

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

Project Management Plan for Managing Improvements of a Smart Farming Device and
Application for Saint Lucian Farmers.

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DEDICATION

This project is dedicated to my partner, for his unwavering support and compassion toward me during this MPM.

Special dedication to my family and friends who continued to cheer me along even on days when I felt like giving up.

I am eternally grateful for your support.

ACKNOWLEDGMENTS

I would like to express sincere gratitude to Novay Inc. especially the Director, for allowing me to utilize this project to complete this MPM.

To the General Secretariat of the Organization of American States (OAS), and to the University of International Cooperation (UCI), I am eternally grateful for the scholarship awarded, creating limitless opportunities.

Special thanks to my family, for their continued encouragement and to my UCI colleagues with whom I was able to share this experience. Your guidance was invaluable.

ABSTRACT

The primary objective of this Final Graduation Project (FGP) is the development of a Project Management Plan (PMP) to guide the project team with the successful management of improvements to a smart farming device and application created for Caribbean farmers. The device and application came about as a positive response to the negative impacts of climate change. The implementation of this smart farming device and application also serves to equip farmers with a basic tool to facilitate the restoration of crop health and reduce crop loss.

Additionally, when placed in the soil, the smart farming device and application inform farmers accurately of what their crops need. The device pairs with smartphones or tablets and speaks to the farmer to give real-time information and interventions to restore crop health. The Team seeks to improve its functionality, therefore, the Project management plan developed in this FGP will assist in the completion of this Project.

The Project Management Plan is guided by the best practices of the Project Management Body of Knowledge (*PMBOK® Guide*). The final deliverables include the project charter, and management plans for scope, schedule, cost, quality, resource, communication, risk, procurement, and stakeholders. Furthermore, this project makes practical and effective use of descriptive and analytical methods of research as well as primary and secondary sources of information.

The Project Management Plan is aimed at aiding the project team to complete the project not only on schedule but within budget while meeting the overall and specific objectives, as well as the expectations of stakeholders.

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ABBREVIATIONS AND ACRONYMS

CARICOM	Caribbean Community
EVM	Earned Value Management
FGP	Final Graduation Project
GPM	Green Project Management
IPCC	Intergovernmental Panel on Climate Change
NPK	Nitrogen, Phosphorus and Potassium
pH	Potential of Hydrogen
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMP	Project Management Plan
RBS	Risk Breakdown Structure
RTM	Requirements Traceability Matrix
SDGs	Sustainable Development Goals
SOW	Statement of Work
TOR	Terms of Reference
UCI	University of International Cooperation
UN	United Nations
UX	User Experience
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

The Caribbean islands have not been spared from the effects of climate change. The Intergovernmental Panel on Climate Change (IPCC) estimated that average temperatures in the region increased by 0.1 to 0.2 degrees Celsius per decade over the past three decades (iadb.org). The Caribbean is plagued with issues including increased intensity of hurricanes, more frequent droughts, and higher sea level temperatures. These factors have jeopardized farmers' ability to access reliable water supplies throughout the year, therefore, farmers are faced with loss of income due to reduced crop output as these crops depend on water for survival. As a result, Novay Inc. developed a smart farming device and application named CropMate, which assisted farmers to alleviate this problem. This product was born out of the need to help farmers both cope with the increasing unpredictability of water and optimize water use which improved plant health during drought. The device, through the application, gave assistance to farmers: it offered accurate and easily accessible information directly from plants and the soil and made it easier for farmers to plan for rain, conserve water, and reduce crop loss. The team recognized the need to improve the already existing device and application, to provide more features to farmers.

The general objective of this Final Graduation Project (FGP) was to create a project management plan based on the Project Management Institute's (PMI) guidelines to effectively manage the improvement of a smart farming device application for Saint Lucian farmers. The specific objectives were: to develop a project charter that will be used in the elaboration of the project deliverables, to create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed, to develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project, to create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget, to develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs, to create a resource management plan to ensure effective use of the various assigned resources, to develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information, to create a risk management plan to evaluate and plan for possible risks and to help mitigate negative risks and threats that could adversely impact the project, to create a procurement management plan to define the procurement requirements for the project and how it will be managed, to create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project.

The FGP utilized an analytical and descriptive methodology to conduct research. Primary sources in the forms of reports and interviews were utilized, as well as secondary sources: books, web pages, and internet articles were used to source information.

1 INTRODUCTION

The Caribbean is one of the geographical regions most vulnerable to climate change, a phenomenon which has severely affected agriculture in the region. This has become a growing threat to food security in the Caribbean. As a result, throughout the region, the importance of the role of small farmers in the development of the agricultural industry is being recognized. It is for this reason that the company Novay Inc. has developed a product in the form of a smart farming device and application to assist farmers.

The region is currently challenged with the problem of food insecurity; temperature changes as well as changes in rainfall patterns affect agricultural production and crop yields, affecting prices as well as availability of food. Hence, this has made it increasingly difficult for farmers to meet the demand for crops. As a direct result, Novay Inc. innovatively proposed a solution to assist farmers who are trying to manage water efficiently, farmers are often uncertain about the requirements in terms of water and fertilizer to maintain healthy crops. The Novay team utilized design thinking to develop this smart mobile device and application which addresses the increasing unpredictability of weather and helps farmers optimize water use as well as improve plant health especially in times of drought.

This Final Graduation Project (FGP) concentrates on the development of a Project Management Plan to manage improvements to a smart farming device and application for farmers.

1.1. Background

In the Caribbean community, there continues to be the recognition that agro-development plays a critical role to the expansion of the agricultural sector. Driven by its core values of regionalism, empowerment, passion, unity, and love, Novay Inc. seeks to empower farmers in the Caribbean towards sustainable agricultural

practices. This company focuses its efforts on sustainable farming practices and as such, has developed a smart farming device and application (CropMate) as a sustainable solution to reduce the problem of crop loss being experienced by farmers thereby supporting food sustainability.

Novay Inc. has developed a smart farming device and application intended for the use of small to medium sized open field farmers who find it difficult to maintain crop health because of increasing climatic fluctuations. These farmers are unable to manage water efficiently and are unclear on what their crops require. They often pay exorbitant fees to facilitate soil testing in laboratories and some results are unclear or undetermined. On the other hand, some farmers within the region do not have access to laboratories as these are not available in all farming communities. Overall, these farmers are losing income.

The smart device and application (CropMate) provide farmers with a viable option to healthy crop growth and maintenance, thus increasing their chances of food sustainability. Food sustainability as defined as by Alfaro (2022) is *“producing food in a way that protects the environment, makes efficient use of natural resources, ensures the quality of life in communities that produce food, including the animals as well as people”*. The application once paired via the device, provides farmers with reliable soil information to allow for healthy crop growth, thus contributing to sustainable food production.

1.2. Statement of the Problem

There are approximately that 4.8 million registered farmers in Caribbean Community (CARICOM), and an even greater number in the wider region, who experience loss of income because of reduced crop output. This reduced crop output is as a result of increased drought conditions and changes in the soil caused by climate change. Currently, many farmers rely on agricultural extension officers to provide scientific information on soil condition.

The sustainable solution to this was the development of a smart farming device and application, the talking plant which provides information on soil moisture, nutrients, and salt levels. This smart farming device, when placed in the soil tells farmers exactly what their crops need. The device pairs with smartphones or tablets and through the application, speaks to the farmer to give real time information and interventions to restore crop health. Born out of the need to help farmers cope with the increasing unforeseeable weather conditions and optimize water use and improve plant health in times of drought, the application offers timely, accurate and easily accessible information directly from plants and the soil. This way, farmers are better able to plan for rain, conserve water, and reduce crop loss.

Within the region, there is generally a lack of technology and technical support for the agro-industrial sector. CropMate aims to provide much needed technical and hands on assistance to farmers in their crop production.

With the initial development of CropMate, there was a lack of planning tools and templates. As such, it was necessary to develop this project management plan to manage the new improvements to the existing product, thereby increasing the probability of success of the intended project.

1.3. Purpose

The final deliverable for this Final Graduation Project (FGP) is the development of a project management plan to guide the project team with the successful management of improvements to a smart farming device and application (CropMate) that was created for Caribbean farmers. The original project, launched in 2021 initiated the development of a smart farming device and application which when placed in the soil tells farmers exactly what their crops need. The device pairs with smartphones or tablets and speaks to the farmer to give real time information and interventions to restore crop health.

The information provided by the application gives farmers critical insight on the health of the soil which can help them make important decisions on how to water their plants or what solutions they can implement consequently improving the overall health of their plants. As an added feature, the application informs of expected weather. The application is currently in the prototype phase and the functionality of all its features has been validated by an app developer and robotics service provider. The Team seeks to improve the product's functionality, therefore, the project management plan developed in this FGP will assist in the completion of this project.

In 2021, when CropMate was first developed, a project management plan was not used. Now that the team is managing improvements to the product, this project management plan was developed to increase the chances of success of the project. Developing a project management plan has several additional advantages two of them are to promote the use of best practices in the improvement of the application as well as to effectively manage stakeholder expectations.

Upon completion of this project management plan, the project team should successfully be able to manage the application improvements.

1.4. General Objective

To create a project management plan to effectively manage the improvement of a smart farming device and application for Saint Lucian farmers.

1.5. Specific Objectives

1. To develop a project charter that will be used in the elaboration of the project deliverables.
2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.

3. To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.
4. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.
5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs.
6. To create a resource management plan to ensure effective use of the various assigned resources.
7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.
8. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.
9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.
10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project.

2 THEORETICAL FRAMEWORK

This chapter includes information to support the qualitative research on the development of a project management plan for managing improvements of a smart farming device and application for Saint Lucian farmers. It includes concepts, definitions, references, and bibliographical sources that were used to develop the FGP. It gives a full outlook on the company, justifying the reason the project exists.

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise Background

Climate change continues to impact countries globally, and Saint Lucia is no exception. The Intergovernmental Panel on Climate Change (IPCC) estimates that average temperatures within the Caribbean Region have increased by 0.1 to 0.2 degrees Celsius per decade over the past three decades (iadb.org). As a result, livelihoods are significantly affected by these rising temperatures. Farmers particularly, have been adversely impacted by climate change as drought conditions impede the water supply which is vital for crop survival.

The Caribbean Island of Saint Lucia is marred by issues of food security and climate change. Thousands of farmers stand in the front line of vulnerability to the impacts of these issues. Novay Inc., a company which focuses precisely on these vulnerabilities, has sought a sustainable way to assist these farmers with resolving climate change issues. The company also collaborates with farmers to grow their business. It brings all the knowledge and technical competence in one place and gives the farmer the information and autonomy they need to maintain and remedy crop health.

2.1.2 Mission and vision statements

Novay Inc. has defined its mission and vision and its overarching goal is “empowering farmers in the Caribbean towards agricultural sustainability”. The mission and vision are detailed below.

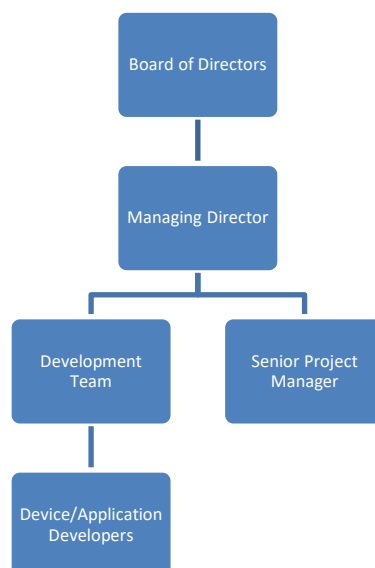
Mission: Empowering farmers in the Caribbean towards agricultural sustainability.

Vision: To inspire innovation in response to climate change issues affecting the Caribbean.

2.1.3 Organizational structure

As a recently incorporated company, Novay Inc. is led by a Board of Directors who is ultimately responsible for the strategic planning oversight of the organization. As depicted in the organizational structure (Figure 1), the Managing Director reports to the Board and directly oversees the Project Development Team as well as the Senior Project Manager. The Managing Director is responsible for the performance of the company, as dictated by the Board's overall strategy. The Project Development Team is tasked with the responsibility of developing the software product and managing any improvements to the smart farming device. Among their key functions the development team performs testing and analysis as well as programming of the application and device. The Device and Application Developers are outsourced by the Development Team. Their primary functions include designing, application management and providing end user support of the application.

Figure 1 - Organizational Structure of Novay Inc.



Source (Author)

2.1.4 Products Offered

The main product resulting from the project is the development of a smart farming device and application that assists small farmers in making informed decisions about their soil handling. This smart farming application also referred to as the “talking plant”, is a cloud-based device and application which assists small farmers in making empowered decisions on how they handle soil. Moreover, the device provides farmers with important information on soil moisture, nutrients, and salt levels, all in an effort to manage healthy plant growth.

2.2 Project Management Concepts

2.2.1 Project

According to the PMI, “*a project is defined as a temporary endeavor undertaken to create a unique product, service or result*”. (PMI, 2017, p. 4). Projects are temporary in nature and create value through a unique product or service. A project is deemed successful if its objectives are achieved according to the project acceptance criteria, within the agreed timescale and budget.

Projects are undertaken at all organizational levels and can involve a single individual or a group. This Project Management Plan is being undertaken by a single individual, however, the underlying project for which the plan is being prepared, will be managed by a group of professionals.

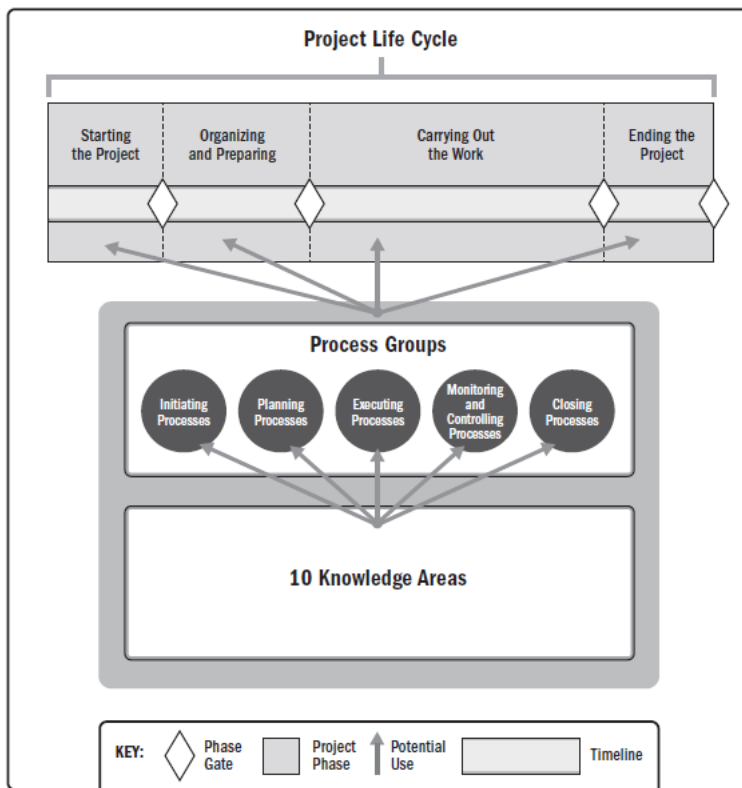
2.2.2 Project Management

Project management, as defined by the PMI, *is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements*. (PMI, 2017, p. 10). The Association for Project Management (2019) refers to project management as “*the application of processes, methods, skills knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters*”. Project management is differentiated from other type of management in the sense that there is always a final deliverable whether a product or service and a definite time span.

