battery Storage. Source (J. Husbands, June 2023)

	Materials			
	Items	**Quantity**	**Unit Cost**	**Total Cost**
1.0	**PV System**			
1.1	PV Panels	250	$1,200.00	$300,000.00
1.2	Inverter	1	$35,000.00	$35,000.00
1.3	Racking or Mounting system	1	$30,000.00	$30,000.00
1.4	AC Isolators	4	$800.00	$3,200.00
1.5	DC isolators	4	$800.00	$3,200.00
1.6	Combiner Boxes	6	$1,000.00	$6,000.00
1.7	AC cables in ft	500	$10.00	$5,000.00
1.8	DC Cables in ft	1000	$4.00	$4,000.00
1.9	AC switchgear	1	$10,000.00	$10,000.00
1.10	Accessories (such as cable ties, insulation tape etc.)	1	$1,000.00	$1,000.00
	Subtotal			**$397,400.00**
2	**Battery System Components**			
2.1	Battery Modules Bank(s)	1	$370,000.00	$370,000.00
2.2	Battery Management System (BMS)	1	$20,000.00	$20,000.00
2.3	Inverter/Converter for battery system	1	$35,000.00	$35,000.00
2.4	Electrical Switchgear (circuit breakers, switches, fuses)	1	$18,000.00	$18,000.00
	Subtotal			**$443,000.00**
3	**Battery System Integration**			
31	Energy Management System (EMS) for battery and PV system integration	1	$15,000.00	$15,000.00
3.2	Control and Monitoring Equipment	1	$5,000.00	$5,000.00

	Materials			
	Items	**Quantity**	**Unit Cost**	**Total Cost**
3.3	Communication Equipment (if required)	1	$5,000.00	$5,000.00
	Subtotal			**$25,000.00**
4.0	**Battery Cooling and Ventilation Systems:**			
4.1	Cooling Equipment (combination of fans, heat sinks)	1	$4,000.00	$4,000.00
4.2	Ventilation System	1	$8,000.00	$8,000.00
	Total			**$12,000.00**
5.0	**Battery Safety and Protection Equipment**			
5.1	Fire Extinguishers	3	$1,500.00	$4,500.00
5.2	Personal Protective Equipment (PPE)	1	$1,500.00	$1,500.00
5.3	Emergency Shutdown Systems	1	$5,000.00	$5,000.00
5.4	Signage and Warning Labels	1	$1,500.00	$1,500.00
	Total			**$12,500.00**
	Total Material Cost			**$889,900.00**
	Description	**Quantity**	**Unit Cost**	**Total Cost**
6	**PV system Components**			
6.1	Installing & wiring the PV Panels	250	$120.00	$30,000.00
6.2	Laying out and installing the mounting System	1	$29,000.00	$29,000.00
6.3	Installing & Wiring the Inverter(s)	1	$4,000.00	$4,000.00
6.4	Installing and wiring the combiner boxes	4	$1,000.00	$4,000.00
6.5	Installing and wiring all isolators (Both AC&DC)	10	$800.00	$8,000.00

	Materials			
	Items	**Quantity**	**Unit Cost**	**Total Cost**
	Total			**$75,000.00**
7	**Battery System Components**			
7.1	Installing the Battery Modules	1	$40,000.00	$40,000.00
7.2	Installing the Battery Management System (BMS)	1	$7,000.00	$7,000.00
7.3	Installing the Inverter/Converter for battery system	1	$5,000.00	$5,000.00
7.4	installing Electrical Switchgear (circuit breakers, switches, fuses)	1	$5,000.00	$5,000.00
	Total			**$57,000.00**
8	**Battery System Integration:**			
8.1	Installing Energy Management System (EMS) for battery and PV system integration	1	$4,000.00	$4,000.00
8.2	Installing Control and Monitoring Equipment	1	$3,500.00	$3,500.00
8.3	Installing Communication Equipment (if required)	1	$2,500.00	$2,500.00
	Total			**$10,000.00**
9	**Cooling and Ventilation Systems:**			
9.1	Installing the Cooling Equipment	1	$4,000.00	$4,000.00
9.2	Installing the Ventilation System	1	$4,500.00	$4,500.00
	Total			**$8,500.00**
10	**Safety and Protection Equipment**			
10.1	Installing Fire Extinguishers	3	$200.00	$600.00
10.2	Personal Protective Equipment (PPE)	1	$1,500.00	$1,500.00

	Materials			
	Items	**Quantity**	**Unit Cost**	**Total Cost**
10.3	Installing Emergency Shutdown Systems	1	$2,000.00	$2,000.00
10.4	Installing all Signage and Warning Labels	1	$1,500.00	$1,500.00
	Total			**$5,600.00**
	Total cost of Labour			**$156,100.00**
11	Commissioning and testing of entire system	1	$15,000.00	**$15,000.00**
12	Transportation and equipment	1	$20,000.00	**$20,000.00**

Total Material Cost	**$889,900.00**
Total Labour cost	**$156,100.00**
Commissioning & Testing	**$15,000.00**
Transportation and Labour	**$20,000.00**
Total cost	**$1,081,000.00**

Chart 20 Installation of Sea moss Agro-Processing Plant - Bill of quantities. Source (J. Husbands, June 2023)

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	COST	TOTAL
A. SUBSTRUCTURE						
	Excavating and work up to finish floor level (Reinforcement not included)					
1	Exc. for pad footing 4'-0" deep	21.33	cy	$50.00	$1,066.50	
2	Exc. for strip footing 3'-8" deep	62.84	cy	$50.00	$3,142.00	
3	Conc. to reinforced pad footing (14" thk.)	5.33	cy	$650.00	$3,464.50	
4	Conc. to reinforced strip footing (10"thk.)	14.27	cy	$650.00	$9,275.50	

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	COST	TOTAL
5	Conc. to columns below floor slab (10"x10")	1.23	cy	$650.00	$799.50	
6	Foundation wall block work (8" thk.)	134.26	sy	$120.00	$16,111.20	
7	Conc. to reinforced ground floor slab (5" thk.)	26.27	cy	$650.00	$17,075.50	
8	Floor Screed (1" internal floors)	189.13	sy	$20.00	$3,782.60	
					Subtotal A	**$54,717.30**
B. SUPERSTRUCTURE						
	Ground Floor-wall/stairs (reinforcement not included)					
1	Conc. to reinforced lintels (8"x8")	2.70	cy	$600.00	$1,620.00	
2	Conc. to column (10"x10")	4.59	cy	$650.00	$2,983.50	
2	External block work (8" thk.)	278.00	sy	$100.00	$27,800.00	
3	Internal block work (8"thk.)	220.58	sy	$100.00	$22,058.00	
4	Plastering walls	556.00	sy	$22.00	$12,232.00	
5	Concrete in walls	22.80	cy	$600.00	$13,677.60	
6	Conc. to reinforced internal stairs	1.20	cy	$650.00	$780.00	
7	Balustrade at internal stairs	18	lf	$55.00	$990.00	
8	Balustrade at balcony	126	lf	$55.00	$6,902.50	
						$89,043.60
C	**STEELWORK & FORMWORK**					
1	Column pads Y16	423.63	lbs	$4.20	$1,779.25	
2	steel to strip footings	994.40	lbs	$4.20	$4,176.48	
3	Columns Y16	1304.79	lbs	$4.20	$5,480.12	
4	Columns R10 Links	534.37	lbs	$4.20	$2,244.35	
5	Beams Y16	1427.64	lbs	$4.20	$5,996.09	
6	Beams R10 Links	810.09	lbs	$4.20	$3,402.38	
7	Slab Y12 (top)	1591.30	lbs	$4.20	$6,683.46	

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	COST	TOTAL
8	Slab Y12(bottom)	2122.16	lbs	$4.20	$8,913.07	
8	Slab Y10 (top)	611.13	lbs	$4.20	$2,566.75	
9	Stairs Y12	313.93	lbs	$4.20	$1,318.51	
10	Stairs Y16	529.48	lbs	$4.20	$2,223.82	
11	Reinforcement in walls Y12	595.61	lbs	$4.20	$2,501.56	
12	Ring beam Y12	357.36	lbs	$4.20	$1,500.91	
13	Ring beam R10	325.37	lbs	$4.20	$1,366.55	
						$50,153.29
	FORMWORK					
15	Columns	63.80	sy	$65.00	$4,146.71	
16	Beams (Longitudinal)	75.00	sy	$80.00	$6,000.00	
17	Beams (Transverse)	84.82	sy	$80.00	$6,785.20	
18	Slab & Stairs	200.00	sy	$80.00	$16,000.00	
						$32,931.91
D	**ROOF**					
1	Supply and install 2" X 6" common rafter	1,048.00	lf	12.00	$12,576.00	
2	Supply and install 2" X 8" hip rafter	120	lf	12.00	$1,440.00	
2	Supply and install 1" X 10" Fascia	253	lf	9.00	$2,277.00	
4	Supply PVF 2 Colour coated metal sheets	1,995	sf	8.00	$15,956.56	
5	Installation of PVF 2	1,995	sf	2.50	$4,986.43	
6	Roof fittings & accessories	1	sum	6500.00	$6,500.00	
7	Roof fittings/hurricane strap	55	No.	10.00	$550.00	
8	Purlins (1" x 3")	720.00	lf	6.00	$4,320.00	
9	Ridge cap (Angular)	120	lf	8.00	$960.00	
10	Roof guttering	316	lf	40.00	$12,640.00	
11	Down pipe	52	lf	40.00	$2,080.00	
						$62,205.99
E	**FITTING -DOORS & WINDOWS**					
1	External doors/solid (3'-0" x 6'-8")	7	sum	$850.00	$5,950.00	

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	COST	TOTAL
2	Internal doors/solid (3'-0" x 6'-8")	11	sum	$550.00	$6,050.00	
3	Window (3'-0"x 4'-0")	9	sum	$550.00	$4,950.00	
6	Window (3'-0"x 3'-0")	6	sum	$450.00	$2,700.00	
7	Window (3'-0" x2'-0")	5	sum	$400.00	$2,000.00	
8	Door frame (2"x6") & stops	180	lf	$20.00	$3,600.00	
						$25,250.00
FINISHES-FLOORS & WALLS & CUPBOARDS						
1	Ceramic tiles for int. floors (12"x12") (non skid)	356.51	sy	$55.00	$19,608.05	
2	Installation of ceramic tiles	356.51	sy	$35.00	$12,477.85	
3	Painting of walls (2 coats emulsion)	556.00	sy	$22.00	$12,232.00	
4	Varnishing or painting/doors	40.00	sy	$22.00	$880.00	
5	Varnishing or painting/ceilings	455.02	sy	$22.00	$10,010.44	
6	kitchen cupboards & bedroom closets	1.00	sum	$19,000.00	$19,000.00	
						$74,208.34
G	**PLUMBING**					
1	Face basin & vanity	5	sum	$2,500.00	$12,500.00	
2	W.C.	4	sum	$550.00	$2,200.00	
3	Sanitary fittings (cold)	2	sum	$3,000.00	$6,000.00	
4	Plumbing (labour only) hot & cold	1	sum	$10,000.00	$10,000.00	
5	laundry & kitchen sink	1	sum	$1,000.00	$1,000.00	
6	showers & baths (3 no)	1	sum	$3,500.00	$3,500.00	
						$35,200.00
H	**ELECTRICAL**					
1	Electricals 110/220v	1	sum	$25,000.00	$25,000.00	
						$25,000.00

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	COST	TOTAL
I	**TOTAL FOR BUILDING**					**$448,710.43**
J	**EXTERNAL WORKS**					
1	Site cleanup	1	sum	$200.00	$200.00	
2	Septic tank & soak away	1	sum	$6,000.00	$6,000.00	
3	Manholes (2'x2')	3	no.	$250.00	$750.00	
4	Sewer line (4")	148	If	$8.00	$1,184.00	
5	driveway	1	sum	$3,000.00	$3,000.00	
7	drainage	1	sum	$2,500.00	$2,500.00	
						$13,634.00
K	**TOTAL FOR EXTERNAL WORKS**					**$13,634.00**
L	**PRELIMINARIES**					
1	Site clearance	1	sum	$200.00	$200.00	
2	Earthworks	1	sum	$1,500.00	$1,500.00	
3	Setting out	1	sum	$1,000.00	$1,000.00	
4	Construction Shed	1	sum	$4,000.00	$4,000.00	
5	Temp. electricity	1	sum	$800.00	$800.00	
6	Water supply	1	sum	$800.00	$800.00	
7	Insurance of the works	1	sum	$2,500.00	$2,500.00	
8	Scaffolding	1	sum	$1,500.00	$1,500.00	
						$12,300.00
M	**TOTAL FOR PRELIMINARIES**					**$12,300.00**

Chart 21 Summary of Resources for Seamoss Processing Plant. Source (J. Husbands, June 2023)

ITEM NO.	DESCRIPTION	COST
A	PRELIMINARIES	$12,300.00
B	SUBSTRUCTURE	$54,717.30
C	SUPERSTRUCTURE	$89,043.60
D	STEELWORK & FORMWORK	$83,085.20
E	ROOF	$62,205.99
F	FITTINGS - DOORS & WINDOWS	$25,250.00
G	FINISHES - FLOORS & WALLS	$74,208.34
H	PLUMBING	$35,200.00
I	ELECTRICAL	$25,000.00
J	EXTERNAL WORKS	$13,634.00
	GRAND TOTAL	474,644.43

4.7 Risk Management Plan

This process involves defining how to conduct risk management activities for a project (PMI, 2017, 395). Therefore, to adequately identify and plan for the project risks, the project risks were identified and qualitatively analyzed, then planned responses were identified for each risk. Risks were not quantitatively analyzed due to the lack of resources. Inputs to the plan risk management were: 1. the previously developed management plans and 2. the project charter. The tools and techniques used for this process were root cause analysis, expert judgement, and meetings with the principal consultant, engineers, and project manager.

4.7.1 Risk Breakdown Structure (RBS)

PMI (2021) defines a risk breakdown structure (RBS) as "a hierarchical representation of potential sources of risk" (p. 248). The RBS is detailed below.

Chart 22 Risk Breakdown Structure (RBS). Source (J. Husbands, June 2023)

RBS LEVEL 0	RBS LEVEL 1	RBS LEVEL 2	RBS LEVEL 3
0. ALL SOURCES OF PROJECT RISK	1. Technical Risk	1.1 Scope definition	1.1.1 If the customer makes a change to the project scope, then it can compromise the scope definition,
		1.2 Requirement definition	1.2.1 If the industry standard changes, then it can change the requirement definition.
		1.3 Estimates, assumptions, constraints	1.3.1 If the cost inflation on materials during project implementation changes, then it can affect the estimates, assumptions and constraints.
			1.3.2 If the time to complete a task is underestimated, then it can affect the estimates, assumptions, and constraints.
		1.4 Technical processes	1.4.1 If the labor skill and competencies are inadequate then it can affect the technical processes.
			1.4.2 If the labor skill is greater than expected then it can impact the technical processes.
		1.5 Technology	1.5.1 If there is equipment failure and theft during project implementation then it can delay project progress.
			1.5.2 If there is record and data management system failure then it can result in the loss of project information
	2. Management Risk	2.1 Project management	2.1.1 if there is labor unrest, then it can delay the implementation of the project.
		2.2 Operations management	2.2.1 If there is a lack of adherence to safe work practices then it can result in staff injury and accidents.
			2.2.2 If the staff is overworked then it can result in staff illness.

RBS LEVEL 0	RBS LEVEL 1	RBS LEVEL 2	RBS LEVEL 3
		2.3 Organization	2.3.1 If staff payments are delayed then it can impact the operational progress on the project.
			2.3.2 If there are delays in reviews and approvals by leadership, then it can delay the progress of activities on the critical path of the project.
		2.4 Communication	2.4.1 If stakeholders are uninformed and communication is delayed, then it can delay the progress of activities on the critical path of the project.
			2.4.2 If the project team is not working cohesively then this can result in poor project communication.
		2.5 Resourcing	2.5.1 If there are inadequate labor resources then this can affect the progress on project implementation.
			2.5.2 If there is not enough materials, tools, and equipment then this can impact the progress on project implementation.
	3. Commercial Risk	3.1 Contractual terms and conditions	3.1.1 If there is poor contract terms and conditions then this can impact the delivery of the project scope requirements.
		3.2 Suppliers and vendors	3.2.1 If the material delivery is late, then this can delay the project.
			3.2.2 If materials are of poor quality and does not reflect agreed requirements, it can impact the delivery of meeting quality requirements.
			3.2.3 If materials are damaged, then this can delay project implementation.
			3.2.4 If concrete fails compression testing then this can delay project implementation and increase budget.
			3.2.5 If there is savings on material purchased in bulk then this can reallocate to support other areas of need under the project.
		3.3 Subcontracts	3.3.1 If there are poorly negotiated contracts and communication then this and impact the delivery of meeting customer and project requirements.
			3.3.2 If there is subpar quality work in execution, then this can impact project requirements.

