UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN FOR THE CONSTRUCTION OF THE FIRST URBAN HYDROPONICS FARM WITHIN THE RESIDENTIAL COMMUNITY IN THE KING'S PARK AREA OF BELIZE CITY, BELIZE

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DEDICATION

This document is dedicated to my mother resting in heaven who has always been passionate about serving her community. It is also dedicated to my father who continues to have a love for agriculture and horticulture. I also dedicate this project to my family, friends and colleagues that provided unwavering support throughout the development of this document. Finally, dedication also goes out to all hardworking farmers in Belize and globally that continue to find ways to maintain global food security despite several challenges through the continued use of innovative technologies such as hydroponics.

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ABSTRACT

The objective of this document is to develop an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. Given the challenges of sustainability and food security facing the world including Belize in the face of growing urbanization, this research addresses the need for a thoroughly researched integrated Project Management Plan template for an urban community-based hydroponics farm that can be replicated in other parts of Belize. Overall, the FGP aims to increase the chances of project success. WeGrow Ltd. is the newly formed family-owned enterprise proposed to implement the project's construction.

The final product of this FGP research includes an integrated Project Management Plan for the construction of the urban community-based hydroponics farm in Belize City. The Project Management Plan consists of the final deliverables of the FGP's specific objectives. These include the corresponding management plans for scope, schedule, cost, quality, resources, communications, risks, procurement, stakeholder engagement, and sustainability. The analytic-synthetic method is used across the research specifically focusing on the *PMBOK® Guide's* methodologies (PMI, 2017).

The conclusions highlight that it is possible to develop a thoroughly researched integrated Project Management Plan for an urban community-based hydroponics farm using the standards set by the *PMBOK® Guide* including all ten (10) knowledge areas. Additionally, the research shows that the project can be classified as sustainable and regenerative. Several recommendations are also included. The main recommendation is for the Project Management Plan developed under this FGP to be used when developing the hydroponics farm to ensure its success.

Key Words: Project Management, Project Management Plan, Hydroponics, Food Security, Sustainability, Urbanization

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ABBREVIATIONS AND ACRONYMS

AC	Actual Cost
BAC	Budget at Completion
BAHA	Belize Agricultural Health Authority
BBS	Belize Bureau of Standards
BCE	Before the Common Era
BMDC	Belize Marketing and Development Corporation
BZD	Belize Dollars
CBA	Central Building Authority
CPI	Cost Performance Index
CV	Cost Variance
DOE	Department of Environment
EEFs	Enterprise Environmental Factors
ETC	Estimate Time to Complete
EV	Earned Value
EVM	Earned Value Management
FAO	Food and Agriculture Organization
FGP	Final Graduation Project
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPM	Green Project Management
IRR	Internal Rate of Return
MAFSE	Ministry of Agriculture, Food Security and Enterprise
NFT	Nutrien Film Technique
NGO	Non-Governmental Organization
OPAs	Organizational Process Assets
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PSC	Project Steering Committee
PV	Planned Value
PVC	Polyvinyl Chloride
RACI	Responsible, Accountable, Consulted, Informed
RAM	Responsibility Assignment Matrix
RBS	Resource Breakdown Structure
RFP	Request for Proposal
RFQ	Request for Quotation
ROI	Return on Investment
SDG	Sustainable Development Goal
SIB	Statistical Institute of Belize
SOW	Statement of Work
SPI	Schedule Performance Index
SV	Schedule Variance

TBD	To be determined
TOR	Terms of Reference
UCI	University for International Cooperation
UN	United Nations
UN-HABITAT	United Nations Human Settlement Programme
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

One of the major issues facing the world today has been that of sustainability and food security. The world's natural resources have continued to deplete requiring new and innovative approaches to projects that contribute to sustainable and regenerative development. Urbanization has also been a major challenge since cities are projected to take on an additional 2.2 billion people by 2050 (UN-HABITAT, 2022). This would place additional pressures on food systems within cities. In Belize, 28% of the population experienced moderate or severe food insecurity, while 9% experienced severe food insecurity going an entire day without eating. This FGP project targeted some of these issues through its innovative solution of an urban community-based hydroponics farming solution in Belize City.

The main problem that this FGP research addressed was the lack of a thoroughly researched integrated Project Management Plan template for an urban community-based hydroponics farm. Despite high capital costs, hydroponics or soilless agricultural farming was found to have several benefits including being climate smart, with high yields, using no soil, with no pests or diseases, using 90% less water, and requiring less land being ideal for crowded cities (Nerantzis et al., 2018; Gumisiriza et al., 2022). WeGrow Ltd. was the newly formed family-owned enterprise proposed to implement the construction of the urban community-based hydroponics farm in Belize City. The main purpose of this FGP research was to increase the chances of success through an integrated Project Management Plan.

The general objective of the FGP was to develop an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. The specific objectives were: objective 1 to create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion, objective 2 to create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements, objective 3 to create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe, objective 4 to create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources, objective 5 to create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project, objective 6 to create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project, objective 7 to create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated, objective 8 to create a Risk Management Plan to establish how risk

management activities will be structured and performed for the urban hydroponics farming project, objective 9 to create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project, objective 10 to create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project, and objective 11 to develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.

The analytic-synthetic method of analysis was used to develop this FGP research. There were several primary and secondary sources used in the research. Primary sources included meetings, interviews, correspondences, surveys, focus groups, conference proceedings, and photographs. The main secondary sources included the *PMBOK® Guides* 6th and 7th editions (PMI, 2017; PMI, 2021); however, the structure of the FGP's analysis and Project Management Plan was predominantly based on the 6th edition (PMI, 2017). Several tools were also used including templates, guidelines, models and software including Microsoft Word, Excel and Project. A variety of books, journals and articles were also consulted to arrive at the best recommendations for the hydroponics farming project in Belize City.

The conclusions defined under the FGP highlight that it is possible to develop a thoroughly researched integrated Project Management Plan for an urban community-based hydroponics farm using the standards set by PMI (2017). Overall, the We Grow Ltd. Project Management Plan was effectively and efficiently developed for the construction of an urban community-based hydroponics farm within the residential community in the Kings Park Area of Belize City. The plan clearly utilized all ten (10) knowledge areas under PMI (2017) including Integration, Scope, Schedule, Cost, Quality, Resource, Communications, Risk, Procurement and Stakeholder Management. It can be concluded that the Project Management Plan developed presented a unique array of inputs, tools and techniques, and outputs for each knowledge area tailored to the specific project's context. Ultimately, the project was generally concluded as one that can be classified as sustainable and regenerative based on the analysis completed in Chapter 7.

It is recommended that the We Grow Ltd. urban community-based hydroponics project utilizes the Project Management Plan developed under this FGP. This would ensure that all areas recommended by PMI (2017) are thoroughly factored into the project's development. It is also recommended that the project utilizes the Integrated Change Control Process that has been defined in order to ensure that changes across any of the ten (10) knowledge areas are managed effectively following the defined approval processes being thoroughly documented. Finally, in ensuring that the project maintains its commitment to sustainability and regenerative development, it is strongly recommended that a sustainability PACT is signed with the community. This would also help to have a standardized model and Project Management Plan for the development of other similar projects in other cities within Belize.

1 INTRODUCTION

1.1. Background

In Belize and globally, sustainability and food security remain critical issues to sustainable development for future generations to come. According to Muller (2017), the world already stands at the cusps of challenging times having pushed four (4) out of nine (9) planetary boundaries including: loss of biosphere integrity, land system change, biochemical flow, and climate change. As the world's natural resource continue to deplete, there is an increased need for project planners to determine innovative new solutions to solve the development challenges currently facing many countries across the world, including Belize. This includes taking into consideration sustainable development and regenerative development elements in projects. This is where the focus of this FGP research arises. It focuses on the development of an urban community-based hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. However, the proposed solution recognizes that a hydroponics farm may also have its limitations and challenges. For this reason, and in order to ensure successful implementation, this FGP aims to develop an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize.

Given that the project selected is a new and innovative venture, the project proposes the formation of a new company under the name "WeGrow Ltd." The firm's goal is to ensure that its prototype community-based hydroponics farming model can be duplicated across Belize once the first prototype is successfully implemented. This newly formed enterprise would be incorporated under the laws of Belize and would be tasked with the implementation of the Project Management Plan generated under this FGP research. The firm's mission would be to develop a sustainable, environmentally conscious, and community-based social enterprise that maximizes the potential of the latest urban hydroponics farming technology to produce healthy and organic fruits and vegetables that create value for consumers, employees, and

families in Belize. Subsequently, its vision would be to become an internationally recognized model of innovative community-based hydroponics farming solutions that address the challenges of food security and sustainability. In its initial stage, WeGrow Ltd. would entail a small core team as family-owned enterprise.

The current global context is one that is focused on sustainable development, with new debates around regenerative development taking sustainability to another level. Since September 2015, world leaders under the United Nations collectively agreed on 17 Sustainable Development Goals (SDGs) and 169 targets under the 2030 Sustainable Development Agenda to tackle issues focusing on people, planet and prosperity (United Nations, 2015). Through its implementation providing communities and families with alternative mechanisms to food security, this FGP would support several SDGs including Goal 1 – No Poverty, Goal 2 – Zero Hunger, Goal 3 – Good health and Well-being, Goal 9 – Industry, Innovation and Infrastructure, and Goal 12 – Responsible Consumption and Production. Another component to the current context is that cities and urbanization is projected to continue growing with 2.2 billion new people forecasted to urbanize or move to cities by 2050 (UN-HABITAT, 2022). This would place added pressures on the sustainability of cities. Furthermore, Belize is in a context that faces challenges with food security since 28% of the population experience moderate or severe food insecurity, while 9% experienced severe food insecurity going an entire day without eating due to a lack of money or other resources (Stevenson et al., 2021). This background context shows why this FGP is relevant to support the successful implementation of alternative and sustainable mechanisms to tackle food insecurity.

When analyzing the current state of the matter in relation to this FGP, there has been some research completed regarding hydroponics farming projects in other countries and communities. These previous studies can offer several lessons learned that can contribute to the successful development of this FGP research. Previous studies would also ensure that the Project Management Plan being developed takes into consideration any challenges, risks or opportunities that previous studies have

identified. Hydroponics is defined as a method of producing agricultural products with a soilless means of production (Nerantzis et al., 2018). Previous studies have shown that hydroponics provide several benefits including being climate smart, with high yield products, using no soil, having no pests or diseases, and using 90% less water with more efficient land use particularly in crowded cities. Nevertheless, several disadvantages were also noted which this Project Management Plan would need to take into consideration. These include the high costs of capital, lack of technical expertise needed, and the potential for pollution if mineral waste is not disposed correctly (Gumisiriza et al., 2022). Overall, background literature suggests that there have been case studies where cities have been able to contribute to biodiversity through green spaces, rooftop gardens and community gardens with examples from India, Japan, Tanzania and Uganda (CityZen, 2022; Galloway, 2022; Gumisiriza et al., 2022; UN-HABITAT, 2022). This therefore sets the context for this FGP research which would ensure that the integrated Project Management Plan being developed for an urban community-based hydroponics farm in Belize City, takes into consideration the lessons learned from previous similar projects.

1.2. Statement of the Problem

Given that the project being proposed is a new and innovative venture in Belize City, the main problem is the lack of a thoroughly researched integrated Project Management Plan template. WeGrow Ltd. would be a newly formed enterprise that would be tasked with the construction of the urban community-based hydroponics farm in Belize City. However, without a Project Management Plan template or previous research conducted, the project could be set out for failure due to insufficient planning (UCI, 2021). According to PMI (2017), a Project Management Plan is the document which describes how the project will be executed, monitored and controlled, and closed. In this context, the initiating and planning process groups as defined by PMI (2017) remain key and aligned with this FGP. The initiating process group entails the definition of a new project by obtaining authorization to start the project, while the planning process group establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives. The key benefits of the initiating process under the FGP

Charter is to ensure that the business case, benefits and stakeholders are considered from the start of the project. Regarding planning, the main benefit is to define the course of action to successfully complete the project or phase.

In this context, the problem of a lack of an integrated Project Management Plan for the implementation of an urban community-based hydroponics farm is being addressed. This FGP research therefore aims to ensure that the project being implemented by WeGrow Ltd. is successful and can be replicated by other urban community-based hydroponics farms in Belize. This is the main opportunity that the FGP aims to seize. Through the completion and publication of an integrated Project Management Plan, other firms from other cities in Belize or beyond will be able to use the data, information and research, in order to implement additional hydroponics projects successfully replicating the model. The project in Belize city is an innovation given that such practices do not currently exist. The main hydroponics farm, Belizean Fresh, is currently a commercial enterprise and not a community-based project located in a rural area in Northern Belize(Channel5 News, 2017). In the long-term and upon its implementation, the project aims to support national efforts to combat food insecurity while also contributing to sustainable and regenerative development.

1.3. Purpose

The main purpose of this FGP research is to increase the chances of success for the construction and implementation of an urban community-based hydroponics farm in Belize City by WeGrow Ltd. The way in which the chances of success can be increased is through the development of an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the farm's construction by the firm. The purpose of the FGP is to answer the following research question: What elements are required to develop an integrated Project Management Plan for the construction of an urban hydroponics farm within the Kings Park residential community in Belize City that meets national health and building standards for small-scale agricultural production? The hypothesis therefore is: Is it possible to develop an integrated Project Management Plan for the construction of an urban hydroponics farm within the Kings

Park residential community in Belize City that meets national health and building standards for small-scale agricultural production?

A large part of the motivation to complete this research is due to the challenges of food insecurity and sustainability that currently faces Belize and several other countries in the world. One of the main challenges facing cities, including Belize City today, is the reliance on rural areas or imports to obtain produce or other agricultural products for food security. Additionally, with 28% experiencing moderate food insecurity and 9% experiencing severe, it shows that there is a need for a self-sustainable solution, particularly in the context of the growth of urbanization. For this reason, this FGP is important as it aims to develop an integrated Project Management Plan to increase the chances of successful implementation of an urban community-based hydroponics farm in Belize City. Several benefits can be realized from the development of this Project Management Plan including:

1. Provision of the necessary guidance to execute the construction of the hydroponics farm throughout the entire project life cycle.
2. Definition of all project work including an establishment of how the work will be executed and completed.
3. Support to be used as a template for replication in future projects.
4. Establishing a baseline and framework for project benefits to be realized.

1.4. General objective

To develop an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize.

1.5. Specific objectives

1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.

2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise Framework

2.1.1 Company/Enterprise Background

Given that the researcher has selected a new personal family and community-based project that is not yet in operation, there is currently no company or enterprise that exists. Nevertheless, as a part of this FGP research and at its conclusion, there is the possibility of incorporating a private sector firm under the Chapter 250 Laws of Belize as a social enterprise. This Project Management Plan for the construction of the first urban hydroponics farm within the residential community in the King's Park Area of Belize City, Belize would serve as the baseline framework for the formation of the social enterprise that would be focused on improving sustainability and community member livelihoods. This would primarily be through a profit-sharing mechanism as the community-based hydroponic farming project expands to sell produce to other locations within and even beyond the Kings Park residential community in Belize City. However, the FGP research would initially be carried out in the specific vicinity of the Kings Park Area in Belize City.

The firm's goal would be to have the prototype community-based hydroponics farming model developed at its initial location be duplicated once successful. It aims to contribute to the community by enabling families within the area to learn the techniques of hydroponic farming that can be done from residential space available. Through the social enterprise, families would be able to grow and sell produce under a community cluster which supports investment while allowing families to gain returns from the profit-sharing mechanism based on produce sold on the local market. In this way, the enterprise will support food security initiatives by allowing families to learn how to become self-sustainable while providing secondary income streams that support livelihoods. The name of the social enterprise to be formed would be "WeGrow Ltd." for which a company logo has been conceptualized in **Figure 1** below.

Figure 1. WeGrow Ltd. Organizational Logo

Note. Own work.

2.1.2 Mission and Vision Statements

Since WeGrow Ltd. would be a newly formed social enterprise incorporated in Belize that would implement the Project Management Plan being developed under this FGP, there is currently no existing mission or vision statement. Nevertheless, the statements below have been proposed based on the project sponsor's goal to have a positive impact on food security and sustainability issues in urban residential communities in Belize through the hydroponics farming project. In determining the mission and vision statements, the theory referenced by Ghafoor (2017) was applied where the nine (9) elements recommended were considered. These include (1) customers, (2) products, (3) markets, (4) technology, (5) concern for survival, growth, and profitability, (6) philosophy, (7) self-concept, (8) concern for public image, and (9) concern for employees. From this, the mission and vision can be stated s follows.

Mission:

To develop a sustainable, environmentally conscious, and community-based social enterprise that maximizes the potential of the latest urban hydroponics farming technology to produce healthy and organic fruits and vegetables that create value for consumers, employees, and families in Belize.