2.2.3 Project Life Cycle

A project life cycle is a phased framework planned to assist project managers in completing projects successfully. According to A Guide to the Project Management Body of Knowledge (*PMBOK® Guide*), the project life cycle refers to a series of phases that a project passes through from its start to completion, which provides the basic framework for managing a project. The phases may be sequential, iterative, or overlapping, however, all projects are mapped to the generic life cycle shown in Figure 2.

Figure 2 - Project Life Cycle



Source (PMI, 2017)

2.2.4 Project Management Processes

The Guide to the Project Management Body of Knowledge (*PMBOK® Guide*, 2017) categorizes the overarching process of managing a project into five stages, or “process groups.” These process groups are typically defined as:

- **Initiating:** During this phase, the project is conceptualized, and feasibility is determined.
- **Planning:** Processes required to establish the project’s scope. This blueprint will map out the project’s scope; resources required to create the deliverables; estimated time and financial commitments; communication

strategy to ensure stakeholders are kept up to date and involved; execution plan; and proposal for ongoing maintenance.

- **Executing:** During this phase, the project manager will conduct the procurement required for the project and staff the team.
- **Monitoring and control:** During this process group, project managers will closely measure the project's progress to ensure it is developing properly.
- **Closing:** The closing process group occurs once the project deliverables have been produced and the stakeholders validate and approve them.

The project management plan for the improvement of a smart farming application will be limited to only the initiating and planning processes. Figure 3 illustrates the Project Management Processes as depicted by Kissflow (2022).

Figure 3 - Project Management Process



Source (Kissflow, 2022)

2.2.5 Project Management Knowledge Areas

The PMI outlines ten (10) key knowledge areas that are widely accepted and recognized by project managers globally. Each knowledge area covers different parts of a project and involves several management processes. The knowledge areas determine the processes, requirements, tools, techniques, and outcomes for every process in a project. The project management knowledge areas are project integration management, project scope management, project schedule management, project cost management, project quality management, project

resource management, project communications management, project risk management, project procurement management and project stakeholder management. Each knowledge area will be briefly described below.

1. Project Integration Management

Project integration management is the umbrella that covers all other project management knowledge areas. It knits together individual processes and tasks into one project with defined goals and deliverables. The project charter for the project will be completed in this process and will then be used to develop the improvements of the smart farming device and application.

2. Project Scope Management

These are the processes required to ensure the project includes all the work required and only the work required to successfully complete the project. This involves both understanding and setting the objectives of the project, exactly what is needed to successfully complete the project and to define what is not required.

3. Project Schedule Management

It entails the processes required to manage the timely completion of the project. It includes the time that is catered to complete each individual task pertaining to the project's objectives with the desired skills, tools, and techniques.

4. Project Cost Management

This is the process that is concerned with planning and controlling the budget of the project. This process includes activities such as planning, budgeting, estimating, financing, funding, managing, and monitoring costs to make sure that the project is finished within the scheduled budget. It is all about handling the project's financial requirements.

5. Project Quality Management

Project quality management is the main criterion when it comes to determining the value of a project. At all times, the project is required to meet the standards which were originally defined for it. The bottom line is that the quality of the project must meet the needs of the stakeholders. The goal of project quality management is to achieve consistency across projects.

6. Project Resource Management

Project resource management includes the processes to identify, acquire and manage the resources needed for the successful completion of the project.

7. Project Communications Management

Project communications management refers to the set of processes which make it possible to ensure that the right messages are sent, received, and understood by the right stakeholders. The communications management plan is crucial to identifying who needs to know what and when before the project starts.

8. Project Risk Management

Project risk management are processes of conducting risk management planning, identification, analysis, response planning, response implementation and risk monitoring on a project.

9. Project Procurement Management

This project management knowledge area gives the blueprint for which tasks or services will be completed by outside contractors. It also builds and plans the legal paperwork and coordination process ahead of time.

10. Project Stakeholder Management

These are processes required to identify the people, groups or organizations that could impact or be impacted by the project. Ultimately, the success or failure of a project depends on the delivery of your project to the stakeholders.

It is important to be aware of all the project management knowledge areas. In that way, a project manager can execute a project more efficiently and productively. The skills acquired by understanding these knowledge areas will assist the project manager to avoid crisis, and scope deviation and enable the project manager to make proactive decisions. Figure 4 depicts the relationship between each knowledge area and the process groups.

Figure 4 - Project Management Process Group and Knowledge Mapping

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	

Source (PMI, 2017)

2.3 Other applicable Theory/Concepts Related to the Project Topic and Context

2.3.1 Regenerative Development

An approach that encourages communities to support and create positive relationships that will benefit society and our environments by allowing the system to evolve and adapt to changing circumstances. (Hernandez, 2019). In relation to

the FGP, there is a focus on engaging farmers to adopt green, sustainable practices, thereby reducing the ecological footprint. Implementing the smart farming application will set new standards for sustainable and regenerative development in farming and food security.

2.3.2 Device

A device refers to a thing made or adapted for a particular purpose, especially a piece of mechanical or electronic equipment. The Graduation Project will see the development of a PMP for the managing of improvements of a smart farming device to assist farmers with crop growth.

Consequently, the FGP will see the management of improvements to an existing application. The Project Management Plan being developed will provide the guidelines and best practices to follow to ensure that the improvement to the application is a successful project.

2.3.3 Smart Farming

Smart farming is an emerging concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology for tracking, monitoring, and analyzing operations (Bernstein, n. d). Smart farming technology is important as Novay Inc. is focused on utilizing regenerative and sustainable practices. Some of the benefits the application will bring about are:

- Improved crop health – enables farmers identify problems earlier
- Reduce the ecological footprint of farming
- Provide food security in climate change impacted region – more efficient smart farming helps to adapt to changing climates while maintaining production levels

3 METHODOLOGICAL FRAMEWORK

Ahmad (2021) defines the methodological framework as the part of research which exposes the theoretical and practical methods used to analyze the problem posed or the topic being dealt with. He goes on to explain that the methodological framework consists in explaining the theoretical-methodological strategy that links all the investigative stages. It is what gives internal consistency to the research work. The following methodological framework of the FGP will describe how the topic is analyzed as well as the methods used. This section will describe information sources, research methods, tools, assumptions, constraints, and deliverables that are used to develop the FGP.

3.1 Information Sources

3.1.1 Primary Sources

Primary sources are those sources which contain original information that has been published, reported, or recorded for the first time. The University of Minnesota (2015) defines primary sources as information that is shown for the first time or original materials on which other research is based. It displays original thinking, report on new discoveries, or fresh information.

For this FGP, the primary sources that will be used are interviews, reports, and research based scholarly journal articles.

3.1.2 Secondary Sources

Secondary sources are works that analyze, assess, or interpret a historical event, era or phenomenon, generally using primary data to do so.

The secondary information sources that will be utilized for this FGP are textbooks, articles, internet and reviews.

Chart 1 - Information Sources

Objectives	Information sources	
	Primary	Secondary
1. To develop a project charter that will be used in the elaboration of the project deliverables.	<ul style="list-style-type: none"> • Interviews with farmers • Reports 	<ul style="list-style-type: none"> • <i>PMBOK® Guide</i> 6th Edition • PMI database • Internet • UCI Articles and lectures
2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.	<ul style="list-style-type: none"> • Interviews 	<ul style="list-style-type: none"> • <i>PMBOK® Guide</i> 6th Edition • PMI database • Internet • Articles
3. To develop a schedule management plan that will guide the management of project activities to ensure the timely	<ul style="list-style-type: none"> • Reports 	<ul style="list-style-type: none"> • Practice Standard for Scheduling (2019) • <i>PMBOK® Guide</i>, 6th edition • The Standard for Earned Value Management (2019) • PMI database • Internet • Articles

Objectives	Information sources	
	Primary	Secondary
completion of the project.		
4. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.	<ul style="list-style-type: none"> • Reports 	<ul style="list-style-type: none"> • <i>PMBOK® Guide</i> 6th edition (2017) • The Standard for Earned Value Management (2019) • PMI database • Internet • Articles from the web
5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and	<ul style="list-style-type: none"> • Interviews 	<ul style="list-style-type: none"> • <i>PMBOK® Guide</i> 6th Edition • PMI database • Internet • Articles

Objectives	Information sources	
	Primary	Secondary
are in line with stakeholder needs.		
6. To create a resource management plan to ensure effective use of the various assigned resources.	<ul style="list-style-type: none"> • Interviews 	<ul style="list-style-type: none"> • <i>PMBOK® Guide 6th Edition</i> • PMI database • Internet • Articles
7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.	<ul style="list-style-type: none"> • Interviews 	<ul style="list-style-type: none"> • <i>PMBOK® Guide 6th Edition</i> • PMI database • Internet • Articles
8. To create a risk management plan to evaluate and plan for	<ul style="list-style-type: none"> • Interviews 	<ul style="list-style-type: none"> • <i>PMBOK® Guide 6th Edition</i> • <i>PMBOK® Guide 7th Edition</i> • PMI database • Internet

Objectives	Information sources	
	Primary	Secondary
possible risk and to help mitigate negative risks and threats that could adversely impact the project.		<ul style="list-style-type: none"> Articles
9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.	<ul style="list-style-type: none"> Interviews 	<ul style="list-style-type: none"> <i>PMBOK® Guide</i> 6th Edition <i>PMBOK® Guide</i> 7th Edition PMI database Internet Articles
10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement	<ul style="list-style-type: none"> Interviews 	<ul style="list-style-type: none"> <i>PMBOK® Guide</i> 6th Edition <i>PMBOK® Guide</i> 7th Edition PMI database Internet Articles

Objectives	Information sources	
	Primary	Secondary
throughout the project.		

Source (Author)

3.2 Research Methods

Research methods are specific procedures for collecting and analyzing data.

Galauner (2021) describes research methods as ways in which data is collected for research projects.

3.2.1 Analytical Method

Analytical research involves critical thinking skills and the evaluation of facts and information relative to the research being conducted. In analytical research, the researcher has to use facts or information already available and analyze these to make a critical evaluation of the material.

3.2.2 Descriptive Method

Descriptive research classifies, describes, compares, and measures data.

Chart 2 - Research Methods

Objectives	Research methods	
	Method 1	Method 2
	Analytical method	Descriptive method
1. To develop a project charter that will be used in the elaboration of	<ul style="list-style-type: none"> Analytical method will be used in the form of interviews to develop the 	

Objectives	Research methods	
	Method 1 Analytical method	Method 2 Descriptive method
the project deliverables.	project charter.	
2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of books and articles for the scope management plan. 	
3. To develop a schedule management plan that will guide the management of project activities to ensure the timely	<ul style="list-style-type: none"> The analytical method will be used in the form of analysis of previously conducted reports, 	

Objectives	Research methods	
	Method 1 Analytical method	Method 2 Descriptive method
completion of the project.	books and articles.	
4. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.	<ul style="list-style-type: none"> The analytical method will be used in the form of analysis of previously conducted reports, books and articles. 	
5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of 	

Objectives	Research methods	
	Method 1 Analytical method	Method 2 Descriptive method
fulfilled and are in line with stakeholder needs.	books and articles.	
6. To create a resource management plan to ensure effective use of the various assigned resources.	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of books and articles. 	
7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, nalysis of 	

Objectives	Research methods	
	Method 1 Analytical method	Method 2 Descriptive method
distribution of project information.	books and articles.	
8. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of books and articles. 	
9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of books and articles. 	

Objectives	Research methods	
	Method 1	Method 2
	Analytical method	Descriptive method
10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project	<ul style="list-style-type: none"> The analytical method will be used in the form of interviews with subject matter experts, analysis of books and articles. 	

Source (Author)

3.3 Tools

According to the *PMBOK® Guide (2017)*, tools are defined as something tangible, such as a template or software program, used in performing an activity to produce a product or result. Tools are specifically designed to assist a project team in organizing and managing their project tasks effectively.



The following tools defined below will be used on the FGP. The summary of tools is also shown in chart 3 below.

- Alternatives analysis – technique used to evaluate identified options in order to select the options or approaches to use to execute and perform project work. (PMI, 2017, pg. 699).

- Cost-benefit analysis – a financial analysis tool used to determine the benefits provided by a project against its costs. (PMI, 2017, pg. 703).
- Cost of quality – all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraisal of the product or service for conformance to requirements, and failure to meet requirements. (PMI, 2017, pg. 703).
- Data analysis – techniques used to organize, assess and evaluate data and information. (PMI, 2017 pg. 703)
- Data gathering – techniques used to collect data and information from a variety of sources.
- Expert judgement – judgement provided based upon expertise in an application area, knowledge area, discipline or industry defined as appropriate for the activity being performed. (PMI, 2017, pg. 79).
- Flowchart – the depiction in a diagram format of the inputs, process actions, and outputs of one or more processes within a system. (PMI, 2017, pg. 707).
- Make-or-buy analysis – the process of gathering and organizing data about product requirements and analyzing them against available alternatives including the purchase or internal manufacture of a product. (PMI, 2017, pg. 710).
- Matrix diagrams – a quality management and control tool which seeks to show the strength of relationships between factors, causes and objectives that exist between the rows and columns that form the matrix. (PMI, 2017, pg. 710).
- Meetings – gathering of two or more people convened for the purpose of achieving a common goal through verbal interaction such as sharing information or reaching an agreement.
- Resource Breakdown Structure – lists all resources needed to complete a project.
- Risk Breakdown Structure – a hierarchical representation of potential sources of risks. (PMI, 2017 pg. 720). Can be represented in a grid which contains broad definitions of a project's risks and captures the specific definitions of those risks.

- Stakeholder Engagement Assessment Matrix – a matrix that compares current and desired engagement levels of stakeholders. (PMI, 2017, pg. 723)
- Stakeholder Power - Interest Matrix – this matrix documents the power and interest stakeholders have in project outcomes.
- Trend Analysis – an analytical technique that uses mathematical models to forecast future outcomes based on historical results. (PMI, 2017, pg. 725).
- Work Breakdown Structure – a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish project objectives and create the required deliverables. (PMI, 2017, pg. 726).

Chart 3 - Tools

Objectives	Tools
1. To develop a project charter that will be used in the elaboration of the project deliverables.	<ul style="list-style-type: none"> • Expert judgement • Meetings • Data gathering – interviews
2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.	<ul style="list-style-type: none"> • Expert judgement • Meetings • Data analysis • Trend analysis
3. To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.	<ul style="list-style-type: none"> • Expert judgement (Scheduling software) • Alternatives analysis
4. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.	<ul style="list-style-type: none"> • Expert judgement •  Cost estimating and budgeting •  Use of information in the industry • Meetings • Data analysis
5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs.	<ul style="list-style-type: none"> • Cost-benefit analysis • Cost of quality • Expert judgement • Flowcharts • Matrix diagrams

Objectives	Tools
<p>6. To create a resource management plan to ensure effective use of the various assigned resources.</p>	<ul style="list-style-type: none"> • Expert judgement • Hierarchical charts • Work breakdown structure (WBS) • Resource breakdown structure • Responsibility assignment matrix • Meetings
<p>7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.</p>	<ul style="list-style-type: none"> • Expert judgement • Stakeholder engagement assessment matrix • Meetings
<p>8. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.</p>	<ul style="list-style-type: none"> • Meetings • Stakeholder analysis • Expert judgment
<p>9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.</p>	<ul style="list-style-type: none"> • Expert judgement • Market research • Make or buy analysis • Source selection analysis • Meetings
<p>10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated</p>	<ul style="list-style-type: none"> • Expert judgement • Surveys

Objectives	Tools
<p>approach is taken to stakeholder engagement throughout the project.</p>	<ul style="list-style-type: none"> • Stakeholder analysis • Power/interest grid

Source (Author)

3.4 Assumptions and Constraints

An assumption, as defined by the PMI is a factor in the planning process which is considered to be true, real or certain, without proof or demonstration (PMBOK, 2016). Assumptions are made based on experience or information available at hand.