RBS LEVEL 0	RBS LEVEL 1	RBS LEVEL 2	RBS LEVEL 3
		3.4 Customer stability	3.4.1 If there is a delay in payments from customer, then this can impact the progress on project implementation.
	4. External Risk	4.1 Legislation and regulatory	4.1.1 If there is local plant, utility, construction, and food safety code changes then this can impact the progress on project implementation.
			4.1.2 If there is a change in permit requirements then this can impact the progress on project implementation.
		4.2 Bad weather	4.2.1 If there is incessant rain resulting in delay, then this can impact the progress on project implementation.
			4.2.2 If there are natural disasters, then this can impact the progress on project implementation.

4.7.2 Probability and Impact Scales and Matrix.

Each of the cells in this matrix has been given one of the following colors, which represent the urgency of risk response planning and determine the following reporting levels:

Red (very high risk/very significant): A very high risk with a score of more than 0.29 is critical and top priority.

Orange (high risk/significant): A score of 0.11 to 0.28 is deemed high risk. These risks must be addressed but are not prioritized as highly as very high risks.

Yellow (medium): A score of 0.06 to 0.18 is deemed medium risk.

Green (low/ very low): A score of 0.05 to 0.045 is deemed low to very low risk in impact, probability or both.

Charts 23 and 24 show the probability and impact scales and matrix for the solar-powered sea moss agro-processing plant project.

Chart 23 Probability and Impact Scale. Source (J. Husbands, June 2023)

Scale	Probability	Probability Score	Impact on Project			
			Schedule	Cost	Scope	Impact Score
Nil	<1%	0	No change	No change	No change to planned cost and time.	0.00
Very Low	< 10%	0.1	< 2 weeks	< 1%	Temporary defects, causing minor short-term consequences.	0.05
Low	10% to < 30%	0.3	2 weeks to < 1month	1% to < 2%	Product performance shortfall in area of tertiary (minor) importance.	0.1
Medium	30% to < 50%	0.5	1 month to < 2 months	2% to < 4%	Product performance shortfall in area of secondary importance.	0.2
High	50% to < 70%	0.7	2 months to < 4 months	4% to < 8%	Minor product performance shortfall in area of primary (critical) performance.	0.4
Very High	> 70%	0.9	> 4 months	> 8%	Significant failure of product to meet one of its primary (critical) purposes.	0.8

Chart 24 Probability and Impact Matrix. Source (J. Husbands, June 2023)

		Threats					Opportunities				
Probability	0.9	0.045	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.045
	0.7	0.035	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.035
	0.5	0.025	0.05	0.1	0.2	0.4	0.4	0.2	0.1	0.05	0.025
	0.3	0.015	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.015
	0.1	0.005	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.005
		0.05	0.1	0.2	0.4	0.8	0.8	0.4	0.2	0.1	0.05
		Impact									

4.7.3 Risk Register

PMI (2017) states “the risk register captures details of identified individual project risks. The results of perform qualitative risk analysis, plan risk responses, implement risk responses, and monitor risk are recorded in the risk register as those processes are conducted throughout the project” (p. 417). Qualitative Risk Analysis will be done using the probability and impact scale and matrix shown above.

Chart 25 Risk Register. Source (J. Husbands, June 2023)

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.1.1	The customer adds additional items to the project scope.	The customer makes a change to the project scope.	Increase in the project budget and schedule extension as more activities will be needed to successfully complete the project. This can compromise the quality requirements.	0.1	0.3	0.03	Change in the customer's needs.	Principal consultan t	Mitigate: During the project planning phase, make sure that each part of the plan is reviewed thoroughly so that the customer is satisfied that all their needs are met through the established requirements.	Feasibility report & environmental impact assessment

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.2.1	Industry standards change to develop a higher quality product	The industry standard changes.	Increase in the project budget and schedule extension as there will be changes to the project scope and possibly procurement and quality plan, to ensure that the project satisfies industry standards.	0.1	0.7	0.07	Change in technolog y and regulatory measures in the industry.	Principal consultan t	Accept: During the planning phase of the project, all research must be done prior to make sure that what has been designed still meets any new industry standards	Feasibility report & environmental impact assessment
1.3.1	Increase in price of raw materials, tools, equipment, and solar batteries	The inflation in the cost of materials, tools, equipment, and solar batteries changes during the project due to the post COVID-19 era	Increase in the project budget as cost of materials, tools, equipment, and solar batteries is greater than estimated cost.	0.3	0.2	0.06	Raw materials become scarce.	Project manager	Mitigate: Monitor the cost of materials, tools, equipment, and solar batteries during the project and buy in bulk early, if necessary, to save on cost.	Installation of solar-powered system with battery storage and sea moss agro-processing plant.

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.3.2	Non-clarity on all the steps involved to complete a task.	The time to complete a task is underestimated.	Increase in rework, costs and additional resources as tasks take longer to complete than estimated and project falls behind schedule.	0.3	0.1	0.03	Poor communication and gaps in work experience.	Project manager	Mitigate: Consult with subcontractors to make sure that all task steps are understood clearly, and schedule requirements will be met, especially the activities on the critical path of the project.	Architectural design and drawing

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.4.1	Laborers do not possess as much skill as they professed to.	Labor skill is inadequate.	Work completed is below standard and must be redone by another professional.	0.4	0.2	0.8	New labor hired.	Owner-Rayneau Construction & Industrial Products and site engineer	Avoid: Review whether requirements are being met when engaging staff and vet them accordingly to ensure all requirements are met. Also, request references and samples/ examples of their work product deliverables to ensure that their work is of high quality.	Completed sea moss agro-processing plant

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.4.2	Laborers did not have many opportunities to demonstrate skills and competencies	Labor skill is greater than expected.	Work is completed ahead of schedule with high quality.	0.3	0.1	0.3	New labor hired.	Owner-Rayneau Construction & Industrial Products and site engineer	Mitigate: Inquire from highly skilled workers whether they have any associates with similar skills who could be hired.	Completed sea moss agro-processing plant

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
1.5.1	Equipment not available and not properly maintained.	Equipment malfunctions during project and is stolen during project implementation.	Project budget is increased, and schedule must be extended because equipment must be replaced. Vital project information is lost, and work must stop until equipment is replaced.	0.3	0.4	0.12	No data and information storage, maintenance and equipment replacement plan implemented.	Project manager and Rayneau Construction & Industrial Products	Mitigate: When all tools, materials and equipment arrive on site, ensure that they are secured, counted, checked to determine whether they are functioning, and maintenance should be implemented to ensure they remain in good working condition. Pay for cloud storage for project data and information.	Completed sea moss agro-processing plant

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.1.1	Unsatisfactory work conditions.	Labor unrest.	Delay in project schedule because staff refuses to work in existing work conditions.	0.3	0.8	0.21	Staff needs not considered with regard to occupational health and safety conditions.	Principal consultant and Rayneau Construction & Industrial Products	Mitigate: Ensure that all conditions stipulated by labor laws are met. Prioritize the comfort of staff and the achievement of project deliverables.	Completed sea moss agro-processing plant

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.2.1	Unsafe working conditions.	Lack of adherence to safe to work practices resulting in staff injury and accidents.	Schedule, resource cost and quality limitations. Project reputation maybe under scrutiny due to increased incidents. Increase in project budget due to the number of disbursements required to cover the medical fees of injured staff members as well providing staff with new resources which may cause schedule delays.	0.3	0.4	0.12	Staff safety not prioritized.	Principal consultant and Rayneau Construction & Industrial Products	Mitigate: Ensure safe to work procedures are implemented and functionally operational. Have a meeting with staff to ensure they understand what is expected of them with regards to safety and ensure they have all personal protective equipment they need to safely complete their work.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.2.2	Contraction of the common cold or flu, COVID-19, or related virus	Staff illness.	Delay in project schedule as project resources (human) are temporarily depleted.	0.3	0.1	0.03	Flu season and COVID 19-community spread.	Principal consultant	Mitigate: Place labor resources on standby to take over for staff who fall ill	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
2.3.1	Miscommunication between project administrator and accounting and finance specialists	Staff payment is late.	Delay in project schedule because staff is unwilling to work without pay.	0.1	0.8	0.08	Lack of communication between project team members.	Project administrator, accounting, and finance specialists, Owner-Rayneau Construction & Industrial Products	Mitigate: Ensure that hours worked for all project staff are submitted on time so that it can be processed on time.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.3.2	Poor leadership interest	Delays in reviews and approvals by leadership	Delay in project activities on the critical path due to approvals which require prior informed consent.	0.1	0.8	0.08	Loss of interest in the project due to competing work priorities.	Principal consultan t	Mitigate: Schedule meetings to ensure high priority items are reviewed and endorsed. Review best modes of communication with leader to ensure buy-in and desired support.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.4.1	Not enough communication between project team and stakeholders.	Stakeholders uninformed.	Customer dissatisfaction because the stakeholders are left out of the decision-making process or are not aware of project progress.	0.1	0.04	0.04	Lack of communication between project team and stakeholders.	Project manager	Mitigate: Adhere to communication plan recommendations so that all stakeholders are properly informed and make adjustments as necessary based on stakeholder preferred methods.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
2.4.2	Project team misunderstanding their roles and responsibilities.	Project team not working cohesively.	Delay in project schedule due to project team members not working as a team to complete tasks.	0.1	0.4	0.04	Lack of communication between site management and site workers.	Principal consultant and Owner-Rayneau Construction & Industrial Products	Mitigate: Ensure that all information about roles and responsibilities is clearly communicated and understood during weekly project meetings.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
2.5.1	Unable to find suitably qualified workmen to hire for the project.	Not enough labor.	Delay in project schedule due to having insufficient workmen to complete the tasks on time.	0.1	0.3	0.03	More work activities will have to start concurrently to remain on schedule	Site engineer and Owner-Rayneau Construction & Industrial Products	Mitigate: Inquire from highly skilled workmen about associates they may have that are looking for work.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
2.5.2	Necessary equipment is unavailable during project.	Not enough equipment resulting in procurement delays.	Delay in project schedule as equipment needed to complete work on time is unavailable.	0.1	0.8	0.08	More work activities will have to start concurrently to remain on schedule	Principal consultant	Accept: Inquire from equipment suppliers during the planning stages whether they have capacity to provide for the project so that plans can be made.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
3.1.1	First time working on a project of this type.	Poor contract terms.	Project delay because it takes longer for all parties to reach a consensus.	0.1	0.6	0.06	Limited skills in dispute resolution, and/or mediation.	Project consultant and procurement, purchasing & inventory control specialists	Mitigate: Hire a lawyer to provide third party consultation and mediation services to review the terms and conditions for the resolution of items of concern.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
3.2.1	Delay in shipment from supplier.	Material is delivered late.	Delay in project schedule as material is not available to complete task.	0.3	0.4	0.12	Request for material.	Principal consultant	Accept: Order material in advance, with enough time to facilitate an earlier arrival.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
3.2.2	Poor fabrication by manufacturer.	Material is of poor quality.	Delay in project schedule as new material will have to be delivered to replace old material.	0.3	0.4	0.12	Request for material.	Principal consultant, procurement, purchasing & inventory control specialists, Rayneau Construction & Industrial Products	Mitigate: Ask for supplier material inspection reports prior to shipment of material to ensure that the highest quality material is being sent.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
3.2.3	Not enough care paid to materials on site.	Material is damaged.	Increase in project budget as damaged material must be replaced and possible schedule delays.	0.5	0.2	0.1	Lack of care by project team members.	Principal consultant	Mitigate: Store material on site in an area away from where project work is being completed where there is a lot of traffic.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
3.2.4	Concrete cubes for testing are not produced correctly.	Concrete fails compression testing.	Delay in project schedule and increase in project budget as all areas where concrete would have failed, need to be repoured.	0.1	0.8	0.08	Concrete pour.	Principal consultant and Rayneau Construction & Industrial Products	Avoid: Professionally train mason to produce concrete cubes to the testing standard.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
3.2.5	Discount from supplier due to high volume of material purchased.	Savings on material bulk purchases.	Project completed under budget as materials are cheaper than estimated.	0.5	0.4	0.2	Good relationship with supplier.	Principal consultant, procurement, purchasing & inventory control specialists, and Rayneau Construction & Industrial Products	Mitigate: Build a good rapport with the supplier through timely, clear communication.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
3.3.1	First time working with a particular subcontractor.	Poorly negotiated contract.	Increase in project budget as subcontractor can negotiate a higher pay which is higher than the project's budget allocation.	0.1	0.2	0.02	Completed contract with subcontractors.	Principal consultant and procurement, purchasing & inventory control specialists	Mitigate: Have the project team member with the best negotiation skills be tasked with the responsibility to ensure that the best contract terms are agreed upon by both parties.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
3.3.2	First time working with a particular subcontractor.	Subpar quality work.	Increase in project budget and delay in project schedule due to the work having to be redone.	0.3	0.3	0.09	Completed contract with subcontractors.	Owner-Rayneau Construction & Industrial Products	Mitigate: In the contract terms, make note that the highest quality work is expected from the subcontractor and if rework needs to be done, it will be done at their expense and not the company's.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
3.4.1	Payment terms not fully agreed upon.	Delay in payment from customer.	Delay in project schedule.	0.1	0.8	0.08	Lack of customer finances.	Principal consultant	Mitigate: Have all funding processes and deadlines agreed upon during project planning stages to avoid delays in project timeline.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
4.1.1	The government changes and newly elected government makes changes to requirements.	Local plant, utility, construction, and food safety code changes.	Increase in project budget and delay in project schedule and achievement of quality requirements due to changes in the scope that would need to be made.	0.1	0.3	0.03	Change in government and legislation to reflect their manifesto.	Principal consultant	Escalate: When the project is in the planning stages, negotiate with the regulatory bodies that the local plant, utility, construction, and food safety code at the time/ of the day will be used to reflect existing requirements.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
4.1.2	The government changes and makes changes to requirements.	Permit requirements change.	Delay in project schedule due to having to meet different requirements to get the construction permit.	0.1	0.1	0.01	Change in government.	Principal consultant	Escalate: When the project is in the planning stages, negotiate with the regulatory bodies that the local plant, utility, construction, and food safety code at the time/ of the day will be used to reflect existing requirements.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage
4.2.1	Nature.	Incessant rain resulting in delays.	Delay in project schedule due to work not being able to be completed in rainy weather.	0.5	0.05	0.25	Weather.	Owner-Rayneau Construction & Industrial Products and Site Engineer	Mitigate: Add days to the project schedule during planning to account for possible rainy days where no work will be able to be completed.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Trigger	Owner	Strategy	Deliverable
4.2.2	Nature.	Natural disaster.	Delay in project schedule and increase in project budget due to the site having to be shut down due to impending bad weather and possible mrial damage.	0.1	0.7	0.07	Weather.	Principal consultan t	Mitigate: Add days to the project schedule during planning to account for possible rainy days where no work will be able to be completed, as well as have project insurance to cover loss due to bad weather. Also tap into contingency budget allocation to support the continuation of the project in the event of any major disasters.	Completed sea moss agro-processing plant and installation of solar-powered system with battery storage

4.7.4 Risk Monitoring

The project manager will monitor the status of risks by comparing the data collected during project execution with the risk register and risk analysis summary. The risk register will be updated weekly and communicated to the project team and relevant stakeholders during the project status meetings. The risk owners will be responsible for deciding when/if to execute the corresponding risk response.

4.8 Procurement Management Plan

The procurement management plan serves as a guide for managing procurement throughout the project life cycle and will be updated, as necessary. Due to the industry experience and history that Rayneau Construction & Industrial Products has in the construction field, a make-or-buy analysis will not be used for this project. The project team is already familiar with what can be made versus what must be purchased. As such, the procurement management plan will identify the types of contracts to be used, the approval process, and the decision criteria.

4.8.1 Procurement Management Approach

The principal consultant will provide oversight and management for all procurement activities during the project. The project manager and the procurement, purchasing & inventory control specialists will collaborate with the principal consultant to identify all items or services to be procured for the successful completion of the project. Once the list has been finalised, the vendor selection, purchasing, and contracting processes will commence.

4.8.2 Procurement Definition

The following chart shows the procurement items and services that have been determined to be essential for project success.

Chart 26 Procurement Items and Services. Source (J. Husbands, June 2023)

Item/Service	Justification
Steel structure	The steel skeleton of the plant.
Reinforcement steel	Used to reinforce concrete beams, columns, and floors.
Bolts	Fasteners for the steel structure.
Purlins	Structure for roof sheets to be fastened.
Galvanized steel sheets	Providing cover for the plant.
Steel erectors	Persons who will erect the steel structure.
Head duty padlocks	For security gates and perimeter fences.
Angle grinder discs	Used to cut steel.
Chop saw blades	Used to cut steel.
Impact wrench	Used to drive bolts.
Insulation	To keep out moisture.
Ceiling tile tee/cross tee	Used to make ceiling structure for ceiling tiles.
Ceiling tiles	Used to complete ceiling.
500g polythene membrane	To provide plastic sheets that keep out moisture.
Marl	To supply stones of varied sizes for mixing concrete.
Guttering	Plastic system used to divert water from roof.
Excavation/backfilling	Service to remove in-place material and fill it with marl compacted to 98% proctor density.
Cement mixer	To support construction of keys items.
Metal fence	To support construction of keys items.
Formwork	To support construction of keys items.
Aggregate	To support construction of keys items.