Vision:

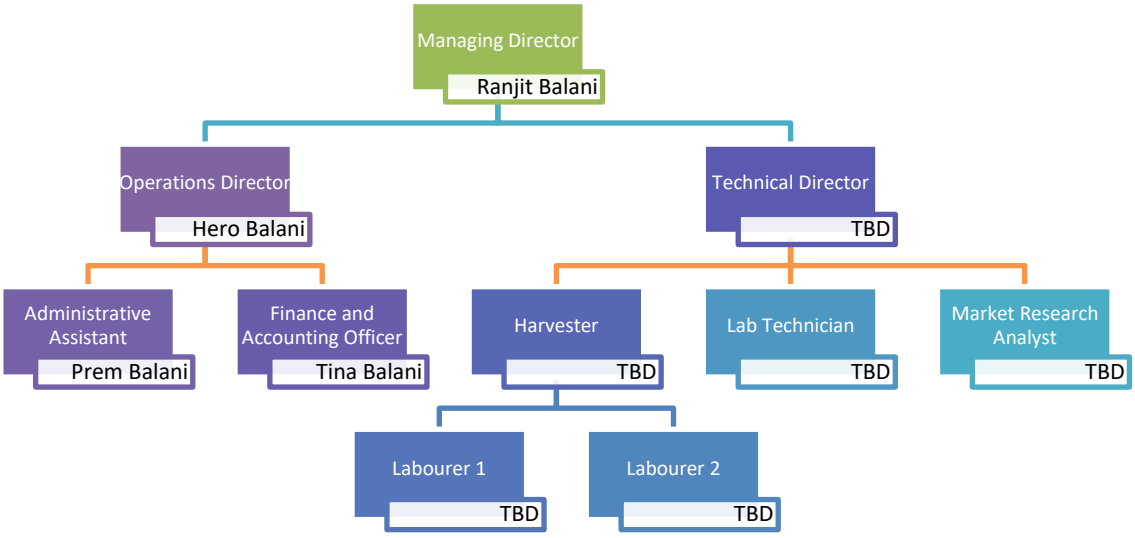
To become an internationally recognized model of innovative community-based hydroponics farming solutions that address the challenges of food security and sustainability.

2.1.3 Organizational Structure

In the inception, WeGrow Ltd. will entail a small core team under the project. The Managing Director of WeGrow would be Mr. Ranjit Balani, the researcher's father and project sponsor. This is due to the initial location for the first community-based hydroponics farm being located at Mr. Balani's property, specifically, on his residential rooftop at 3 Corner Hopkins and First Street in Belize City. Mr. Ranjit Balani would also be the founding member and main shareholder of the enterprise to be formed providing the initial investment for the project and the Project Management Plan being developed under the FGP. However, as the project grows with additional shareholders added from the community under the profit-sharing mechanism, this list would expand. Mr. Hero Balani, the researcher, would fulfill the role of Operations Director as well as the Project Manager of the project. This is due to the researcher's experience in project management theory and practice. The researcher's sister, Ms. Tina Balani, would be the Finance and Accounting Officer, while the researcher's cousin, Mr. Prem Balani, would serve as the Administrative Assistant. All members stated above reside on the property of the project location. These four (4) persons would form a part of the Project Planning Team.

Subsequently, the initial Technical Team would be led by one (1) Technical Director who would oversee two (2) Labourers, one (1) Harvester, one (1) Lab Technician, and one (1) Market Research Analyst. In total, the initial organizational structure of WeGrow Ltd. would entail ten (10) staff members from which six (6) remain to be determined (TBD). The key difference is that the four (4) core members identified would form the initial project planning team, while the technical team would be added to form the full general structure of WeGrow Ltd. upon project implementation. **Figure 2** highlights the organizational structure of the social enterprise to be formed.

Figure 2. WeGrow Ltd. Organizational Structure



Note. Own work.

2.1.4 Products Offered

As cited previously, since a company or enterprise has not yet been formed, the products offered are based on an analysis of existing hydroponics and aquaponics farms in Belize and internationally. Perhaps one of the most common vegetables grown through hydroponics farming is lettuce. This is evidenced in the case study in East Africa by Gumisiriza et. al. (2022) where the most frequently grown vegetable through hydroponics farming was lettuce occurring 22 times in the study or 43.1% followed by tomatoes, bell peppers and spinach. Nevertheless, Velazquez-Gonzalez (2022) highlights over 40 types of fruits and vegetables that can be grown through hydroponics farming not requiring soil or large plots of land. These include bulbs, leafy greens, roots, tubers, stems, inflorescent, pulse and fruit vegetables.

In the case of WeGrow Ltd. the specific products to be offered would be based on stakeholder demand and requirements determined when developing the Project

Management Plan under the FGP. However, the initial list of products to be developed can be based on firsthand experience and examples of existing hydroponics farms in Belize. Current backyard hydroponics farms show evidence of being able to grow different types of lettuce, sweet basil, swiss chard, collard greens and other kinds of leafy greens (Channel5 News, 2017). Based on this experience and research conducted, the products that can be offered by WeGrow Ltd. include:

Products:

1. Lettuce
2. Cabbage
3. Spinach
4. Celery
5. Onion
6. Carrot
7. Potato
8. Broccoli
9. Cauliflower
10. Cucumber
11. Watermelon
12. Cantaloupe

Services:

1. Project Management
2. Technical Advisory Services

These products were selected being essential cooking ingredients given the project's focus on targeting food security alongside sustainability. However, the list of initial products would be adjusted based on stakeholder needs and requirements from the community of the Kings Park Area targeted in Belize City. The survey to be conducted as a part of the development of the Project Management Plan under this FGP would also help to determine community demands for produce. Apart from produce, WeGrow Ltd. would also eventually offer project management and technical advisory services once it completes the pilot project located at No. 3 Corner Hopkins and First Street in Belize City. The documentation of lessons learned would form a key part of knowledge transfer and future services offered to other community-based hydroponics farming projects.

2.2 Project Management Concepts

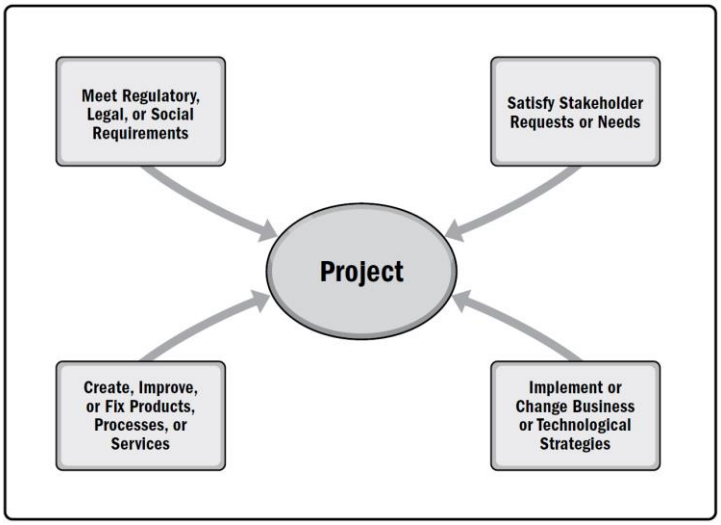
2.2.1 Project

According to the *PMBOK® Guide* 6th edition, project management is not new as it has been used for hundreds of years (PMI, 2017). From the Pyramids of Giza to the Great Wall of China, and even the Taj Mahal, many of these wonders of the world were developed as projects. This section seeks to examine theory around what is a project and how does it differ from a program or a portfolio.

2.2.1.1 Project Definitions

There are several sources that can be used to determine the definition of a project and its characteristics. Starting with the global standard set by PMI, a project is defined as “a temporary endeavor undertaken to create a unique product, service or result” (PMI, 2017, p.4). When comparing this definition under the 6th edition of the *PMBOK® Guide* to the 7th edition, there was no change in the generally recognized and good practice definition of a project (PMI, 2021). When analyzing other definitions, Kissflow (2022) defines a project as a sequence of tasks that must be completed to attain a certain outcome. Depending on its complexity, it can be managed by a single person or hundreds of persons. Essentially, projects have boundaries with a clear start and end date to create something new that is not business as usual (Kissflow, 2022). PMI (2017) also recognizes projects to have a set of characteristics which include that (1) projects fulfill objectives by delivering a unique product service or result, (2) projects have a definite beginning and end being temporary, (3) projects drive change in organizations moving from the current state to the future state, (4) projects enable business value creation, and (5) projects can be initiated based on various contexts. **Figure 3** below highlights the four (4) main project initiation contexts as elaborated by PMI (2017).

Figure 3. Project Initiation Context



Note. Reprinted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 1-2, p. 8 Copyright 2017 by PMI, Inc. Permission not sought.

In the case of this FGP, the characteristics of a project based on the definitions discussed are clearly evidenced. Primarily, the FGP has a start date of July 18, 2022, and an end date of February 2, 2023, having a set timeframe for completion of 12 weeks. In this manner, the FGP is a temporary endeavor which aims to deliver a unique product. In this case, the product is an Integrated Project Management Plan to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize city, Belize. Overall, the project also seeks to drive change in the urban residential community while simultaneously creating business value. The urban hydroponics farming project can also be linked to all four (4) initiation contexts from (PMI, 2017) shown in Figure 3.

2.2.1.2 Projects, Programs and Portfolios

When discussing projects, it is also critical to differentiate a project from a program and a portfolio given that the terms are often inter-changed. The complication is that a project can be managed in three separate scenarios which include (1) as a stand-alone project, within a program, or within a portfolio. PMI (2017, p.11) defines a program as “a group of related projects, subsidiary programs, and program activities

managed in a coordinated manner to obtain benefits not available from managing them individually," while a portfolio is defined as "projects, programs, subsidiary portfolios, and operations managed as a group to achieve strategic objectives." One of the key aspects to note is that a portfolio is linked to the business and organizational strategy level ensuring that the right programs and projects are implemented to achieve the strategy. Essentially, the portfolio is the larger umbrella that is the collection of projects and programs that are managed together to meet the financial and strategic goals of an organization (ProjectManager.com, 2022). Subsequently, programs are clusters of projects that are managed in a coordinated manner. It is important to note that projects, programs and portfolios differ in terms of management, life cycles, activities, objectives, focus and benefits (PMI, 2017).

Based on this differentiation between a project, program and portfolio, the FGP can be linked to belong more to the project group. There are several reasons for this. First, the FGP is a temporary endeavor with a start and end date that aims to deliver a unique product in the form of a Project Management Plan. It is clearly a singular project and not a cluster of projects, therefore, it is not a program. Second, the FGP is also not a collection of projects and programs that are managed together to meet financial or strategic goals. Therefore, it is not a portfolio. However, while it may not be classified as a program or portfolio, the implementation of a successful urban hydroponics farming project in the Kings Park Area of Belize City has the potential to grow into a program of several projects across other communities in Belize and beyond. This can translate into a portfolio of community-based urban hydroponics projects and programs to support the national strategies of the Government of Belize to tackle food security and sustainability. Hence, the Project Management Plan developed under this FGP can help to realize future programs and portfolios.

2.2.2 Project Management

Since the focus of this FGP is the development of an integrated Project Management Plan for the construction of an urban hydroponics farm in Belize City, it is important to understand what project management is, including its principles and operationalization. Both aspects are discussed in the subsequent sections.

2.2.2.1 Project Management Definitions

The *PMBOK® Guide* 6th edition defines project management as the "application of knowledge, skills, tools and techniques to project activities to meet the project requirements" (PMI, 2017, p.10). The 7th edition of the *PMBOK® Guide* mirrors this definition highlighting that the standard remains the same (PMI, 2021). When examining literature on how other authors define project management, there are some notable similarities and differences. One author describes project management as the discipline of planning, executing, and completing projects (ProjectManager.com, 2022). The similarity with this definition to that of the *PMBOK® Guide* is that it refers to completing a project which is aligned to meeting the project's requirements. However, one notable description is defining project management as a discipline itself. Another author defines project management as the process of steering a project from the start through its life cycle with the objective to complete the project within the established time, budget and quality (Kissflow, 2022). Here, project management is compared to a ship that needs to be steered to its destination, or in other words, the project's completion. Such steering would require the application of the knowledge, skills, tools and techniques to ensure successful project completion. Analyzing these definitions, it is clear that project management is the means to an end, which is project completion that meets the requirements established.

Overall, projects are a key way to create business value and benefits in organizations which has led to many companies embracing project management co consistently deliver such value (PMI, 2017). The case of the FGP is no different since the creation of the Project Management Plan for the construction of an urban community-based hydroponics farm in Kings Park, Belize City aims to deliver such value. The project aims to deliver value and benefits to the citizens of the surrounding residential community by providing a mechanism for food security, self-sustainability and an additional income stream through the community-based hydroponics farming project which includes a profit-sharing mechanism under WeGrow Ltd. Since project

management is one of the services offered by the enterprise, WeGrow Ltd. will apply the knowledge, skills, tools and techniques gained from the FGP to future projects.

2.2.2.2 Principles of Project Management

Based on the definitions of project management examined, the principles of project management then become critical to the operationalization of project work. The *PMBOK® Guide* 7th edition defines 12 principles of project management which are aligned with the values identified in the *PMI Code of Ethics and Professional Conduct*, namely: responsibility, respect, fairness and honesty (PMI, 2017). It is important to note that a principle is a fundamental norm, truth, or value. Hence, the principles of project management as defined by PMI (2021) sit above the performance domains providing guidance for the behavior project personnel that have the power to influence and shape each domain to produce the intended outcomes. **Figure 4** below summarizes the 12 principles of project management as defined by the *PMBOK® Guide* 7th edition (PMI, 2021).

Figure 4. Principles of Project Management

Principles of Project Management			
Be a diligent, respectful, and caring steward	Create a collaborative team environment	Effectively engage with stakeholders	Focus on value
Recognize, evaluate, and respond to system interactions	Demonstrate leadership behaviors	Tailor based on context	Build quality into processes and deliverables
Navigate complexity	Optimize risk responses	Embrace adaptability and resiliency	Enable change to achieve the envisioned future state

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Based on the 12 principles highlighted above, each would be operationalized in the various project performance domains under the FGP Project Management Plan being completed for the WeGrow Ltd. urban hydroponics farming project in Belize City. Each principle would also be operationalized across the general and specific

objectives specified in Sections 1.4 and 1.5. For example, in the development of the Project Management Plan, the researcher would ensure that stakeholders are effectively engaged, focusing on value while tailoring the plan based on the context. The researcher would also ensure that quality is built into its processes and deliverables under the FGP, ensuring that complexity is effectively navigated with proper risk responses, adaptability, and resiliency. Overall, it is also clear that the FGP embodies the 12th principle of project management as it works to enable change to achieve the envisioned future state of having a Project Management Plan to efficiently and effectively construct a new community-based urban hydroponics farm in the Kings Park Area of Belize City.

2.2.3 Project Life Cycle

In order to be able to effectively and efficiently manage the FGP, it is key to understand the different types of project life cycles and development approaches that are available. These basic frameworks apply, regardless of the specific project work involve, and PMI (2017) recommends that project managers tailor approaches based on the specific project context. These sections discuss project life cycles and differences between predictive, adaptive or hybrid development approaches.

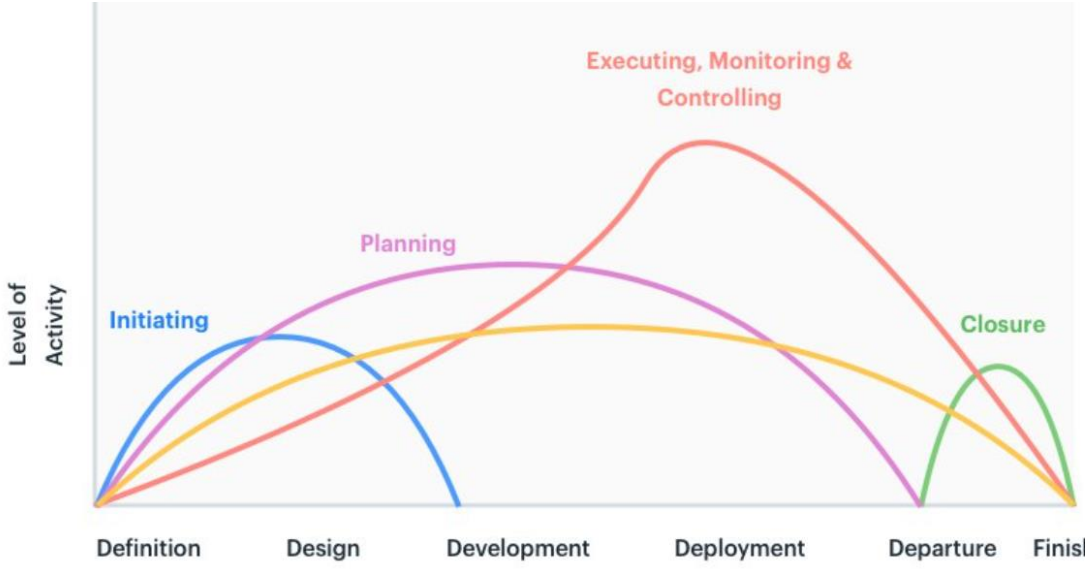
2.2.3.1 Project Life Cycle Definitions

According to the *PMBOK® Guide* 6th edition, a project life cycle is the series of phases that a project passes through from its start to its completion providing the basic framework for managing the project (PMI, 2017). It is similarly defined in the *PMBOK® Guide* 7th edition (PMI, 2021). The phases can be sequential, iterative or overlapping. However, there seem to be some differences in definitions. For example, PMI (2017) links the generic life cycle to the project management process groups and knowledge areas, illustrating them separately. However, ProjectManager.com (2022) instead aligns the project life cycle as being made up of the five (5) project management process groups including: initiation, planning, execution, monitoring and control, and closure. This author is similar to that of Kissflow (2022) which also links the project life cycle to the five (5) process groups of initiation, planning, execution, monitoring and control, and closure or completion.