On the other hand, PMI (2016) defines a constraint as a limiting factor that affects the execution of a project. Constraints are things known to be true, and must be accounted for in the plan, so they can be avoided or worked around.

Chart 4 - Assumptions and Constraints

Objectives	Assumptions	Constraints
1. To develop a project charter that will be used in the elaboration of the project deliverables.	<ul style="list-style-type: none"> All authorizations required will be readily accessible to develop the charter. 	<ul style="list-style-type: none"> Time – the timeframe to develop the charter is 2 weeks
2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.	<ul style="list-style-type: none"> The scope will be clearly defined at the beginning of the project, in accordance with stakeholder requirements. 	<ul style="list-style-type: none"> Poor stakeholder expectations management may lead to scope creep.
3. To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.	<ul style="list-style-type: none"> Project will be completed on schedule. All required resources will be available to facilitate timely completion of project. 	<ul style="list-style-type: none"> Delays in sourcing resources may cause extension to project deadline.
4. To create a cost management plan to	<ul style="list-style-type: none"> The project budget is 	<ul style="list-style-type: none"> Poorly allocated resources will

Objectives	Assumptions	Constraints
<p>establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.</p>	<p>accurately estimated.</p>	<p>lead to project going over budget.</p>
<p>5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs.</p>	<ul style="list-style-type: none"> Quality requirements are properly defined to ensure that the outcome matches stakeholder expectations. 	<ul style="list-style-type: none"> Inferior quality material may cause rework, delaying project completion.
<p>6. To create a resource management plan to ensure effective use of the various assigned resources.</p>	<ul style="list-style-type: none"> Project resources will be efficiently managed. 	<ul style="list-style-type: none"> Poorly allocated resources will cause the project to go over budget and schedule.
<p>7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.</p>	<ul style="list-style-type: none"> The project team will have access to various communications methods, and will make use of modern 	<ul style="list-style-type: none"> Technological failure may cause breakdown in communications.

Objectives	Assumptions	Constraints
	<p>technology to disseminate project information</p>	
<p>8. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.</p>	<ul style="list-style-type: none"> Mitigation measures are put in place to account for all possible risk that may arise. 	<ul style="list-style-type: none"> Unforeseen risks will arise causing project delay.
<p>9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.</p>	<ul style="list-style-type: none"> Suppliers will be readily available. 	<ul style="list-style-type: none"> Pandemic related constraints may cause supply chain issues, thereby increasing the cost of sourcing materials and experts.
<p>10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder</p>	<ul style="list-style-type: none"> All stakeholders are identified, ensuring that the project meets their requirements 	<ul style="list-style-type: none"> Key stakeholders were not engaged, leading to scope

Objectives	Assumptions	Constraints
engagement throughout the project.	and specifications	not being clearly defined.

Source (Author)

3.5 Deliverables

Deliverables are the products, services or results of a process or project.

The following deliverables were developed in the FGP:

- Project Charter
- Scope Management Plan
- Schedule Management Plan
- Cost Management Plan
- Quality Management Plan
- Resource Management Plan
- Communication Management Plan
- Risk Management Plan
- Procurement Management Plan
- Stakeholder Engagement Plan

Chart 5 shows the summary of deliverables for each specific objective of the FGP.

Chart 5 - Deliverables

Objectives	Deliverables
1. To develop a project charter that will be used in the elaboration of the project deliverables.	<ul style="list-style-type: none"> • Project Charter • Assumptions log

Objectives	Deliverables
<p>2. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.</p>	<ul style="list-style-type: none"> • Scope Management Plan The following are included in the plan: • Requirements traceability matrix • Project scope statement • Creation of the WBS and WBS dictionary • Change requests • Scope baseline
<p>3. To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.</p>	<ul style="list-style-type: none"> • Schedule Management Plan • Milestones and schedules
<p>4. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.</p>	<ul style="list-style-type: none"> • Cost Management Plan The following are included in the plan: • Cost estimation • Earned Value Management (EVM) • Control thresholds • Cost baseline • Budget
<p>5. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring</p>	<ul style="list-style-type: none"> • Quality Management Plan Included in the plan are the following: • Quality standards

Objectives	Deliverables
<p>that requirements are fulfilled and are in line with stakeholder needs.</p>	<ul style="list-style-type: none"> • Quality audits • Quality inspections
<p>6. To create a resource management plan to ensure effective use of the various assigned resources.</p>	<ul style="list-style-type: none"> • Resource Management Plan The following are included in the plan: • Resource Breakdown Structure (RBS) • Responsibility Assignment Matrix • Resource leveling • Cost-benefit analysis
<p>7. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.</p>	<ul style="list-style-type: none"> • Communication Management Plan The following are included in the plan: • Stakeholder communications requirements • Communications matrix • Stakeholder register • Communications management approach • Roles and responsibilities
<p>8. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.</p>	<ul style="list-style-type: none"> • Risk Management Plan Included in the plan are the following: • Risk Breakdown Structure (RBS) • Risk register

Objectives	Deliverables
	<ul style="list-style-type: none"> • Risk response plan
<p>9. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.</p>	<ul style="list-style-type: none"> • Procurement Management Plan The following are included in the plan: • Statement of work (SOW)
<p>10. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project</p>	<ul style="list-style-type: none"> • Stakeholder Engagement Plan • Identification of stakeholders • Stakeholder analysis matrix • Engagement approach • Monitoring and reporting

Source (Author)

4 RESULTS

This chapter contains the formal project charter. The creation of a Project Management Plan stemmed from the need to improve an existing smart farming application and device which assist farmers with their everyday needs. The project management plan composes of nine subsidiary plans which covers nine project management knowledge areas. The Project Integration Plan which would have represented the tenth knowledge area; was not included as a specific objective as it will be integrated in the other nine knowledge areas of this project.

4.1 Project Charter

The following project charter is the document which formally authorizes the collaboration of the sponsor with all project stakeholders. The charter provides a high-level view of the project.

Chart 6 - Project Charter

Project Charter	
Project name: Improvements of a Smart Farming Device and Application for Saint Lucian Farmers.	
Start date	Finish date
June 1, 2022	Jan 23, 2023
Project objectives (General and Specific)	
General Objective: <ul style="list-style-type: none"> • To develop the improvement of an existing smart farming device and application to comply with the identified requirements for Saint Lucian farmers. Specific Objectives: <ol style="list-style-type: none"> 1. To implement improvement in operability of new updated version of the device 2. To implement improvements of application user interface, to provide new features to farmers 3. To improve the accuracy of the agricultural information which supports the Application 	

Project Charter
4. To develop and execute a marketing plan for the soft launch of the updated version of the product
Project purpose/justification (merit and expected results)
<p>The final deliverable for this project is an improved version of a smart farming device and application that was created for Saint Lucian farmers. The original project, launched in 2021 saw the development of a smart farming device and application. The device, when placed in the soil conveys to farmers their crops' need. The device pairs with smartphones or tablets and speaks to the farmer via an application to give real-time information and interventions to restore crop health. Born out of the need to help farmers cope with the increasing unpredictability of weather and to help them optimize water usage, farming inputs, and improve plant health in during dry weather periods, the application offers timely, accurate, and easily accessible information directly from the soil to help farmers plan for rain, conserve water, and reduce crop loss.</p> <p>With the guide of the project management plan, the project team should successfully be able to manage and implement upgrades to the device and application. The upgrade is in the form of developing a new device and an improved application.</p> <p>The information provided by the device via the application gives farmers critical insight on the health of the soil which can help them make important decisions on how to water their plants or what solutions they can implement to increase the health of the soil, thereby increasing the health of their plants. As an added feature, the application informs of expected weather. The existing product (device and application) is currently in the prototype phase and the functionality of all its features has been validated by an app developer and robotics service provider. The Team seeks to improve its efficiency, therefore, the project management plan developed in this FGP will assist in the completion of this project.</p>
Description of product or service to be generated by the project – project final deliverables
This project seeks to upgrade a smart farming solution called Crop Mate to cater to the farmer's need. Crop Mate provides information on soil moisture, pH, nutrients, and salt

Project Charter

levels. This Smart Farming device receives information on soil conditions pairs with smartphones or tablets via the application to speak to farmers, telling them exactly what their crops need in simple, audible unambiguous language.

The project has the following deliverables:

Deliverables:

- Procurement of developers
- Functional requirements
- Designs
- Device prototype
- Device user manual
- Application user manual
- Finished product (device and application)

Assumptions

- The budget is sufficient to complete the project
- The application will meet industry standards
- Farmers will maintain an interest in using the product (device and application)
- Stakeholder funding will be available and accessible for project completion
- Ministry of Agriculture Field Officers will raise product awareness

Constraints

- The scope of the project will be fulfilled based on resources and time
- The project will be completed within the specified timeframe

Preliminary Risks

- Increase in the cost of consultancy work due to inflation, which can result in an increase in budget
- Challenges in identifying suitably qualified consultants to develop the product may result in schedule delay

Project Charter	
Budget	
Project Management	USD12,500.00
Application Development	USD14,000.00
Device Development	USD20,000.00
Deployment	USD4,500.00
Reserve (Management & Contingency)	USD7,905.00
Total Budget	USD58,905.00
Milestones	
Milestone	Estimated end date
Procurement	July 6, 2022
Client approval	September 5, 2022
User manual	September 22, 2022
Soft Launch to deploy product	January 23, 2023
Stakeholders	
<p>The key stakeholders for this project include:</p> <ul style="list-style-type: none"> • Sponsor – Compete Caribbean/Novay Inc. • Project Manager • Project Team • Farmers • Product Development Team; app developers, device developers, user experience (UX) designers, agricultural consultants • Ministry of Agriculture extension officers 	
Approval	
Project Sponsor	
Project Manager	

Source (Author)

4.2 Scope Management Plan

The following plan provides the framework for the scope of the project. It contains the processes to ensure that the scope of this project is accurately defined and mapped.

The scope management plan will follow an adaptive or agile approach to manage the project. This plan is the responsibility of the project manager, with the collaboration of the project team, the developers, and the project sponsors.

4.2.1 Collect Requirements

This stage of the project plays a very vital part. The Project Manager was charged with this and was responsible for the management of all stakeholder needs and requirements. Use of a prototype, expert judgment and data gathering were the primary tools and techniques utilized to gather requirements.

The pilot model of CropMate device and application developed in the first phase of the project was tested to get stakeholder feedback. Improvements were suggested and documented to be included in the requirements traceability matrix.

Interviews were carried out with Argo experts (extension officers) to first validate the product. Focus groups were organized with the project team, farmers, and Agri experts along with questionnaires to farmers.

Each stakeholder group informed of what functionalities they would like to see in the updated device and the application. The information gathered was then prioritized to determine what were the functional and non-functional requirements of the new upgraded product.

4.2.2 Define Scope

The scope of work is detailed in the scope statement in Chart 7.

Chart 7 - Scope Statement

Scope Statement
<p>Project Description:</p> <p>This project seeks to upgrade and enhance a smart farming device and application called Crop Mate to better cater to the farmer's need. Crop Mate provides information on soil moisture, pH, nutrients, and salt levels. This smart farming device receives information on soil conditions pairs with smartphones or tablets via the application to speak to farmers, telling them exactly what their crops need in simple, audible unambiguous language.</p>
<p>Project Deliverables:</p> <ul style="list-style-type: none"> • Procurement of developers • Functional requirements • Designs • Device prototype • Device user manual • Application user manual • Finished product (device and application)
<p>Acceptance Criteria</p> <p>Application:</p> <ul style="list-style-type: none"> ➤ Upgrades to the App must include simplification and improvement of the App interface to connect to and retrieve readings from the device including via voice commands. ➤ Updated version of the App must include 2 premium features: ➤ Premium Feature 1- Farming Community. This feature must allow farmers on the App to: <ul style="list-style-type: none"> • Chat with each other

Scope Statement

- Visit the Farmers market where tools, seeds, fertilizers, and other inputs can be sold or rented.
- Premium Feature 2- Remedial information.
This feature will provide farmers with actions to be taken when readings on soil moisture, temperature, pH and nutrient level are not optimal
- Updated version of the App to include pH and Nutrient readings
- Upgraded version to improve the App user interface based on findings of User Experience research

Device:

- The updated Crop Mate soil testing device must be able to measure soil pH and the nutrients Nitrogen, Phosphorus and Potassium (NPK)
- The device to run on solar power
- Must incorporate relevant pH and NPK probes/sensors
- The storage casing of the device must be sturdy to withstand harsh weather conditions

Project Exclusions

Maintenance of the final product (application and device) is excluded from the scope of work.

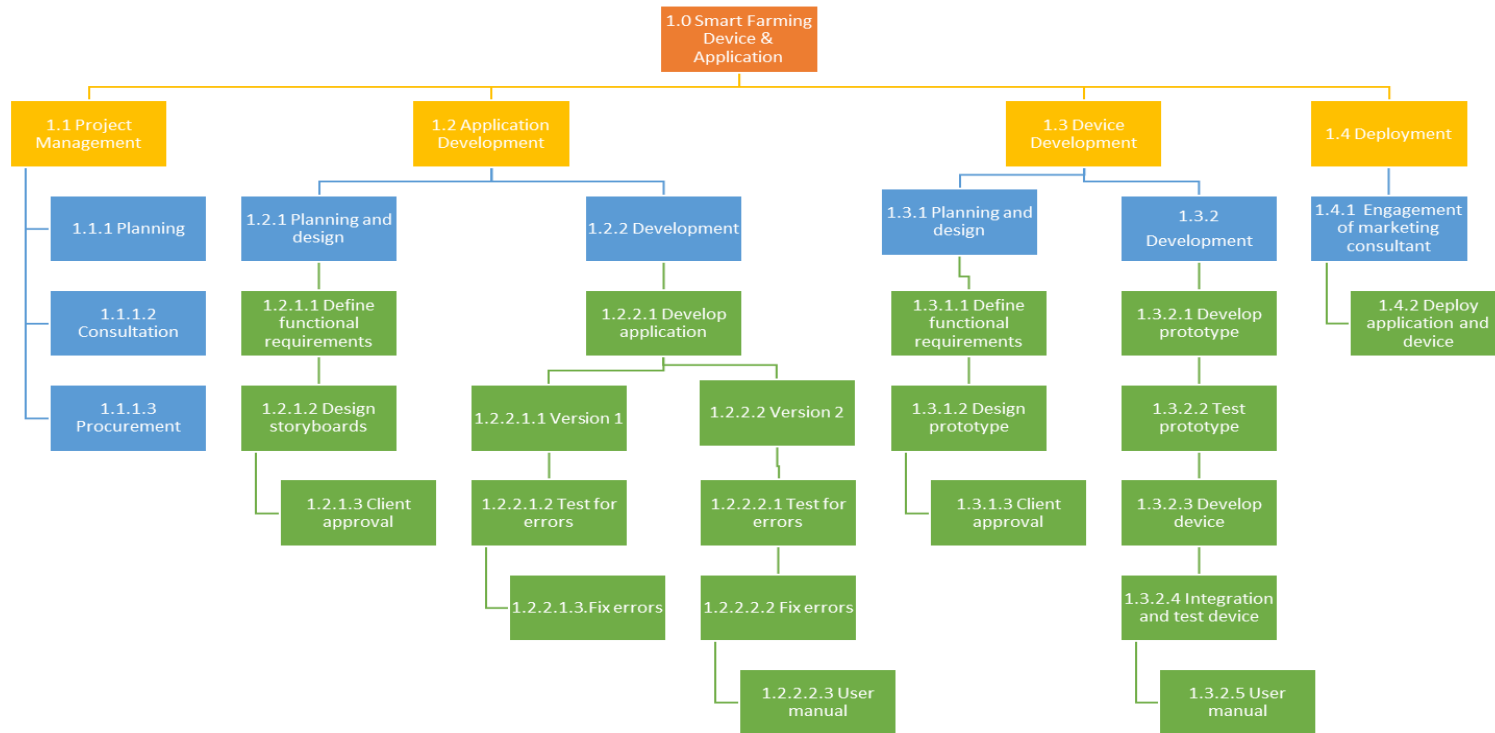
Approvals		
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Source (Author)

4.2.3 Create WBS

The Work Breakdown Structure (WBS) for this project has been decomposed to three levels.