Item/Service	Justification
Tissue dispenser	For installation in washroom, kitchen, and processing areas of the plant.
Sealant	To support construction of keys items.
Dehumidifier and air purifier	To maintain good air quality and humidity levels between 40- 60% at the plant.
Extractor Fans	To support construction of keys items.
Windows	To support construction of keys items.
Pipes	To support construction of keys items.
Shovel	To support construction of keys items.
Primer	To support construction of keys items.
Gloves	To support plant safety requirements.
Dust masks	To support plant safety requirements.
Eye protection glasses	To support plant safety requirements.
Air muffs	To support plant safety requirements.
Cables, switches, and connectors	To support construction of keys items.
Drying racks	To support agro-processing activities.
Cleaning machines	To support construction of keys items.
Milling equipment	To support agro-processing activities.
Valves and fittings	To support construction of keys items.
LED lights	To support plant safety and security requirements.
Surveillance camera	To support plant safety and security requirements.
Alarm system	To support plant safety and security requirements.
Smoke detectors	To support plant safety requirements.
Fire extinguisher	To support plant safety requirements.
Chairs	To support agro-processing activities.
Tables	To support agro-processing activities.

Item/Service	Justification
Storage cabinet	To support agro-processing activities.
Computers	To support agro-processing activities and communication.
Printers	To support agro-processing activities and labelling.
Recycling bins	For collection and storage of generated plant waste.
Bin liners/ garbage bags	For collection and storage of generated plant waste.
Agro-processing machines	To support agro-processing activities.
Soap and sanitizer dispenser	For installation in washroom, kitchen entrances and processing areas of the plant.
Electrical/IT	Service to install all electrical plugs, lights, switches, and data points.
Air-conditioning units	Service to install and gas a/c units.
Windows	Opening fitted with glass to allow persons inside to see out, as well as to allow natural light in.
Tiles	Aesthetic feature that makes cleaning floors easier.
Epoxy	Sealed finish for a concrete floor.
Steel bending	Service to cut, bend, and place reinforcement steel.
Crane	Service to lift heavy objects into place.

The following chart shows the procurement item justification for the installation of a 100 kW AC PV solar system with (2 hour) battery storage.

Chart 27 Procurement item justification for the installation of a 100 kW AC PV solar system with (2 hour) battery storage. Source (J. Husbands, June 2023)

	Items	Quantity	Justification	Deliverable
1.0	**PV System**		To support installation of solar-powered	Installation of solar-powered
1.1	PV Panels	250		
1.2	Inverter	1		

	Items	Quantity	Justification	Deliverable
1.3	Racking or Mounting system	1	system with battery storage	system with battery storage
1.4	AC Isolators	4		
1.5	DC isolators	4		
1.6	Combiner Boxes	6		
1.7	AC cables in ft	500		
1.8	DC Cables in ft	1000		
1.9	AC switchgear	1		
1.10	Accessories (such as cable ties, insulation tape etc.)	1		
2.1	Battery Modules Bank(s)	1		
2.2	Battery Management System (BMS)	1		
2.3	Inverter/Converter for battery system	1		
2.4	Electrical Switchgear (circuit breakers, switches, fuses)	1		
31	Energy Management System (EMS) for battery and PV system integration	1		
3.2	Control and Monitoring Equipment	1		
3.3	Communication Equipment (if required)	1		
4.1	Cooling Equipment (combination of fans, heat sinks,)	1		
4.2	Ventilation System	1		
5.1	Fire Extinguishers	3		
5.2	Personal Protective Equipment (PPE)	1		
5.3	Emergency Shutdown Systems	1		
5.4	Signage and Warning Labels	1		
6.1	Installing & wiring the PV Panels	250		
6.2	Laying out and installing the mounting System	1		
6.3	Installing & Wiring the Inverter(s)	1		

	Items	Quantity	Justification	Deliverable
6.4	Installing and wiring the combiner boxes	4		
6.5	Installing and wiring all isolators (Both AC&DC)	10		
7.1	Installing the Battery Modules	1		
7.2	Installing the Battery Management System (BMS)	1		
7.3	Installing the Inverter/Converter for battery system	1		
7.4	installing Electrical Switchgear (circuit breakers, switches, fuses)	1		
8.1	Installing Energy Management System (EMS) for battery and PV system integration	1		
8.2	Installing Control and Monitoring Equipment	1		
8.3	Installing Communication Equipment (if required)	1		
9.1	Installing the Cooling Equipment	1		
9.2	Installing the Ventilation System	1		
10.1	Installing Fire Extinguishers	3		
10.2	Personal Protective Equipment (PPE)	1		
10.3	Installing Emergency Shutdown Systems	1		
10.4	Installing all Signage and Warning Labels	1		
11	Commissioning and testing of entire system	1		
12	Transportation and equipment	1		

The following chart shows the procurement item list with justification for the installation of a 100 kW AC PV solar system with (2 hour) battery storage to complete installation of sea moss agro-processing plant.

Chart 28 Procurement item justification for the construction of sea moss- agro processing plant. Source (J. Husbands, June 2023)

ITEM NO.	DESCRIPTION	QTY
A	**SUBSTRUCTURE** Excavating and work up to finish floor level (reinforcement not included)	
1	Exc. for pad footing 4'-0" deep	
2	Exc. for strip footing 3'-8" deep	21.33
3	Conc. to reinforced pad footing (14" thk.)	62.84
4	Conc. to reinforced strip footing (10"thk.)	5.33
5	Conc. to columns below floor slab (10"x10")	14.27
6	Foundation wall block work (8" thk.)	1.23
7	Conc. to reinforced ground floor slab (5" thk.)	134.26
8	Floor Screed (1" internal floors)	26.27
		189.13
B	**SUPERSTRUCTURE**	
	Ground Floor-wall/stairs (reinforcement not included)	
1	Conc. to reinforced lintels (8"x8")	
2	Conc. to column (10"x10")	2.70
2	External block work (8" thk.)	4.59
3	Internal block work (8"thk.)	278.00
4	Plastering walls	220.58
5	Concrete in walls	556.00
6	Conc. to reinforced internal stairs	22.80
7	Balustrade at internal stairs	1.20
8	Balustrade at balcony	18
		126
C	**STEELWORK & FORMWORK**	
1	Column pads Y16	
2	steel to strip footings	423.63
3	Columns Y16	994.40
4	Columns R10 Links	1304.79

ITEM NO.	DESCRIPTION	QTY
5	Beams Y16	534.37
6	Beams R10 Links	1427.64
7	Slab Y12 (top)	810.09
8	Slab Y12(bottom)	1591.30
8	Slab Y10 (top)	2122.16
9	Stairs Y12	611.13
10	Stairs Y16	313.93
11	Reinforcement in walls Y12	529.48
12	Ring beam Y12	595.61
13	Ring beam R10	357.36
	FORMWORK	
15	Columns	
16	Beams (Longitudinal)	63.80
17	Beams (Transverse)	75.00
18	Slab & Stairs	84.82
D	**ROOF**	
1	Supply and install 2" X 6" common rafter	1,048.00
2	Supply and install 2" X 8" hip rafter	120
2	Supply and install 1" X 10" Fascia	253
4	Supply PVF 2 Colour coated metal sheets	1,995
5	Installation of PVF 2	1,995
6	Roof fittings & accessories	1
7	Roof fittings/hurricane strap	55
8	Purlins (1" x 3")	720.00
9	Ridge cap (Angular)	120
10	Roof guttering	316
11	Down pipe	52
E	**FITTING -DOORS & WINDOWS**	
1	External doors/solid (3'-0" x 6'-8")	
2	Internal doors/solid (3'-0" x 6'-8")	7
3	Window (3'-0"x 4'-0")	11
6	Window (3'-0"x 3'-0")	9
7	Window (3'-0" x2'-0")	6
8	Door frame (2"x6") & stops	5
		180
F	**FINISHES-FLOORS & WALLS & CUPBOARDS**	
1	Ceramic tiles for int. floors (12"x12") (nonskid)	
2	Installation of ceramic tiles	356.51

ITEM NO.	DESCRIPTION	QTY
3	Painting of walls (2 coats emulsion)	356.51
4	Varnishing or painting/doors	556.00
5	Varnishing or painting/ceilings	40.00
6	Cupboards	456.02
G	**PLUMBING**	
1	Face basin & vanity	5
2	W.C.	4
3	Sanitary fittings (cold)	2
4	Plumbing (labour only) hot & cold	1
5	laundry & kitchen sink	1
6	showers & baths (3 no)	1
H	**ELECTRICAL**	
1	Electricals 110/220v	1
I	**TOTAL FOR BUILDING**	
J	**EXTERNAL WORKS**	
1	Site cleanup	1
2	Septic tank & soak away	1
3	Manholes (2'x2')	3
4	Sewer line (4")	148
5	driveway	1
7	drainage	1
K	**TOTAL FOR EXTERNAL WORKS**	
L	**PRELIMINARIES**	
1	Site clearance	**1**
2	Earthworks	1
3	Setting out	1
4	Construction Shed	1
5	Temp. electricity	1
6	Water supply	1
7	Insurance of the works	1
8	Scaffolding	1

In addition to the above list of procurement items, the following individuals are authorized to approve purchases for the project teams:

- Jasmine Hutchinson – principal consultant
- Carlos Bruce – project manager
- Kay Marion – procurement, purchasing & inventory control specialist.

4.8.3 Types of Contracts

All services to be procured for this project will be solicited under a firm fixed price contract. The project team will collaborate with the principal consultant, project managers and procurement, purchasing & inventory control specialist to define the item types, quantities, services, and delivery dates. The purchasing & inventory control specialist will then send out a request for tenders (RFT), and once a vendor is selected, procurement of the items and services will commence. All additional items to be procured for this project will be solicited under a material only contract.

4.8.4 Cost Determination

Costs will be based on the proposals sent in by the vendor for a particular service. The proposals will include a line-by-line breakdown of the cost to provide the service and using that breakdown, the price for the firm fixed contract will be determined.

4.8.5 Procurement Documentation

The following templates will be developed and maintained in the company's shared drive as artifacts, so that they may be used for future projects:

- Request for tenders
- Tender evaluation form
- Non-disclosure agreement

- Letter of intent
- Contracts:
  - Procurement statement of work or major deliverables.
  - Schedule, milestones, or date by which a schedule is required.
  - Performance reporting.
  - Pricing and payment terms.
  - Inspection, quality, and acceptable criteria.
  - Warranty and future product support.
  - Incentives and penalties.
  - Insurance and performance bonds.
  - Subordinate subcontractor approvals.
  - General terms and conditions.
  - Change request handling.
  - Termination clause and alternative dispute resolution mechanisms.
- Procurement audit form
- Procurement performance evaluation form and Lessons learned form.

4.8.6 Procurement Constraints

There are several constraints which must be considered as part of the procurement management plan. These constraints will be communicated to all vendors and included in the RFT. The constraints are as follows:

- Project schedule is not flexible and the procurement activities, contract administration, and contract fulfilment must be completed within the established project schedule.
- Project budget has a built-in contingency reserve; however, the reserve may not be applied to procurement activities. Reserves are only to be used in the event of an approved change in project scope. All procurement activities and contract awards must support the approved project scope statement. Any procurement activities or contract awards which specify work which is not in direct support of the project's scope statement will be considered out of scope and disapproved.
- All procurement activities must be performed and managed with current personnel. No additional personnel will be hired or re-allocated to support the procurement activities on this project.

4.8.7 Contract Approval Process

Once general procurement notices are complete and all tenders have been received by the procurement, purchasing & inventory control specialists, the evaluation process will begin. The first step of this process is to conduct a review of all vendor proposals to determine which meets the established criteria. The criteria for the selection and award of procurement contracts under this project will be based on the following decision criteria (PMI, 2017, p. 478):

- <u>Price or Cost</u>: The cost or price proposed by the supplier is often a significant factor in the decision-making process. This involves considering the total cost of ownership, including not only the initial price but also ongoing operational costs, maintenance expenses, and potential long-term benefits.

- Technical and functional specifications: The vendor’s ability to meet the technical and functional requirements outlined in the project specifications is crucial. This criterion involves evaluating the vendor’s expertise, experience, technical capability, and the compatibility of their proposed solution with the project's needs.
- Quality and reliability: Assessing the quality and reliability of the vendor products, services, or works is important to ensure that they meet the desired standards. This criterion involves reviewing the supplier's track record, references, certifications, warranties, and guarantees of quality.
- Past performance: Evaluating the vendor’s past performance on similar projects or contracts provides insight into their ability to deliver as per expectations. This criterion involves assessing the vendor’s reputation, references, client feedback, and performance history.
- Compliance and legal considerations: Ensuring that the vendor complies with legal and regulatory requirements is essential. This criterion involves verifying the supplier's licenses, permits, insurance coverage, adherence to applicable laws, regulations, and industry standards.
- Financial stability: Assessing the financial stability and capability of the supplier is crucial to mitigate risks. This criterion involves evaluating the vendor’s financial statements, creditworthiness, and ability to meet contractual obligations.

- Project schedule and delivery time: The vendor's ability to meet the project schedule and deliver within the specified timeframes. This involves evaluating the supplier's proposed timeline, production capacity, and ability to mobilize resources to ensure overall successful outcomes.
- Risk management: Evaluating the vendor's risk management capabilities and their ability to identify and mitigate potential risks is important. This criterion involves assessing the supplier's risk management plan, contingency measures, and ability to handle unexpected events.
- Sustainability and social responsibility: Assessing the vendor's commitment to sustainability, environmental practices, and social responsibility. The criterion involves evaluating the supplier's sustainability policies, environmental certifications, labor practices, and corporate social responsibility initiatives.
- Collaboration and communication: Assessing the supplier's ability to collaborate effectively with the project team and communicate transparently is important for project success. This criterion involves evaluating the supplier's responsiveness, communication skills, and willingness to engage in a collaborative relationship.

These criteria will be measured by the project manager and procurement, purchasing & inventory control specialists and the contract will be awarded to the highest-ranking vendor who best meets the criteria.

4.8.8 Vendor Management

Vendor management will be the responsibility of the principal consultant. All vendors providing services on site will be part of the weekly site meeting that sets a plan for the work for the week. Vendors that are only providing materials will not be a part of the meeting. Additionally, the project manager, engineers, renewable energy & solar PV specialist will be monitoring the work completed by these vendors to ensure it is of acceptable quality.

4.9 Stakeholder Management Plan

PMI (2017) describes the project stakeholder management as "the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyse stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution" (p. 503).

4.9.1 Identify Stakeholders

Chart 29 shows the stakeholder register matrix for the construction of The Solar-powered Sea Moss Agro-processing Plant Project. Once the stakeholders were identified, they were analysed using stakeholder analysis and this information was presented in a stakeholder register matrix.

Chart 29 Stakeholder Register Matrix. Source (J. Husbands, June 2023)

ID	Stakeholders	Main Expectations	Influence/Impact (Low-Medium-High)
1	Project sponsor	To support successful outcomes of the project.	High Influence/ High Impact
2	Principal consultant; JH Consultancy & Management Services	The successful completion of the Solar-powered Sea Moss Agro-processing Plant Project.	High Influence/High Impact
3	Project manager, JH Consultancy & Management Services	The successful completion of the Solar-powered Sea Moss Agro-processing Plant Project.	High Influence/High Impact
4	Architect	To design a plant that meets the needs of the customer and satisfies industry and local plant code requirements.	High Influence/High Impact
5	Quantity surveyor	To estimate the costs involved in the construction of the project. They analyze project specifications, drawings, and other relevant documents to determine the quantities of materials, labor, and equipment required.	High Influence/High Impact
6 7	Engineers - electrical, mechanical, structural, construction & maintenance	To collaborate with project teams to develop project plans and design concepts for construction, mechanical, electrical, maintenance and structural elements.	High Influence/High Impact