For PMI (2017), the example of the generic project life cycle shown in **Figure 7** entails starting of the project, organizing and preparing, carrying out the work, and ending the project. Here, each phase or logically related project activities that yield one or more deliverables, are separated by phase gates held at the end of a phase to determine progress.

For this FGP and the creation of the WeGrow Ltd. community-based urban hydroponics farming Project Management Plan, the project life cycle selected is that drafted by Kissflow (2022). Essentially, the FGP would go through each of the five (5) project life cycle phases, from initiation, to planning, to execution, to monitoring and control, and finally to the FGP's closure upon the approval by the Board of Examiners. **Figure 5** illustrates the project life cycle visually based on the level of activity within each phase. It is clear that during the 12-week period of actually executing the FGP and drafting the Project Management Plan is where the bulk of the effort would be given that all eleven (11) specific objectives would need to be completed by the researcher. Another reason that this life cycle model was selected is due to its simplicity for replication upon implementation of the community-based urban hydroponics farms itself. For example, the phases indicated of definition, design, development, deployment, departure and finish, can also be used to replicate the construction of hydroponics farms in other communities outside of the Kings Park Area in Belize City, once the successful prototype is evidenced.

Figure 5. Project Management Life Cycle



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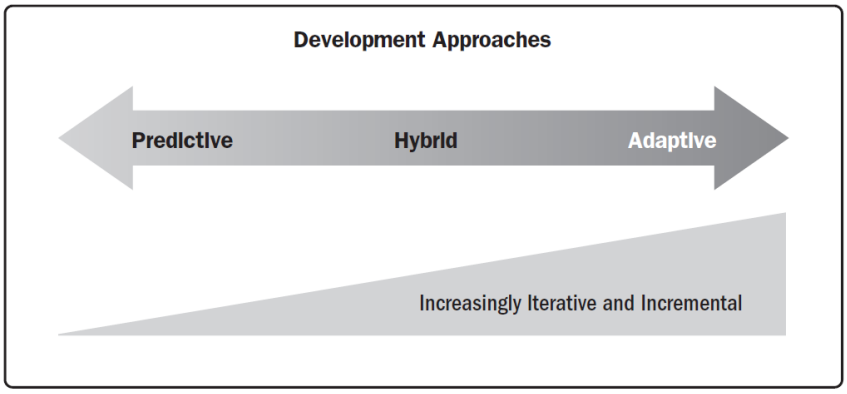
2.2.3.2 Predictive, Adaptive or Hybrid Development Approaches

One of the key aspects related to the project life cycle is the development approach. The *PMBOK® Guide* 7th edition defines the development approach as "the means used to create and evolve the product, service, or result during the project life cycle" (PMI, 2021, p. 130). These often differ across industries; however, three (3) of the most used approaches are predictive, adaptive, or hybrid approaches as shown in **Figure 6** below. Within the *PMBOK® Guide* 6th edition, this understanding was slightly different where five (5) development life cycles were described including predictive, iterative, incremental, adaptive and hybrid. Nevertheless, it is important to understand the three (3) main approaches when selecting which approach would best suit a given project. According to PMI (2021), the predictive approach is useful when the project and product requirements can be defined, collected, and analyzed at the start of the project. It is often referred to as the waterfall or traditional approach following a sequence of predictive steps. The adaptive approach is useful when

requirements are subject to a high level of uncertainty and volatility, likely to change throughout the project. This is where the agile approaches are considered. Finally, the hybrid approach is simply a combination of elements from both the adaptive and predictive approaches. This is useful when there is some uncertainty or risk around the requirements (PMI, 2021). Overall, as the development approaches become more adaptive, it entails a greater level of iterative and incremental delivery. Iterative development refers to developing a produce through a series of repeated cycles, while incremental development refers to successfully adding to the functionalities in each iteration until the final iteration is reached (PMI, 2017).

Figure 6. Development Approaches



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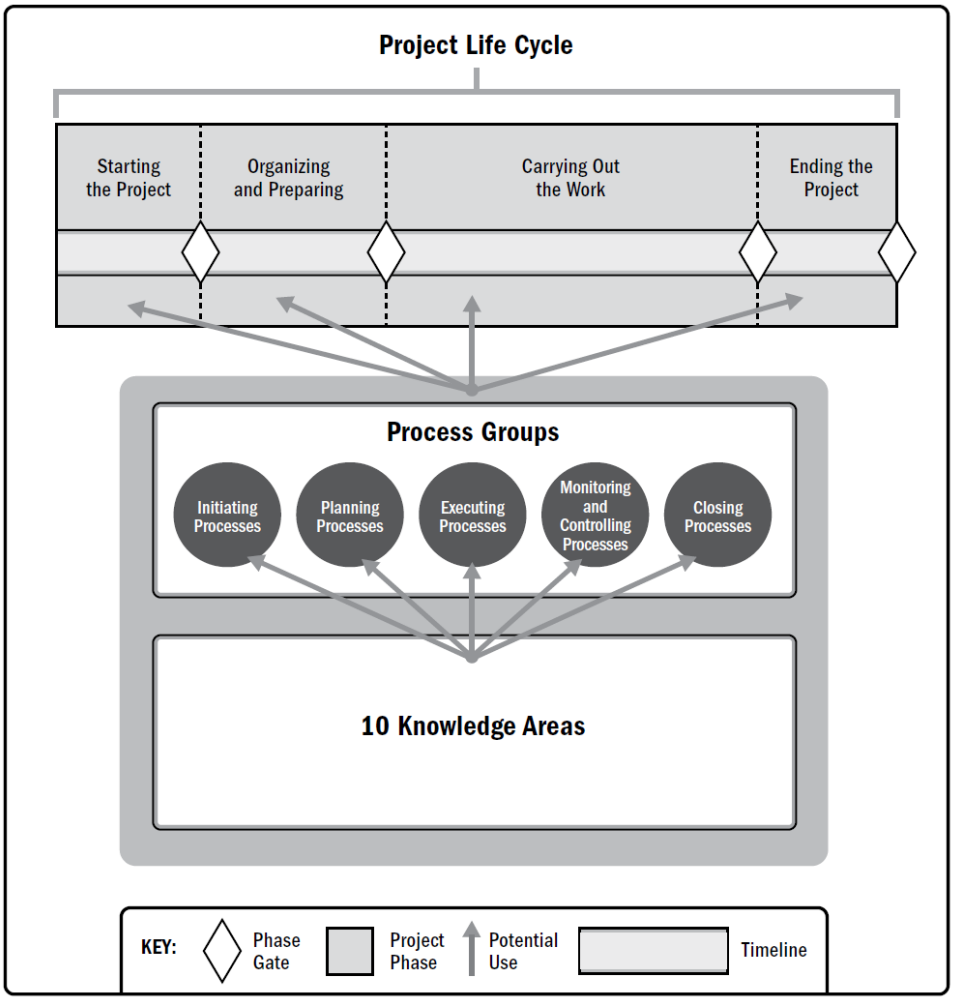
In the case of the FGP, it can therefore be determined that the project belongs to the predictive approach. Here, the project's scope, time and cost are predetermined in the early phase of the life cycle and any changes to the scope are carefully managed (PMI, 2017). This is true since any changes would need to receive approval from the researcher's tutor providing project supervision. Additionally, PMI (2021) cites that projects that use this approach have templates from previous, similar projects, which is true in this case. Finally, given that the project is to develop a Project Management

Plan for the construction of the first urban hydroponics farm within the residential community in the King's Park Area of Belize City, it is therefore best suited for the predictive approach. This is due to the hydroponics farm construction scope, schedule, cost and resources being determined up front with changes being minimal following the plan or blueprint (PMI, 2021).

2.2.4 Project Management Processes

The project life cycle is managed by executing a series of project management activities known as project management processes (PMI, 2017). These processes are logically linked by the outputs produced having overlapping activities that occur throughout the project. For PMI (2017), the processes entail inputs, tools and techniques, and outputs. They are organized into five (5) process groups as logical groupings of project management processes to achieve specific project objectives. The process groups include initiating, planning, executing, monitoring and controlling, and closing processes as shown in **Figure 7** below. The term project management process group was coined by PMI and is widely used in the industry today to refer to the 49 processes that are categorized into 10 knowledge areas (ProjectManager.com, 2022). Nevertheless, the project management lexicon and categorization of process groups has shifted when comparing the structure of the *PMBOK® Guide* 6th edition (PMI, 2017), to the *PMBOK® Guide* 7th edition (PMI, 2021).

Figure 7. *PMBOK® Guide* Life Cycle, Process Groups and Knowledge Areas



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For the FGP, each process group would be addressed as the project progresses from start to finish. For example, the initiating process group is linked to the approval of the FGP Charter in Appendix 1 formally authorizing the project during the Graduation Seminar under component 1.1. of the WBS Thereafter, the planning process group is when the course of action required to achieve the general and specific objectives were determined. This includes the theoretical and methodological frameworks established in Chapters 2 and 3. The executing process

group would entail the processes to complete the work defined satisfying project requirements (PMI, 2017). This would include the results determined in Chapter 4. Subsequently, throughout the process, the monitoring and control group can be evidenced particularly through the tutoring process, reading by reviewers and adjustments indicated under components 1.2, 1.3, and 1.4 of the WBS in Appendix 2. These areas would support the tracking, review and regulation of progress and performance under the FGP. Finally, the processes performed to formally complete or close the project can be linked to component 1.5 of the WBS which is the presentation to the board of examiners. In this manner the FGP can be linked to all five (5) process groups.

2.2.5 Project Management Knowledge Areas

Following the discussion on the project management process groups, it is also important to note that the processes are also categorized by knowledge areas. PMI (2017) categorizes the 49 processes across the five (5) process groups and the ten (10) knowledge areas. However, there is a shift noted once again between the 6th and 7th editions of the *PMBOK® Guide* where the latter also focuses on project performance domains. The following sections discuss both theoretical frameworks.

2.2.5.1 Project Management Knowledge Areas Definitions

A knowledge area is an “identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools and techniques” (PMI, 2017, p.23). Essentially, the ten (10) knowledge areas defined by PMI are used in most projects, most of the time. The term is used to describe all aspects of a project that need to be managed (ProjectManager.com, 2022). Each of the project management processes and knowledge areas have a specific purpose through the project life cycle, and when done correctly, the successful completion of a project is guaranteed. According to Kissflow (2022), the knowledge areas also coincide with the chronological phases of project management being the core technical subject areas. These ten knowledge areas include: integration management, scope management, schedule management, cost management, quality management, resource management,

communications management, risk management, procurement management, and stakeholder management. When comparing the 6th edition of the *PMBOK® Guide* to the 7th, there is a shift in the system of categorization noted where eight (8) project performance domains are now used instead of knowledge areas (PMI, 2021).

Nevertheless, for the purposes of this FGP, the focus remains on the ten (10) knowledge areas as defined by the 6th edition of the PMI and as linked to the specific objectives defined in Section 1.5. The scope of development for the Project Management Plan has been defined according to the ten (10) knowledge areas in ensuring that the relevant technical subject areas and core topics are covered for successful project implementation. This would also ensure that the Project Management Plan is comprehensive enough for potential replication to other community-based urban hydroponics farms in Belize City and beyond. Finally, by integrating all ten (10) project management knowledge areas into the Project Management Plan, WeGrow Ltd. will also be able to ensure that its technical and project management advisory services are able to cover all topic areas. **Figure 8** presents a summary of the 49 processes by knowledge area and process group and the sections that follow include brief explanations of each knowledge area.

Figure 8. Project Management Processes, Process Groups and Knowledge Areas

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

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2.2.5.1.1 Project Integration Management

Project Integration Management includes the "processes and activities to identify, define, combine, unify and coordinate the various processes and project management activities within the Project Management Process Groups" (PMI, 2017, p. 69). It essentially takes the various project management processes and methodologies to create a strategy that helps teams work better together while synchronizing information more clearly (ProjectManager.com, 2022). The process should be applied from the start of the project through completion. Under the FGP, this process is linked to the FGP Charter and specific objective number 1 which aims to create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion. The processes include:

1. Develop Project Charter
2. Develop Project Management Plan
3. Direct and Manage Project Work
4. Manage Project Knowledge
5. Monitor and Control Project Work
6. Perform Integrated Change Control
7. Close Project or Phase

2.2.5.1.2 Project Scope Management

Project Scope Management "includes the processes required to ensure that the project includes all the work required, and only the work require, to complete the project successfully" (PMI, 2017 p. 129). Here, project tasks, deliverables and milestones are identified, defined and controlled through a process that includes collecting stakeholder requirements, creating a WBS), and monitoring any changes requiring management (ProjectManager.com, 2022). Since this FGP is classified

under the predictive approach, the scope and project deliverables are defined at the start of the project with any changes being progressively managed. Under the FGP, this process is linked to specific objective number 2 which aims to create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled, and validated to meet stakeholder requirements. The processes include:

1. Plan Scope Management
2. Collect Requirements
3. Define Scope
4. Create WBS
5. Validate Scope
6. Control Scope

2.2.5.1.3 Project Schedule Management

Project Schedule Management includes “the processes required to manage the timely completion of the project” (PMI, 2017, p.173). It is a part of the planning stage and creates a realistic timeline to achieve project goals (ProjectManager.com, 2022). For the FGP, schedule management is a critical aspect as the timeframe is set for completion at 12-weeks. Under the FGP, this process is linked to specific objective number 3 which aims to create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe. The processes include:

1. Plan Schedule Management
2. Define Activities
3. Sequence Activities
4. Estimate Activity Durations
5. Develop Schedule
6. Control Schedule

2.2.5.1.4 Project Cost Management

Project Cost Management includes the “processes involved in planning, estimating, budgeting, financing, funding, managing and controlling costs so that the project can be completed within the approved budget” (PMI, 2017, p. 231). This knowledge area is primarily concerned with the cost of the resources needed to complete project activities. It also entails collecting, analyzing, and reporting on costs to forecast and monitor the project budget to keep from overspending (ProjectManager.com, 2022). The budget for this FGP has been determined as BZD $422.50. Therefore, it is key that it remains within the budget. Under the FGP, this process is linked to specific objective number 4 which aims to create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources. The processes include:

1. Plan Cost Management
2. Estimate Costs
3. Determine Budget
4. Control Costs

2.2.5.1.5 Project Quality Management

Project Quality Management includes the “processes for incorporating the organization’s quality policy regarding planning, managing, and controlling project and product quality requirements in order to meet stakeholders’ objectives” (PMI, 2017, p. 271). Here, continuous improvement also remains key and it applies to all projects, regardless of the nature of deliverables. It entails the oversight of all activities to ensure that quality expectations are met by continuously measuring quality throughout project execution correcting any deviations identified (ProjectManager.com, 2022). For this FGP, having a high-quality Project Management Plan is critical as the project aims to allow for replication of the model to other hydroponics farms in urban communities within Belize City and other areas. Under the FGP, this process is linked to specific objective number 5 which aims to create a Quality Management Plan to establish the policies, procedures and

guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project. The processes include:

1. Plan Quality Management
2. Manage Quality
3. Control Quality

2.2.5.1.6 Project Resource Management

Project Resource Management includes the “processes to identify, acquire, and manage the resources needed for the successful completion of the project” (PMI, 2017, p. 307). This knowledge area helps to ensure that the right resources are available to the project manager and project team at the right time and place. It entails getting the most from the people, materials, and equipment needed for project execution (ProjectManager.com, 2022). In a similar manner, the resources for the completion of the FGP would need to be closely managed given that there is only one researcher to complete all deliverables. This would also include the management of financial and non-financial resources required. Under the FGP, this process is linked to specific objective number 6 which aims to create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project. The processes include:

1. Plan Resource Management
2. Estimate Activity Resources
3. Acquire Resources
4. Develop Team
5. Manage Team
6. Control Resources