Figure 5 - Work Breakdown Structure



Note. Source (Author)

Chart 8 - WBS Dictionary

WBS Code	WBS Name	WBS Description
	Project	
1.1	Management	All activities required for the coordinating and undertaking of the project
1.1.1	Planning	All consultancy work required to gather data to procure consultants for the project. Consultants include: <ul style="list-style-type: none"> • Device Development Consultant • App Development Consultant • Back End Research Consultant
1.1.2	Consultation	<ul style="list-style-type: none"> • User Experience Consultants
1.1.3	Procurement	Procurement process to identify and select qualified developers to improve the application and device
1.2	Application Development	Application development for improvements
1.2.1	Planning and design	Technical resources required to design the updated application
1.2.1.1	Define functional requirements	Identification of functional requirements of the application
1.2.1.2	Design storyboards	Creation of visual guide which will provide a high-level view of the project and tasks that need to be assigned and completed
1.2.1.3	Get client approval	Formal client approval
1.2.2	Development	Iterative development of application

WBS Code	WBS Name	WBS Description
1.2.2.1	Develop application	
1.2.2.1.1	Version 1	
1.2.2.1.1.1	Test for errors	Testing of first version of application with stakeholders to identify errors and build confidence in the product
1.2.2.1.1.2	Fix errors	Correction of any errors identified in Version 1 of the application
1.2.2.2	Version 2	Iterative development of application
1.2.2.2.1	Test for errors	Testing of second and final version of application with stakeholders to identify errors and build confidence in the product
1.2.2.2.2	Fix errors	Correction of any errors identified in Version 2 of the application
1.2.2.2.3	User manual	Provision of a technical communication document to educate users on how to use the device
1.3	Device Development	Development of device for improvements
1.3.1	Planning and design	Technical resources required to develop the improved device
1.3.1.1	Define functional requirements	Identification of functional requirements of the device
1.3.1.2	Design prototype	Design of device prototype
1.3.1.3	Client approval	Formal approval of prototype and requirements
1.3.2	Development	Development of device prototype

WBS Code	WBS Name	WBS Description
1.3.2.1	Develop prototype	
1.3.2.2	Test prototype	Testing device functionalities
1.3.2.3	Develop upgraded device	Develop upgraded device based on user requirements, and results of prototype testing
1.3.2.4	Test device & integrate application	Testing of the device with stakeholders and integration with the application
1.3.2.5	User manual	Provision of a technical communication document to educate users on how to use the device
1.4	Deployment	Release and implementation of the upgraded device and application
1.4.1	Engagement of marketing consultant	A Marketing consultancy firm will be engaged to execute a marketing plan for the soft launch of the updated version of the device and application
1.4.2	Soft launch to deploy application and device	The final product (upgraded device and application) will be launched with a test group of farmers

Source (Author)

4.2.4 Validate Scope

The software developers will perform validating testing themselves, in collaboration with the project manager and farmers to identify elements to improve. This will be done through various iterative processes.

The formal acceptance will be signed by the project manager and sponsors.

4.2.5 Control Scope

Throughout the project, the project manager, the project team along with the sponsors will monitor the project to ensure that it is always aligned with the scope and that there is no scope creep. Any request for change will be made via a formal change request.

4.3 Schedule Management Plan

The schedule management plan is required and necessary to ensure that the project is completed within the allotted time.

Once the schedule baseline is established, any change that will affect the overall baseline schedule by ten percent or more will be managed through the project's integrated change control process and must be approved by the project sponsors. Any change that does not meet this threshold can be submitted to the project manager for approval.

4.3.1 Schedule Model Development

A work breakdown structure (WBS) was elaborated as part of the Scope Management Plan. This WBS is the basis for the development of the project schedule. Schedule tasks are represented by level three of the WBS. Expert judgment was used as an input to the project schedule in the form of interviews with consultants. This was to determine the sequence and duration of each activity.

The tasks, associated activities, and durations will be entered into Microsoft Project, the chosen schedule software tool. The project manager will oversee the schedule and ensure that it is reasonable to complete the project within the allotted time.

4.3.2 Unit of Measure

This project will use number of days as the unit of measurement for each task and associated activity.

4.3.3 Estimate Activity Duration

Defined activities were sequenced, to document relationships among the project activities. Activity durations were estimated based on an analogous estimation, using data from projects of a similar size and type. Chart 8 below depicts the project duration activities with their start and finish dates, along with duration and predecessors.

Chart 9 - Project Activities and Sequence

WBS	Task Name	Start	Finish	Duration	Predecessors
1	Smart farming device and application	Wed 6/1/22	Mon 1/23/23	169 days	
1.1	Project Management	Wed 6/1/22	Wed 7/6/22	26 days	
1.1.1	Planning	Wed 6/1/22	Tue 6/21/22	15 days	
1.1.2	Consultation	Wed 6/22/22	Tue 7/5/22	10 days	3
1.1.3	Procurement	Wed 7/6/22	Wed 7/6/22	0 days	4
1.2	Application Development	Wed 8/10/22	Fri 11/25/22	78 days	
1.2.1	Planning and design	Wed 8/10/22	Mon 9/5/22	19 days	
1.2.1.1	Define functional requirements	Wed 8/10/22	Tue 8/23/22	10 days	3
1.2.1.2	Design storyboards	Wed 8/24/22	Fri 9/2/22	8 days	8
1.2.1.3	Get client approval	Mon 9/5/22	Mon 9/5/22	0 days	9
1.2.2	Development	Wed 8/10/22	Thu 9/22/22	32 days	
1.2.2.1	Develop application	Wed 8/10/22	Tue 9/20/22	30 days	
1.2.2.1.1	Version 1	Wed 8/10/22	Tue 8/30/22	15 days	
1.2.2.1.1.1	Test for errors	Wed 8/10/22	Tue 8/23/22	10 days	
1					
1.2.2.1.1.1.1	Fix errors	Wed 8/24/22	Tue 8/30/22	5 days	14
2					
1.2.2.2	Version 2	Thu 9/1/22	Thu 9/22/22	16 days	
1.2.2.2.1	Test for errors	Thu 9/1/22	Wed 9/14/22	10 days	15
1.2.2.2.2	Fix errors	Thu 9/15/22	Wed 9/21/22	5 days	17
1.2.2.2.3	User manual	Thu 9/22/22	Thu 9/22/22	0 days	18
1.3	Device Development	Wed 8/10/22	Tue 11/29/22	80 days	
1.3.1	Planning and design	Wed 8/10/22	Mon 9/5/22	19 days	
1.3.1.1	Define functional requirements	Wed 8/10/22	Fri 8/19/22	8 days	
1.3.1.2	Design prototype	Mon 8/22/22	Fri 9/2/22	10 days	22
1.3.1.3	Get client approval	Mon 9/5/22	Mon 9/5/22	0 days	23
1.3.2	Development	Tue 9/6/22	Tue 11/29/22	61 days	
1.3.2.1	Develop prototype	Tue 9/6/22	Mon 9/19/22	10 days	24

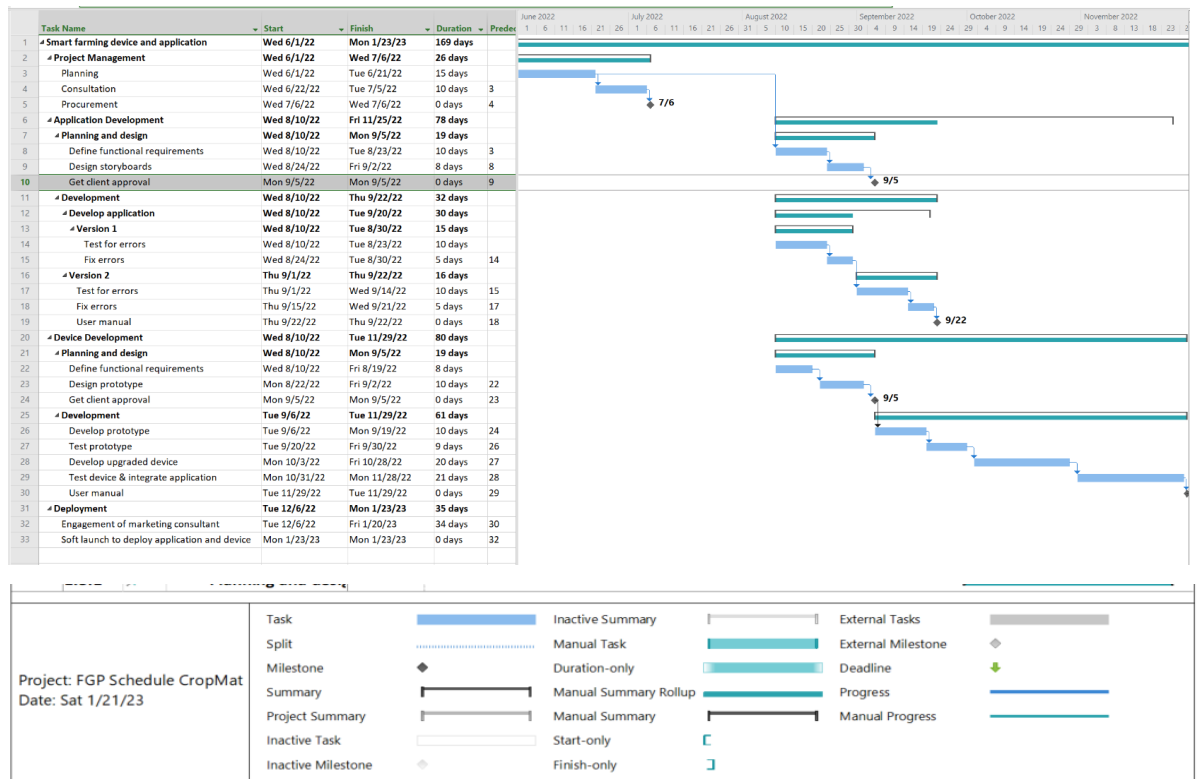
1.3.2.2	Test prototype	Tue 9/20/22	Fri 9/30/22	9 days	26
1.3.2.3	Develop upgraded device	Mon 10/3/22	Fri 10/28/22	20 days	27
1.3.2.4	Test device & integrate application	Mon 10/31/22	Mon 11/28/22	21 days	28
1.3.2.5	User manual	Tue 11/29/22	Tue 11/29/22	0 days	29
1.4	Deployment	Tue 12/6/22	Mon 1/23/23	35 days	
1.4.1	Engagement of marketing consultant	Tue 12/6/22	Fri 1/20/23	34 days	30
1.4.2	Soft launch to deploy application and device	Mon 1/23/23	Mon 1/23/23	0 days	32

Source (Author)

4.3.4 Project Schedule

The project schedule includes the tasks that will be assigned to project team members. Execution of the project will be tracked according to this baseline. Efforts must be made to ensure that project approvals are made in the allotted time. Failure to do so can adversely affect the project timeline. The project schedule will be tracked during regular team meetings. Actual start and finish dates will be added to tasks along with a column that indicates whether the task/project on schedule.

Figure 6 - Project Schedule



Source (Author)

4.3.5 Control Schedule

The project manager will monitor the project to ensure alignment with the schedule. Any proposed change to the schedule must go through a change management process.

4.4 Cost Management Plan

The objective of this cost management plan is to establish the policies and general elements for the estimation, budget, management, and control of project cost throughout the project life cycle.

4.4.1 Cost Management Approach

Financial support for the project will be through the project sponsors, therefore, proper management of funds is expected. The project manager will have general oversight and will ensure that the project is completed within the approved budget.

4.4.2 Estimate Costs and Determine Budget

Cost estimation and budget determination was closely linked for this project. The cost estimates were expressed in United States Dollars (USD). Analogous estimating was used to determine the cost estimates at the activity level in the WBS.

Chart 10 - Project Budget

WBS	Task Name	Cost - USD
1	Smart farming device and application	
1.1	Project Management	12,500.00
1.1.1	Planning	
1.1.2	Consultation	
1.1.3	Procurement	
1.2	Application Development	14,000.00
1.2.1	Planning and design	
1.2.1.1	Define functional requirements	
1.2.1.2	Design storyboards	
1.2.1.3	Get client approval	
1.2.2	Development	
1.2.2.1	Develop application	
1.2.2.1.1	Version 1	
1.2.2.1.1.1	Test for errors	
1.2.2.1.1.2	Fix errors	
1.2.2.2	Version 2	
1.2.2.2.1	Test for errors	
1.2.2.2.2	Fix errors	
1.2.2.2.3	User manual	
1.3	Device Development	20,000.00
1.3.1	Planning and design	
1.3.1.1	Define functional requirements	
1.3.1.2	Design prototype	
1.3.1.3	Get client approval	
1.3.2	Development	
1.3.2.1	Develop prototype	
1.3.2.2	Test prototype	
1.3.2.3	Develop upgraded device	

WBS	Task Name	Cost - USD
1.3.2.4	Test device & integrate application	
1.3.2.5	User manual	
1.4	Deployment	4,500.00
1.4.1	Engagement of marketing consultant	
1.4.2	Soft launch to deploy application and device	
	Total Cost	51,0000.00
	Contingency 10%	5,100.00
	Management Reserve 5%	2,805.00
	Total Cost	58,905.00

Note: Source (Author)

4.5 Quality Management Plan

The quality management plan is an integral part of this project management plan. The purpose of quality management is to describe how quality will be managed throughout the lifecycle of this project and define how the project team will implement, support and communicate quality practices for use with the project. The quality management plan for this project will establish the activities, processes and procedures for ensuring a quality product upon conclusion of the project.

4.5.1 Quality Management Approach

The approach to quality management is guided by the three processes listed in the *PMBOK® Guide*: plan quality, control quality, manage quality.

4.5.2 Quality Management Roles and Responsibilities

All members of the project team will play a role in quality management. It is imperative that the team ensures that work is completed at an adequate level of quality from individual work packages to the final project deliverable.