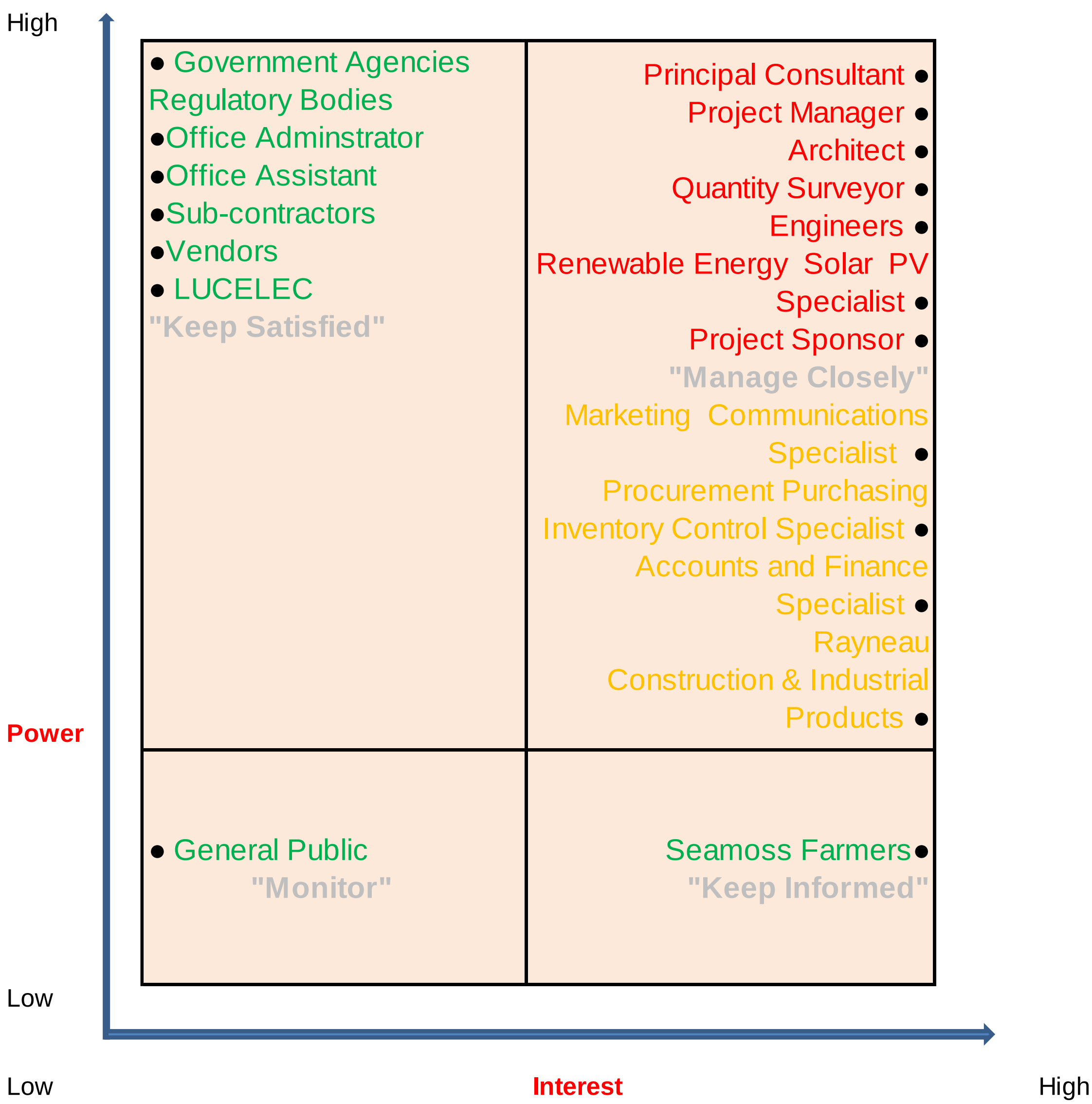
ID	Stakeholders	Main Expectations	Influence/Impact (Low-Medium-High)
8	Renewable energy & solar PV specialist	To support the design solar PV systems that meet project requirements, considering factors such as available space, energy demand, and system efficiency within regulatory and industry requirements.	High Influence/High Impact
9	Owner, Rayneau Construction & Industrial Products	To successfully complete the project while maintaining a high-quality track record for successful product handovers within customers' requirements.	High Influence/High Impact
10	Marketing & communications specialist	To collaborate with cross-functional teams to develop marketing strategies that align with the organization's goals and define target audiences, positioning, messaging, and promotional tactics to effectively reach and engage stakeholders.	Medium Influence/High Impact
11	Procurement, purchasing & inventory control specialists	To develop procurement strategies and policies that align with the organization's goals and project requirements, as well as analyzing project needs, identifying suitable suppliers, and determining the most effective procurement methods.	Medium Influence/High Impact
12	Accounts and finance specialists	To provide and maintain financial reporting, systems and process, transactions, budgeting and forecasting, accounts payable and receivable, general ledger management, financial analysis, tax compliance, finance planning and strategy, cash flow management.	Medium Influence/High Impact

ID	Stakeholders	Main Expectations	Influence/Impact (Low-Medium-High)
13	LUCELEC	To facilitate electrical grid connection, inspections, and approvals for commissioning.	Low Influence/ High Impact
14	Government agencies	To ensure that the project follows the rules and regulations set by the government.	Low Influence/ High Impact
15	Sea moss farmers	To be aware of project updates.	Low Influence/ Medium Impact
16	Office administrator	To manage the day-to-day operations of the project office.	Low Influence/ Medium Impact
17	Office assistant	To provide administrative support, document management, data entry and reporting assistance, meeting support, assistance with communication and correspondence, travel and logistics, data and information management and general office assistance.	Low Influence/ Medium Impact
18	Subcontractors	To complete their work to the highest standard possible within project, process, and customer requirements.	Low Influence Medium Impact
19	Vendors	To provide the highest quality materials to the project site.	Low Influence/ Medium Impact
20	General public	To be informed of the project status and related outcomes	Low Influence/ Low Impact

4.9.2 Power/Interest Classification

The power/interest grid "groups stakeholders according to their level of authority (power, level of concern about the project's outcomes (interest, ability to influence the outcomes of the project (influence), or ability to cause changes to the project's planning or execution" (PMI, 2017, p. 517). Figure 12 shows the power/interest grid for the project.

Figure 15 *Stakeholder Power/Interest Grid. Source (Joanne Husbands, June 2023)*



4.9.3 Stakeholder Engagement

Based on the information gathered from the stakeholder register matrix and the communications management plan, the principal consultant can determine the level of engagement necessary for each stakeholder. Notwithstanding, the level of engagement required for each stakeholder may vary over the life of the project. Thus, the stakeholder engagement assessment matrix would ensure that the correct level of engagement is being achieved by each stakeholder, as well as identifying potential strategies for effectively engaging stakeholders.

Chart 30 Stakeholders Engagement Assessment Matrix. Source (J. Husbands, June 2023)

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Project sponsor					C D
Principal Consultant; JH Consultancy & Management Services					C D
Project manager, JH Consultancy & Management Services					C D
Architect					C D
Quantity surveyor					C D
Engineers - electrical, mechanical, structural, construction & maintenance					C D
Renewable energy & solar PV specialist					C D
Owner, Rayneau Construction & Industrial Products					C D

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Marketing & communications specialist				C D	
Procurement, purchasing & inventory control specialists				C D	
Accounts and finance specialists				C D	
LUCELEC			C D		
Government agencies			C D		
Sea moss farmers			C		
Office administrator				C D	
Office assistant				C D	
Sub-contractors				C D	
Vendors			C		
General public			C		

Key:

- Unaware – this group has no information about the project.
- Resistant – aware of project and resistant to the changes and impacts the project may bring.
- Neutral – aware of the project and neither supportive nor resistant.
- Supportive – aware of the project and the potential changes and impacts and is supportive.
- Leading – aware of the project and actively engaged to ensure the project's success.
- C – Current level of engagement.
- D – Desired level of engagement.

4.9.4 Stakeholder Plan Updates

The stakeholder management is not static in nature and is to be reviewed at the end of every month and updated, if necessary, to reflect new or changed management strategies required to effectively engage stakeholders and to meet stakeholder requirements.

4.9.6 Stakeholder Plan Monitoring

Face to face and virtual status meetings, standup meetings, retrospectives, and other meetings as agreed upon in the stakeholder engagement plan are scheduled to monitor stakeholder engagement levels on a weekly and monthly basis. Through these updates, performance is tracked and measured to determine if stakeholder requirements are met.

4.10 Communication Management Plan

PMI (2021, p.73 & 237) the communications plan describes "how, when, and by whom information about the project will be administered and disseminated. It entails formal and informal communication, in addition to verbal and written communication, as well as information collected in meetings, conversations, and by pulling information from electronic repositories."

4.10.1 Communication Matrix

The communication matrix shows the information to be communicated, the communication method, frequency and goal of communication, sender, and receiver of the information. This data is important in ensuring that information is disseminated to all stakeholders as often as necessary. Chart 31 shows the project communication matrix for the Solar-powered Sea Moss Agro-processing Plant Project.

Chart 31 Project Communication Matrix. Source (J. Husbands, June 2023)

Communication	Method	Frequency	Goal	Owner	Audience
Project progress report	Email	Monthly	Monthly update to stakeholders on the project progress.	Principal consultant and project manager	Owner and site engineer - Rayneau Construction & Industrial Products, project sponsor JH Consultancy and Management Services Team
Project status report	Email	Quarterly	Quarterly update to all the relevant stakeholders on the project status. Opportunity to discuss problems encountered and recommendations.	Principal consultant and project manager	Owner and site engineer - Rayneau Construction & Industrial Products, project sponsor JH Consultancy and Management Services Team

Communication	Method	Frequency	Goal	Owner	Audience
Project progress meeting	Zoom (online)	Monthly	Monthly update for all the relevant stakeholders of the project progress so far, to discuss problems encountered since last meeting, gather feedback, and discuss next steps.	Principal consultant	Owner and site engineer - Rayneau Construction & Industrial Products, project sponsor JH Consultancy and Management Services Team
Site meeting	Meeting	Weekly	To discuss the plan of activities for the upcoming week, any housekeeping matters or concerns that may arise.	Site engineers, Owner- Rayneau Construction & Industrial Products	Project manager, engineers, renewable energy & solar PV specialist, site workers

Communication	Method	Frequency	Goal	Owner	Audience
Financial report	Email	Monthly	To update on project expenditures.	Accounts and finance specialists and principal consultant	Subcontractors, project sponsor, project manager, principal consultant
Site management meeting	Meeting	Weekly	To discuss the work plan for the upcoming week and future deadlines that are critical for project success.	Subcontractor	Project manager, site engineers, site workers
Final account meeting	Meeting	Once (At end of project)	To present complete audit of project finances.	Principal consultant Accounts and finance specialists	Subcontractors, project sponsor, project manager JH Consultancy Management Services Team

Communication	Method	Frequency	Goal	Owner	Audience
Change Order Meeting	Zoom (online)	As necessary	To discuss proposed changes to project.	Principal consultant	Project sponsor, project manager
Subcontractor meeting	Meeting	As necessary	To discuss any issues found with the project design and to create solutions.	Principal consultant	Subcontractor project manager, engineers
Project debriefing	Meeting	Once (At end of project)	To discuss lessons learned.	Principal consultant	JH Consultancy and Management Services Team Subcontractors
Terminal project report	Email and hard copy	Once	To provide final report on project outcomes, conclusions, recommendations, and lesson learned.	Principal consultant	JH Consultancy and Management Services Team Project sponsor

4.10.2 Communication Escalation Process

An internal or external opportunity or threat to the project may arise which may be outside of the project team or project manager's authority or control. In this case, the project manager determines who should be notified about the event and communicates the details about the event to that person or to that part of the organisation. It is important to note that once the details are communicated, ownership of that event is shifted to the person or part of the organisation to whom it was communicated.

4.10.3 Monitor Communications

Monitor communications "determines if the planned communications artifacts and activities had the desired effect of increasing or maintaining stakeholders' support for the project's deliverables and expected outcomes. Communication will be monitored through customer satisfaction surveys, reviewing data from the issue log and evaluating changes in the stakeholder engagement assessment matrix, observation/conversation of/with the project team and collecting feedback and lessons learned" (PMI, 2017, p. 389).

Observing the project team will reveal whether the communications had their desired effect or not. If it is found that it has not, the project manager will have a meeting with the communication owner and formulate a plan to assist the owner in communicating with his/her audience. The change in the communication management plan will go through the change control process.

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

5.1 Validation of Regenerative Development

For this FGP, a special focus is placed on developing a project management plan for a solar-powered sea moss agro-processing plant at the Castries Fisheries Complex. This will help support the governance of sea moss agro-processing for farmers in the Castries basin and overall management of energy, environmental, social, financial (economic) and quality systems. In addition, this will improve appropriate methods and controls to be applied throughout the project life cycle such as coherence between business strategy and project portfolios, improved decision making and communication, clearly defined criteria for reporting project status and escalation of risks and issues to the levels required by the organization, thus fostering a culture of improvement and frank internal disclosure of project information, resulting in better engagement with project stakeholders at a level that is commensurate with their importance to the organization and in a manner that inspires trust.

The following chart provides information on Regenerative Development along with its relationship with the FGP.

Chart 32 FGP and Regenerative Development (Source: J. Husbands, January 2023)

Processes of Regenerative Development	Relationship to FGP
Functional regeneration of ecosystems and their services, supporting biodiversity and allowing life to continue thriving throughout the planet. (Müller, 2017).	Scope management.

Processes of Regenerative Development	Relationship to FGP
Social strengthening, which fosters community organization and development to be able to cope with adaptation to climate change and reduce sumptuous consumption patterns. (Müller, 2017).	Stakeholder, risk, and communication management.
A new paradigm for economic development where people matter more than markets and money, where entrepreneurship for youth is more important than employment, where economic development is promoted at all levels of society allowing for more opportunities to achieve better living standards. (Müller, 2017).	Cost, procurement, and communication management.
Conservation and valuation of living culture which is the necessary bond for community life, where local knowledge, values and traditions are shared within family, friends, and the community, giving meaning to these terms. (Müller, 2017).	Communication, stakeholder, and resource management.
Rethinking and redesigning current political structures so they can reflect true participatory democracy without the influence of money and power and especially fostering long term vision and actions that seek increased livelihoods and happiness and not only gross income. (Müller, 2017).	Scope and stakeholder management.

Processes of Regenerative Development	Relationship to FGP
Fostering deep spiritual and value structures based on ethics, transparency, and global well-being to allow humanity to live in peace with itself and Mother Earth. (Müller, 2017).	Stakeholder, communication, and resource management.

5.2 Key Performance Indicators

PMI (2021, p. 95-96) states that key performance measures are "quantifiable measures used to evaluate the success of a project. There are two types of key performance indicators (KPI): leading and lagging indicators. Mostly lagging indicators will be used for this FGP, and they usually measure project deliverables or events, providing information after the fact, to find correlations between outcomes and environmental variables.

Chart 33 Key Performance Indicators. (Source: J. Husbands, January 2023)

P5 Domain	Category	Key Performance Indicator
Product	Lifespan of the product	▪ Completion of an asset management plan ▪ Completion of a contingency plan
	Servicing of product	▪ % completion of annual maintenance
Process	Effectiveness of project processes	▪ % completion of scheduled inspections from approving bodies for compliance
	Efficiency of project processes	▪ % completion of implementation of proper practices utilizing expert judgment
	Fairness of project processes	▪ % implementation of a communication management plan which included emails, meeting, emails, and internal communication
People	Employment and staffing	▪ Recruitment of all technical experts required based on resource requirements
	Project health and safety	▪ % of reported accidents, injuries, near misses and illness
	Training and education	▪ % of trained beneficiaries (agro-processors)

P5 Domain	Category	Key Performance Indicator
	Organizational learning	▪ Lessons learned gathered at each stage of the project lifecycle
	Diversity and equal opportunity	▪ Gender balanced and equal opportunity considerations implemented at each stage of the project
	Local competence and development	▪ 20% of agro-processing of sea moss local competence built in community of Castries
	Community support	▪ Public testimonials of community members endorsing project and its benefits to the community
	Product and service labelling	▪ Completion of training in product and service labelling requirements
	Customer health and safety	▪ Adherence to customer health and safety requirements
	Procurement practices	▪ Adherence to procurement standards and practices
	Anti-corruption	▪ No case of reported anti-corruption breaches and policy requirements
	Fair corruption	▪ Adherence to fair corruption guidelines and policy requirements
Planet	Local procurement	▪ Adherence to local procurement standards and local vendor participation
	Renewable energy	▪ Implementation of solar power infrastructure
	Energy consumption	▪ % in reduction of electricity bill from local Utility company
	Clean energy return	▪ % of solar power generated and stored daily
	CO2 emissions	▪ % reduction in fossil fuel from electricity used or utilized directly from electricity grid
	Biological diversity	▪ Execution which contributed to a healthy environment that protects natural resources and utilizes them in a productive way
	Water consumption	▪ Execution which contributed integrated natural elements the project and improved air quality
	Sanitary water displacement	▪ No water-related illness due to project water displacement
	Water and air quality	▪ Execution which contributed integrated natural elements the project and improved air quality
	Recycling and reuse	▪ % utilization of reusable natural products and materials within the project and workspace
	Disposal	▪ Implementation of disposal system that preserves the environment

P5 Domain	Category	Key Performance Indicator
	Contamination and pollution	▪ % Utilization of materials and products that do not contaminate the environment
	Waste generation	▪ % waste minimization by promoting a circular economy withing the company
Prosperity	Return on Investment	▪ % of long-term project cost benefits realized
	Flexibility/optionality	▪ % increase production or expansion in the energy efficiency equipment capacity in the long run
	Business flexibility	▪ % training in new technologies, and ensure that agro-processors are also trained in these emerging areas
	Local economic impact	▪ % of agro-processors from Castries basin signed up to utilize the agro-processing plant
	Indirect benefits	▪ % increase in certified Sea moss farmers in Castries pursuing agro-processing partnership opportunities

5.3 P5 Analysis

Green Project Management (2022) asserts "the P5 Analysis connects projects to sustainability by allowing them to evaluate their effects and take steps to support the United Nations' sustainable Development Goals (SDGs). It also aids organizations in aligning their strategy with sustainable performance through principle-based project management techniques."

The main purpose of P5 is to identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation. The key areas of impact will be highlighted in the P5 analysis, as seen below.