2.2.5.1.7 Project Communications Management

Project Communications Management includes the “processes necessary to ensure that the information needs of the project and its stakeholders are met through development of artifacts and implementation of activities designed to achieve

effective information exchange" (PMI, 2017, p. 359). It includes developing an effective communication strategy for stakeholders, as well as carrying out the necessary activities to implement the communication strategy. It involves the delivery of clear messages in a project through various channels and frequency ensuring that messages are correctly received in a timely manner being understood by the receiver (ProjectManager.com, 2022). For the FGP, communications management is key for success both internally with the tutor and reviewers, as well as externally with stakeholders in the residential community of Kings Park, Belize City. Under the FGP, this process is linked to specific objective number 7 which aims to create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated. The processes include:

1. Plan Communications Management
2. Manage Communications
3. Monitor Communications

2.2.5.1.8 Project Risk Management

Project Risk Management includes the "processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project" (PMI, 2017, p. 395). The main objective is to avoid negative risks, while exploiting positive risks to optimize the chances of project success (ProjectManager.com, 2022). For this FGP, there are several risks that have been identified that can affect its successful completion if the necessary preventive or corrective actions are not taken. Under the FGP, this process is linked to specific objective number 8 which aims to create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project. The processes include:

1. Plan Risk Management
2. Identify Risks
3. Perform Qualitative Risk Analysis
4. Perform Quantitative Risk Analysis

5. Plan Risk Responses
6. Implement Risk Responses
7. Monitor Risks

2.2.5.1.9 Project Procurement Management

Project Procurement Management includes the “processes necessary to purchase or acquire products, services, or results needed from outside the project team” (PMI, 2017, p. 459). It involves the building and maintaining of external relationships including with vendors that sell products and services needed to meet project objectives (ProjectManager.com, 2022). The main processes that need to be procured under this FGP include the printing of surveys and the final product, as well as transportation services. However, the procurement processes for the actual implementation of the hydroponics farm will also be analyzed. Under the FGP, this process is linked to specific objective number 9 which aims to create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project. The processes include:

1. Plan Procurement Management
2. Conduct Procurements
3. Control Procurements

2.2.5.1.10 Project Stakeholder Management

Project Stakeholder Management includes the “processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution” (PMI, 2017, p. 503). It involves the development of strategies to manage stakeholders based on levels of interest and influence, while also ensuring that timely updates are provided (ProjectManager.com, 2022). For the FGP, stakeholder management is critical given that the Project Management Plan is being developed for a community-based urban hydroponics farm. Hence, the

community members themselves would be key to defining requirements. Under the FGP, this process is linked to specific objective number 10 which aims to create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project. The processes include:

1. Identify Stakeholders
2. Plan Stakeholder Engagement
3. Manage Stakeholder Engagement
4. Monitor Stakeholder Engagement

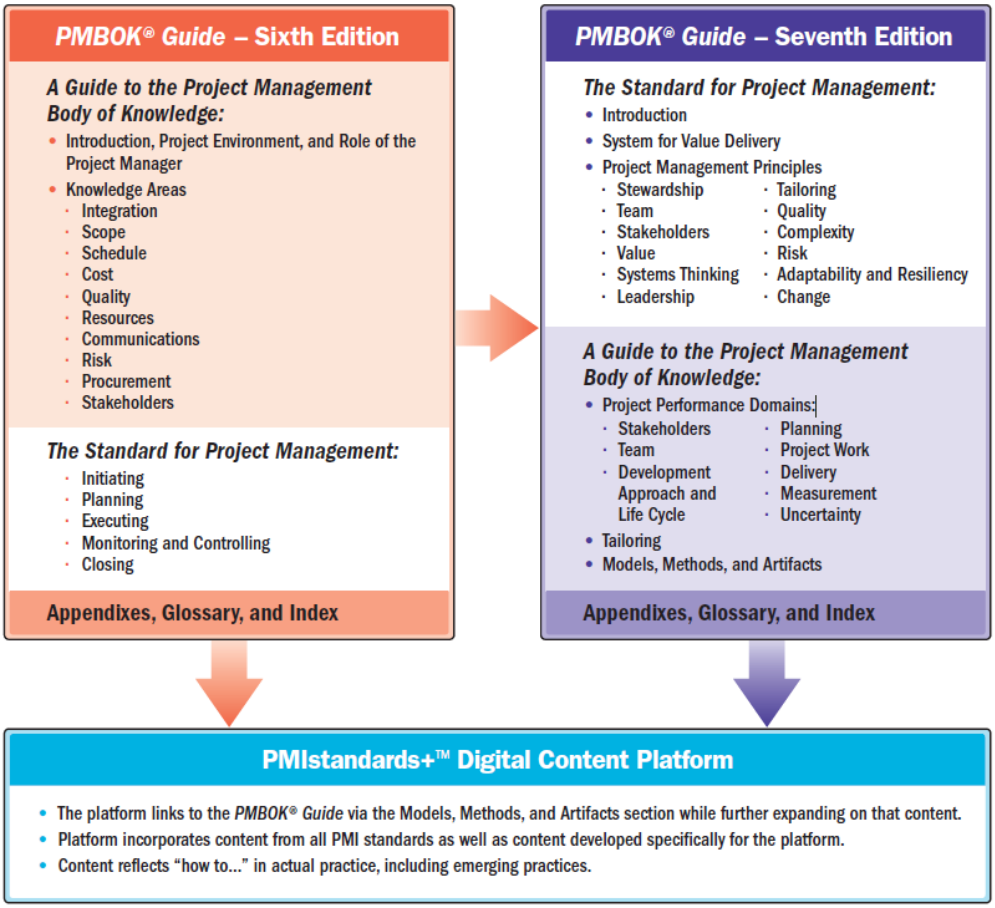
2.2.5.2 Project Performance Domains

As discussed briefly before, there is a notable shift in the *PMBOK® Guide* 7th edition when compared to the 6th edition where eight (8) project performance domains are used instead of ten (10) knowledge areas. This difference in the theoretical framework is clearly demonstrated in **Figure 9**. According to PMI (2021), a performance domain is a group of related activities that are critical for the delivery of project outcomes. Collectively, the performance domains represent a project management system of value delivery including interactive, interrelated, and interdependent management capabilities that work in unison to achieve desired project outcomes. The project management principles highlighted in **Figure 4** provide guidance for the behavior of project teams that influence and shape the performance domains. The eight (8) performance domains by PMI (2021) include:

1. **Stakeholders** – associated with stakeholders;
2. **Team** – associated with the people responsible for producing project deliverables that realize business outcomes;
3. **Development Approach and Life Cycle** – associated with the development approach, cadence and life cycle phases of the project;
4. **Planning** – associated with the initial, ongoing, and evolving organization and coordination necessary for delivering project deliverables and outcomes;

5. **Project Work** – associated with establishing project processes, managing physical resources, and fostering a learning environment;
6. **Delivery** – associated with delivering the scope and quality that the project was undertaken to achieve;
7. **Measurement** – associated with assessing project performance and taking appropriate actions to maintain acceptable performance;
8. **Uncertainty** – associated with risk and uncertainty.

Figure 9. Comparison of the *PMBOK® Guide* 6th edition versus 7th edition



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Though the project performance domains under the *PMBOK® Guide* 7th edition seem to overlap with the knowledge areas of the 6th edition, for the purposes of this FGP, the focus will remain on the ten (10) knowledge areas as defined by the 6th edition (PMI, 2017). The scope of work under the specific objectives has also been linked to the ten (10) knowledge areas. Nevertheless, the FGP recognizes the importance of the project performance domains which run concurrently throughout the project, regardless of how value is delivered (frequently, periodically, or at the end of the project) (PMI, 2021). Therefore, the FGP development process will also take into account the performance domains from a knowledge perspective in ensuring that the Project Management Plan considers these factors. Finally, it is clear that both versions of the *PMBOK® Guide* agree that tailoring remains key which entails determining the appropriate combination of processes, inputs, tools, techniques and life cycle phases to manage a project (PMI, 2017). For this reason, the FGP development process will deliberately adapt the project management approach for suitability to the environment and work at hand. WeGrow Ltd. would also ensure that the project management performance domains are considered in future project management advisory services offered to other hydroponics farms.

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

2.3.1 Current Context of Sustainable Development and Food Security

The current global context is one in which the world continues to grapple with several challenges to achieve sustainable development with other approaches such as regenerative development also making headlines as an alternative approach (Muller, 2017). Since September 2015, world leaders under the United Nations collectively agreed on 17 Sustainable Development Goals (SDGs) and 169 targets under the 2030 Sustainable Development Agenda to tackle issues focusing on people, planet and prosperity (United Nations, 2015). The SDGs are summarized in **Figure 10** below providing results monitoring framework. Despite progress that has been made, many debates continue on the ideal model with critics calling sustainable development a linear short-term approach making the case for a more holistic long-term and circular approach under regenerative development (Gabel, 2015; Muller,

2017). Humanity continues to push several of the nine planetary boundaries restraining the natural resources available. Nevertheless, is key to understand the theory around sustainable development which focuses on *Realizing the Future We Want* through harmonizing environmental (planet), social (people), and economic (prosperity) factors along with partnership and peace (Carboni et al., 2018).

Figure 10. The United Nations Sustainable Development Goals (SDGs)

Note. Reprinted from *Sustainable Project Management – The Green Project Management (GPM) Reference Guide*. GPM Global, 2018 Figure 1-4, p. 19 Copyright 2018 by GPM Global. Permission not sought.

The main problem that this FGP aims to support is that of sustainability and food security challenges currently being faced globally. The United Nations World Cities Report 2022 “Envisaging the Future of Cities” highlights that 2.2 billion additional people will be living in cities by 2050 increasing urbanization to 68% (UN-HABITAT, 2022). Currently, cities around the world occupy 3% of the Earth’s land, but account for 60-80% of energy consumption, 75% of carbon emissions, and 56% of the people (Velazquez-Gonzalez et al., 2022). The COVID-19 pandemic and climate crisis further exacerbates the challenges that countries will face if urban development continues in an unsustainable manner. For this reason, optimizing cities to address sustainability and food security issues can help to reduce inequality and poverty, fostering productive and inclusive urban economies that promote clean energy and protect ecosystems while prioritizing public health (UN-HABITAT, 2022). Food

insecurity is defined as uncertain availability or access to high quality, nutritious food (Stevenson et al., 2021). Understanding this theoretical framework and the context of the current problem makes a case for the FGP's project management plan for a community-based hydroponics farm in Kings Park, Belize City which can support sustainability and food security challenges.

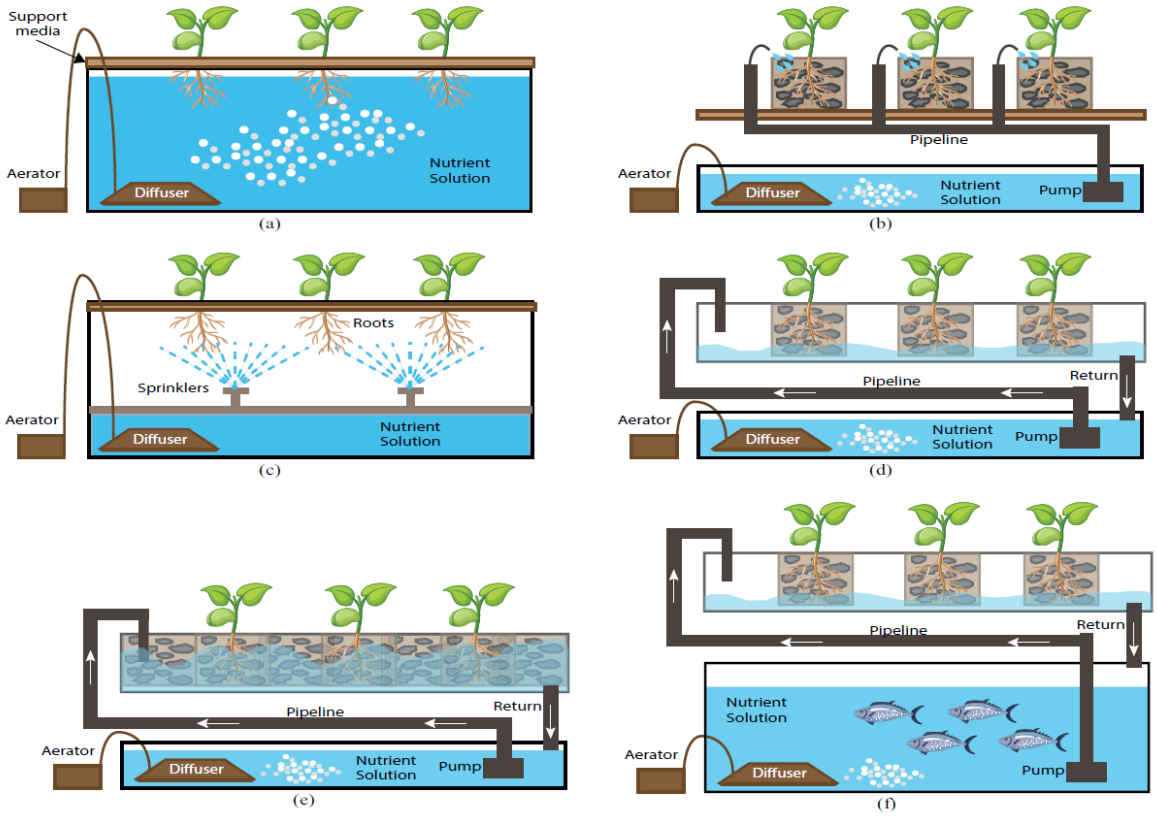
2.3.2 Community-Based Hydroponics Projects

Currently, there are several pieces of literature examining the theoretical frameworks around hydroponics farms, including the community-based model. In this day and age, when space is crucial and water is scarce, cities are quickly turning to new technologies such as hydroponics farms to create urban gardens that are self-sustainable and capable of feeding citizens. In general, hydroponics is defined as a method to produce agricultural products with a soilless means of production (Nerantzis et al., 2018). It is where crops are grown in water composed of mineral nutrients supported by medium (Gumisirriza et al., 2022). This type of farming date as far back as the Egyptian empire during the 6th century BCE and it was also used around the 10th and 11th centuries by the Mexican Aztec culture which developed the chinampa to grow crops on shallow lake beds (Velazquez-Gonzalez et al., 2022). In theory; however, it is also important to note that hydroponics is not the only soilless method of farming as there are other forms. For example, aquaponics is a soilless farming system where plants and fish are raised together as the water is recycled through the system and plants uptake nutrients from recycled fish waste. Another example is also aeroponics, which is a technique where devices like foggers are used to supply plant roots with nutrients in the form of a mist (Gumisiriza et al., 2022).

Overall, this FGP is concerned with hydroponics and the development of a project management plan for a community-based hydroponics farm in the Kings Park Area of Belize City. Current literature suggests that the project is relevant since many cities continue to promote the development of green spaces, rooftop gardens, and community gardens to promote sustainable farming practices while supporting food security. For example, UN-HABITAT (2022) highlights the example of how traditional knowledge has played a role in biodiversity preservation in communities in

northeastern India through the maintenance of community gardens. The examples shared by Gumisiriza (et. al. 2022), also highlight the benefits that hydroponic farms had on cities in East Africa. It is also key to understand the technologies available and cultivation techniques possible under soilless hydroponics as inputs for this FGP. Some of these technologies are summarized in **Figure 11** below.

Figure 11. Types of Hydroponics Systems



Note. Reprinted from *A Review on Hydroponics and the Technologies Associated for Medium- and Small- Scale Operations*. Velazquez-Gonzalez et al., 2022 Figure 1, p. 4 Copyright 2022 by Agriculture, MPDI. Permission not sought.