Quality roles and responsibilities for the CropMate project is as follows:

Chart 11 - Quality Management Roles and Responsibilities

Role	Responsibilities
Project Sponsors	<ul style="list-style-type: none"> • Responsible for approving all quality standards for the project • Reviews quality reports and assists in the resolution of escalated issues • Provides support for internal and external quality audits for the project if deemed necessary • Signs off authority on the final acceptance of the project deliverables
Project Manager	<ul style="list-style-type: none"> • Implements the Quality Management Plan to ensure all tasks, processes, and documentation are compliant with the plan • Responsible for quality management throughout the duration of the project • Collaborates with the Quality Managers/developers, Quality Specialists, and Process Owners in the development of quality metrics and standards by phase

Role	Responsibilities
	<ul style="list-style-type: none"> • Ensure team member compliance with quality management processes • Participate in quality management reviews as required • Provide oversight to the closure of corrective actions arising from quality reviews • Communicate quality standards to the project team and stakeholders
Quality Manager/Developers	<ul style="list-style-type: none"> • Provide overall leadership of quality management activities, including managing quality reviews and overseeing follow-on corrective actions • Develop and maintain the project software quality assurance plan • Generate and maintain a schedule of software quality assurance activities • Schedule and perform evaluations of process quality assurance reviews • Escalate non-compliance issues to the project manager.

Role	Responsibilities
	<ul style="list-style-type: none"> • Provide oversight to the closure of corrective actions arising from quality reviews

Source (Author)

4.5.3 Manage Quality

For this project, managing quality is the responsibility of the consultants as well as the project manager. The project team will maintain records that document assessments performed on the project. These records will provide objective evidence and traceability of assessments performed throughout the project's life cycle. Examples of these records include completed checklists, metrics, weekly status reports. The project team will use a Trello Board as the shared document repository to contain the reporting data and reports produced as part of quality reviews.

4.5.4 Control Quality

The quality control process for the CropMate project involves the following steps:

- Verifying, validating, and monitoring of work to ensure the requirements for quality and scope of work are being fulfilled
- Inspecting deliverables and documentation and comparing these items to the standard of quality previously defined
- Verifying that both the user's requirements and technical specifications are met before and after the product (device and application) is approved
- Monitoring output of workflows progress, detecting problems and defects, and allowing for corrections prior to delivery of device and application

The project manager will schedule regular meetings for reviews. These reviews will include a review of the product, any discrepancies and/or audit findings from the developer/quality reviewer and discussions on product improvement initiatives.

The final product (device and application) must be measured and should fall within the established standards and tolerances. When quality control measurements do not meet the agreed-upon quality levels, the project manager and project sponsors will define the action steps for the discrepancies.

Chart 12 below is an example of a quality control log that will be used by the CropMate Project Team in conducting these measurements.

Chart 12 - Quality Control Log

ID Number	Review Date	Deliverable Reviewed	Findings	Resolution	Resolution Date

Source (Author)

4.6 Resource Management Plan

The objective of this plan is to establish the processes utilized to identify, outsource, assign, and manage project resources. Through this plan, the project manager and the project team will have the resources required adequately assigned at the required time.

The timely availability of resources for the CropMate project will have a significant impact to the schedule and cost.

4.6.1 Resource Management Approach

The resource management plan will be guided by the processes of the *PMBOK® Guide*.

4.6.2 Acquire Resources

The resources for this project will primarily be human as all physical resources required for the development of the product, will be the responsibility of the developers as per the terms and conditions negotiated in their contracts.

The selection criteria for human resources will be based on availability, cost, experience, skills and aptitude.

The Development Team acquired through the procurement process consisted of various consultants: User Experience (UX) Designer, Application Developer, Device Developers and Agronomists.

4.6.3 Responsibility Assignment Matrix (RACI)

Below is the RACI matrix for this project's human resources. This matrix illustrates the connections between project team members and shows the summary activities as well as the assigned resources. The chart is designed to ensure clear communication and smooth workflows across all parts of the team.

Responsible – person responsible for completing the task

Accountable – person who delegates and reviews the work involved

Consulted – individual whose subject matter expertise is required to complete the task

Informed – needs to be kept informed of the task status

Chart 13 - RACI Matrix

Tasks	Project Sponsor	Project Manager	Project Team	Product Development Team	Farmers	Extension officers
Project Management	C	R, A	C	C	I	I
Application Development	C	R, A	C	R	C	I

Device Development	C	R, A	C	R	C	I
Deployment	C	R, A	C	C	C	I

Source (Author)

4.6.4 Resource Management Roles and Responsibilities

There are responsibilities which must be performed by key stakeholders to ensure that the resources are effectively managed. Chart 14 depicts the roles and responsibilities for the CropMate project.

Chart 14 - Roles and Responsibilities

Role	Responsibility
Project Sponsor	<ul style="list-style-type: none"> • Funds project execution • Approves change control process • Approves final deliverables
Project Manager	<ul style="list-style-type: none"> • Procurement of all consultants/developers • Manages scope, budget, and schedule • Manages relationships between all project stakeholders • Monitors and reports progress of the development team • Securing of farmers for prototype testing and coordinates the testing sessions
Product Development Team User Experience (UX) Designer	<ul style="list-style-type: none"> • Gather and evaluate user requirements in collaboration with product development team and end users. • Illustrate design ideas using storyboards, process flows and sitemaps, UI mockups/ prototypes that clearly

Role	Responsibility
	<p>illustrate how the App and device should function and look like</p> <ul style="list-style-type: none"> • Design graphic user interface elements of the CropMate App, like menus, tabs, widgets, navigation buttons and search fields as well as original graphic designs (e.g. images, sketches and tables) • Test updated App and device to identify and troubleshoot UX problems
Agronomist	<ul style="list-style-type: none"> • Reviews backend information and calibrates soil sensors • Research and compilation of actions to be taken by farmers to improve soil moisture, pH and NPK per soil type • Works with App developer to compile information on optimal levels by soil types to feed into the App • Test and troubleshoot the App to ensure accurate functioning
Application Developer	<ul style="list-style-type: none"> • Responsible for upgrading/developing App
Device Developer	<ul style="list-style-type: none"> • Responsible for upgrading/developing the smart farming device
Farmers	<ul style="list-style-type: none"> • Conducts field testing of product (device and application)
Field Officers	<ul style="list-style-type: none"> • Responsible for raising product awareness with farmers and end users

Source (Author)

4.7 Communications Management Plan

Proper, effective communication is critical to the success of the CropMate project. The communications management plan for this project includes the necessary processes to ensure that information requirements of each stakeholder are met.

4.7.1 Plan Communications Management

The project manager will be the center of project communication and will channel all stakeholder communication accordingly, based on the information needs of CropMate project stakeholders.

4.7.2 Manage Communications

The communications management plan has established the matrix below (Chart 15) explaining when and how often information must be relayed to stakeholders. Various channels of communication will be utilized to inform and engage key stakeholders as depicted in the matrix.

Chart 15 - Communications Matrix

Type	Audience	Description	Frequency	Owner	Channels
Project Presentations	Project Sponsor	Kick-off Meeting	Once	Project Manager	Meeting (virtual and in person)
	Project Team	Regular communication throughout the project life cycle	As necessary		Meetings
Project announcement	Product Development Team	Milestones of project	As necessary	Project Manager	Blog Posts, articles, Ads, social media.
Personal Communication	Project Sponsor	Regular communication throughout the project life cycle	Monthly	Project Manager	Telephone calls Email Meetings Zoom/Conference calls
	Project Team	Updates on project status, issues, and milestones	Weekly	Product Development Team	
	Farmers	Updates on project status	As necessary	Project Manager	In person meetings

Type	Audience	Description	Frequency	Owner	Channels
Reviews and Meetings	Project Team	Updates on issues and review project status	Weekly	Product Development Team	Telephone calls Email Meetings
	Product Development Team			Project Manager	Zoom/Conference calls
Reports	Project Team	Teams provide their status reports	Weekly	Project Manager	Emails and Meetings
	Product Development Team	Provides status reports on work completed	Weekly	Project Manager	Email Meetings Zoom/Conference calls
Visual/Audio Materials	Farmers	To provide stories on user testing of product	After each product version release	Project Manager	In person Meetings
Final Report	Project Sponsors	Complete project status	Once	Project Manager	Email & Meetings

Source (Author)

The project team will identify, track, and resolve issues arising throughout the project life cycle using the escalation model for communications issues to key decision-making stakeholders to resolve issues. The project manager will log any issues in an issues log and assign a responsible owner.

4.7.3 Monitor Communications

This process ensures that the communications approach as defined in the communications management plan is working and stakeholder support and engagement is maintained throughout the project. The project manager will carefully monitor the project to ensure that the information needs of the CropMate project and that of stakeholders are met. A tracking mechanism will be established to track whether the communication activities have had the desired effect.

Any adjustments to communications activities will be performed via an integrated change control process.

4.8 Risk Management Plan

Risk management will be a continuous process of the CropMate project. To minimize risks and their potential impact on the success of this project, risks will be identified and monitored throughout the project life cycle. Once the project manager has identified risks, qualitative analysis will be used to determine both the impact and the likelihood of the risk, to determine the risk response that will be applied. The project manager is responsible for the overall project risk management and will monitor for risk triggers.

4.8.1 Plan Risk Management

Risks must first be identified to effectively manage them. Identifying risks is an iterative process, as new risks can arise during the life cycle of the project. To identify potential risks, interviews were conducted with consultants and the project team also used information obtained from lessons learned registers of similar projects.

The project manager then performed a qualitative risk analysis to prioritize individual risks. The probability of occurrence of each risk was determined so that their impact could be assessed. Results were documented in the risk register.

4.8.2 Risk Management Roles and Responsibilities

As part of the risk management process, roles and responsibilities are defined to ensure that risks are monitored, and appropriate action is taken. Chart 16 identifies the roles and responsibilities of key members of the project team in risk management.

Chart 16 - Risk Management Roles and Responsibilities

Role	Responsibility
Project Sponsor	<ul style="list-style-type: none"> Provides the framework and guidelines for the project risk management plan

Role	Responsibility
	<ul style="list-style-type: none"> • Approves the risk management plan • Provides feedback on the risk management plan throughout the projects • Resolves issues which may be escalated by the project manager • Reviews reports on risk management • Provides support and guidance on risk management related matters
Project Manager	<ul style="list-style-type: none"> • Leads the development of the risk management plan • Conducts meetings to review risk management • Reviews risk management reports • Reviews, approves or denies risk management change requests. • Escalates risk management issues to the project sponsor, when necessary
Product Development Team	<ul style="list-style-type: none"> • Reports on project risk management. • Attends risk management meetings.

Role	Responsibility
	<ul style="list-style-type: none"> • Submits requests for changes to the risk management plan, when necessary. • Escalates risk management issues to the project manager.

Source (Author)

4.8.3 Identify Risks

Chart 17 details a Risk Breakdown Structure into main categories. Risks will then be assessed to increase the probability and impact of positives risks and decrease the probability and impact of negative risks.

Chart 17 - Risk Breakdown Structure

RBS Level 0	RBS Level 1	RBS Level 2
Project Risks	1. Technical Risks	1.1 Requirements
		1.2 Technology
		1.3 Quality
	2. External Risk	2.1 Market
		2.2 Suppliers
	3. Operational or Management Risk	3.1 Communications
		3.2 Resources
		3.3 Monitoring and reporting

Source (Author)

4.8.4 Perform Qualitative Risk Analysis

Once risks have been identified, they will then be analyzed qualitatively. A probably and impact scale will be integral to this process to reflect the risk appetite and thresholds of the organization and key stakeholders.

Chart 18 - Probability Scale

Scale	Very low	Low	Medium	High	Very High
% Probability	<10%	10-30%	31-50%	51-70%	71-90%
Probability score	0.1	0.3	0.5	0.7	0.9
Description	Very low chance of occurring	Unlikely to occur	May occur	Likely to occur	Very likely to occur

Note: Source: Author of Study, 2023

Chart 19 - Impact Scale

Scale	Very low/negligible	Low/Less than significant	Medium/Potentially Significant	High/Significant	Very High/Very Significant
Impact	0.1	0.3	0.5	0.7	0.9
Scope	Barely noticeable change	Minor areas affected	Important areas affected	Unacceptable change in scope	Change in project objectives
Cost	<5% Insignificant cost increase	5-10% cost increase	11-20% cost increase	21-25% cost increase	> 40% cost increase
Schedule	1-5 days Can be absorbed	6-10 days	11-20 days	21-30 days	>30 days

Source (Author)

Chart 20 - Probability and Impact Matrix

		Scores	IMPACT				
			Very Significant	Significant	Potentially Significant	Less than significant	Negligible
			0.9	0.7	0.5	0.3	0.1
PROBABILITY	Very High	0.9	0.81	0.63	0.45	0.27	0.09
	High	0.7	0.63	0.49	0.35	0.21	0.07
	Medium	0.5	0.45	0.35	0.25	0.15	0.05
	Low	0.3	0.27	0.21	0.15	0.09	0.03
	Very Low	0.1	0.09	0.07	0.05	0.03	0.01

Note: Adapted from Levels of Risk Matrix, by Vector Solutions, 2022

Chart 21 - Urgency of Risk, Response Planning Levels

Color	Urgency of Risk	Risk Score	Response Planning and Reporting Levels
■	Very High	≥ 0.8	<ul style="list-style-type: none"> Highest priority Prevention and mitigation strategies for very high risks must be framed in advance to prevent occurrence/mitigate their impacts at the earliest
■	High	$0.36 \leq x \leq 0.8$	<ul style="list-style-type: none"> High risks must also be optimally addressed but are not prioritized as highly as very high risks The aim is to ensure that its impact is reduced to a level that is as minor as reasonably practicable.
■	Medium	$0.21 < x \leq 0.35$	<ul style="list-style-type: none"> Medium risks cannot be ignored Medium risks may be excluded from the initial risk management strategies but become increasingly significant as they arise
■	Low	$0.03 < x \leq 0.21$	<ul style="list-style-type: none"> Can be safely ignored Most low and very low risks are nearly harmless May not require any mediation
■	Very Low	≤ 0.03	

Source (Author)

The percentage probability of a risk will determine its probability score derived from Chart 18. Therefore, a risk with a percentage probability of less than 10% will be assigned a probability score of 0.1. The combination of impacts a risk has on the project objectives (triple constraints) will determine its impact score from Chart 19. As such, a risk that will delay the schedule by 1 to 5 days (0.1); results in less than 5% cost increase (0.1) and will produce a barely noticeable scope change (0.1); and have a minor impact on secondary functions (0.1) will be assigned an impact score of 0.1. Thus, its impact is negligible.

However, if a risk delays a schedule by 11 to days (0.3); results in an 11 to 20% cost increase (0.5); and produces a minor scope change (0.3) with a very significant impact on overall functionality (0.9), its impact score will be 0.5. The product of the probability score and impact score produces a risk score in Chart 20. Thus, if the probability of the latter scenario is low (0.3), its risk score will be 0.15.

This risk score is then used to determine the urgency of risk response planning. Each of the cells in Chart 21 is color-coded — red, orange, yellow, dark green, and light green. The colors represent the urgency of risk response planning and determine the reporting levels as described in Chart 21. The dark green color of the corresponding cell for the aforementioned risk indicates the urgency of this risk is low so it can be safely ignored.