Chart 34 P5 Standard Impact Analysis (Source: J. Husbands, January 2023)

P5 Impact Analysis
Sample Entries

This impact will improve the project's outcome(s) from a sustainability perspective.
5 = Strongly agree 4 = Agree 3 = Neutral 2 = Disagree 1 = Strongly disagree

Category / Subcategory / Element	Description (Cause)	Potential Impact	t Score E	Proposed Response	ct Score	Change
2 Product Impacts						
2.1.1 Lifespan of the product	The construction of a solar powered agro-processing plant that will be designed to provide a reliable, cost effective, and seamoss agro-processed products in a sustainable manner	Maintenance can be neglected and no allocations to keep up with maintenance expenses.	2	Engage the service of a technical maintenance crew to upkeep the maintainence and recyling, and other efficient state of the art equipment on a bi/ annual basis	5	3
2.1.2 Servicing of product	State of the art building with energy saving and storage, agroprocssing sytem	Qualified expertise for knowledge of upkeep and maintainenance	2	Higher key experts for upkeep of state of the art equipment	4	2
2 Process (Project Management) Impacts						
2.2.1 Effectiveness of project processes	Timley and proper inspection from approving bodies for compliance	Having poor constrution of poorly installed equipment for efficiency	3	Allow project to pause at every phase to ensure proper inspection by authorities	5	2
2.2.2 Efficiency of project processes	The implemenation of proper practices utilizing expert judgment	Delay of project deliverables	3	Ensure proper vetting process of employees for competencies	4	1
2.2.3 Fairness of project processes	The implementation of a Communication Management plan which included emails, meeting , emails and internal communication	If the communication plan is not executed properly this can lead to many misunderstandings or disagreements, making mistakes or completing tasks incorrectly or not on time	4	Implemented to use of WhatsApp groups which seems to be an easier and faster mean of communication and have biweekly meetings as opposed to monthly	5	1
		Product and Process Average	**2.8**		**4.6**	**1.8**

3 People (Social) Impacts						
3 Labor Practices and Decent Work						
3.1.1 Employment and staffing	Requisite technical skills and team to complete the project	Poor execution and quality in delivering the desired project	3	Ensure monitoring and evaluation is done throughout the project to ensure activities are on track to meet requirements	5	2
3.1.2 Labor/management relations	Poor labour and management relations	Unavailabity of the right resources to complete the project within customer and project requirements	2	Deal with labour/ management relation issue when they arise (promptly)	5	3
3.1.3 Project health and safety	Adherence to national and project health and safety standards	Accidents, Injury, Illness and Death	2	Communication and Implementation of safe to work practices policies and guidelines	4	2
3.1.4 Training and education	Contractors/builders/architects/engineers, Implemntation agency have limited training and education in agro-procesisng sea moss, plant building and retrofitting offers.	Limited training and knowledge transfer	2	To empower stakeholders to exploit offerings	4	2
3.1.5 Organizational learning	Lessons learned from development project	Add value to future investments and human capital projects	2	Widespread national development and contribution to reducing carbon footprint	5	3
3.1.6 Diversity and equal opportunity	All demographics to receive an equal opportuniy to support a sustainable livelihood	Unachievement of gender balance in beneficiaries	2	Encourage support in gender balanced participation for benefit sharing and optimisation	4	2
3.1.7 Local competence development	Community membersdo not have the requisite knowledge , skills and experience in seamoss agro-processing engagements	Increase in local compentence and employment	2	Higher employment rate and contribution to GDP	5	3

3 Society and Customers						
3.2.1 Community support	Community members not interested in stakeholder engagements	Apathy among residents/community members in relation to the project	2	Widespread communication engagement and awareness campaigns	4	2
3.2.2 Public policy compliance	Minimial focus on reporting to stakeholders on compliance matters	Decreased accountability to public and community stakeholders	3	Incorporate transparency and accountability measures,(internally and	4	1
3.2.3 Protection for indigenous and tribal peoples						
3.2.4 Customer health and safety	Ocuppational health and safety practices	Injury of agro-processors and ilness to customers	3	Ensure adequate standards and occupational measures and approvals are in place for safe operations and consumption of products	5	2
3.2.5 Product and service labeling	Marketing and food safety servings	Reduce visibility of products, sales and compliance and reporting of product food & health requirements	2	Ensure visibility of products, sales and reporting of product food & health requirements	4	2
3.2.6 Market communications and advertising						
3.2.7 Customer privacy						
3 Human Rights						
3.3.1 Non-discrimination						
3.3.2 Age-appropriate labor						
3.3.3 Voluntary labor						

3 Ethical Behavior						
3.4.1 Procurement practices	Budget creep for resources under project and not be within quiality standards	Delay in project schedule,implementation and benfits derived	2	Make appropriate procurement planning by taking into account the availibilty on local and external market. Engage with local material suppliers to publicize the project's support for sustainability and share accurate information about the project's activities.	4	2
3.4.2 Anti-corruption	Suppliers bidding process is not well documented and share with family and friends	Lack of trust from the investors and potential bidders	1	Implement shared system of communication of responses to questions asked with all with bidders and investors to avoid conflict of interest	2	1
3.4.3 Fair competition	Contracts for private companies not fairly advertised and distributed	Unfair awarding of contracts and attraction of the right talent	1	Engage with local material suppliers to publicize the project's support for sustainability and share accurate information about the project's activities. Post general procurement notices to national, regional and international websites and journals for maximum exposure based on procurement type/ method.	3	2
		People Average	**2.1**		**4.1**	**2.1**

4 Planet (Environmental) Impacts						
4 Transport						
4.1.1 Local procurement	Availability of resources, goods and services in the local market	There may be a lack of variety available locally, limited quantity for a project of that magnitude	3	With proper planning, local service providers can prepared to supply variety and quantity necessary	5	2
4.1.2 Digital communication	The need for improved communication infrastructure and digital practices	Reduced travel and convenient and efficient communication	2	Employees will be able to make themselves more available, they will have more time to be productive and maintain a healthy live/work life	4	2
4.1.3 Traveling and commuting						
4.1.4 Logistics	Many companies provide the products and services that will be needed	Remote suppliers will consume more fuel and generate more pollution	2	Give bonus points in selection process to local suppliers	3	1
4 Energy						
4.2.1 Energy consumption	Reduce energy consumption by using energy efficient supplies and materials	Lower energy cost with minimal environmental impact	2	Implement energy efficient design practices and investing in energy efficient materials, fixtures and supplies	5	3
4.2.2 CO2 emissions	Proper management of practices and procedures put in place to manage and reduce the carbon footprint from project activities.	Contributes to the health and safety of agro-processors as well as help minimize the effects of natural disasters and slow down the process of climate change	3	Invest in alternative energy where energy can be reused and conserved simultaneously e.g. solar	4	1
4.2.3 Clean energy return	Implement processes to generate clean energy and secondary energy sources options.	Reduce the amount of fuel needed for electricity and reduction of green house gas emissions	2	Invest in an alternative energy sources	4	2
4.2.4 Renewable energy	Implement natural practicies to generate renewable energy recourses throughout the project	Reduction in impact of climate change and less air and water pollution	2	Sustainable energy efficient practices as well as educating agro-processors of the importance of energy efficiency. More solar panels	5	3

4 Land, Water, and Air						
4.3.1 Biological diversity	Consideration of living organisms within our eco-system throughout the lifecycle of the project	Healthy and productive eco system that is able to thrive in a resistant environment	4	Healthy environment that protects natural resources and utilizes them in a productive way	5	1
4.3.2 Water and air quality	Preservation of the impact on the water table and naturally flowing bodies of water in surrounding areas or in close proximity	Helps to preserve the natural elements and encourages design and planning around these elements	3	Integrated natural elements the project and improved air quality	5	2
4.3.3 Water consumption	Controlled and necessary use of water during construction phase as well as implementation of water peserving practicies	Lower environmental damage and reduce cost of water use on the project	2	Invest in grey water treatment and water saving practicies	5	3
4.3.4 Sanitary water displacement	The proper management and handling of water run off and grey water treatment	Reduction and prevention of water related illnesses	2	Healthier staff where production can be maintained	5	3
4 Consumption						
4.4.1 Recycling and reuse	Implementation of energy and resource waste minimizing policies and responsible use of materials	Protects the natural resources and reduce pollution	2	Utilization of reusable natural products and materials within the project and work space	4	2
4.4.2 Disposal	Enforce proper disposal practicies to reduce contamination and illness	Irresponsible disposal can cause contamination of the soil, air and water	2	Responsible and reliable disposal system that preserves the environment	4	2
4.4.3 Contamination and pollution	Utilization of eco friendly materials and products to reduce contaminants	Contamination of our eco system and increased sicknesses and diseases	3	Utilization of materials and products that do not contaminate the environment	4	1
4.4.4 Waste generation	Implement practicies that actively reuse and recycle products to reduce environmental impact	Attract unwanted pests and induce harmful bacteria and viruses	2	Encourage waste minization by promoting a circular economy withing the company	4	2
		Planet Average	**2.4**		**4.4**	**2.0**

5 Prosperity (Economic) Impacts						
5 Business Case Analysis						
5.1.1 Modeling and simulation						
5.1.2 Present value						
5.1.3 Direct financial benefits						
5.1.4 Return on investment	Investment ion project for an expected retrn on investment within the next 5 years	Will reduce on fossil fuel dependence and consumption in agro-prcessing, redice import bill and build more sustaiinble livelihoods in the seamoss sector	3	Plan for realisation of project cost-benefitss of in the long run	5	2
5.1.5 Benefit-cost ratio						
5.1.6 Internal rate of return						
5 Business Agility						
5.2.1 Flexibility/optionality	Utilization of alternate energy sources in times when renewable energy may not be available	May reduce tremendously in the amount of electricity and generator fuel in the long term	3	Plan for increased production or expansion in the energy effciency equipmnt capacity in the long run	5	2
5.2.2 Business flexibility	Utilizing more digital infrastructure Use of advanced smart technology and energy efffciency and mangufacturing systems	Reduction in human resoure costs Improvement in energy effeciency and agro-processing infrastructure	4	Keep abreast of and utilize new technologies, and ensure that agro-processors are also trained in these emerging areas	5	1
5 Economic Stimulation						
5.3.1 Local economic impact	Promoting resource conservation, including energy efficiency, renewable energy, and water conservation features Manufacturing/ Agro-Processing System for the area/community	Improved employment, healthy food options, manaufacturing potential in the community and its environs	4	Promote employment, healthy food options, manaufacturing potential in the community and its environs through town criers, radio and television advertisments and through Social Transformers Officers	5	1
5.3.2 Indirect benefits	Creating a state of the art solar powered agro-processing plant Providing sea-moss products to local corner shops, and other local , regional and international businesses Energy effcient fish processing	Increase in the manfaufacturing of new seamoss and fish products Creation of new businesses Increase in business partnerships Increase of community participation and promotion	4	Maintain community participation and entrepeneaural support	5	1
		Prosperity Average	**3.6**		**5.0**	**1.4**
		Overall Average	**2.5**		**4.4**	**1.9**

6 CONCLUSIONS

1. The project charter is used as a reference point throughout the project for decision-making, issue resolution, and overall project governance, as it provides a baseline against which progress, and decisions can be measured. JH Consultancy & Management Services project team members referred to the charter to ensure alignment and adherence to the project's original goals and objectives. The project charter and findings from the feasibility and environmental social impact assessment will be used as an input for future projects and a template for other project team members who are not familiar with the structure and development of a project charter and carrying out feasibility studies and environmental social impact assessments.
2. The scope management plan set a solid foundation for the development of the overall project management plan, The scope of works for the final deliverable was clearly defined in a WBS dictionary, and methods for validating and controlling the scope were outlined in the scope management plan. JH Consultancy & Management Services will be able to use such a plan as input for similar projects going forward, to streamline the planning process.
3. The subcontractors are now better able to clearly define the project objectives and deliverables to establish a solid foundation for developing the project schedule and to ensure that the necessary resources are available when needed to prevent schedule delays. The activities on the critical path are easily identified and can be better managed, and their progress closely monitored, as any delays in these activities will impact the overall project timeline. By utilizing a well-defined schedule management

plan, project managers and subcontractors can optimize resource utilization, proactively manage risks, and improve overall project performance.

4. By incorporating a well-defined cost management plan, JH Consultancy & Management Services can optimize cost control, manage financial risks, and ensure the project's overall financial management and success with meeting requirements. This also serves as a best practice, as allocating the estimated costs to the specific project activities or work packages helps in tracking and monitoring the expenditure related to each activity and therefore provides insights into the overall cost distribution across the project. Also, through assessing the impact and probability of cost uncertainties, and creating contingency plans, this helps the project team actively manage cost-related risks throughout the project life cycle.
5. The quality management plan provides a structured approach to define, manage, and control quality throughout the project life cycle. By incorporating a comprehensive quality management plan, JH Consultancy & Management Services can ensure that quality is embedded into all project processes and deliverables, leading to increased customer satisfaction, reduced rework, and successful project outcomes. Thus, a well-defined quality management plan helps project teams proactively address quality-related challenges and deliver high-quality results. For the Solar-powered Sea Moss Agro-processing Plant Project, it allowed members of the project team, regardless of the amount of experience they possessed, to be able to determine if a particular task was completed within acceptable limits of the documented quality requirements. All

this information adds value to the project lessons learned and overall project teams' knowledge bank to improve implementation on similar projects.

6. JH Consultancy & Management Services and subcontractors can reap the benefits of this resource plan by using it to optimize resource allocation, minimize bottlenecks, and ensure that the right resources are available at the right time, minimizing waste. This management plan ensures that everyone involved has a clear understanding of resource availability, needs, and responsibilities, fostering effective communication and teamwork which provides a foundation for ongoing monitoring, evaluation, and improvement of resource management practices. Therefore, by regularly reviewing and refining the plan based on project performance and feedback, implementing agencies and subcontractors can continuously improve their resource management capabilities.
7. The risk management plan provides JH Consultancy & Management Services and subcontractors with the empowering notion that everyone is responsible for the management of risks within the scope of the project, as it directly impacts the achievement of the project outcomes. By identifying potential risks early in the project life cycle and systematically analysing project activities and stakeholders' inputs, JH Consultancy & Management Services and subcontractors can identify and assess risks before they escalate into major issues. This initiative-taking approach enables timely risk mitigation and reduces the likelihood of negative impacts on the project. Allocations of appropriate resources and attention to high-priority risks can be made to ensure that mitigation efforts are focused on the most critical areas.

8. The procurement management plan provides JH Consultancy & Management Services and subcontractors with a structured framework for managing procurement activities, ensuring transparency, fairness, and value for money. It helps with streamlining procurement activities, optimizes costs, minimize risks, and ensures that the availability of resources and materials are aligned with project schedules and critical path activities, avoiding delays and potential project disruptions. By capturing lessons learned from previous procurements and incorporating feedback from stakeholders, this can refine procurement strategies, streamline processes, and enhance overall procurement performance for both provides JH Consultancy & Management Services and subcontractors. Furthermore, it would also ensure that vendors who provide quality and reliable services or materials are recorded as recommendations for use in future projects by the customer.
9. The stakeholder management plan provided the basis for effective stakeholder engagement, according to their interest and involvement throughout the project life cycle. JH Consultancy & Management Services will document lessons learned from stakeholder management experiences and/or expectations for future projects. These insights can be used to continuously improve stakeholder engagement practices and refine the stakeholder management plan, as well as an input to add value to other subsidiary plans.
10. The project communications plan provided JH Consultancy & Management Services and subcontractors with clear, consistent communication, tailored to the needs of the different stakeholders. The flow of information was clearly outlined to facilitate the

alignment with project objectives. The development of a comprehensive communication management plan which considered the unique needs and circumstances of the respective stakeholders, will facilitate a more focused and effective implementation of the project.

7 RECOMMENDATIONS

1. JH Consultancy & Management Services should regularly review and update the scope management plan throughout the project life cycle. As new information becomes available or project requirements change, it is indispensable that the plan reflects the current project scope. This will help maintain the accuracy and relevance of the plan. If there are too many requests for changes in the scope which deviate from the original plan, a decision must be made to stop the project and resubmit a new proposal due to scope, schedule, cost, quality, risk, and customer satisfaction creep. Therefore, implementing agencies can consider adopting agile principles and practices for scope management, especially in dynamic and complex projects. Breaking the scope into smaller, manageable increments or iterations and embracing change as well as adapting the scope accordingly as new insights emerge, will guarantee continuous alignment with project objectives.

2. JH Consultancy & Management Services should provide training to all subcontractors and make licensed project management software easily accessible. This will aid in the integration of change control processes and in the assessment of the impact of scope changes on the project schedule. Currently, the company does not have any such software available for subcontractors and they would have to procure their own. Synchronizing similar project management software across the board can easily integrate and strengthen collaboration between project teams. This will help the implementing agency and subcontractors better evaluate and prioritize changes based

on their impact and urgency, and update the schedule accordingly, especially critical path activities, so that contribution to accurate task estimation and sequencing can be made and course correcting project governance decisions can be taken.

3. JH Consultancy & Management Services can consider setting up a Microsoft Teams channel, not only to support communications management plans activities but also cost management for value engineering. By adopting value engineering approaches, opportunities for cost optimization without compromising project quality or objectives can be identified. Collaboration among project team members, subcontractors, and suppliers is encouraged to explore cost-effective alternatives and innovative solutions to evaluate the potential cost savings and benefits of each option before making decisions. This interactive forum can derive valuable insights and, lessons learned can be created to capture valuable insights to promote learning and continuous improvement in cost management. Equally, this same forum on Microsoft Team can be used to established clear lines of communication among project team members and subcontractors, and provide channels for sharing quality-related information, concerns, and updates. This can foster open dialogue and proactive problem-solving to address quality issues promptly. In addition, this platform can be used for sharing release and test plans. Nevertheless, in addition to the Microsoft Team platform, other communication channels can be used to better reach stakeholders based on their preferences and optimum reach.