Types: (a) Deep Water Culture; (b) Drip System; (c) Aero-ponics; (d) Nutrien Film Technique (NFT); (e)Ebb and Flow; (f) Aquaponics

2.3.2.1 Success Stories and Lessons Learned

The literature on community-based urban hydroponics farms also points to several success and lessons learned. For example, the study by Gumisiriza (et al., 2022) in East Africa highlights several benefits experienced by hydroponic farmers in

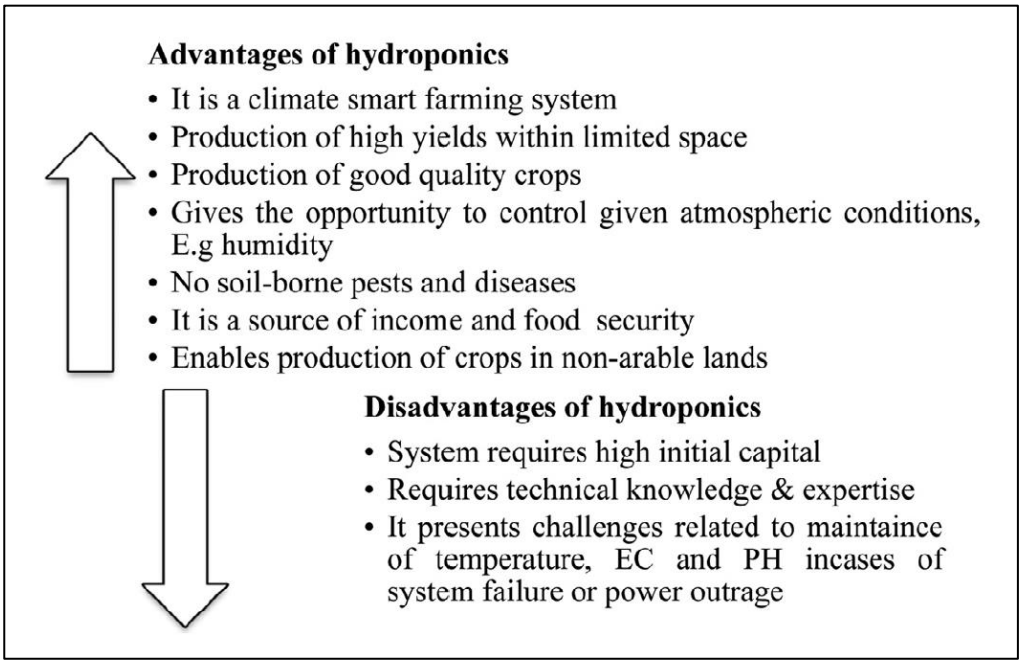
Tanzania and Uganda. These include that hydroponics is a climate smart agriculture system, it produces high yield and quality crops, it has no soil borne pests and diseases, among other benefits. Under this FGP project specifically, the success of less land and water use can create added efficiencies in Belize City given that hydroponics technology uses 90% less water than traditional farming (CityZen, 2021). Furthermore, Nerantzis (et al., 2018) and Galloway (2022) both make the case for urban vertical hydroponics in cities using skyscrapers or rooftop farming. CityZen (2022) and Galloway (2022) also both point to Japan for lessons learned on the new technology in vertical hydroponics farming which has grown to become accepted as a healthy, non-pesticide, produce source which can now be shipped all over Japan in as little as 24 hours. Smart cities like Tokyo, Japan use all the modern technologies to help plan for the future and reduce its carbon footprint. These theoretical lessons from literature can be applied in Belize under the FGP to ensure that the benefits are realized from the development of the Project Management Plan.

2.3.2.2 Challenges and Risks Identified

Although urban community-based hydroponics can offer many benefits and advantages discussed above, it is not without its shortfalls and challenges. It is important that such lessons are also considered in the development of the FGP as a part of the theoretical background. One of the biggest challenges cited by Gumisiriza (et. al. 2022) in the study in East Africa was that of the high investment costs required to set up a hydroponics farm. These costs include greenhouse construction, cost of fertilizers, electricity for system installation, hydroponic equipment such as PVC pipes, net cups, climate monitoring systems, artificial lighting, among others. Another challenge identified was also the lack of technical knowledge and expertise to easily install a hydroponics farm in a community, as well as the bias from the community who consider hydroponic produce to be non-organic (GUmisiriza et al., 2022). For this reason, when completing the FGP to create a Project Management Plan for a hydroponics farm in Belize City, these factors would need to be considered, especially stakeholder perceptions. Similarly, Velazquez-Gonzalez (et al., 2022) also shares that hydroponics is not a panacea to the sustainability and food security issues faced today. Similar challenges regarding the

high initial cost of investment, as well as the requirement of highly trained labor to operate the farm were cited. Additionally, hydroponic farming can also cause environmental pollution if the residual nutrient solution is not property disposed causing excessive growth of algae in bodies of water. **Figure 12** below summarizes some of the advantages and disadvantages of hydroponics farming discussed.

Figure 12. Advantages and Disadvantages of Hydroponics Farming



Note. Reprinted from *Can Soiless Farming Feed Urban East Africa? An Assessment of the Benefits and Challenges of Hydroponics in Uganda and Tanzania*. Gumisiriza et al., 2022 Figure 7, p. 6 Copyright 2022 by Environmental Challenges, Science Direct. Permission not sought.

2.3.3 Sustainable Project Management

Another theoretical framework that needs to be considered closely in this FGP is that of Sustainable Project Management. The theme and topic of hydroponics farming itself is one that transcends both sustainable development theory, as well as regenerative development. For this reason, sustainability aspects should be considered in the project. The subsequent sections summarize theory around sustainable project management, followed by the Green Project Management (GPM) P5 Standard, and some final comments on Regenerative Development.

2.3.3.1 Sustainable Project Management Definition

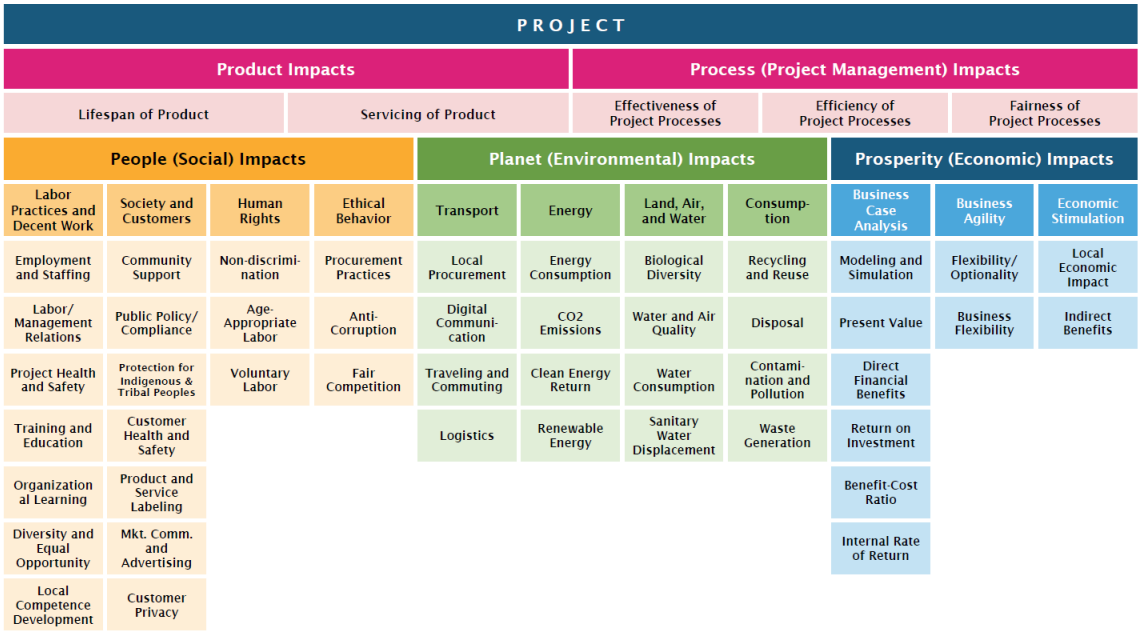
Before being able to understand what Sustainable Project Management is, it is first important to reflect back on what project management is in general. The *PMBOK® Guide* 6th edition defines project management as the "application of knowledge, skills, tools and techniques to project activities to meet the project requirements" (PMI, 2017, p.10). For ProjectManager.com (2022), project management is the discipline of planning, executing, and completing projects. Therefore, sustainable project management would also need to apply knowledge tools and techniques to meet project requirements; however, in this case, one can argue that it also includes sustainability requirements. Carboni (et al., 2018) defines sustainable project management as moving beyond the traditional focus of time, cost and scope, towards delivering the objectives in the business case. It is where projects adopt a sustainability ethos which does not come at the expense of the planet and its limited resources. In essence, it looks at the benefits, value and risk for the economic, environmental, social and purpose factors of a given project (Carboni et al., 2018). Furthermore, the theory also states that sustainable project managers are benefits focused, inclusive leaders, change agents, ethical, systematic, intentional, ambitious, collaborative and accountable. The project team under WeGrow Ltd. would emphasize such traits in staying true to its commitment of sustainability.

2.3.3.2 Green Project Management (GPM) P5 Standard for Sustainability

Subsequently, Green Project Management (GPM, 2019) has also defined the P5 Standard for Sustainability in Project Management. The main purpose of the P5 is to "identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation" (GPM, 2019, p.3). The P5 is not a methodology for how to create a sustainable project environment, but rather it is a set of principles and foundations. It is both a periodic table of elements for sustainability measures that should be considered in every project being a link between projects and the SDGs (Carboni et al., 2018). For this reason, this FGP takes the P5 ontology into consideration when analyzing the aspects of the Project Management Plan for the hydroponics farm in

Kings Park Belize City. The considerations of the P5 would help to ensure that the Project Management Plan is holistic in its approach minimizing negative impacts to sustainability which could affect the “WeGrow” brand that aims to foster a sense of community. The P5 stands for People, Planet, Prospertity, Process and Products and the elements and measures considered under each are summarized in **Figure 13** below.

Figure 13. The P5 Ontology



Note. Reprinted from *The P5 Standard for Sustainability in Project Management*. GPM, 2019 Figure 3, p. 3 Copyright 2019 by Green Project Management (GPM) Global. Permission not sought.

2.3.3.3 Regenerative Development Considerations

Finally, this FGP has incorporated a specific objective and a chapter related to sustainable development and regenerative development. Specific objective number 11 aims to create an analysis to describe and document how the sustainability aspects of the hydroponics farming project will be managed to balance economic, environmental and social responsibility. While Sustainable Development is defined as the “use of resources to improve society’s wellbeing in a way that does not destroy or undermine the support systems needed for future growth;” Regenerative

Development is defined as the “use of resources to improve society’s wellbeing in a way that builds the capacity of the support systems needed for future growth” (Gabel, 2015, p.1). Hence, Regenerative Development focuses on enhancing capacity and reversing humanity’s damage. Chapter 7 discusses some of these considerations including the six dimensions of Regenerative Development: Environmental, Social, Economic, Political, Cultural, and Spiritual (Muller, 2017).

3 METHODOLOGICAL FRAMEWORK

Having a methodological framework in place for this FGP research provided multiple benefits. Primarily, the methodological framework provided an outline of the standards and guidelines on how the research was conducted. It also supported the maximization of credibility in the work by establishing the way in which the research will be completed, including the types of sources, research methods, tools, assumptions and constraints, and deliverables that would need to be considered for successful project completion. According to PMI (2021), a method is a means for achieving an outcome, output, result, or project deliverable. For this reason, the methodological framework is critical as the means to the end, or in other words, the completion of this FGP. Overall, the framework helped to guide the research completed in delivering the Project Management Plan.

3.1 Information Sources

The methodological framework that was selected for the completion of this FGP project leveraged several information sources. Information sources are defined as a "person, thing, or place from which information comes, arises, or is obtained" (IGI Global, 2022, paragraph 2). In this manner, information can be obtained from various sources. It is important to note that project management is not exempt from the challenges that the world continues to face regarding credible sources of information. False or "fake" news continues to be a problem. For this reason, researchers often consult multiple types of sources. PMI (2017) also recommends the use of various sources of information to inform project decisions, particularly the use of lessons learned from previous projects. The University of Minnesota Crookston (2022) defines three different types of sources including primary, secondary, and tertiary. However, for this FGP, the two main sources that were used include primary and secondary sources discussed in the sections that follow. This is also since tertiary sources are simply an index, abstract, or organization of other reference materials such as dictionaries or encyclopedias. For the development of the Project Management Plan under this FGP, the focus remained on primary and secondary.

3.1.1 Primary Sources

Primary sources are records of events or evidence as they were first described or actually happened without any interpretation or commentary (University of Minnesota Crookston, 2022). It is information shown for the first time often displaying original thinking, reporting on new discoveries, or fresh information. Some examples include theses, dissertations, conference proceedings, original artworks, photographs, speeches, letters, memos, diaries, interviews, autobiographies and correspondence. The main primary sources that were used to achieve the objectives of this FGP include interviews, surveys, focus group meetings, conference proceedings, photographs, and correspondence with hydroponics stakeholders. Surveys and interviews were especially key as formal or informal approaches to obtain information from stakeholders by engaging them directly (PMI, 2017).

3.1.2 Secondary Sources

Subsequently, secondary sources are an analysis or restatement of primary sources often trying to describe or explain the sources further (University of Minnesota Crookston, 2022). Secondary sources tend to be works or publications that summarize, interpret, reorganize, or otherwise provide an added value to a primary source. Some examples include textbooks, edited works, books and articles, histories, biographies, literary criticism, reviews of laws and legislation, political analyses and other commentaries. The main secondary sources that were used to achieve the objectives of this FGP included the *PMBOK® Guide* 6th edition (PMI, 2017), books, textbooks, journals, articles and other commentaries on the topic of hydroponics farming in urban areas. While the *PMBOK® Guide* 7th edition was used to complement the Sixth, it is important to note that the methodology of application was primarily based on the Sixth edition under this FGP research.

Chart 1 below summarizes the primary and secondary information sources that were selected for this FGP research.

Chart 1. Information Sources

Objectives	Information Sources	
	Primary	**Secondary**
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	• Personal meetings and interviews with project sponsor. • Government stakeholder interviews on media. • Correspondences with public and private sector stakeholders.	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Conference Proceedings • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the	• Personal meetings with the project sponsor • Interviews • Community Surveys • Photographs of sample scope of works	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations.

Objectives	Information Sources	
	Primary	**Secondary**
construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.	• Correspondences	• Books • Academic Journals • Articles • Commentaries
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Conference Proceedings • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries

Objectives	Information Sources	
	Primary	**Secondary**
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	• Personal meetings with the project sponsor • Interviews • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban	• Personal meetings with the project sponsor • Interviews • Community Surveys • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations.

Objectives	Information Sources	
	Primary	**Secondary**
hydroponics farming project.		• Books • Academic Journals • Articles • Commentaries
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Conference Proceedings • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Conference Proceedings • Photographs of sample scope of works • Correspondences	• *PMBOK® Guide* 6th edition for methodology. • *PMBOK® Guide* 7th edition for analytical consultations. • Books • Academic Journals • Articles • Commentaries

Objectives	Information Sources	
	Primary	**Secondary**
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.	• Personal meetings with the project sponsor • Interviews • Community Surveys • Focus Group Meetings • Conference Proceedings • Photographs of sample scope of works • Correspondences	• UN Sustainable Development Goals • GPM Reference Guide on Sustainable Project Management • P5 Standard for Sustainability in Project Management • Regenerative Development Sources • Books • Academic Journals • Articles • Commentaries

Note. Own work.

3.2 Research Methods

In order to ensure that this FGP research was thoroughly completed, it was not only enough to ensure that credible sources were used. The research methods used to analyze and synthesize the data required to complete this Project Management Plan for an urban community-based hydroponics farm in Belize City was also critical to its completion. According to the *PMBOK® Guide* 7th edition, a method is a means for achieving an outcome, output, result, or project deliverable (PMI, 2021). However, the *PMBOK® Guide* 6th edition defines a methodology as a system of practices, techniques, procedures, and rules used by those who work in a discipline (PMI, 2017). Though a method is not the same as a methodology, the two definitions from PMI show that ultimately, it is a means or a system to achieve results. Subsequently, research methods can be defined as the tools for collecting data, formulating and

answering questions to reach conclusions through a systematic and theoretical analysis applied to some field of study (LifePersona, 2022). In this case, the field of study was Project Management under the topic area of hydroponics farming. Accordingly, there are several types of research methods. The nine (9) most common types include quantitative, qualitative, inductive, deductive, analytical, synthetic, scientific, and comparative. For the purposes of this FGP, the analytical-synthetic method was used which is to allow for the division of the whole Project Management Plan separated and studied apart (analysis) and thereafter brought together to formulate the final product (synthesis) (LifePersona, 2022). This analytic-synthetic method is further explained as follows.

3.2.1 Analytic-Synthetic Method

The analytic-synthetic method is a combination of two forms of research that are used to achieve formal objectives set. The analytical method is to decompose or disintegrate a whole into is constituent parts so that each part can be studied and analyzed individually determining the relationships between the parts and the whole (LifePersona, 2022). In the case of the FGP, this method was selected due to the research methodology itself being based on the ten (10) knowledge areas of the *PMBOK® Guide* 6th which forms the basis of the structure in this research including the five (5) process groups and forty-nine (49) processes itself (PMI, 2017). Hence, the parts will be studied under each knowledge area as a separate objective and subcomponent of Chapter 4. Next, the synthetic method is the reconstruction of the parts of a whole until the whole of the research is formed (LifePersona, 2022). Essentially, the synthesis goes from the abstract to the concrete which is where all the studied elements come together. For this FGP, all the parts come together in the form of the full Project Management Plan which is linked to the overall general objective of the FGP. For these reasons, the analytic-synthetic method was selected. **Chart 2** below summarizes the research methods selected for this FGP research.