4.8.5 Risk Register

Chart 22 - Risk Register

RBS	Risk Category	Risk Description	Probability	Impact	Pxl	Owner	Potential Response
1.1	Technical	Inadequate time spent in preliminary research/prototyping can lead to budget changes	0.70	0.9	0.63	Project Manager	Consult with subject matter experts to set reasonable timelines for research
1.2		Functionalities for the product are not identified in a timely manner resulting in increase in time required to develop these functionalities as well as scope creep	0.30	0.70	0.21	Product development Team	Requirements documentation clearly outlining required functionalities
1.3		Lack of quality standards decreases the agility of the project	0.30	0.50	0.15	Project Manager	Implement user acceptance criteria making stakeholders affirm that the project is up to standard
2.1	External	Unexpected increase in prices of raw material due to market changes will	0.20	0.9	0.18	Product Development Team	Contingency reserve to absorb additional costs

RBS	Risk Category	Risk Description	Probability	Impact	Pxl	Owner	Potential Response
		increase cost of raw materials consultants require					
2.2		Consultants may not be able to outsource material for device	0.20	0.50	0.10	Product Development Team	Engage various service providers to ensure a reliable/steady availability of raw materials
3.1	Operational/Management	Poor communication among relevant stakeholders can lead to discontinued support for the project	0.30	0.60	0.18	Project Manager	Establish clear and effective communication links
3.2		Reassignments or departures of key staff members can delay key milestones.	0.30	0.70	0.21	Project Manager	Ensure detailed up-to-date documentation of project scope and progress
3.3		Untimely submission or incomplete reports can result in Inconsistent monitoring and reporting, which may lead to increase in project cost	0.60	0.90	0.54	Project Manager	Ensure detailed up-to-date documentation of project scope and progress

Source (Author)

4.9 Procurement Management Plan

The procurement management plan outlines the procurement activities necessary to acquire labor required to effectively implement to CropMate project.

This plan is important to ensure that the project stays on track and within budget.

4.9.1 Plan Procurement Management

Due to the nature of the project, it was decided that fixed type contracts would be utilized. The project manager will provide general oversight and manage all procurement activities during the procurement process.

Chart 23 below outlines the responsibilities of key stakeholder as it relates to project procurement.

Chart 23 - Procurement Roles and Responsibilities

Role	Responsibility
Project Sponsors	<ul style="list-style-type: none"> Provides the framework and guidelines for the Procurement Management Plan Approves Terms of Reference (TOR) and contracts
Project Manager	<ul style="list-style-type: none"> Leads the process of creating the procurement management plan Establishes selections criteria Prepares Terms of Reference (TOR) Manages the procurement change control process of the procurement plan Lead negotiations and signing of contracts
Project Team	<ul style="list-style-type: none"> Shortlists qualified consultants Monitors procurement against budget Assists project manager with the development of the procurement management plan

Source (Author)

4.9.2 Conduct Procurements

All consultants will be outsourced via a formal bidding process. Consultants will be selected based on the following criteria: qualifications, experience, expertise, cost and areas of specialization.

The Terms of Reference (TOR) will outline the project background, the objectives, required qualifications, schedules and scope of work. The TOR will be advertised to encourage bid submissions.

At the end of the tender period, short-listed consultants will be subjected to an evaluation conducted by the project manager, with the guidance of the project sponsors. Consultants will be selected based on the selection criteria. The negotiations on contract signing will begin upon selection of suitable candidates to fill the consultancy requirements for the project. The process will be considered complete once each consultant has signed the fixed-price contract in acceptance of the terms and conditions.

4.9.3 Control Procurements

Contractors will provide weekly progress reports as part of the control procurements process. This will be necessary to ensure that all contractors are comply with the contract conditions and adheres to the project schedule budget and quality requirements.

Any changes in relations to procurement will be submitted via the change management process which will be managed by the project manager.

4.10 Stakeholder Management Plan

The final objective of this project is the stakeholder management plan which includes the processes the CropMate project requires to identify the people, groups or organizations that could impact or be impacted by the project. This plan also

develops the appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

4.10.1 Identify Stakeholders

The project stakeholders will be identified at the beginning of the project and will be engaged from the onset and throughout the project life cycle. The stakeholders were classified by their level of authority (power) and level of concern about the project's outcome (interest) and their position on the project (whether they are for or against) as depicted in Chart 24 below. Then this information was then represented in the power/interest grid (chart 17).

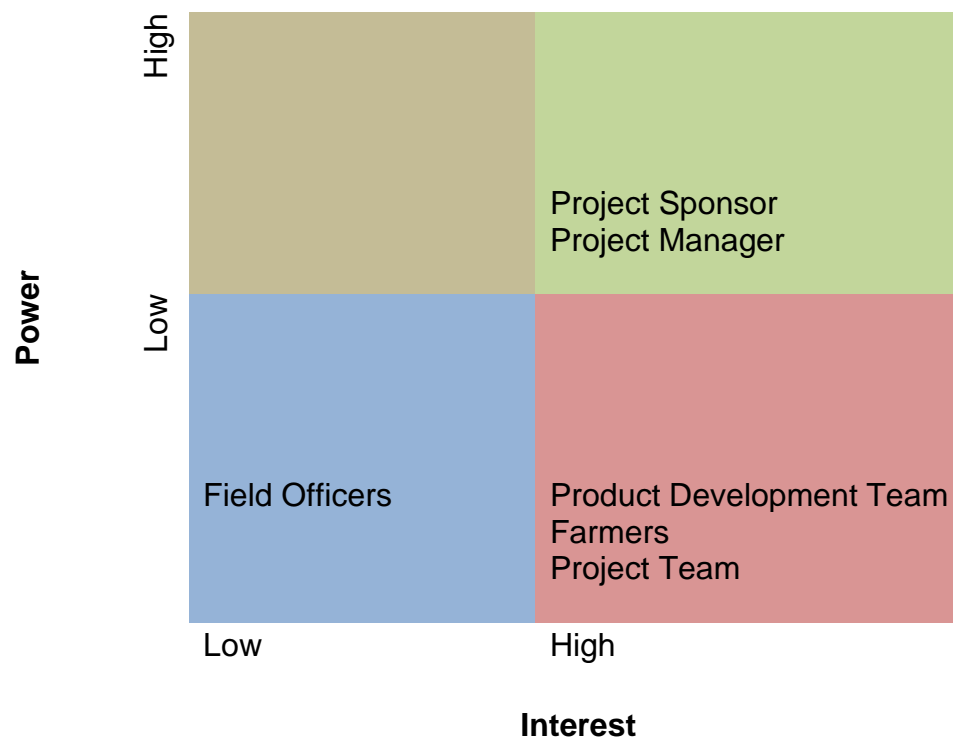
Chart 24 - Classify Stakeholders

Stakeholders	Position	Power	Interest
1. Project Sponsors	+	5	5
2. Project Manager	+	5	5
3. Product Development Team: <ul style="list-style-type: none"> • User Experience Designer • Application Developer • Device Developer • Agronomist 	+	4	4
4. Project Team	+	3	5
5. Farmers	+	3	5
6. Field Officers	+	1	3

Key:

Power: 1 = Low 5 = High
Interest: 1 = Low 5 = High
Position: += In favor – = Against

Source (Author)

Chart 25 - Power/Interest Matrix

Source (Author)

4.10.2 Plan Stakeholder Engagement

During this process, the project manager will develop the necessary approaches to engage stakeholders based on their needs, expectations, interest and potential impact. The communications plan will be developed to ensure that the project receives the maximum support from each stakeholder.

Chart 26 - Stakeholder Register Matrix

Stakeholders	Functional Area	Roles/Responsibilities	Main Expectations	Major Requirements	Direction of Influence	Impact	Interest	Power
Project Sponsor	Sponsorship	Provide overall support for the project including funding.	Project completion	Funding to ensure successful completion of project within schedule, cost and scope requirements	Upward	High	High	High
Project Manager	Project Management	General oversight of the project and all project management processes.	Project completion	Successful completion of project within schedule,	Downward	High	High	High

Stakeholders	Functional Area	Roles/Responsibilities	Main Expectations	Major Requirements	Direction of Influence	Impact	Interest	Power
				cost and scope requirements. Engage stakeholders appropriately				
Project Team	Project Management	Support the project manager in project planning and implementation.	Project completion	Successful completion of project within schedule, cost and scope requirements	Downward	High	High	Med
Product Development Team	Project Development	Design and develop CropMate Application and device. Provide expertise to design, develop, test	Development of product that meets industry standards	Provide expertise and stay within scope to ensure the success	Outward	Medium	High	Med

Stakeholders	Functional Area	Roles/Responsibilities	Main Expectations	Major Requirements	Direction of Influence	Impact	Interest	Power
		and troubleshoot product		criteria is met for each deliverable				
Farmers	End Users	Provide requirements so product can meet their needs and expectations. Responsible for field testing of product	Engagement to improve user experience of App & device	Participation in preliminary consultations. Provide expert feedback to improve design and functionality of CropMate product	Outward	Med	High	Med
Field Officers	Project Support	Liaise with farmers to create awareness of final product	Provide general project support	Share product information with farmers	Outward	Low	Med	Low

Source (Author)

4.10.3 Manage Stakeholder Engagement

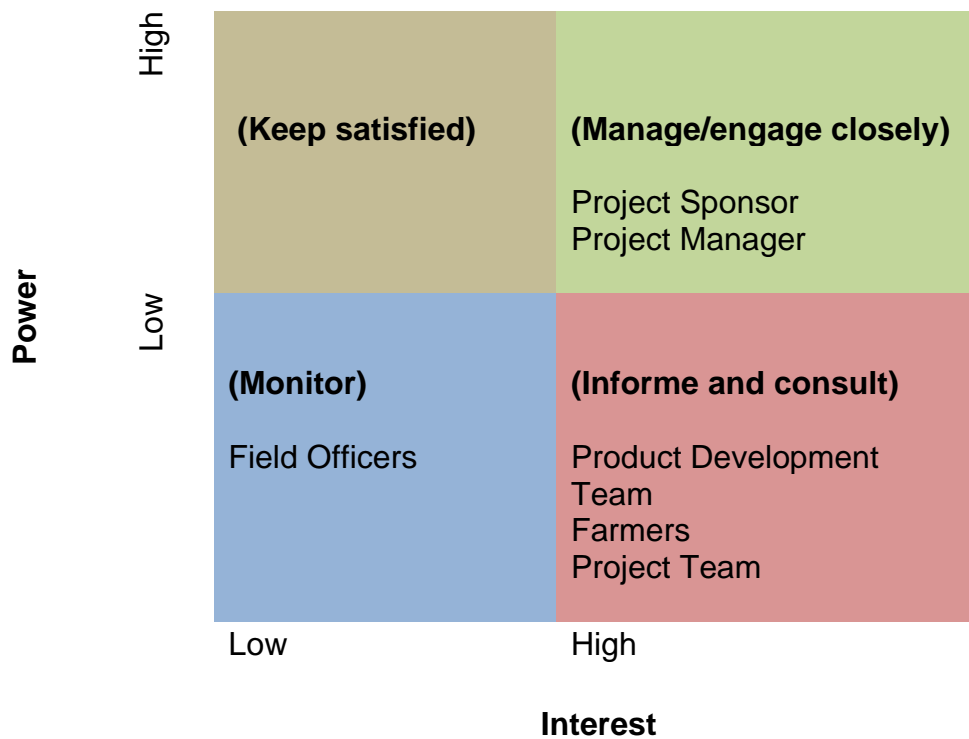
Determining how each stakeholder should be approached is an integral part of stakeholder management plan. Stakeholder engagement for the CropMate project entails identifying and involving stakeholders in consultation throughout the project. Collaborative communication strategies will be used to develop trust between stakeholders.

Chart 19 shows the stakeholder engagement matrix for the project along with the management strategies that will be implemented.

- **High power, high interest** – these stakeholders should be fully engaged.
- **High power, low interest** – keep satisfied. Ensure that there is awareness of the project among these stakeholders.
- **Low power, high interest** – consult with. These stakeholders must be adequately informed and engaged.
- **Low power, low interest** – monitor. These stakeholders will be kept informed; however, the least amount of time will be spent on them.

Chart 27 depicts the stakeholder engagement assessment matrix which highlights a comparison on how each stakeholder is currently engaged (C) and the desired engagement level (D) required for successful project completion. Stakeholders are considered properly engaged where (C) and (D) fall under the same column. The matrix will be updated throughout the duration of the project.

Chart 27 - Stakeholder Engagement Matrix



Source (Author)

Chart 28 - Stakeholder Engagement Assessment Matrix

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Project Sponsor					C, D
Project Manager					C, D
Product Development Team					C, D
Farmers				C	D
Field Officers				C, D	

Source (Author)

4.10.4 Monitor Stakeholder Engagement

In addition to managing stakeholder engagement, the project manager and the project team will assure that stakeholder relationships are monitored. Engagement strategies and plans will be modified during the project as needed. The project manager has the critical responsibility to track, review and regulate project progress and performance, and to identify areas where modifications are required and to perform the necessary corrective and preventative actions needed.

While it is not expected that stakeholder power and interest levels change during the project life cycle, if this happened, it would lead to a change in strategies to engage them. Any changes to the plan will be processed through an integrated change control process to be approved by the project manager and sponsors.

5 CONCLUSIONS

The project management plan will serve as a guide for the execution of the CropMate project. The plan outlines how the project will be carried out, monitored, and managed from the initiation phase to the final product. Effective project management will be assured through the development of nine subsidiary plans, to ensure overall project success.

1. The project charter developed in the FGP provided the framework that will guide the project's progress on a high-level basis. This document grants the formal approval of the project and authorizes the project manager to use project resources.
2. The scope management plan details the work packages that must be executed to successfully upgrade CropMate, with the WBS decomposed to three levels.
3. The project has a duration of seven months, and the schedule management plan reflects the proposed timelines as a guide to plan, implement and close the project. Microsoft Projects is the scheduling tool selected for the project, with the schedule information represented in a Gantt Chart.
4. A cost management plan was created to estimate and control the project budget. Analogous estimating will be used to determine the budget.
5. To ensure that the project's outcomes would meet stakeholder expectations, the quality management plan was developed. The roles and responsibilities of each stakeholder was described with regards to quality management.
6. The project requires human resources for its successful completion. The resource management plan outlined the processes of identifying, acquiring, and managing these resources.
7. The communications management plan outlined the expected frequency and modes of communication among identified stakeholders to ensure effective communications during the project life cycle. The objective of the plan is to leverage the most effective communications tools and strategies to obtain

stakeholder buy-in and engagement at all levels, to meet the information needs of each stakeholder.

8. To prepare for uncontrollable and unexpected events, a risk management plan was developed. This plan will be utilized for managing both known and unknown risks in the execution of the CropMate project.
9. The procurement management plan outlined and defined the procurement activities needed to hire the required consultants to develop the final product. The project will utilize fixed priced contracts when engaging consultants.
10. The stakeholder management plan was created to identify key project stakeholders and their needs. The plan will define how stakeholder engagement for the project will be planned, managed, and monitored.

6 RECOMMENDATIONS

The following recommendations are directed to the Director of Novay Inc., the company responsible for implementing this project.