4. JH Consultancy & Management Services can consider resource contingency planning to mitigate any unexpected shortages or changes in project requirements. Alternative resources or backup options should be identified in case of resource unavailability or constraints. Therefore, incorporating contingency reserves into the resource management plan can address unforeseen events or changes which may impact resource availability.

5. JH Consultancy & Management Services should support ethical and sustainable project management practices by incorporating a sustainability criterion into supplier selection and contract evaluation. Green Project Management credentials can be included in requirements as a value add. This is a step in the right direction in leading more mindful environmental and sustainable practices in project implementation. Also beneficial is the inclusion of a maintenance, asset and sustainability management plan, post implementation, as part of the deliverables to subcontractors.

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9 APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)

1. Student name

Joanne Samantha Natasha Husbands

2. FGP name

A Project Management Plan for The Construction of a Solar-powered Sea Moss Agro-processing Plant at The Castries Fisheries Complex in Saint Lucia

3. Application Area (Sector or activity)

Infrastructure Sector (Energy) and Agriculture

4. Student signature

5. Name of the Graduation Seminar facilitator

Mr. Carlos Brenes

6. Signature of the facilitator

7. Date of charter approval

February 26th, 2023

8. Project start and finish date.

Jan 09, 2023	June 30, 2023

9. Research question

What elements are required for the development of a Project Management Plan to construct a Solar-Powered Sea moss Agro-Processing Plant at The Castries Fisheries Complex in Saint Lucia?

10. Research hypothesis

Is it possible to develop a Project Management Plan for the construction of a Solar-powered Sea Moss Agro-processing Plant at the Castries Fisheries Complex in Saint Lucia which would allow for increased manufacturing potential and value-added economic benefits of the sea moss to support sustainable livelihoods in agriculture in the Castries basin?

11. General objective

To develop a Project Management Plan for the construction of a Solar-powered Sea moss Agro-processing Plant at the Castries Fisheries Complex in Saint Lucia.

12. Specific objectives

1. To develop a project charter and carry out a feasibility environmental social impact study to guide the project requirements for implementation by the project manager to achieve project outcomes.
2. To develop a scope management plan to ensure the scope of the project is executed as planned to achieve the project objectives.
3. To develop the schedule management plan to ensure the project is completed on time.
4. To develop a cost management plan to ensure the project is completed within budget.
5. To develop a quality management plan to ensure the project meets and is in compliance with set project quality standards.
6. To develop a resource management plan to ensure there are adequate resources to support project implementation.
7. To develop a risk management plan to help identify, evaluate, and plan for possible risks that may arise within the project management process.

8. To develop a procurement management plan to ensure that project planning stays on track and within budget whilst ensuring stakeholders know the procuring organization's expectations for input at various stages of the process.
9. To develop a stakeholder management plan to ensure stakeholders are effectively involved in project decisions and execution.
10. To develop a communications management plan to organize and document the processes, types, and expectations of communication to internal and external stakeholders.

13. FGP purpose or justification

The creation of a project management plan for the construction of a Solar-powered Sea Moss Agro-processing Plant to increase the agro-processing potential and value-added economic benefits of sea moss to support sustainable livelihoods in agriculture in the Castries basin.

14. Work breakdown structure (WBS).

1. FGP
    - 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 Graduation Seminar
            - 1.2.1.1 FGP Deliverables
            - 1.2.1.2 Charter
            - 1.2.1.3 WBS
            - 1.2.1.4 Chapter I. Introduction
            - 1.2.1.5 Chapter II. Theoretical Framework
            - 1.2.1.6 Chapter III. Methodological framework
            - 1.2.1.7 Annexes
                - 1.2.1.7.1 Bibliography
                - 1.2.1.7.2 Schedule
            - 1.2.1.8 Validation of Regenerative and Sustainable Development For Projects

2. Tutoring Process
    2.1 Tutor
        2.1.1 Tutor Assignment
        2.1.2 Communication
    2.2 Adjustments of Previous Chapters (if needed)
    2.3 Chapter IV. Development (Results)
        2.3.1 Scope Management Plan
        2.3.2 Schedule Management Plan
        2.3.3 Cost Management Plan
        2.3.4 Quality Management Plan
        2.3.5 Resource Management Plan
        2.3.6 Risk Management Plan
        2. 3.7 Procurement Management Plan
        2.3.8 Stakeholder Management Plan
        2.3.9 Communications Management Plan
        2.3.10 Integration Management Plan
        2.3.11 Validation on Regenerative and Sustainable Development Plan
    2.4 Chapter V. Conclusions
    2.5 Chapter VI. Recommendations
3. Reading by reviewers
    3. 1 Reviewers assignment request
        3.1.1 Assignment of two reviewers
        3.1.2 Communication
        3.1.3 FGP submission to reviewers
…   3.2 Reviewers work
        3.2.1 Reviewer 1
            3.2.1.1 FGP Reading
            3.2.1.2 Reading 1 report
        3.2.2 Reviewer 2
…. 3.2.2.1 FGP Reading.
            3.2.2.2 Reading 2 report
4. Adjustments
    4. 1 Report for Reviewers
    4.2 FGP Update
    4.3 Second Review by Reviewers
5. Presentations to Board of Examiners
    5. 1 Final Review by Board
    5.2 FGP Grade Report
6. Conclusions
7. Recommendations
8. Reference Lists
9. Annexes

10 Tutor Approval for Reading.
11.Reader's Review.
12. Board of Examiners Evaluation

15. FGP Budget

Software license acquisition- USD 2, 500.00
Catering for in- person interviews (focus group or forum type)- USD 150.00
Report printing and Mailing- USD 300.00
Information sources and published research & reports- USD 500.00
Reviewers Fee- USD 500.00

Total Cost: USD 3950.00

16. FGP Planning and Development Assumptions.

- Readily available information on how to construct a solar-powered sea moss agro-processing plant.
- All interviews are held on mutually agreed scheduled dates.
- Researcher time for the FGP will be at least 15 hours per week during the FGP development process.
- Feedback on deliverables will be given before the weekly webinars to incorporate adjustments and generate questions to support the previous and present deliverable at weekly webinars.
- There are guidelines to support the project management planning and development process.

17. FGP Constraints

The maximum time frame to finalize the FGP is 12 weeks.

16. 1 FGP Development Risks

- Lack of dedicated resource support to complete the project management plan on time.
- Limited data sources to refine research and development process for a successful and detailed project management plan.
- Delayed review and dissemination of feedback to support the successful completion of the FGP.
- Limited clarity on research topic which would result in a decision to change the topic and cause schedule constraints.

17. FGP Main Milestones

Deliverable	Finish estimated date
1.FGP	Jan 11,2023
1.1 FGP profile	Feb 12, 2023
1.1.1 Introduction	Feb 12, 2023
1.1.2 Theoretical framework	Feb 12, 2023
1.1.3 Methodological framework	Feb 12, 2023
1.1.4 Preliminary bibliographical research	Feb 12, 2023
1.1.5 Annexes (FGP schedule, FGP WBS, FGP Charter)	Feb 12, 2023
1.2 FGP development	Feb 19, 2023
1.2.1 Graduation Seminar	Feb 19, 2023
1.2.1.1 FGP Deliverables	Feb 19, 2023
1.2.1.2 Charter	Feb 26, 2023
1.2.1.3 WBS	Feb 26, 2023
1.2.1.4 Chapter I. Introduction	Feb 26, 2023
1.2.1.5 Chapter II. Theoretical Framework	Feb 26, 2023
1.2.1.6 Chapter III. Methodological Framework	Feb 26, 2023
1.2.1.7 Annexes	Feb 26, 2023
1.2.1.7.1 Bibliography	Feb 26, 2023
1.2.1.7.2 Schedule	Feb 26, 2023
1.2.1.8 Validation of Regenerative and Sustainable Development for Projects	Feb 26, 2023
2. Tutoring Process	March 23,2023
2.1 Tutor	March 13,2023
2.1.1 Tutor Assignment	March 16,2023

Deliverable	**Finish estimated date**
2.1.2 Communication	March 16,2023
2.2 Adjustments of previous chapters (if needed)	May 16, 2023
2.3 Chapter IV. Development (Results)	May 09, 2023
2.3.1 Scope Management Plan	May 09, 2023
2.3.2 Schedule Management Plan	May 09, 2023
2.3.3 Cost Management Plan	May 09, 2023
2.3.4 Quality Management Plan	May 09, 2023
2.3.5 Resource Management Plan	May 09, 2023
2.3.6 Risk Management Plan	May 09, 2023
2. 3.7 Procurement Management Plan	May 09, 2023
2.3.8 Stakeholder Management Plan	May 09, 2023
2.3.9 Communications Management Plan	May 09, 2023
2.4 Chapter V. Conclusions	May 09, 2023
2.5 Chapter VI. Recommendations	May 09, 2023
2.6 Reference List	May 09, 2023
2.7 Annexes	May 09, 2023
2.8 Tutor approval for reading	May 09, 2023
2.9 Reader’s review	May 23, 2023
3. Reading by reviewers	June 06, 2023
3. 1 Reviewers assignment request	Mar 21, 2023
3.1.1 Assignment of two reviewers	Mar 21, 2023
3.1.2 Communication	Mar 21, 2023
3.1.3 FGP submission to reviewers	May 23, 2023
3.2 Reviewers work	June 06, 2023
3.2.1 Reviewer 1	June 06, 2023
3.2.1.1 FGP Reading	June 06, 2023
3.2.1.2 Reading 1 report	June 06, 2023
3.2.2 Reviewer 2	June 11, 2023
…. 3.2.2.1 FGP reading	June 11, 2023
3.2.2.2 Reading 2 report	June 11, 2023
4. Adjustments	June 17,2023
4. 1 Report for reviewers	June 18,2023
4.2 FGP update	June 19,2023
4.3 Second review by reviewers	June 25,2023
5. Presentations to Board of Examiners	June 30,2023
5. 1 Final review by board	June 26,2023
5.2 Board of examiners evaluation	June 28,2023
5.3 FGP grade report	June 30,2023

20. Theoretical framework

20.1 Estate of the “matter”

In 2018, the Sea Moss Industry in Saint Lucia garnered popular interest as a sustainable livelihood (farming and production) due its value-added economic benefits and export potential world-wide. At current, there are no existing plans to support the construction of solar- powered sea moss agro-processing plant through the expansion of the existing Castries Fisheries Complex. This can add value to supporting the manufacturing potential in the sea moss sector, whilst supporting sustainable livelihoods in farming in the Castries basin. Thus, the problem was investigated, and a solution provided through a detailed proposal of a project management plan for construction of solar- powered sea moss agro-processing facility, for assured growth and innovation within the sector.

20.2 Basic Conceptual Framework

- Project charter
- Project management plan
- Project life cycle
- Project management knowledge areas.
- Regenerative development

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a project charter which formally authorizes the existence of the project and granting the project manager authority to use organizational resources and to start project activities.	A project charter which validates the existence of the project and provides the project manager with the authority to carry out the project.	Analytical Research Method: Available information from the PMBOK 6th and 7th edition, were used to make decisions is used in the elaboration of the project charter. Qualitive Research Method: Gathered information from the experts and historical data, experts	**Primary** Interviews with Mr. Lovence Hilton – Consultant, Sol-Lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia; review of mandates and regulatory requirements from the NURC and LUCELEC, reports and existing plans and designs for the Castries Fisheries Complex. **Secondary** The PMBOK® Guide 7th edition. Journal articles. Web research; and Lecture presentation notes	Microsoft Word & Excel, expert judgement, journals, charter template.	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a scope management plan to ensure the scope of the project is executed. as planned to achieve the project objectives.	A scope management plan which includes the requirements traceability matrix. WBS, WBS dictionary, scope statement.	Analytical Research Method: Available data and information from primary and secondary sources were used to accurately elaborate scope baseline. Qualitive Research Method: An application of the deductive approach, gathering general data (primary and Secondary) and obtaining a specific solution to the proposed hypothesis in terms of requirements for the specific scope of work required.	**Primary** Interviews with Mr. Lovence Hilton – Consultant, Sol-Lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. Email, Lessons learned from similar projects. **Secondary** Lecture presentation notes. Textbooks. Journal Articles from the PMI; and Web research, and PMBOK® Guide 7th edition (2021).	Microsoft Word & Excel, expert judgement, journals, observation, Work breakdown structure template, Work breakdown structure, dictionary template.	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a schedule management plan, which provides the documentation needed for the effective development, monitoring, and controlling of the project schedule so that it is completed on time.	A schedule management plan which includes the activity list, sequence of activities, activity durations, schedule model, schedule baseline.	Analytical Research Method: Available information from the secondary sources were used to make evaluations and decisions is used in the elaboration of the schedule management plan. Qualitive Research Method: Gathered information from the experts and historical data which were used to sequence activities, estimate activity durations etc.	**Primary** Interview with Mr. Carl Bruce, Project Manager, Project charter, email, Lessons learned from similar projects. **Secondary** PMBOK® Guide 7th edition (2021). Practice standard for scheduling 3rd edition (2019). Lecture presentation notes Textbooks Journal Articles from the PMI; and Web research	Microsoft Word & Excel, expert judgement, journals, Microsoft Project, WBS Schedule Pro	There is a lack of historical data, as this is the first project of its type done by the organization. The project is operating within a fixed timeframe or deadline, and as such the project team must complete all tasks and deliverables within the designated time frame.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a cost management plan in which the cost of the project is planned, estimated, budgeted, financed, and completed within the approved budget.	A cost management plan which includes the cost baseline, an estimate of costs and the project budget.	Analytical Research Method: Available information from the PMBOK 6th and 7th edition, as well as data from other similar projects were evaluated and used to make decisions for the accurate elaboration of the cost management plan. Qualitive Research Method:	**Primary** Interviews with Mr. Lovence Hilton – Consultant, Sol-Lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia; Email, Mr. James Hamilton-Quantity Surveyor, Lessons learned from similar projects. **Secondary** PMBOK® Guide 7th edition (2021); Practice Standard for project estimating, PMI (2019); The Standard for Earned Value Management, PMI (2019); Lecture presentation notes. Textbooks. Journal Articles from the PMI; and Web research	Interviews, expert judgement, tools for data analysis: Microsoft excel, Microsoft project.	The researcher must gather information after work hours, and this may pose schedule constraints for the FGP. Thus, the project team needs to manage resources efficiently to deliver the required outcomes within the allocated budget.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a quality management plan to ensure that the project complies with quality standards and the quality requirements and/or standards for the project and its deliverables are correctly identified.	A quality management plan that ensures quality in relation to requirements are an integral part of the project, and it is managed and controlled.	Analytical Research Method: Facts and information were used from various sources to determine the quality management plan that meets the international standards and the requirements of the stakeholders. Qualitive Research Method: Valid data collected using the appropriate data collection tools were analyzed and used to determine the required quality of the project.	**Primary** Interviews with Mr. Lovence Hilton – Consultant, Sol-Lucian and Mr. Verne Craine - Sea Moss Expert, Head of Aqua Culture Unit, Department of Fisheries in Saint Lucia. Lessons learned from similar projects. **Secondary** PMBOK® Guide 7th edition; and Journal Articles.	Microsoft Word & Excel, expert judgement, journals, check list, benchmarking, and cost benefit analysis	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a project resource management plan which defines how to estimate, acquire, manage, and resources to be used in the project.	A resource management plan that ensures all project resources, are efficiently allocated, managed, and controlled for the successful completion of the project within the required scope, time, and quality.	Analytical Research Method: Facts and information from the PMBOK® Guide (edition 6 and 7) such as tools and techniques, primary data from the previous sections such as the WBS were used in the creation of the components of the resource management plan. Qualitive Research Method: Valid data collected using the appropriate data collection tools will be analyzed and used to determine the resources required to carry out the project.	**Primary** Interviews with Mr. Carl Bruce- Project Manager & Mr. James Hamilton- Quantity Surveyor, meetings email, and Lessons learned register from similar projects. **Secondary** Articles from the PMI on resource management. PMBOK® Guide 7th edition	Microsoft Word & Excel, expert judgement, journals, Hierarchical charts, Bottom-up estimating.	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a communications management plan to ensure the effective exchange of information internally and externally so that the information needs of the project and all stakeholders are adequately met.	A communications management plan that includes the formulation of an appropriate approach and plan for communication-based stakeholders, and project needs.	Analytical Research Method: Literature on effective communication including tools and techniques from PMBOK® Guide were used for the analytical approach to the development of the communication management plan. Qualitive Research Method: Literature on effective communication including tools and techniques from PMBOK® Guide were used for the analytical approach to the development of the communication management plan.	**Primary** Interviews with Mr. Carl Bruce- Project Manager, email, and Lessons learned register from similar projects. **Secondary** Articles from the PMI on communication management. PMBOK® Guide 7th edition	Microsoft Word & Excel, expert judgement, journals	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a risk management plan, for identification, evaluation, analysis, response planning for implementation, and monitoring of risks on a project.	A risk management plan that includes the identification of risks, qualitative analysis of those risks, and the associated risk responses.	Analytical Research Method: Facts and information from reliable sources were assessed and used in the identification, categorization, and planning of risk responses. Qualitive Research Method: Qualitative method was used in the Risk management plan by gathering opinions and experiences from experts and using appropriate tools to analyze risk and plan risk responses.	**Primary** Interview with Mr. Carl Bruce, Project Manager Articles from the PMI on risk management. **Secondary** PMBOK® Guide 7th edition The Standard for Risk Management in Portfolios, Programs, and Projects (2019). Web research; and Journal Articles.	Microsoft Word & Excel, expert judgement, journals, P x I template, risk register template	There is a lack of historical data from the organization which can be referred to for risk identification.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a procurement management plan which identifies the processes necessary to purchase or acquire products, services, or results.	A procurement management plan that includes procurement activities stays on track and is monitored and controlled to ensure that project planning stays on track and within budget whilst ensuring stakeholders know the procuring organization's expectations for input at various stages of the process.	Analytical Research Method: Historical information from project documents was used in the preparation of statements of work, assessing market conditions which can impact procurements. Qualitive Research Method: Valid data collected using the appropriate data collection tools were analyzed and used to identify reliable sellers.	**Primary** Interview with Ms. Kay Marion, Procurement, Purchasing & Inventory Control Specialist **Secondary** Articles from the PMI on procurement management. Journal Articles. Web research	Microsoft Word & Excel, expert judgement, journals	There is a lack of historical data, as this is the first project of its type done by the organization.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
To develop a stakeholder management plan which identifies the people, groups, or organizations that could impact or be impacted by the project, analyzes stakeholder expectations and their impact on the project, and develops appropriate management strategies for effectively engaging stakeholders in project decisions and execution.	A stakeholder management plan that includes the identification of stakeholders and the development of approaches to effectively engage them based on their needs, expectations, interests, and the impact they may have on the project execution.	Analytical Research Method: Available information from the PMBOK 6th and 7th edition, journal articles, and other sources were used to make decisions in the identification and engagement strategies elaborated in the stakeholder management plan Qualitive Research Method: Data was collected using secondary resources to develop plan stakeholder engagement.	**Primary** Interview with Ms. Carl Bruce, Project Manager, email **Secondary** Articles from the PMI on stakeholder management. Journal Articles. Web research	Microsoft Word & Excel, expert judgement, journals	Schedule constraints may result, in limited collection information and limited information found on the topic. There is a lack of historical data, as this is the first project of its type done by the organization.