Chart 2. Research Methods

Objectives	Research method(s)
	Analytic-Synthetic Method
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 1. The Project Charter itself was a synthesis of the integrated Project Management Plan; however, the individual sections were also analytically reviewed as separate parts of the whole.
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 2. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 3. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part

Objectives	Research method(s)
	Analytic-Synthetic Method
	of the reconstruction of the full Project Management Plan from its parts.
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 4. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 5. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 6. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part

Objectives	Research method(s)
	Analytic-Synthetic Method
	of the reconstruction of the full Project Management Plan from its parts.
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 7. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 8. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 9. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part

Objectives	Research method(s)
	Analytic-Synthetic Method
	of the reconstruction of the full Project Management Plan from its parts.
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 10. First, the analytical method was applied to review the section on its own. Subsequently, it was synthesized as a part of the reconstruction of the full Project Management Plan from its parts.
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.	The primary and secondary sources of information identified in Chart 1 above were systematically and carefully analyzed to obtain information that could support Objective 11. First, the analytical method was applied to review the section on its own. Since this section was unique, it was later synthesized as a separate section of the Project Management Plan still using the hybrid Analytic-Synthetic Method.

Note. Own work.

3.3 Tools

Tools used to complete this FGP were also critical to the research. The *PMBOK*® *Guide* 6th edition defines a tool as “something tangible, such as a template or software program, used in performing an activity to produce a product or result” (PMI, 2017, p.725). For PMI, the definition of project management itself is the application of knowledge, skills, tools and techniques to project activities to meet project

requirements. Hence, tools and techniques have been included in each of the forty-nine (49) processes by PMI across the ten (10) knowledge areas. However, the *PMBOK® Guides* 6th and 7th editions both agree that tailoring remains critical to select the tools (i.e. software or equipment) that the project team will use for the project (PMI, 2021). According to LifePersona (2022), research methods itself are also tools for collecting data, formulating, and answering questions to reach conclusions in a systematic way. Hence, the research methods established remained one of the main tools. The FGP also deployed several software tools including Microsoft Project, Word and Excel. Additionally, the templates recommended for each knowledge area, including those from GPM Global (2019) were used across each area. These templates included the FGP Template and FGP Charter Template in **Appendix 1**.

Chart 3 below summarizes the tools selected for this FGP research.

Chart 3. Tools

Objectives	Tools
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	• FGP Charter Template (Appendix 1) • Assumption Log Template • Focus Group Questions Format • Interview Questions Format • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be	• Scope Management Plan Template • Requirements Management Plan Template • Context Diagram Template • WBS Decomposition Format • Requirements Documentation Template

Objectives	Tools
defined, developed, monitored, controlled and validated to meet stakeholder requirements.	• Requirements Traceability Matrix Template • Scope Statement Template • WBS Template • Scope Baseline Guidelines • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.	• Schedule Management Plan Template • Decomposition Format • Activity, Attributes and Milestone List Format • Project Schedule Network Diagram Format • Schedule Estimating Guidelines • Duration and Basis of Estimates Template • Critical Path Method Template • Schedule Baseline Format • Project Calendar Template (Gantt Chart) • Schedule Forecast Template • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be	• Cost Management Plan Template • Cost Estimating Guidelines • Cost and Basis of Estimates Templates • Cost Baseline Format • Cost Forecast Template

Objectives	Tools
planned, structured, and controlled to complete the project within the available resources.	• Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	• Quality Management Plan Template • Quality Metrics Guidelines • Audit Templates • Quality Improvement Methods and Guidelines • Quality Report Template • Test and Evaluation Template • Inspection Template • Product Evaluation Template • Quality Control Measurement Guidelines • Deliverable Verification Template • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	• Resource Management Plan Template • Resource Estimating Guidelines • Resource Requirements Format • Resource Breakdown Structure Template • Basis of Estimates Template • Resource Calendar Template • Communication Technology Guide • Recognition and Rewards Guide • Team Performance Assessment Template

Objectives	Tools
	• Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	• Communications Management Plan Template • Communication Requirements Format • Communication Technology, Models, and Methods Guidelines • Project Reporting Templates • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.	• Risk Management Plan Template • Prompt List Template • Risk Register Template • Risk Report Template • Risk Categorization Guideline • Uncertainty Analysis Guideline • Risk Response Strategy Guides • Audit Templates • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project

Objectives	Tools
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.	• Procurement Management Plan Template • Source Selection Analysis Guideline • Bid Document Templates • Statement of Work Template • Procurement Guidelines • Advertising Guidelines • Agreements Templates • Claims Administration Guidelines • Audit Template • Inspection Template • Closed Procurements Template • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.	• Stakeholder Engagement Plan Template • Stakeholder Register Template • Stakeholder Matrix Formats • Ground Rule Guidelines • Focus Group and Interview Guidelines • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project
11. To develop an analysis which determines whether the implementation of the	• General Sustainability Analysis Template • Sustainability Management Plan Template • P5 Impact Analysis Template

Objectives	Tools
urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.	• Regenerative Development Guidelines • Sustainable Development Guidelines • Data Analysis Templates and Guides • Lessons Learned Register Template • Change Requests Template • Change Log Template • Microsoft Word, Excel, and Project

Note. Own work.

3.4 Assumptions and Constraints

In order to ensure that the FGP was successful, it considered the main assumptions and constraints for each specific objective. According to PMI (2017), an assumption is a factor in the planning process that is considered to be true, real, or certain, without proof or demonstration; while a constraint is a limiting factor that affects the execution of a project, program, portfolio or process. Both assumptions and constraints are logged in a project document called the assumption log throughout the project life cycle. The project constraints that typically form restrictions that limit a project often include scope, time and cost which are often referred to as the 'iron triangle.' Beyond this; however, quality, resources and risks are also key constraints (Kissflow, 2022). For this FGP research, several assumptions and constraints were considered. The assumptions were primarily based on data and information needs, case study availability, Sponsor commitment, software availability and researcher dedication. The constraints were based on time, scope, resources, and a lack of success cases. The overall assumptions and constraints for the FGP are listed below. Subsequently, **Chart 4** summarizes the assumptions and constraints that were applicable to each specific objective under this FGP research.

Assumptions:

1. It is assumed that the relevant research data and information to complete each specific objective of the FGP is readily available and accessible in Belize.
2. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required for the FGP completion.
3. It is assumed that the Sponsor will remain committed and provide necessary information throughout the development of the FGP.
4. It is assumed that the relevant project management software, such as Microsoft Project among others, will be accessible to the researcher for the development of the FGP.
5. It is assumed that the researcher will dedicate a minimum of 15 hours per week to develop the FGP within the allocated schedule for completion.

Constraints:

1. Fixed time available to complete the FGP set at 12 weeks.
2. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives.
3. Constrained financial resources based on available budget of the researcher (the student) at the time of expenses incurred during the FGP
4. The template provided to complete the FGP Project Management Plan restricts the scope of work within the chapters indicated.
5. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.

Chart 4. Assumptions and Constraints

Objectives	Assumptions	Constraints
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Project Charter. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.

Objectives	Assumptions	Constraints
	background information required	
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Scope Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks.

Objectives	Assumptions	Constraints
construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.	approve the Schedule Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Cost Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Constrained financial resources based on available budget of the researcher (the student) at the

Objectives	Assumptions	Constraints
	Belize will be receptive to share background information required	time of expenses incurred during the FGP Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Quality Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
6. To create a Resource Management Plan to	It is assumed that the relevant research data and information	Template provided to complete the FGP Project Management Plan restricts the scope of work.

Objectives	Assumptions	Constraints
establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Resource Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Constrained financial resources based on available budget of the researcher (the student) at the time of expenses incurred during the FGP Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Communications Management Plan.	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required

Objectives	Assumptions	Constraints
	It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Risk Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.

Objectives	Assumptions	Constraints
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Procurement Management Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Constrained financial resources based on available budget of the researcher (the student) at the time of expenses incurred during the FGP Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to	Template provided to complete the FGP Project Management Plan restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks.

Objectives	Assumptions	Constraints
stakeholders in decision making and execution of the urban hydroponics farming project.	approve the Stakeholder Engagement Plan. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required	Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability	It is assumed that the relevant research data and information is readily available and accessible. It is assumed that the Sponsor will remain committed to approve the Sustainability Analysis. It is assumed that the relevant project management software, will be accessible. It is assumed that other successful cases of hydroponics farming projects in	Template used to complete the Sustainability Analysis restricts the scope of work. Fixed time available to complete the FGP set at 12 weeks. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives. Constrained financial resources based on available budget of the researcher (the student) at the

Objectives	Assumptions	Constraints
considerations under the project.	Belize will be receptive to share background information required	time of expenses incurred during the FGP Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.

Note. Own work

3.5 Deliverables

A major focus of the FGP was also to ensure that all deliverables were completed successfully. A deliverable is defined as “any unique and verifiable product, result, or capability to perform a service that is required to be produced” (PMI, 2017, p.704). This definition transcends the same across the *PMBOK® Guides* 6th and 7th editions (PMI, 2021). A deliverable varies across projects and can be anything as large as a house constructed, a website, a product, an app, training, or even documentation created. All projects, even this FGP, have deliverables and turning over the deliverables to a client often indicates project completion. According to Kissflow (2022), a project deliverable is any specific output that’s a result of deliberate work done during the project and deliverables can be internal, external or planning deliverables. In the case of this FGP which aimed to create a Project Management Plan for an urban hydroponics farming project in Belize City, the deliverables were classified as planning deliverables. Based on the definitions, the deliverables under this FGP included the specific outputs under each specific objective. In this case, the final and complete deliverable itself was the Project Management Plan which encompassed a total of eleven deliverables linked to each Specific Objectives.

Chart 5 below summarizes the deliverables targeted for this FGP research.

Chart 5. Deliverables

Objectives	Deliverables
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	Project Charter including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Project Charter 2. Integrated Change Control Process
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.	Scope Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Scope Management Approach 2. Project Scope Statement 3. Project Requirements and Acceptance Criteria 4. Work Breakdown Structure (WBS) 5. Scope Validation 6. Scope Control
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.	Schedule Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Schedule Management Approach

Objectives	Deliverables
	2. Activity List 3. Project Schedule 4. Schedule Control
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.	Cost Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Cost Management Approach 2. Project Cost Estimate 3. Project Budget 4. Cost Control
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	Quality Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Quality Management Approach 2. Quality Assurance 3. Quality Control
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	Resource Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Resource Management Approach

Objectives	Deliverables
	2. Resource Estimates 3. Resource Acquisition 4. Team Development 5. Team Management 6. Resource Control
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	Communications Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Communications Management Approach 2. Communications Management 3. Monitoring Communications
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.	Risk Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Risk Management Approach 2. Risk Identification 3. Qualitative Risk Analysis 4. Risk Response Planning and Implementation 5. Risk Monitoring and Control
9. To create a Procurement Management Plan to establish how external goods and services will be	Procurement Management Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th

Objectives	Deliverables
acquired through procurement processes under the urban hydroponics farming project.	edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Procurement Management Approach 2. Conduct Procurement 3. Procurement Control
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.	Stakeholder Engagement Plan including the relevant sub-components as recommended by *PMBOK® Guide* 6th edition tailored to the context of the project (PMI, 2017). Specific sub-components include: 1. Stakeholder Engagement Approach 2. Identify Stakeholders 3. Manage Stakeholder Engagement 4. Monitor Stakeholder Engagement
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.	Sustainability Analysis including the relevant sub-components as recommended by the P5 Standard for Sustainability in Project Management (GPM, 2019) and the GPM Reference Guide on Sustainable Project Management (Carboni et al., 2018) tailored to the context of the project (PMI, 2017). Specific sub-components include:

Objectives	Deliverables
	1. SDG Analysis 2. GPM Global's P5 Sustainability Analysis 3. Regenerative Development Analysis

Note. Own work.

4 RESULTS

4.1. Integrated Project Management Plan – Project Charter

INTEGRATED PROJECT MANAGEMENT PLAN – PROJECT CHARTER
WeGrow Ltd. Urban Community-Based Hydroponics Farm

TABLE OF CONTENTS

4.1.1 Introduction

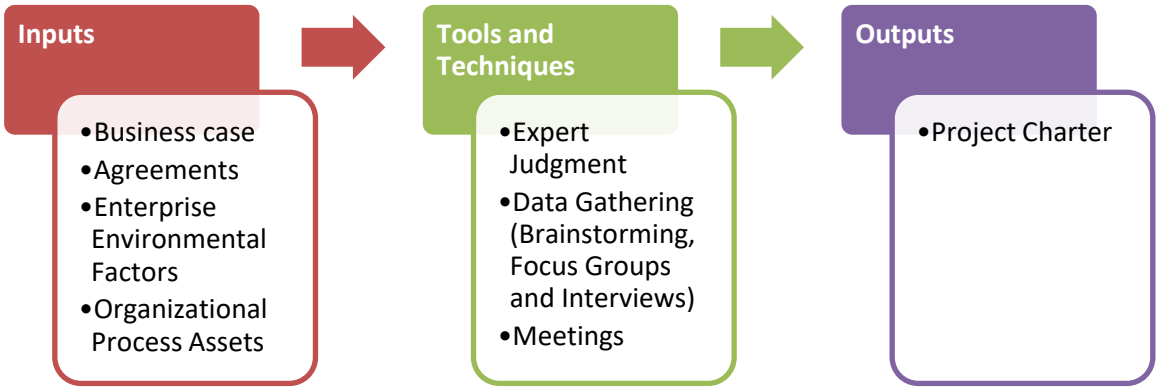
Project Integration Management includes the processes and activities to identify, define, combine, unify and coordinate the various processes and project management activities within the Project Management Process Groups (PMI, 2017). One of the primary outputs under the first process group is to develop the Project Charter which is the main output of this section of the Project Management Plan for WeGrow Ltd.'s urban community-based hydroponics farming project in Belize City. The Project Charter formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities. The Project Charter also provides a direct link between the project and the strategic objectives of the organization creating a formal project record. The main subsections that follow include the Project Charter's development, as well as the Integrated Change Management Process.

4.1.2 Project Charter Development

The Project Charter formally authorizes the existence of this project (PMI, 2017). Several inputs as well as tools and techniques will be used in developing the Project Charter output for WeGrow Ltd.'s urban community-based hydroponics farm as shown in **Figure 14** below. A key input is the business case which supports the justification for the investment in the project considering market demand and social

needs. Agreements with the project sponsor on defining the project, as well as stakeholders in the community, will also be considered. The Enterprise Environmental Factors (EEFs) primarily entail government industry standards, legal regulatory requirements, marketplace conditions and stakeholder expectations. Key Organizational Process Assets (OPAs) also include organizational standards, policies, processes and procedures, templates, governance frameworks and historical information from previous projects. The main tools used include expert judgement, as well as brainstorming, focus groups and interviews with key stakeholders facilitated through meetings to support data gathering. This process supports the development of the Project Charter output as shown in **Chart 6**. The Charter includes several key sections that define the project's parameters including its objectives, the business case, assumptions, constraints, preliminary risks, budget, milestones, and stakeholders. The Charter will be signed by the Project Manager and Project Sponsor to formally authorize the project.

Figure 14. Project Charter Development



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 4-2, p. 75 Copyright 2017 by PMI, Inc. Permission not sought.

Chart 6. Project Charter - WeGrow Ltd. Urban Community-Based Hydroponics Farm

<table>
<tr><td colspan="2">  </td></tr>
<tr><th colspan="2">Project Charter</th></tr>
<tr><th>Project Name:</th><th>Date:</th></tr>
<tr><td>We Grow Ltd. Urban Community-Based Hydroponics Farm</td><td>September 19, 2022</td></tr>
<tr><th>Knowledge Areas /PM Processes:</th><th>Application Area (Sector / Activity):</th></tr>
<tr><td>Knowledge Areas:
Integration Management
Scope Management
Schedule Management
Cost Management
Quality Management
Resource Management
Communication Management
Risk Management
Procurement Management
Stakeholder Management
Process Groups:
Project Initiation
Project Planning</td><td>Urban Agriculture / Hydroponics</td></tr>
<tr><th>Project Start Date:</th><th>Project Finish Date:</th></tr>
<tr><td>January 1, 2023</td><td>June 30, 2023</td></tr>
<tr><th colspan="2">Project Objectives</th></tr>
<tr><td colspan="2">General Objective:
To construct the first urban community-based hydroponics farm under the social enterprise WeGrow Ltd. by June 2023 within the King’s Park residential community</td></tr>
</table>

in Belize City, Belize located at 3 Corner Hopkins and First Street on the rooftop meeting the nationally required quality standards and certifications in order to promote sustainable urban farming in Belize City while supporting national food security efforts at the community level.

Specific Objectives:

1. To develop and deploy a community-based project management plan for the urban hydroponics farm targeting 60% community participation by June 30, 2023.
2. To build a fully functional 20ft x 20ft urban rooftop hydroponics farm by June 30, 2023 within the allocated project budget of BZD $200,000 using sustainable and environmentally friendly materials where possible in order to promote sustainable urban farming in Belize City while supporting national food security efforts at the community level.
3. To obtain all local building, labor, and environmental permits in ensuring that the hydroponics farm meets all nationally required quality standards and certifications by June 30, 2023.