1. It is recommended that Novay Inc. implement projects according to best practices defined by the *PMBOK® Guide* to enhance the chances of success of projects in delivering the expected business values and results.
2. All key stakeholders should be involved in collecting requirements, not only farmers and the product development team. This would ensure that all stakeholder requirements are defined from inception.
3. An implementation period of one year is recommended and would be more practical for this type of project. This would allow for more efficient testing of the various versions of the product. This duration would allow for product testing both during the wet and dry seasons, to provide more accurate soil readings which can be incorporated into the final product.
4. The agile nature of this project requires that proper communications channels are identified so all progress/updates are immediately communicated to relevant stakeholders. A good communications plan is recommended and should be effective and efficient to add value to the project.
5. Novay Inc. should encourage both sustainable and regenerative practices and should consider hiring consultants who can demonstrate that project resources will contribute to zero gas emissions, restore ecosystems, and encourage fair livelihood.
6. Novay Inc. should implement training sessions for farmers post-project to enable knowledge transfer. Continued training will ensure correct, effective use of the product to benefit farmers thereby assisting in some of the food security issues as it relates to crop loss. This training should also focus on encouraging regenerative practices with the use of CropMate.
7. Novay Inc. should implement risk planning in every project to ensure that both known and unknown risks are planned for.

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

“The global focus on sustainable development, climate change, ethical behavior, social responsibility, and transparent supply chains has increased in recent years. So too has the demand for sustainable business practices”. (Carboni, J, 2019). As a GPM Founder, Dr. Carboni stresses the importance of green project management practices. Sustainability for this project means ensuring that food systems benefit everyone equally. In this way, this project aims to create a system where farmers can subsist above poverty.

The project does not merely focus on sustainable practices. It also encourages regenerative development practices. Regenerative development is defined by Hernandez (2019) as *“an approach that encourages communities to support and create positive relationships that will benefit society and our environments by allowing the system to evolve and adapt to changing circumstances”.* With the use of both practices, the project anticipates the following outcomes:

- Improved Food security brought about by the reduced crop loss for farmers
- Increased income for farmers as losses of crops decline
- Improved efficiency in production through improved use and conservation of inputs or resources needed for crops such as water and fertilizers
- Reduced exposure to chemicals from products which are over-fertilized
- Increased technological solutions into the agricultural arena to address effects of climate change on crop yield

To identify this project’s potential impact to sustainability, a P5 analysis will be completed. This will determine both the positive and negative impacts of this project and to determine what sustainable outcomes that can be achieved.

The Sustainable Development Goals (SDGs), also known as the Global Goals were adopted by the United Nations (UN) in 2015 as a universal call to end poverty, protect

the planet, and ensure that by 2030 all people enjoy peace and prosperity (UNDP, n.d.).

There are seventeen (17) SDG Goals which are integrated, as action in one area will affect outcome in other areas. The SDGs recognize that development must balance social, economic and environmental sustainability. The project for which this FGP is developing a project management plan identifies 3 primary SDGs that aligns with the project. They are described below:

Goal 2: Zero Hunger

The SDGs aim to end all form of hunger by the year 2030. By supporting and promoting sustainable agriculture and supporting small scale farmers, Novay Inc. is making its contribution to improve agricultural productivity. Lack of access to food is strongly related to poverty. In assisting farmers (especially those involved in small-scale production), Novay Inc. seeks to play their part to achieving the SDG of zero hunger.

Goal 9: Industry, Innovation and Infrastructure

Technological progress is key in finding lasting solutions to economic and environmental challenges. The application for which this FGP is creating a project management plan promotes a sustainable industry, and by doing so facilitates sustainable development.

Goal 12: Responsible Consumption and Production

Novay Inc. aims to reduce the ecological footprint by promoting greener and more sustainable farming practices. The company mainly aims at avoiding the use of pollutants and toxic chemicals encouraging farmers to move towards sustainable production patterns.

8 BIBLIOGRAPHY

APM. (2019). What Is Project management? Apm.org.uk.
<https://www.apm.org.uk/resources/what-is-project-management/>

Barakoski, M. (2020, January 23). Driving Improvement with Agile and Kaizen. Project Management Institute.
<https://www.projectmanagement.com/articles/604366/Driving>

Cote, A (2022, July 14). Everything that goes into building a project plan. Paymo,
<https://www.paymoapp.com/blog/project-management-plan/>

Carbono et al, (2018). GPM Global. Sustainable Project Management. The GPM Reference Guide. <https://campusuci2.com/REP/152/1522/RSC/U1/03.pdf>

De Alwis et al (2022). A survey on Smart farming data, applications and techniques. Computers in Industry. 138.
<https://www.sciencedirect.com/science/article/abs/pii/S0166361522000197>

Device Application Definition. (n.d.). Law Insider. Retrieved August 22, 2022, from <https://www.lawinsider.com/dictionary/device-application>

Galauner, B. (2021). Pfeiffer Library: Research Methodologies: What are research methods? Library.tiffin.edu.
<https://library.tiffin.edu/researchmethodologies/whatareresearchmethods>

Hughes, J. (2021, March 22). Internet of Things (IoT) Applications: Smart Agriculture.
<https://www.manxtechgroup.com/internet-of-things-iot-applications-smart-agriculture/#:~:text=Smart%20Agriculture%20is%20a%20topic,the%20farming%20and%20agricultural%20sectors.>

Javed, A. (2021, June 23). Methodological framework definition/structure/examples. EngloPedia. <https://englopedia.com/methodological-framework-definition/>

“Kissflow” (2022). 5 Phases of Project Management. Retrieved on August 13, 2022 from <https://kissflow.com/project/five-phases-of-project-management/>

Muell813. (2015, July 15). Primary, Secondary, and Tertiary Sources. University of Minnesota Crookston. <https://crk.umn.edu/library/primary-secondary-and-tertiary-sources>

Mohamed et al. (2021). Smart farming for improving agricultural management. The Egyptian Journal of Remote Sensing and Space Science. 24, (3), 971-981. <https://www.sciencedirect.com/science/article/pii/S1110982321000582>

Mullaly, M. (2015, November 23). What We Are Still Getting Wrong About Quality. Project Management Institute. <https://www.projectmanagement.com/articles/308821/what-we-are-still-getting-wrong-about-quality>

Project Management Institute. (2017). A guide to the Project Management Body of Knowledge (*PMBOK® Guide*) (6th ed.). Project Management Institute.

The Scrum Guide. (2020) The Definitive Guide to Scrum: The Rules of the Game. Schwaber K & Sutherland J. <https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf>

United Nations. (2015). Transforming our world. The 2030 agenda for sustainable development. <https://sustainabledevelopment.un.org/content/documents/2125203%20Agenda%20for%20Sustainable%20Development%20web.pdf>

University of Newcastle Library. (2019). LibGuides: Research Methods: What are research methods? Newcastle.edu.au.

<https://libguides.newcastle.edu.au/researchmethods>

9 APPENDICES

Appendix 1: FGP Charter**CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)**

1. Student name

Vanessa Cox

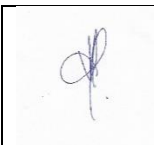
2. FGP name

Project Management Plan for Managing Improvements of a Smart Farming Application for Farmers.

3. Application Area (Sector or activity)

Agriculture

4. Student signature



5. Name of the Graduation Seminar facilitator

Roger Valverde Jimenez

6. Signature of the facilitator

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7. Date of charter approval

--

8. Project start and finish date

--	--

9. Research question

What improvements are required to allow the smart farming device application to provide farmers with reliable information to restore crop health and reduce crop loss?

10. Research hypothesis

An improved smart farming device application will reduce crop loss and farming wastage and improve food security for Saint Lucian farmers.

11. General objective

To create a project management plan to effectively manage the improvement of a smart farming device Application for Saint Lucian farmers.

12. Specific objectives

1. To develop a project charter that will be used in the elaboration of the project deliverables.
2. To validate the use of regenerative and sustainable development to encourage Green Project Management practices.
3. To create a scope management plan to define the work that needs to be done and to ensure that only the required project work is completed.
4. To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.
5. To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within the approved budget.
6. To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs.
7. To create a resource management plan to ensure effective use of the various assigned resources.
8. To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.
9. To create a risk management plan to evaluate and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.
10. To create a procurement management plan to define the procurement requirements for the project and how it will be managed.
11. To create a stakeholder engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project.

13. FGP purpose or justification

The final deliverable for this Final Graduation Project is the development of a project management plan to guide the project team with the successful management of improvements to a smart farming device Application that was created for Saint Lucian farmers. The original project, launched in 2021 saw the development of an application which when placed in the soil tells farmers exactly what their crops need. The device pairs with smartphones or tablets and speaks to the farmer to give real time information and interventions to restore crop health. Born out of the need to help farmers cope with the increasing unpredictability of weather and to help them optimize water use and improve plant health in times of drought, the Application offers timely, accurate and easily accessible information directly from plants and the soil to help farmers plan for rain, conserve water, and reduce crop loss.

Upon completion of this Project management plan, the Project team should successfully be able to manage the App improvements.

The information provided by the App gives farmers critical insight on the health of the soil which can help them make important decisions on how to water their plants or what solutions they can implement to increase the health of the soil, thereby increasing the health of their plants. As an added feature, the App informs of expected weather. The App is currently in the prototype phase and the functionality of all its features has been validated by an app developer and robotics service provider. The Team seeks to improve its functionality, therefore, the Project management plan developed in this FGP will assist in the completion of this Project.

14. Work Breakdown Structure (WBS).

1. Graduation Seminar

1.1. FGP Deliverables

- 1.1.1. Charter
- 1.1.2. WBS
- 1.1.3. Chapter I. Introduction
- 1.1.4. Chapter II. Theoretical Framework
- 1.1.5. Chapter III. Methodological Framework
- 1.1.6. Annexes
 - 1.1.6.1. Bibliography
 - 1.1.6.2. Schedule

1.2. Graduation Seminar Approval

2. Tutoring Process

2.1. Tutor

- 2.1.1. Tutor Assignment
- 2.1.2. Communication

2.2. Adjustments of Previous Chapters

2.3. Chapter IV Development

- 2.3.1. Scope Management Plan
- 2.3.2. Schedule Management Plan
- 2.3.3. Resource Management Plan
- 2.3.4. Cost Management Plan
- 2.3.5. Quality Management Plan
- 2.3.6. Communications Management Plan
- 2.3.7. Risk Management Plan
- 2.3.8. Procurement Management Plan
- 2.3.9. Stakeholder Management Plan
- 2.3.10. Validation in the field of Regenerative and Sustainable
Development

2.4. Chapter V. Conclusions

2.5. Chapter VI. Recommendations

3. Reading by Reviewers

- 3.1. Reviewers Assignment Request
 - 3.1.1. Assignment of Reviewers
 - 3.1.2. Communication
 - 3.1.3. FGP submission to reviewers
- 3.2. Reviewers Work
 - 3.2.1. Reviewer
 - 3.2.1.1. FGP reading
 - 3.2.1.2. Reader Report 1

4. Adjustments

- 4.1. Report for Reviewers
- 4.2. FGP Update
- 4.3. Second review

5. Presentation to the Board of Examiners

- 5.1. Final Review
- 5.2. FGP Grade Report

15. FGP budget

Total Budget: USD420.00

- Cost of printing project and binding pages USD150.00
- Cost of shipping the project to Costa Rica USD120.00
- Cost of telephone bill to communicate with subject matter experts USD50.00
- Transportation cost to facilitate in person interviews USD100.00

16. FGP planning and development assumptions

1. Research time for the FGP will be at least 10 hours per week.

2. The professor will be available to clarify any queries relating to the development of the FGP
3. All relevant resources will be at the team's disposal to develop the FGP
4. The project team will have access to information to develop the FGP

17.FGP constraints

1. The maximum time frame to finalize the FGP is seven weeks
2. Insufficient sessions assigned to clarify queries related to the development of the FGP
3. Balancing work and course work may be a struggle, affecting the quality of the FGP
4. Weather conditions result in unstable internet connections

18.FGP development risks

1. The professor may not provide feedback to deliverables on time, affecting the completion of work
2. Delays in submission may result in the deliverable not being graded
3. Challenges in obtaining information to develop the FGP may affect the quality of information produced
4. The Project Management Plan may not be approved by the Sponsors, thereby delaying the development of the FGP.

19.FGP main milestones

Deliverable	Start Date	Finish Estimated Date
Graduation Seminar FGP	Jul 18, 2022	Sep 2, 2022
Final Graduation Project	Sep 19, 2022	Feb 5, 2023
FGP Charter submission	Jul 18, 2022	Aug 28, 2022
Chapter I: Introduction	Aug 22, 2022	Aug 26, 2022
Chapter II: Theoretical framework	Aug 8, 2022	Aug 12, 2022
Chapter III: Methodological framework	Aug 15, 2022	Aug 19, 2022
Tutor assignment	Sept 19, 2022	Nov 11, 2022
Chapter IV: Development of Project Management Plans	Sept 1, 2022	Oct 28, 2022
FGP submission to reviewers	Nov 18, 2022	Nov 18, 2022
Presentation to the Board of Examiners	Jan 2, 2023	Jan 6, 2023

20. Theoretical framework

20.1 State of the “matter”

There are approximately that 4.8 million registered farmers in Caribbean Community (CARICOM), and an even greater number in the wider region, who experience loss of income because of reduced crop output. This reduced crop output comes as a result of increased drought conditions and changes in the soil caused by climate change. Currently, many farmers rely on agricultural extension officers to provide scientific information on soil condition.

The sustainable solution to this is the development of a Smart farming Application which is the talking plant which provides information on soil moisture, nutrients and salt levels. This smart farming device, when placed in the soil tells farmers exactly what their crops need. The device pairs with smartphones or tablets and speaks to the farmer to give real time information and interventions to restore crop health. Born out of the need to help farmers cope with the increasing unpredictability of weather and to help them optimize water use and improve plant health in times of drought, the App offers timely, accurate and easily accessible information directly from plants and the soil to help farmers plan for rain, conserve water, and reduce crop loss.

20.2 Basic conceptual framework

Project

Project management processes

Project life cycle

Project management knowledge area

Regenerative development

Device application

Smart farming device

21. Methodological framework

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
To develop a report that documents the analysis of different clinics constructions standards to define its basic elements.	Report of the construction standards for clinics construction.	Secondary: thesis, reports Primary: field interviews.	Qualitative. Written information analysis.	Bibliographical files Questionnaires (SurveyMonkey, Google Forms) Semi-structured interviews	Few books on the subject. Difficult to define the population and thus the sample. Limited time of the personnel.
To develop a project charter that will be used in the elaboration of the project deliverables	Project Charter	Primary: Interviews Reports Secondary: Books	Analytical	Expert judgement Meetings Data gathering – interviews	Time – the timeframe to develop the charter is 2 weeks

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
		PMI database Internet Articles			
To validate the use of regenerative and sustainable development to encourage Green Project Management practices.	Impact Analysis Plan	Primary: statistical data reports Secondary: Books PMI database Internet Articles	Descriptive	Data analysis Expert judgement	There may be limitations in terms of accessing information/research regarding sustainable/regenerative practices.
To create a scope management plan to define the work that needs to be done and to ensure that only the required	Scope Management Plan	Primary: Interviews Secondary: Books PMI database Internet	Analytical	Expert judgement Meetings Data analysis Trend analysis	Poor stakeholder expectations management may lead to scope creep.