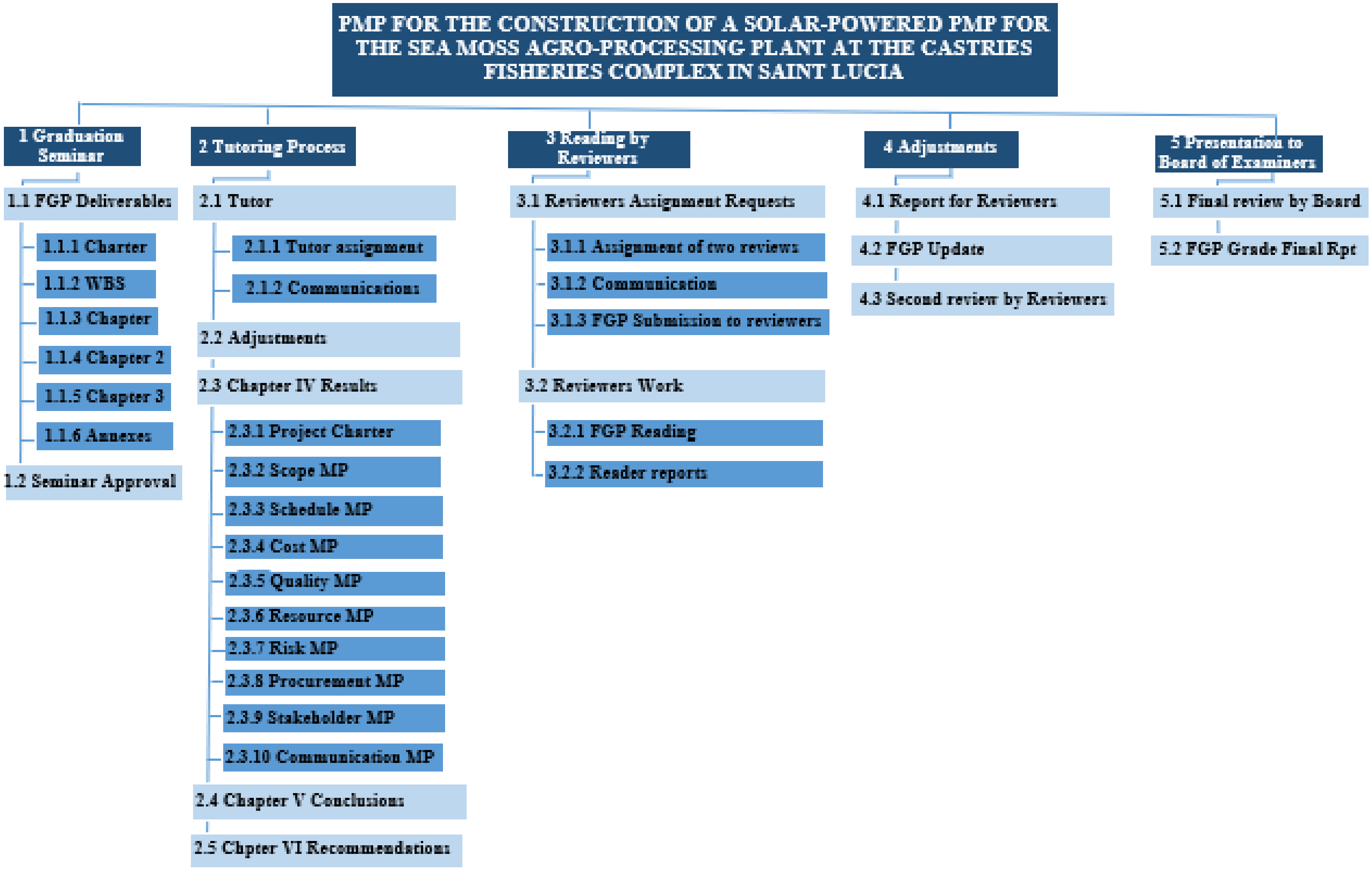
22. Validation of the Work in the Field of Regenerative and Sustainable Development.

The success of this FGP is congruent with sustainability and regenerative development. It explains the relationship and impact of the execution of the project and the operation of the final product with regenerative development and with sustainable development. All of which impacts the execution of the project, deliverables or effects of the maintenance and operation of the product or final result as well as the sustainable development objectives/ goals (SDGs). A P5 impact analysis P5 is also presented for further elaboration.

For this FGP, a special focus is placed on developing a project management plan for a solar powered sea moss agro-processing plant at the Castries Fisheries Complex. This will help support the governance of sea moss agro-processing for farmers in the Castries basin and overall management of their energy, environmental, social, financial (economic) and quality systems. In addition, this will improve appropriate methods and controls to be applied throughout the project lifecycle coherence between business strategy and project portfolios, improve decision making and communication, provide clearly defined criteria for reporting project status and escalation of risks and issues to the levels required by the organization, foster a culture of improvement and of frank internal disclosure of project information, for better engagement with project stakeholder at a level that is commensurate with their importance to the organization and in a manner that fosters trust.

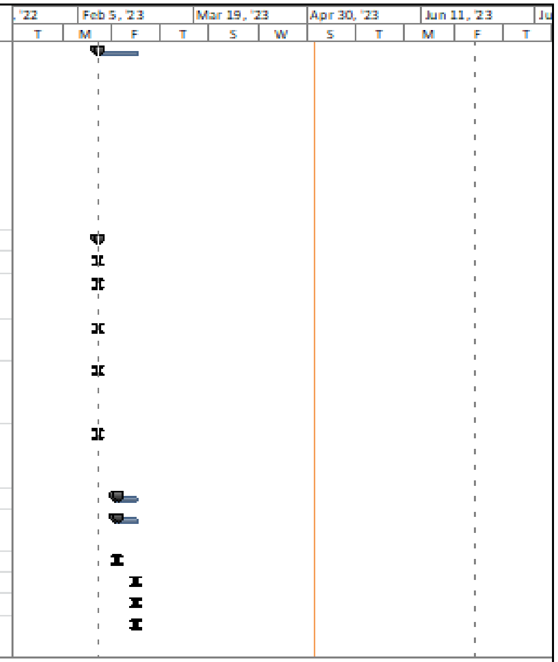
Some indicators are that of product and process (project management) impacts on the lifespan of the product, servicing of the product, effectiveness, efficiency, and fairness of the project processes. The people (social) impacts indicators, with a focus on, labor practices and decent work: project health and safety, training and education, diversity and equal opportunity, local competence development, organizational learning; Society and Customers: community support, product and service labelling, customer health and safety; Ethical behavior: procurement practices, anti-corruption, and fair competition. Planet (environmental) impacts, transport: local procurement, Energy: renewable energy, energy consumption; clean energy return, CO_2 emissions, Prosperity (economic) Impacts, economic stimulation: local economic impact and indirect benefits. All indicators will be measured from primary and secondary sources of information.

Appendix 2: FGP WBS



Appendix 3: FGP Schedule

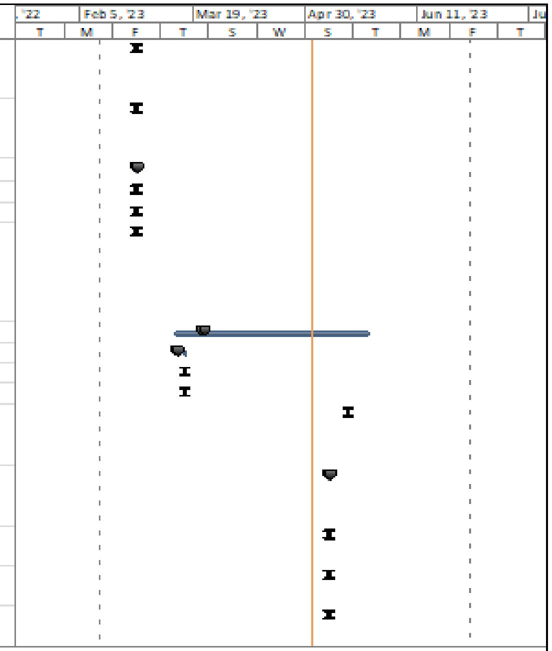
ID	Indicators	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1			**FGP (The creation of a project management plan for an Environmental, Social, and Governance (ESG) Project under the Sustainability Accounting Standard (SASB) for Electric**	**1 day?**	**Sun 2/12/23**	**Sun 2/12/23**		
2			**FGP profile**	**1 day**	**Sun 2/12/23**	**Sun 2/12/23**		
3			Introduction	1 day	Sun 2/12/23	Sun 2/12/23		
4			Theoretical framework	1 day	Sun 2/12/23	Sun 2/12/23		
5			Methodological framework	1 day	Sun 2/12/23	Sun 2/12/23		
6			Preliminary bibliographical research	1 day	Sun 2/12/23	Sun 2/12/23		
7			Annexes (FGP schedule, FGP WBS, FGP	1 day	Sun 2/12/23	Sun 2/12/23		
8			**FGP development**	**1 day**	**Sun 2/19/23**	**Sun 2/19/23**		
9			**Graduation Seminar**	**1 day**	**Sun 2/19/23**	**Sun 2/19/23**		
10			FGP Deliverables	1 day	Sun 2/19/23	Sun 2/19/23		
11			Charter	1 day	Sun 2/26/23	Sun 2/26/23		
12			WBS	1 day	Sun 2/26/23	Sun 2/26/23		
13			Chapter I. Introduction	1 day	Sun 2/26/23	Sun 2/26/23		



Project: FGP Milestone Schedule
Date: Wed 5/3/23

Task		External Tasks		Manual Task		Finish-only	
Split		External Milestone		Duration-only		Deadline	
Milestone		Inactive Task		Manual Summary Rollup		Progress	
Summary		Inactive Milestone		Manual Summary			
Project Summary		Inactive Summary		Start-only			

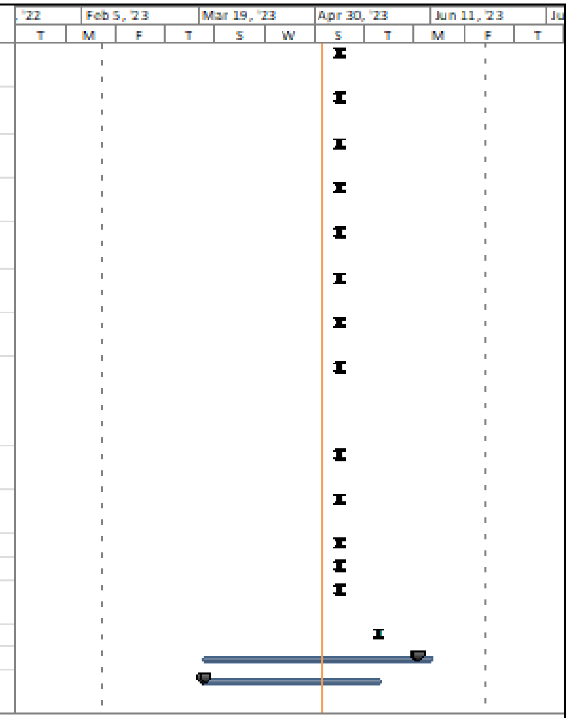
ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
14			Chapter II. Theoretical Framework	1 day	Sun 2/26/23	Sun 2/26/23		
15			Chapter III. Methodological framework	1 day	Sun 2/26/23	Sun 2/26/23		
16			**Annexes**	**1 day?**	**Sun 2/26/23**	**Sun 2/26/23**		
17			Bibliography	1 day	Sun 2/26/23	Sun 2/26/23		
18			Schedule	1 day	Sun 2/26/23	Sun 2/26/23		
19			Validation of Regenerative and Sustainable Development For Projects	1 day	Sun 2/26/23	Sun 2/26/23		
20			**Tutoring Process**	**1 day?**	**Thu 3/23/23**	**Thu 3/23/23**		
21			**Tutor**	**1 day**	**Mon 3/13/23**	**Mon 3/13/23**		
22			Tutor Assignment	1 day	Thu 3/16/23	Thu 3/16/23		
23			Communication	1 day	Thu 3/16/23	Thu 3/16/23		
24			Adjustments of previous chapters (if needed)	1 day	Tue 5/16/23	Tue 5/16/23		
25			**Chapter IV. Development (Results)**	**1 day?**	**Tue 5/9/23**	**Tue 5/9/23**		
26			Scope Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
27			Schedule Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
28			Cost Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		



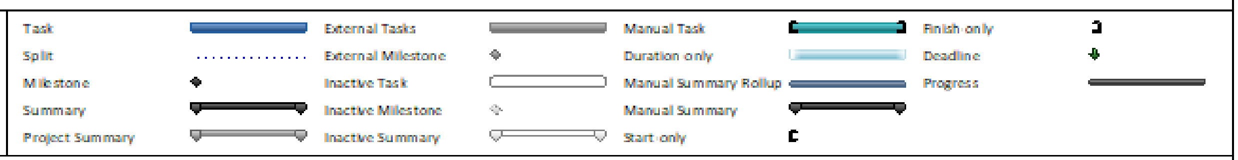
Project: FGP Milestone Schedule
Date: Wed 5/3/23

Task	External Tasks	Manual Task	Finish-only
Split	External Milestone	Duration-only	Deadline
Milestone	Inactive Task	Manual Summary Rollup	Progress
Summary	Inactive Milestone	Manual Summary	
Project Summary	Inactive Summary	Start-only	

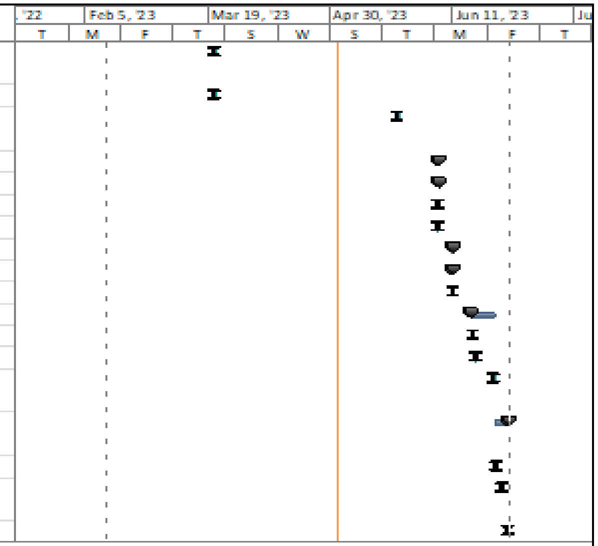
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
29		Quality Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
30		Resource Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
31		Risk Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
32		Procurement Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
33		Stakeholder Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
34		Communications Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
35		Integration Management Plan	1 day	Tue 5/9/23	Tue 5/9/23		
36		Validation on Regenerative and Sustainable Development Plan	1 day	Tue 5/9/23	Tue 5/9/23		
37		Chapter V. Conclusions	1 day	Tue 5/9/23	Tue 5/9/23		
38		Chapter VI. Recommendations	1 day	Tue 5/9/23	Tue 5/9/23		
39		Reference List	1 day	Tue 5/9/23	Tue 5/9/23		
40		Annexes	1 day	Tue 5/9/23	Tue 5/9/23		
41		Tutor approval for reading	1 day	Tue 5/9/23	Tue 5/9/23		
42		Reader's review	1 day	Tue 5/23/23	Tue 5/23/23		
43		**Reading by reviewers**	**1 day?**	**Tue 6/6/23**	**Tue 6/6/23**		
44		**Reviewers assignment request**	**1 day?**	**Tue 3/21/23**	**Tue 3/21/23**		