Business Case:

One of the major issues facing the world today is that of sustainability and food security in a context where several planetary boundaries are pushed. The world's natural resources continue to deplete requiring new and innovative approaches to projects that contribute to sustainable and regenerative development. Urbanization is also a major challenge since cities are projected to take on an additional 2.2 billion people by 2050 (UN-HABITAT, 2022). This places additional pressures on food systems within cities. In Belize, 28% of the population experiences moderate or severe food insecurity, while 9% experience severe food insecurity going an entire day without eating (Stevenson et al., 2021).

This project targets some of these issues through its innovative solution of an urban community-based hydroponics farming solution in Belize City. Despite high capital costs, hydroponics or soilless agricultural farming is noted to have several

benefits including being climate smart, with high yields, using no soil, with no pests or diseases, using 90% less water, and requiring less land being ideal for crowded cities (Nerantzis et al., 2018; Gumisiriza et al., 2022). WeGrow Ltd. is the newly formed family-owned social enterprise proposed to implement the construction of the urban community-based hydroponics farm in Belize City.

Description of Product(s) or Service(s) to be Generated by the Project:

Construction of a 20 ft x 20 ft urban community-based hydroponics farm on the rooftop of the three-story building located at 3 Corner Hopkins and First Street in Belize City which meets nationally required quality standards and certifications, and which includes a Community-based Project Management Plan.

Assumptions:

1. It is assumed that there will be favorable weather conditions
2. It is assumed that all materials will be available without delays.
3. It is assumed that six (6) months will suffice to complete the project
4. It is assumed that all permits will be obtained and approved.
5. It is assumed that there will be no significant change requests or scope creep from the project sponsor.

Constraints:

1. The project must be completed within the fixed budget of BZD $200,000.
2. The project must be completed within the fixed schedule of six (6) months.
3. The availability and cost of construction materials affected by supply chain disruptions due to the war in Ukraine and the COVID-19 pandemic.
4. Site work is limited from 8:00 A.M. to 6:00 P.M.

Preliminary Risks:

1. If the residents of King's Park in Belize City do not buy-in to the project, the community-based aspect of the project's scope may need to be adjusted.
2. If there is an extreme natural disaster such as a hurricane, the construction site might become unavailable causing delays and additional costs.
3. If there is a COVID-19 outbreak on the construction site, construction might be halted impacting the project with delays and additional costs.

4. If there are delays in the shipment of required construction materials, the project schedule and costs would be impacted.

Budget:

The total project budget is BZD $216,300.00

Total Cost of Deliverables	BZD $200,000.00
Contingency (5%)	BZD $10,000.00
Total Cost Baseline	BZD $210,000.00
Management Reserve (3%)	BZD $6,300.00
Total Project Budget	**BZD $216,300.00**

Milestones and Dates

Milestone:	**Start Date:**	**End Date:**
Project Start	January 1, 2023	January 1, 2023
Community Agreement Signed	January 8, 2023	January 31, 2023
Post-Training Evaluation Report	February 1, 2023	February 28, 2023
Approved Construction Permit	February 1, 2023	February 28, 2023
Approved Environmental Clearance	January 15, 2023	February 28, 2023
Approved Labor Permit	February 19, 2023	February 28, 2023
Construction Completion Report	March 1, 2023	May 31, 2023
Quality Test Results and Audit Report	March 31, 2023	June 1, 2023
Quality Standards Certification	May 22, 2023	June 15, 2023
Project Completion Report	January 1, 2023	June 30, 2023
Project End	June 30, 2023	June 30, 2023

Stakeholders:

Direct Stakeholders:	**Indirect Stakeholders:**
1. Project Sponsor (Ranjit Balani) 2. Project Manager (Hero Balani) 3. Project Team 4. Project Steering Committee 5. WeGrow Ltd. Shareholders 6. Contractors	1. Suppliers **Government Authorities:** 2. Central Building Authority 3. Department of Environment 4. Belize Agricultural Health Authority

7. Community Members (Residents of Kings Park Belize City)	5. Labor Department 6. Belize City Council 7. Ministry of Agriculture, Food Security and Enterprise 8. Belize Marketing and Development Corporation 9. Belize Bureau of Standards
Approval:	
Project Manager: Hero Balani	Signature:
Authorized by: Ranjit Balani	Signature:

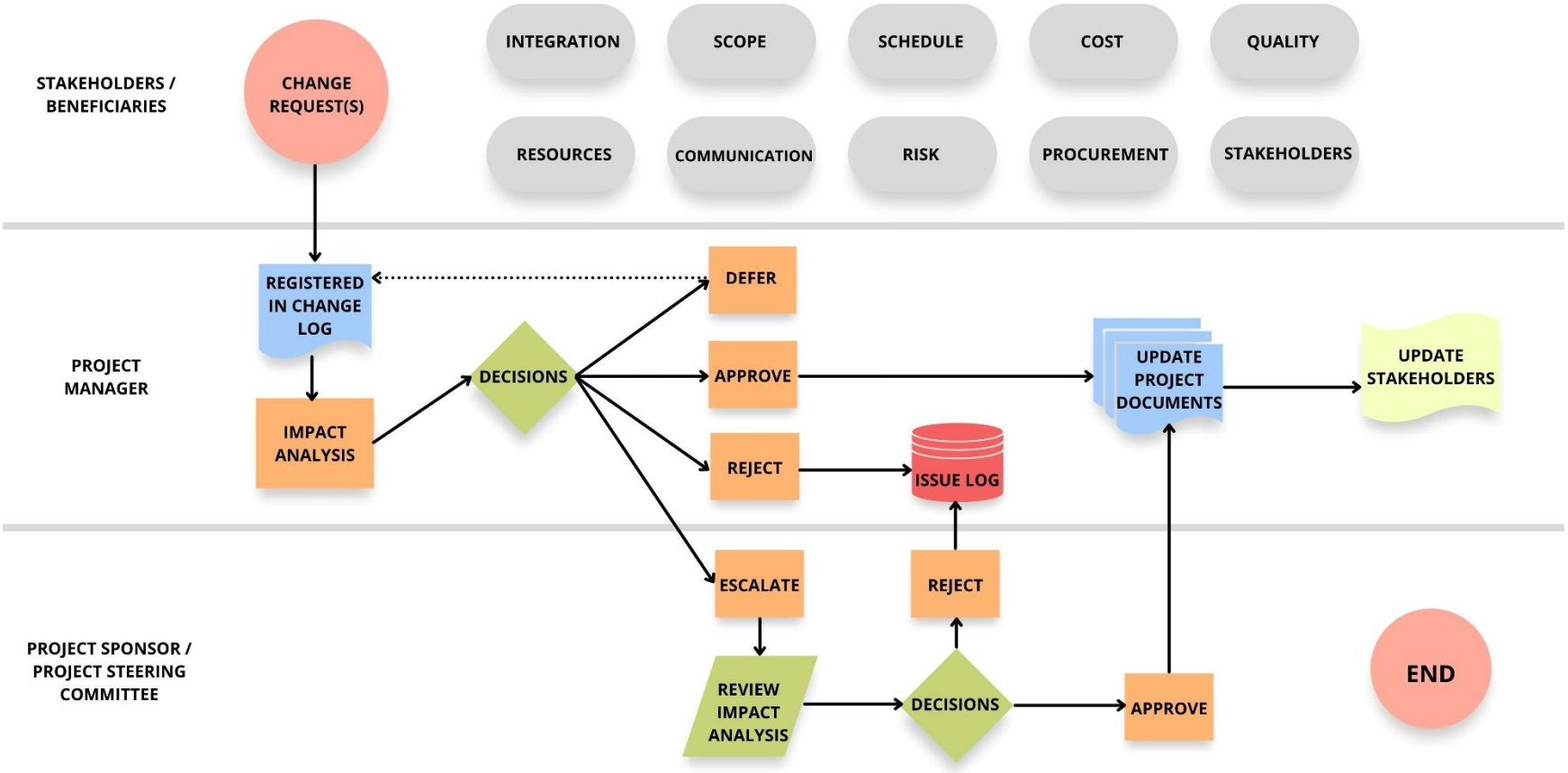
Note. Own work.

4.1.3 Integrated Change Control Process

Any change request made to the Project Charter would follow the integrated change control process. This integrated change control process will be applied across all areas of the project as the process of reviewing all change requests, approving changes and managing changes to deliverables, project documents, and the project management plan; and communicating the decisions (PMI, 2017). The integrated change control process to be followed is outlined in **Figure 15** below. Change requests can originate from any project team member or stakeholder. All change requests would need to be submitted to the Project Manager using the Project Change Request Form in **Chart 7**. Each change request would first be recorded in the Change Log. Based on the level of priority as high, medium, or low, the Project Manager would analyze the change request to either approve, defer, reject, or escalate the request. If the change request is of high priority and would have a major impact on the project, the Project Manager would escalate the request to the Project Sponsor as the Chair of the Project Steering Committee (PSC).

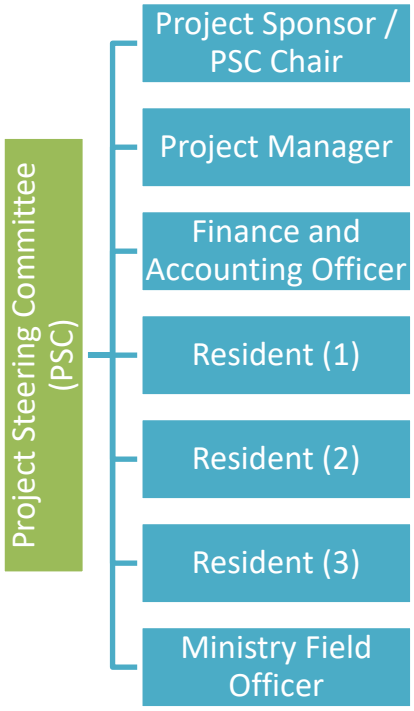
The seven (7) member PSC would comprise of the Project Sponsor as the Chair (1), the Project Manager (1), the Finance and Accounting Officer (1) as well as three (3) members from the Kings Park residential community in Belize City who remain ultimate beneficiaries of the project. The respective Field Officer (1) for the Belize District from the Ministry of Agriculture, Food Security and Enterprise would also be a member of the PSC. The PSC composition is summarized in **Figure 16** below. Once a change request is approved by the Project Manager or the Project Sponsor on behalf of the PSC depending on the level of impact on the project, the respective project documents would be updated, and all stakeholders would be updated of the approved changes. The Project Management Plan would also be updated including the respective version control for any project documents amended. The Change Log would also be updated, and any rejected changes would be logged in the Issue Log.

Figure 15. Integrated Change Management Process



Note. Own work.

Figure 16. WeGrow Ltd. Project Steering Committee (PSC) Composition



Note. Own work.

Chart 7. Integrated Project Change Request Form

Integrated Project Change Request Form	
Submission Details	
Project Name:	We Grow Ltd. Urban Community-Based Hydroponics Farm
Submitted By:	
Date Submitted:	
Priority Level: (select only one)	☐ Low ☐ Medium ☐ High

WBS Code: (where applicable)		
Type of Change Request: (select all that apply)	☐ Integration ☐ Scope ☐ Schedule ☐ Cost ☐ Quality	☐ Resources ☐ Communication ☐ Risk ☐ Procurement ☐ Stakeholders
Change Request Details		
Description:		
Justification:		
Impacts of the Change:		
Alternatives Analysis:		
Project Manager Decision		
Decision:	☐ Defer ☐ Approve	☐ Reject ☐ Escalate
Reason for Decision:		
Date:		
Project Manager: Hero Balani	Signature:	

Project Sponsor / PSC Decision	
Applicable only if escalated	
Decision:	☐ Reject ☐ Approve
Reason for Decision:	
Date:	
Project Sponsor: Ranjit Balani (for) PSC	Signature:

Note. Own work.

4.2. Scope Management Plan

SCOPE MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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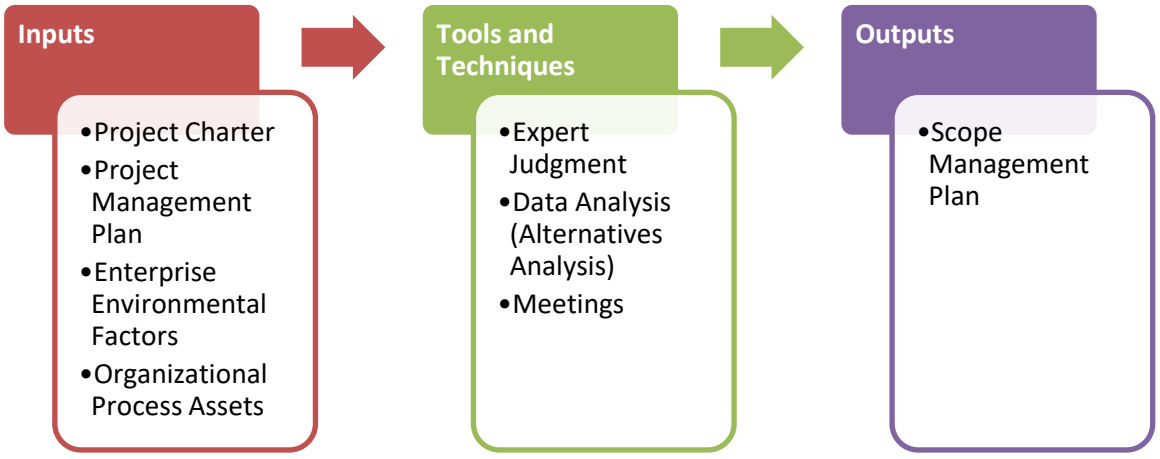
4.2.1 Introduction

Project Scope Management includes the processes required to ensure that the project includes all the required, and only the work required, to complete the project successfully (PMI, 2017). The Plan Scope Management process creates the Scope Management Plan that documents how the project scope will be defined, validated and controlled. Managing the scope for the WeGrow Ltd. urban community-based hydroponics farming project is critical to ensure that project work is managed to deliver on the required results. The inputs, as well as tools and techniques that will be used to reach the output of the Scope Management Plan are shown in **Figure 17**. A key input is the Project Charter which defines the authorized project scope. The EEFs considered include infrastructure, marketplace conditions and organizational culture. The OPAs considered are mainly organizational policies and procedures, including historical information from previous projects. To obtain information needed to develop the Scope Management Plan, expert judgement, data analysis and meetings with key stakeholders will be used. This process supports the development of the Scope Management Plan including the Scope Management Approach, Project Scope Statement, Project Requirements and Acceptance Criteria, Work Breakdown Structure, Scope Validation and Scope Control.

Figure 17. Plan Scope Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 5-2, p. 134 Copyright 2017 by PMI, Inc. Permission not sought.

4.2.2 Scope Management Approach

For the WeGrow Ltd. urban community-based hydroponics farming project, scope management will be the responsibility of the Project Manager. The Project Manager would be supported in managing the project's scope by the Project Team, Project Sponsor, and Project Steering Committee (PSC). The Scope Management Plan will be structured to include the project scope statement, the Work Breakdown Structure (WBS), the scope baseline, and acceptance requirements. The approach will ensure that the scope baseline is maintained specifying the process for the acceptance of project deliverables based on the scope checklists and requirements established. Any changes to the scope received from stakeholders or other parties would undergo the Integrated Change Control Process established in Section 4.1.3 following the process established in **Figure 15** using the change request form established in **Chart 7.** Any changes to the established project scope would be managed to ensure that the agreed requirements with stakeholders are not deviated from significantly.

4.2.2.1 Roles and Responsibilities

Ultimately, the Project Sponsor, acting on behalf of the Project Steering Committee (PSC) would be responsible for the acceptance and approval of the final project deliverables. The Project Manager plays a key role in ensuring adherence to the Scope Management Plan by the Project Team who remain the main implementors. In ensuring the clarity on the roles related to scope management, **Chart 8** elaborates the respective roles and responsibilities for WeGrow Ltd.'s project.

Chart 8. Scope Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Review and analyze scope change requests • Approve / reject escalated scope change requests • Convey project deliverable updates to the PSC • Approve project deliverables on behalf of the PSC • Tracks project progress based on scope baseline
Project Steering Committee	• Support Project Sponsor and Project Manager in the review of escalated scope change requests. • Review and approve project deliverables
Project Manager	• Review and analyze scope change requests • Defer / reject / approve / escalate scope change requests • Evaluate the need for scope changes • Communicate outcomes of scope change requests • Update project documents with scope changes • Monitor compliance with the Scope Management Plan • Review deliverables by requirements and acceptance criteria • Monitor and report on project's performance based on established scope baseline
Project Team	• Elaborate the need for scope changes • Participate in the implementation of scope changes • Ensure compliance with the Scope Management Plan

	• Review deliverables by requirements and acceptance criteria • Communicate risks and challenges to the Project Manager

Note. Own work.