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
project work is completed.		Articles			
To develop a schedule management plan that will guide the management of project activities to ensure the timely completion of the project.	Schedule Management Plan	Primary: Reports Secondary: Books PMI database Internet Articles	Analytical	Expert judgement (Scheduling software) Alternatives analysis	Delays in sourcing resources may cause extension to project deadline.
To create a cost management plan to establish the activities and criteria for planning, structuring, and controlling project costs to ensure that the project is completed within	Cost Management Plan	Primary: Reports Secondary: Books PMI database Internet Articles	Analytical	Expert judgement Cost estimating & budgeting Use of information in the industry Meetings Data analysis	Poorly allocated resources will lead to project going over budget.

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
the approved budget.					
To develop a quality management plan to outline how quality will be managed throughout the project, ensuring that requirements are fulfilled and are in line with stakeholder needs.	Quality Management Plan	Primary: Interviews Secondary: Books PMI database Internet Articles	Analytical	Cost-benefit analysis Cost of quality Expert judgement Flowcharts Matrix diagrams	Inferior quality material may cause rework, delaying project completion.
To create a resource management plan to ensure effective use of the various assigned resources.	Resource Management Plan	Primary: Reports Secondary: Books PMI database Internet Articles	Analytical	Expert judgement Hierarchical charts Work breakdown structure (WBS)	Poorly allocated resources will cause the project to go over budget and schedule.

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
				Resource breakdown structure Responsibility assignment matrix Meetings	
To develop a communication management plan to define the project's structure and methods of information collection, screening, formatting, and distribution of project information.	Communication Management Plan	Primary: Reports Secondary: Books PMI database Internet Articles	Analytical	Expert judgement Stakeholder engagement assessment matrix Meetings	Technological failure may cause breakdown in communications.
To create a risk management plan to evaluate	Risk Management Plan	Primary: Reports	Analytical	Meetings Stakeholder analysis	Unforeseen risks will arise

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
and plan for possible risk and to help mitigate negative risks and threats that could adversely impact the project.		Secondary: Books PMI database Internet Articles		Expert judgment	causing project delay.
To create a procurement management plan to define the procurement requirements for the project and how it will be managed.	Procurement Management Plan	Primary: Reports Secondary: Books PMI database Internet Articles	Analytical	Expert judgement Market research Make or buy analysis Source selection analysis Meetings	Pandemic related constraints may cause supply chain issues, thereby increasing the cost of sourcing materials and experts.
To create a stakeholder	Stakeholder	Primary: Reports	Analytical	Expert judgement	Key stakehold

Objective	Name of deliverable	Information Sources	Research Method	Tools	Restrictions
engagement plan to ensure a comprehensive and coordinated approach is taken to stakeholder engagement throughout the project.	Engagement Plan	Secondary: Books PMI database Internet Articles		Surveys Stakeholder analysis Power/interest grid	ers were not engaged, leading to scope not being clearly defined.

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

Carboni (2019) stresses that the demand for sustainable business practices has increased over the years along with the focus on sustainable development, climate change and ethical behavior. As a result, businesses are more focused on reducing the ecological footprint by focusing on green, sustainable practices.

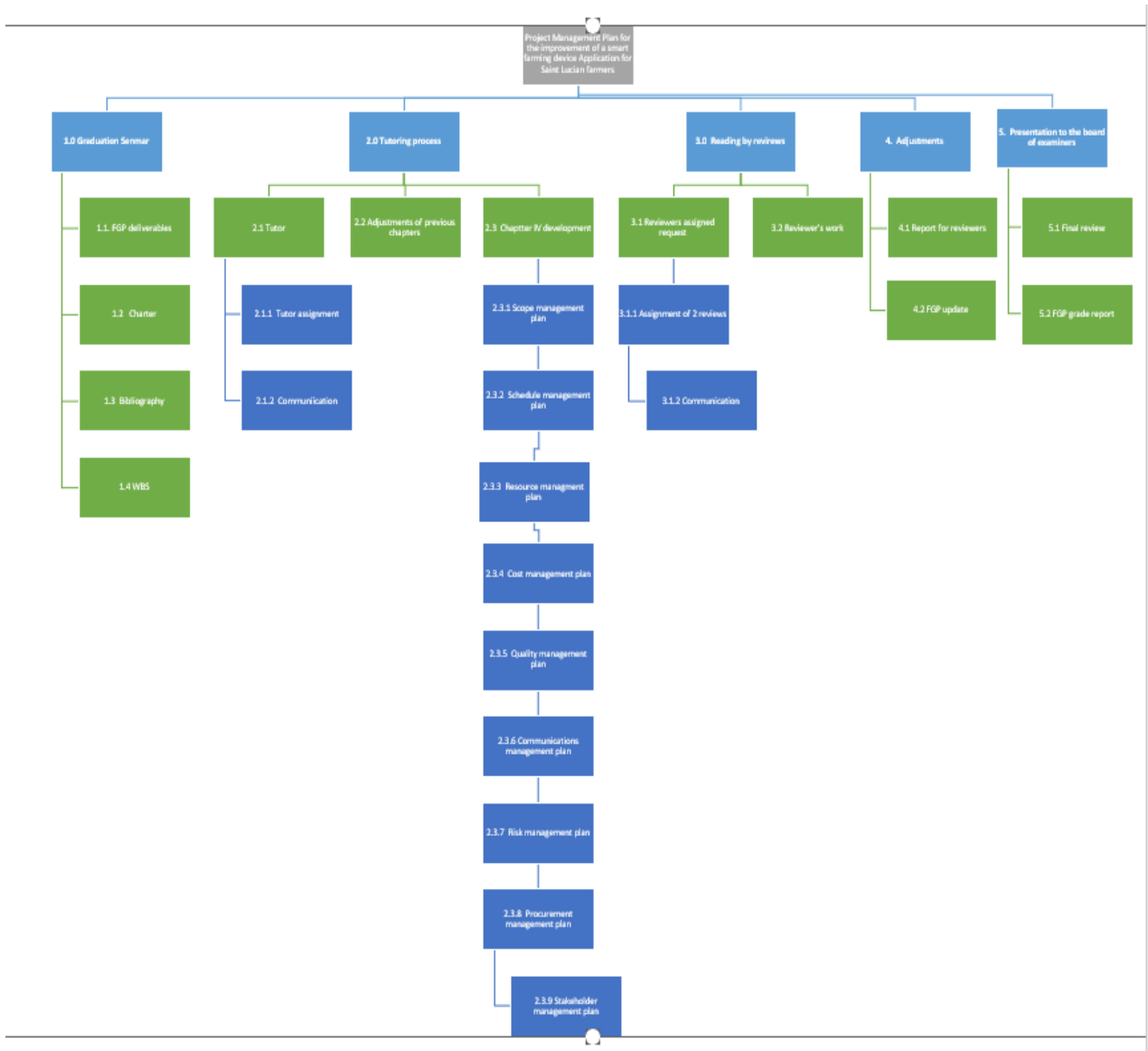
Farmers need healthy soil to be able to grow healthy produce. Crop loss comes with it the crisis of food insecurity. Green practices that small farmers engage in like crop rotation and intercropping are more favorable environmental practices.

This FGP for which the project management plan is being developed focuses on both sustainable and regenerative development practices. Sustainability for this project means ensuring that food systems benefit everyone equally. In this way, this project aims to create a system where farmers can subsist above poverty.

This FGP will complete a P5 Analysis to identify this project's potential impact to sustainability. This will determine both the positive and negative impacts of this project and to determine what sustainable outcomes that can be achieved. The FGP also recognizes the following Sustainable Development Goals (SDGs) adopted by the UN in 2015

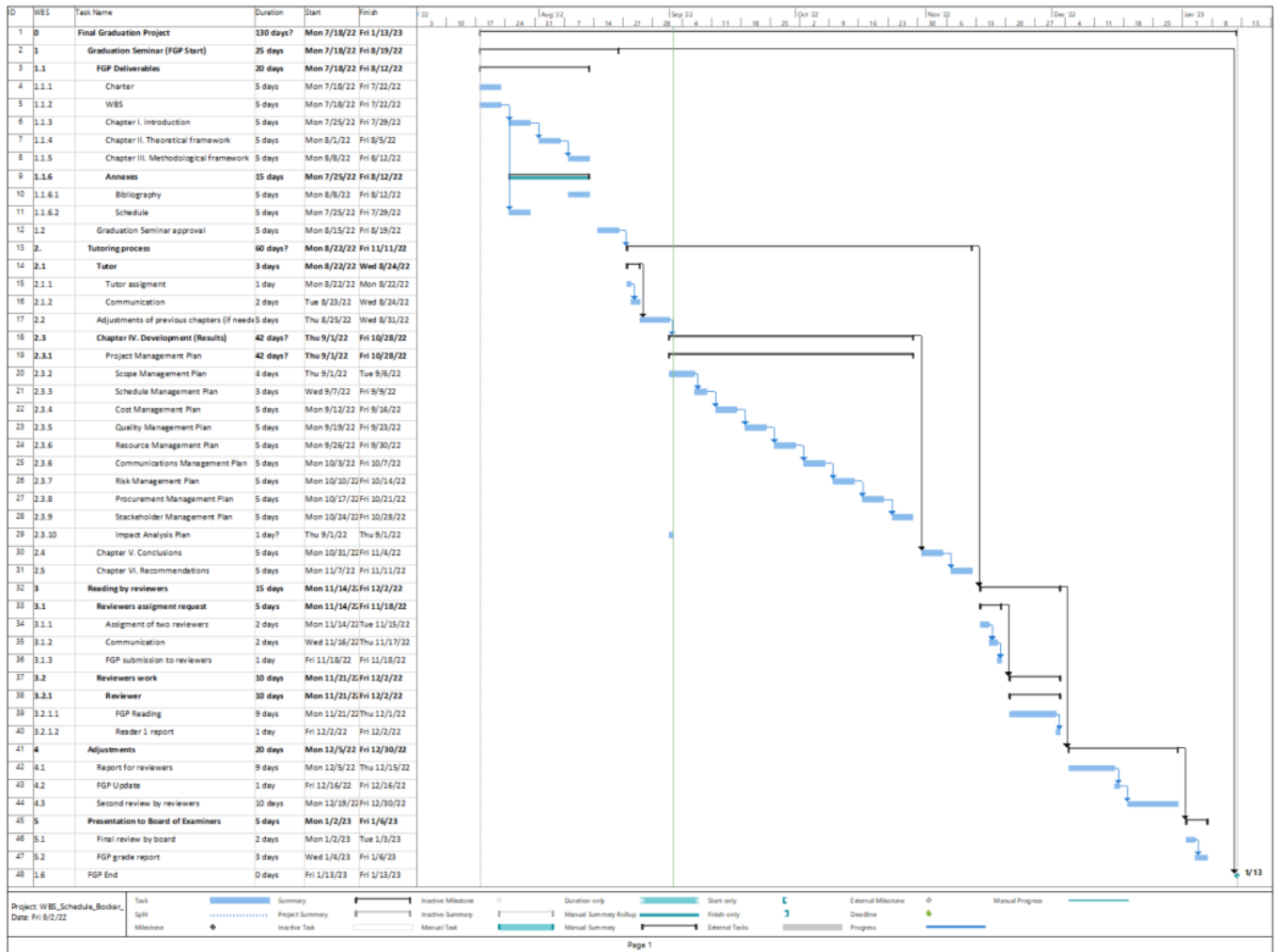
- Goal 2: Zero Hunger
- Goal 9: Industry, Innovation and Infrastructure
- Goal 12: Responsible Consumption and Production

Appendix 2: FGP WBS



Source (Author)

Appendix 3: FGP Schedule



Source (Author)

Appendix 4: Preliminary bibliographical research

- APM. (2019). What Is Project management? Apm.org.uk.
<https://www.apm.org.uk/resources/what-is-project-management/>
- Barakoski, M. (2020, January 23). Driving Improvement with Agile and Kaizen. Project Management Institute.
<https://www.projectmanagement.com/articles/604366/Driving-Improvement-with-Agile-and-Kaizen>
- Cote, A (2022, July 14). Everything that goes into building a project plan. Paymo,
<https://www.paymoapp.com/blog/project-management-plan/>
- Carbono et al, (2018). GPM Global. *Sustainable Project Management. The GPM Reference Guide.*
<https://campusuci2.com/REP/152/1522/RSC/U1/03.pdf>
- De Alwis et al (2022). A survey on Smart farming data, applications and techniques. Computers in Industry. 138.
<https://www.sciencedirect.com/science/article/abs/pii/S0166361522000197>
- Device Application Definition. (n.d.). Law Insider. Retrieved August 22, 2022, from
<https://www.lawinsider.com/dictionary/device-application>
- Galauner, B. (2021). Pfeiffer Library: Research Methodologies: What are research methods? Library.tiffin.edu.
<https://library.tiffin.edu/researchmethodologies/whatareresearchmethods>
- Hughes, J. (2021, March 22). Internet of Things (IoT) Applications: Smart Agriculture. <https://www.manxtechgroup.com/internet-of-things-iot-applications-smart->

agriculture/#:~:text=Smart%20Agriculture%20is%20a%20topic,the%20farmi
ng%20and%20agricultural%20sectors.

Javed, A. (2021, June 23). Methodological framework definition/structure/examples.
EngloPedia. <https://englopedia.com/methodological-framework-definition/>

“Kissflow” (2022). 5 Phases of Project Management. Retrieved on August 13, 2022
from <https://kissflow.com/project/five-phases-of-project-management/>

Muell813. (2015, July 15). Primary, Secondary, and Tertiary Sources. University of
Minnesota Crookston. <https://crk.umn.edu/library/primary-secondary-and-tertiary-sources>

Mohamed et al. (2021). Smart farming for improving agricultural management. *The
Egyptian Journal of Remote Sensing and Space Science*. 24, (3), 971-981.
<https://www.sciencedirect.com/science/article/pii/S1110982321000582>

Mullaly, M. (2015, November 23). What We Are Still Getting Wrong About Quality.
Project Management Institute.
<https://www.projectmanagement.com/articles/308821/what-we-are-still-getting-wrong-about-quality>

Project Management Institute. (2017). *A guide to the Project Management Body of
Knowledge (PMBOK® Guide)* (6th ed.). Project Management Institute.

The Scrum Guide. (2020) *The Definitive Guide to Scrum: The Rules of the Game*.
Schwaber K & Sutherland J.
<https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf>

United Nations. (2015). *Transforming our world. The 2030 agenda for
sustainable development*.

<https://sustainabledevelopment.un.org/content/documents/2125203%20Agenda%20for%20Sustainable%20Development%20web.pdf>

University of Newcastle Library. (2019). LibGuides: Research Methods: What are research methods? Newcastle.edu.au.

<https://libguides.newcastle.edu.au/researchmethods>

Appendix 5: Philological Dictum

Dennery,
Saint Lucia,
West Indies

January 29, 2023

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

Dear Academic Advisor,

Re: Review of Final Graduation Project submitted by Vanessa Cox in partial fulfillment of the requirements for the Masters in Project Management.

I hereby confirm that Vanessa Cox has made all corrections to the Final Graduation Project document: *Project Management Plan for Managing Improvements of a Smart Farming Device and Application for Saint Lucian Farmers* as I have advised. In my opinion, the document meets the literary and linguistic standards expected of a student at that level.

I hold a Bachelors and Masters degree in Linguistics from the Universidad Autonoma Metropolitana in Mexico City, Mexico, with ten years of experience as an educator. I believe this suitably qualifies me to make the above assessment.

Sincerely,



Zenith John
Lecturer
Sir Arthur Lewis Community College