Project: FGP Milestone Schedule
Date: Wed 5/3/23



ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
45			Assignment of two reviewers	1 day	Tue 3/21/23	Tue 3/21/23		
46			Communication	1 day	Tue 3/21/23	Tue 3/21/23		
47			FGP submission to reviewers	1 day	Tue 5/23/23	Tue 5/23/23		
48			**Reviewers work**	**1 day**	**Tue 6/6/23**	**Tue 6/6/23**		
49			**Reviewer 1**	**1 day**	**Tue 6/6/23**	**Tue 6/6/23**		
50			FGP Reading	1 day	Tue 6/6/23	Tue 6/6/23		
51			Reading 1 report	1 day	Tue 6/6/23	Tue 6/6/23		
52			**Reviewer 2**	**1 day**	**Sun 6/11/23**	**Sun 6/11/23**		
53			**FGP reading**	**1 day**	**Sun 6/11/23**	**Sun 6/11/23**		
54			Reading 2 report	1 day	Sun 6/11/23	Sun 6/11/23		
55			**Adjustments**	**1 day**	**Sat 6/17/23**	**Sat 6/17/23**		
56			Report for reviewers	1 day	Sun 6/18/23	Sun 6/18/23		
57			FGP update	1 day	Mon 6/19/23	Mon 6/19/23		
58			Second review by reviewers	1 day	Sun 6/25/23	Sun 6/25/23		
59			**Presentations to Board of Examiners**	**1 day**	**Fri 6/30/23**	**Fri 6/30/23**		
60			Final review by board	1 day	Mon 6/26/23	Mon 6/26/23		
61			Board of examiners evaluation	1 day	Wed 6/28/23	Wed 6/28/23		
62			FGP grade report	1 day	Fri 6/30/23	Fri 6/30/23		



Project: FGP Milestone Schedule
Date: Wed 5/3/23

Task	External Tasks	Manual Task	Finish-only
Split	External Milestone	Duration-only	Deadline
Milestone	Inactive Task	Manual Summary Rollup	Progress
Summary	Inactive Milestone	Manual Summary	
Project Summary	Inactive Summary	Start-only	

Appendix 4: Preliminary bibliographical research

The reference provides background information on the project domains, hybrid, predictive and adaptive approaches, and other project management principles, as well as methodologies.

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The reference provides background information on the comparison of projects, programs, and portfolios.

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The reference provides background information on project assumptions.

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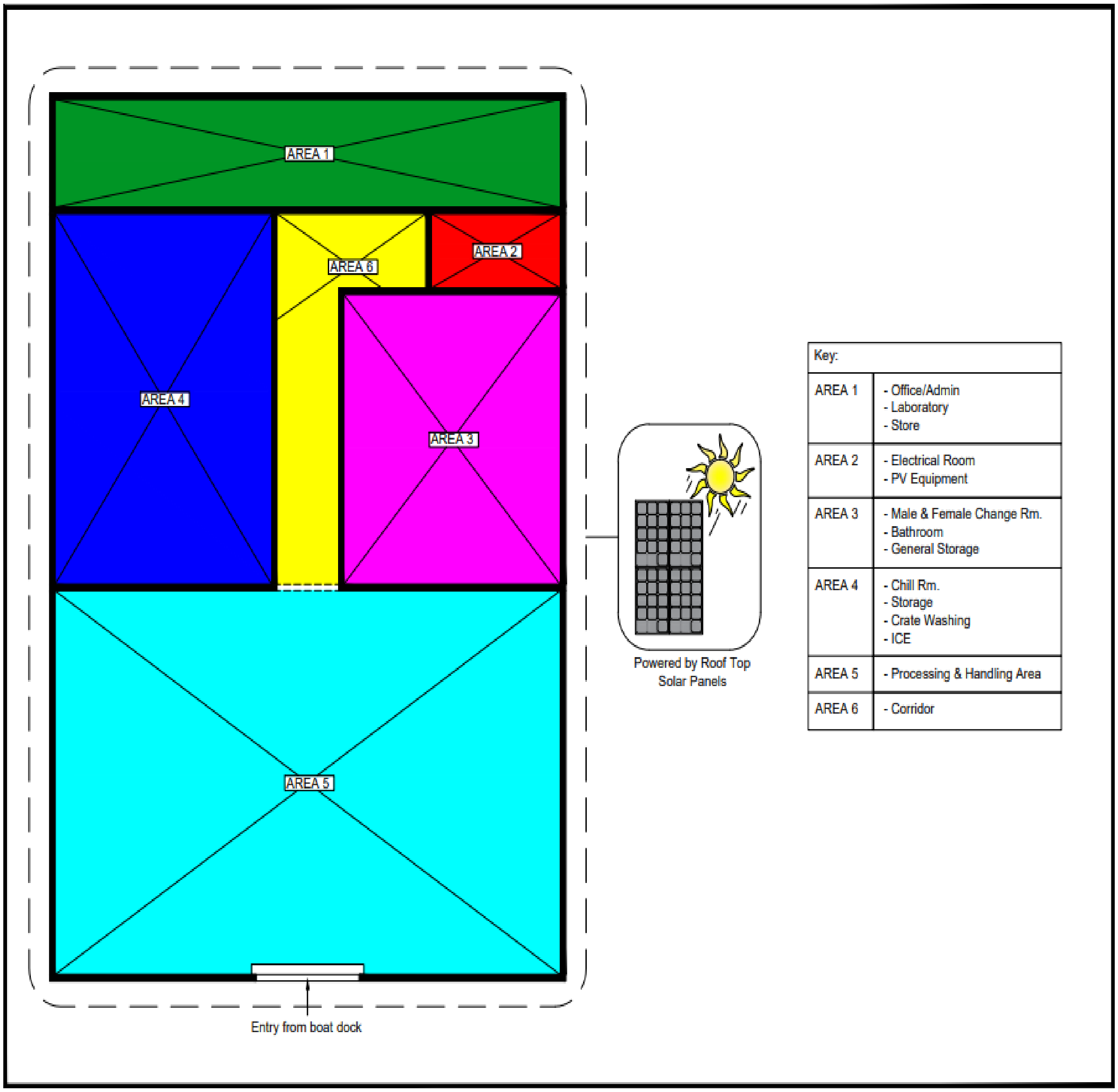
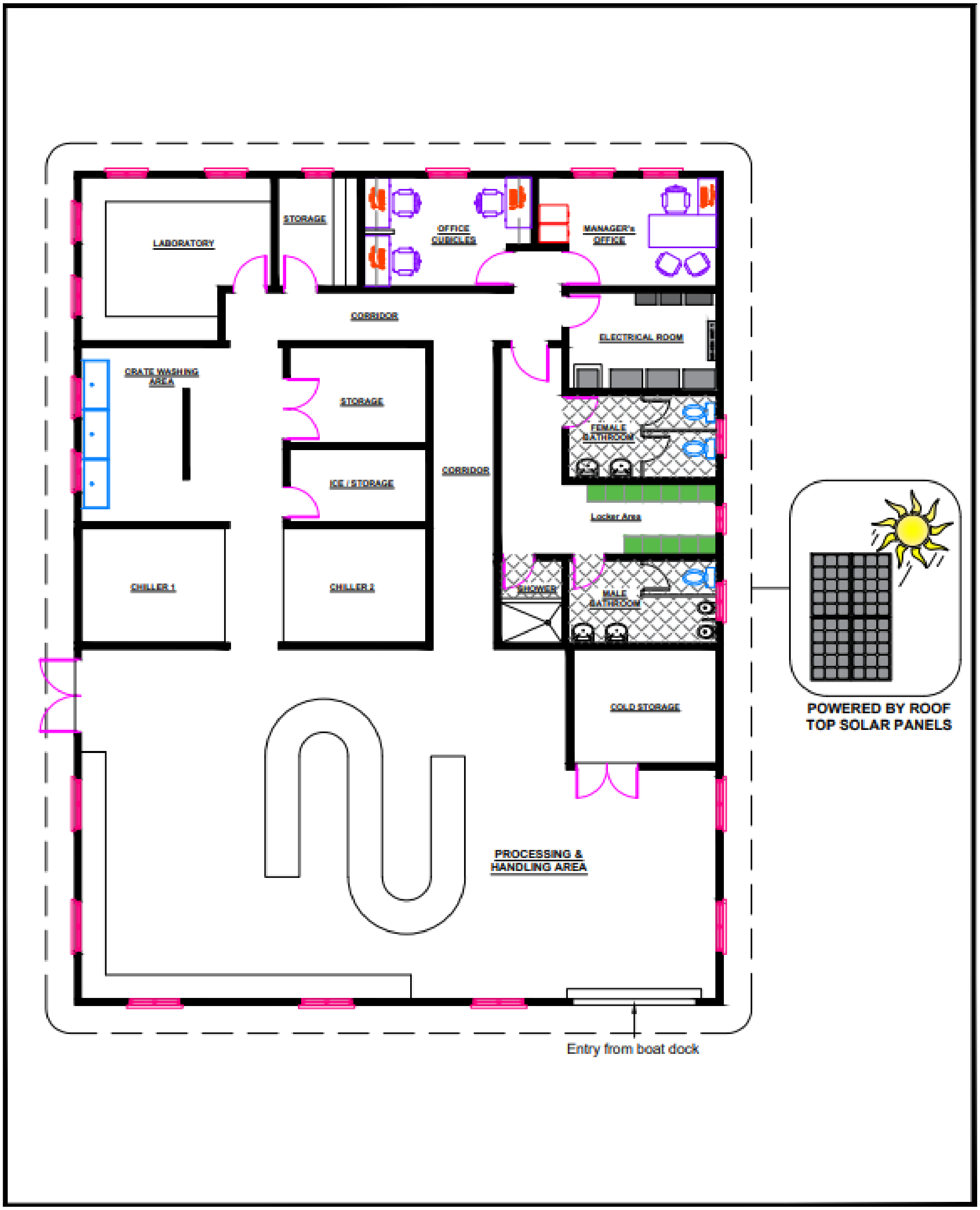
Appendix 5: Solar-powered Sea Moss Agro-processing Plant Design




LABORATORY
STORAGE
OFFICE CUBICLES
MANAGER's OFFICE
CORRIDOR
ELECTRICAL ROOM
CRATE WASHING AREA
STORAGE
ICE / STORAGE
CORRIDOR
FEMALE BATHROOM
Locker Area
CHILLER 1
CHILLER 2
SHOWER
MALE BATHROOM
COLD STORAGE
PROCESSING & HANDLING AREA
Entry from boat dock
POWERED BY ROOF TOP SOLAR PANELS

Appendix 6: Lessons Learned Template

Date	Project Management Area	WIN or ISSUE	Describe What Happened	What Was the Impact?	How Does This Change Future Projects	Action Items

Appendix 7: Revision Dictum

Castries
Saint Lucia
West Indies

June 28, 2023

Academic Advisor
Master's Degree in Project Management
University for International Cooperation (UCI)
San Jose
Costa Rica

Dear Academic Advisor,

Re: Thorough review and proof-reading of Final Graduation Project submitted by Joanne Husbands in partial fulfillment of the requirements for the Master's in Project Management.

I hereby confirm that Joanne Husbands has made all necessary corrections to the Final Graduation Project document: A Project Management Plan for the Construction of A Solar-powered Sea Moss Agro-processing Plant at the Castries Fisheries Complex in Saint Lucia as I have advised. In my opinion, the document meets the literary and linguistic standards expected of a student at that academic level.

I hold a Bachelor's degree in Linguistics from the Universidad Autonoma Metropolitana in Mexico City, Mexico and a Postgraduate Diploma in Methodologies in Teaching Spanish as a Second Language from the Universidad Metropolitana de Ciencias de la Educación in Santiago, Chile with more than a decade of experience as an educator. I believe this suitably qualifies me to make the above assessment.

Sincerely,

JAnnerville

Johan Annerville

Casa abierta al tiempo

LA

UNIVERSIDAD AUTÓNOMA METROPOLITANA

EXPIDE EL TÍTULO DE

LICENCIADA EN LINGÜÍSTICA

A

JOHAN ANNERVILLE

EN VIRTUD DE HABER REALIZADO
LOS ESTUDIOS CORRESPONDIENTES
EN LA UNIDAD IZTAPALAPA
CONFORME A LOS PLANES
Y PROGRAMAS APROBADOS
POR EL COLEGIO ACADÉMICO

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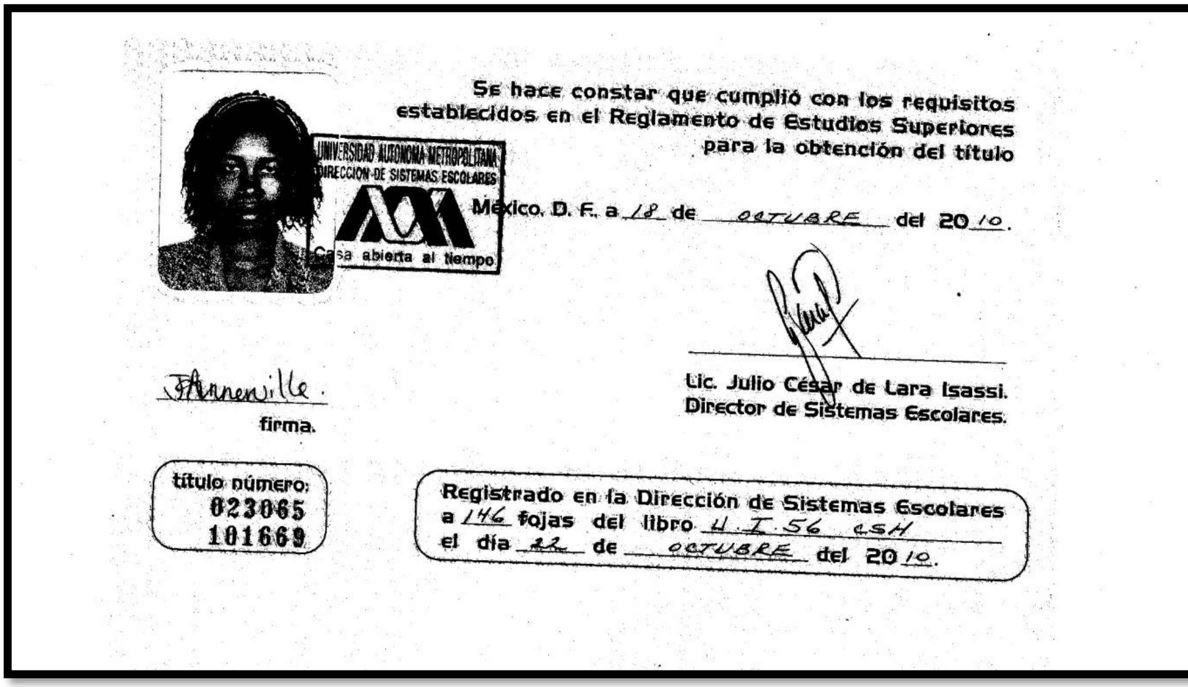
México, D. F. a 20 de octubre del 2010.



UNIVERSIDAD AUTONOMA METROPOLITANA
DIRECCION DE SISTEMAS ESCOLARES
Casa abierta al tiempo

Se hace constar que cumplió con los requisitos establecidos en el Reglamento de Estudios Superiores para la obtención del título

México, D. F. a 18 de OCTUBRE del 2010.

Lic. Julio César de Lara Isassi.
Director de Sistemas Escolares.

JAnnerville.
firma.

título número:
023065
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Registrado en la Dirección de Sistemas Escolares a 146 fojas del libro H.I.56 CSH el día 22 de OCTUBRE del 2010.

Diplomado

UNIVERSIDAD METROPOLITANA DE CIENCIAS DE LA EDUCACIÓN

Se otorga el presente diploma de aprobación a don(ña)

Johan Annerville

por cuanto ha cumplido satisfactoriamente con las exigencias de rendimiento académico, asistencia y participación, establecidas en el DIPLOMADO EN METODOLOGÍAS DE ENSEÑANZA DEL ESPAÑOL COMO SEGUNDO IDIOMA PARA PROFESORES DE ESPAÑOL DEL CARIBE ANGLÓFONO, *impartido en nuestra casa de estudios superiores, entre el 29 de julio y el 30 de agosto de 2013.*
Este Diplomado ha sido patrocinado por la Agencia de Cooperación Internacional del Ministerio de Relaciones Exteriores de la República de Chile.

RAMIRO AGUILAR BALDOMAR
Secretario General

JAIME ESPINOSA ARAYA
Rector

Santiago de Chile, agosto de 2013