4.2.3 Project Scope Statement

The project scope statement is the description of the project scope, major deliverables, assumptions and constraints (PMI, 2017). The statement also includes explicit scope exclusions to support the management of stakeholder expectations. It is also key to note that the Scope Baseline is the approved version of the scope statement, Work Breakdown Structure (WBS) and WBS Dictionary described in subsequent sections. **Chart 9** presents a project scope statement for WeGrow Ltd.'s urban community-based hydroponics farming project.

Chart 9. WeGrow Ltd. Project Scope Statement

Project Scope Statement	
Project Details	
Project Name:	We Grow Ltd. Urban Community-Based Hydroponics Farm
Budget:	BZD $200,000.00
Duration:	6 months (January 1, 2023 – June 30, 2023)
Scope Definition	
Scope Description:	The project's scope includes the construction of a 20 ft x 20 ft urban community-based hydroponics farm on the rooftop of the three-story building located at 3 Corner Hopkins and First Street in Belize City which meets nationally required quality standards and certifications, and which includes a Community-based Project Management Plan.

Project Deliverables:	The project deliverables include: 1. Community-based Project Management Plan 2. 20 ft x 20 ft Functional Hydroponics Farm 3. Quality Standards Certification
Scope Exclusions:	The project's scope does not include: 1. Planting of Seedlings for Production 2. Pricing, Packaging and Marketing of Produce 3. Training of Stakeholders Outside the Community
Acceptance Criteria: (General)	The project's deliverables will be accepted when: 1. All the outlined deliverables are completed according to the requirements and acceptance criteria established by the project sponsor and stakeholders within the Scope Management Plan. 2. All the outlined deliverables are signed off as approved by the Project Sponsor and Project Steering Committee.
Assumptions and Constraints	
Assumptions:	1. That there will be favorable weather conditions 2. That all materials will be available without delays. 3. That six (6) months will suffice to complete the project 4. That all permits will be obtained and approved. 5. That there will be no significant change requests or scope creep from the project sponsor.
Constraints:	1. The project must be completed within the fixed budget of BZD $200,000. 2. The project must be completed within the fixed schedule of six (6) months. 3. The availability and cost of construction materials affected by supply chain disruptions due to the war in Ukraine and the COVID-19 pandemic.

	4. Site work is limited only between 8:00 A.M. to 6:00 P.M with access available 7 days a week.
Scope Statement Approval	
Approval Date:	
Project Manager: Hero Balani	Signature:
Project Sponsor: Ranjit Balani (for) PSC	Signature:

Note. Own work.

4.2.4 Project Requirements and Acceptance Criteria

Collecting project requirements is the process of determining, documenting, and managing stakeholder needs and requirements to meet objectives (PMI, 2017). In the case of the WeGrow Ltd. urban community-based hydroponics farm, the key stakeholders to be consulted include the residents of the Kings Park Area community to determine the requirements for each deliverable. The community members remain the key beneficiaries that help to define the requirements and acceptance criteria. For this reason, the PSC would include three members from the community in representing the requirements shared in the deliverable acceptance process. Data on requirements and acceptance criteria would also be gathered through meetings, interviews, focus groups, surveys, and conferences.

4.2.4.1 Requirements and Acceptance Criteria

Requirements refer to the conditions or capabilities that are necessary in the deliverable to satisfy the business need, while the acceptance criteria refer to the set of conditions required to be met before deliverables are accepted (PMI, 2017). **Chart 10** below summarizes the general requirements and acceptance criteria for the project based on stakeholder consultations. Considerations would also be given, not only to stakeholder requirements, but also to business requirements, functional and non-functional requirements, project requirements and quality requirements.

Chart 10. WeGrow Ltd. Requirements and Acceptance Criteria

Requirements and Acceptance Criteria		
Deliverable	**Requirements Collected**	**Acceptance Criteria**
Community - Based Project Management	• Written in simple English • Easy to read and available digitally and hardcopy • Uses graphics and process flows for readability • Project Management Plan should encompass all knowledge areas from PMI • Community is sensitized	• Use of English language • Digital and hardcopy formats with graphics and process flows • Project Management Plan includes 10 knowledge areas • At least 60% community participation in training
Hydroponics Farm Construction	• Farm must cover 20 ft x 20 ft • Farm must be functional • Materials used should be sustainable where possible • Farm must be operational by June 30, 2022 within budget • Secure location that is easily accessible by community • Signage is clearly visible	• Farm measures 20 ft x 20 ft on the rooftop • Farm passes tests for full functionality • At least 50% of materials sourced are sustainable • Farm is secure and accessible with signage
Quality Standards Certification	• Farm must be built according to approved plans • Contractor must comply with labor, environmental and building regulations • All approved certificates and permits are kept on site • All materials used meet minimum quality standards	• Permits and certificates are approved and signed by authorities • Project complies with labor, environmental and building regulations • Approvals kept on site • Materials and farm pass quality standard tests

Note. Own work.

4.2.4.2 Requirements Traceability Matrix

A Requirements Traceability Matrix is also another tool that would be deployed in managing requirements under the WeGrow Ltd. project. The Matrix helps to link requirements from the origin to the deliverables that satisfy them providing a means to track requirements in managing the scope throughout the project life cycle (PMI, 2017). In prioritizing requirements submitted by stakeholders for the project, a simple prioritization scale of grouping would be utilized. This prioritization supports the determination of the acceptance criteria. The scale categorizes the priority of each requirement as high, medium or low as defined below:

1. **High** – Critical requirements required for the project's success
2. **Medium** – Requirements that support project operations critical to success
3. **Low** – Requirements that are desirable if time and resources permit

Chart 11 presents the Requirements Traceability Matrix for the WeGrow Ltd. urban community-based hydroponics farming project based on stakeholder feedback.

Chart 11. WeGrow Ltd. Requirements Traceability Matrix

ID	WBS ID	WBS Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Requested by: (Stakeholder)	Priority Level
1	1	WeGrow Ltd. Urban Community - Based Hydroponics Farm Project in Belize City, Belize	Project is completed within scope, time and budget meeting stakeholder requirements	To ensure the project is completed successfully with satisfied community stakeholders	Project Sponsor	High
2	1.1	Community - Based Project Management	Project is completed within scope, time and budget with active community participation	To ensure efficient and effective project management with community buy-in	Project Sponsor	High
3	1.1.1	Stakeholder Consultations	Community is sensitized	To ensure at least 60% community buy-in and participation in the project	Project Sponsor	High
4	1.1.1.1	Consultation Report	Written in simple English, is easy to read and available digitally and in hard copy	To provide a readable summary of the consultations completed	Community Members	Medium
5	1.1.1.2	Community Agreement	Written in simple English, is easy to read and available digitally and in hard copy	To provide a readable summary of the community-based agreement	Community Members	High
6	1.1.2	Project Management Plan	Project Management Plan includes all knowledge areas from PMI	To ensure that all 10 knowledge areas under PMI are covered within the Project Management Plan including integration management, scope, schedule, cost, quality, resources, communication, risk, procurement and stakeholders	Project Manager	High

ID	WBS ID	WBS Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Requested by: (Stakeholder)	Priority Level
7	1.1.2.1	Administration	Written in simple English, is easy to read and available digitally and in hard copy	To ensure the project is effectively administered in meeting its objectives	Project Manager	Medium
8	1.1.2.2	Procurement	Written in simple English, is easy to read and available digitally and in hard copy	To ensure that the firm's procurement policies and guidelines are followed including sustainable sourcing	Project Manager	High
9	1.1.2.3	Monitoring and Evaluation	Written in simple English, is easy to read and available digitally and in hard copy	To provide the framework for monitoring and evaluation of the project's results	Project Manager	Medium
10	1.1.3	Community Management Plan	Community is sensitized and the plan is written in simple English, being easy to read and available digitally and in hard copy	To ensure at least 60% community buy-in and participation in the project's community-based model	Project Sponsor	High
11	1.1.3.1	Training Materials	Uses graphics and process flows for readability	To guarantee an understanding by participating community members	Community Members	Low
12	1.1.3.2	Community Training	Community is sensitized	To allow for at least 60% community participation and buy-in to the project	Project Sponsor	High
13	1.2	Hydroponics Farm Construction	Farm must be fully functional covering 20 ft x 20 ft being operational on time and within budget in a secure, accessible location with clear signage	To ensure that farm is fully functional and completed according to stakeholder requirements	Project Sponsor	High

ID	WBS ID	WBS Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Requested by: (Stakeholder)	Priority Level
14	1.2.1	Materials Acquisition	Materials should be sustainable where possible	To ensure that sustainable sourcing is practiced for at least 50% of the materials sourced	Community Members	Medium
15	1.2.1.1	Construction Materials	Materials should be sustainable where possible	To ensure that sustainable sourcing is practiced for at least 50% of the materials sourced	Community Members	Medium
16	1.2.1.2	Nutrients Solution and Seedlings	Materials should be sustainable where possible	To ensure that sustainable sourcing is practiced for at least 50% of the materials sourced	Community Members	Medium
17	1.2.2	Site Preparation	Secure location that is easily accessible by community	To ensure 100% safety and security of contractors and community	Contractor	Medium
18	1.2.3	Construction	Farm must be operational by June 30, 2022 within budget	To maintain the construction schedule established within budget	Project Manager	High
19	1.2.3.1	PVC Pipeline Framework	Farm must cover 20 ft x 20 ft and be fully functional	To meet the project sponsor's size and functional requirements	Project Sponsor	High
20	1.2.3.2	Motor Installation	Farm must be fully functional	To ensure functionality of the farm	Project Sponsor	High
21	1.2.3.3	Greenhouse Roofing	Farm must cover 20 ft x 20 ft and be fully functional	To ensure functionality of the farm	Project Sponsor	Medium
22	1.2.3.4	Signage	Signage is clearly visible	To allow community members to understand the sections of the farm	Community Members	Low
23	1.2.3.5	Finishing Works	Farm must be operational by June 30, 2022 within budget	To maintain the construction schedule established within budget	Project Manager	Medium

ID	WBS ID	WBS Deliverable	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Requested by: (Stakeholder)	Priority Level
24	1.3	Quality Standards Certification	Farm must be built according to approved plans in compliance with labor, environmental and building regulations meeting minimum quality standards	To ensure that the farm is fully functional and is built according to national standards meeting all required permits and regulations	Project Sponsor	High
25	1.3.1	Permits and Approvals	All approved certificates and permits are kept on site	To ensure visibility of all approvals for compliance purposes	Contractor	High
26	1.3.1.1	Construction Permits	Compliance with construction regulations	To ensure that the farm meets local building regulations and codes	Contractor	High
27	1.3.1.2	Environmental Permits	Compliance with environmental regulations	To ensure that the farm obtains environmental clearance	Contractor	High
28	1.3.1.3	Labor Permits	Compliance with labor regulations	To ensure that the labor practices comply with employment regulations	Contractor	Medium
29	1.3.2	Quality Testing	Materials used meet minimum quality standards and farm is build according to plans	To ensure that the farm can meet the minimum quality standards and functional testing requirements	Project Sponsor	High
30	1.3.2.1	Inspections	All materials used meet minimum quality standards	To allow for quality assurance of materials through inspections	Project Sponsor	High
31	1.3.2.2	Standards Certification	All materials used meet minimum quality standards	To allow for the farm to meet national minimum quality standards	Project Sponsor	High

Note. Own work.

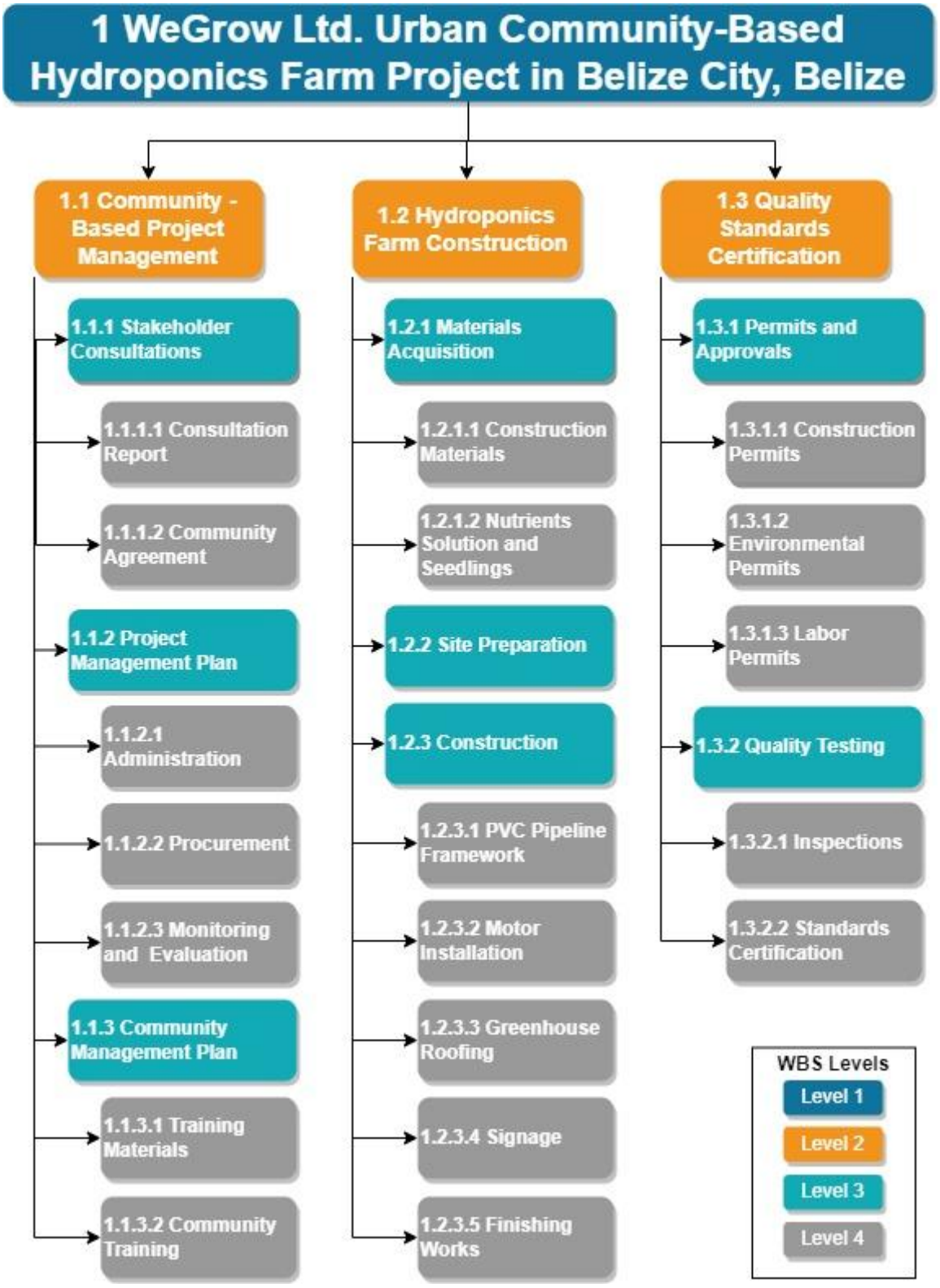
4.2.5 Work Breakdown Structure

The create Work Breakdown Structure (WBS) process entails subdividing the project deliverables and project work into smaller, more manageable components providing a framework on the scope to be delivered (PMI, 2017). For the WeGrow Ltd. urban community-based hydroponics project, the WBS demonstrates a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project's objectives. The subsequent sections elaborate the project's WBS and WBS dictionary in defining its scope.

4.2.5.1 Work Breakdown Structure for WeGrow Ltd.

As demonstrated in **Figure 18** below, the WBS for the WeGrow Ltd. urban community-based hydroponics farming project (level 1) consists of three (3) main components as the primary deliverables (level 2). These have subsequently been decomposed into respective control accounts (level 3) and work packages (level 4).

Figure 18. WeGrow Ltd. Work Breakdown Structure (WBS)



Note. Own work.

4.2.5.2 WBS Dictionary

The WBS dictionary provides detailed deliverable and activity information about each component in the WBS. The WBS dictionary for WeGrow Ltd.'s urban community-based hydroponics farming project is presented in **Chart 12** using the collected requirements and acceptance criteria from stakeholders.

Chart 12. WeGrow Ltd. WBS Dictionary

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
1	1	WeGrow Ltd. Urban Community - Based Hydroponics Farm Project in Belize City, Belize	Completion of the total project scope including Project Management, Farm Construction and Quality Standards Certification	Project Manager	Project Completion Report	$200,000.00	Literature Review, Project Management Plan	Approved Project Charter
2	1.1	Community – Based Project Management	Completion of required Stakeholder Consultations, Project Management Plan and Community Management Plan	Project Manager	Reports, Plans and Agreements	$40,000.00	Project Management Plan, Community Directory, and Literature	Approved Project Charter, Community Agreement

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
3	1.1.1	Stakeholder Consultations	Completion of stakeholder consultation report and community agreements	Project Manager	Reports and Agreements	$12,000.00	Community Directory	Community Agreement
4	1.1.1.1	Consultation Report	Documentation and consolidation of minutes from the three (3) stakeholder consultations	Admin. Assistant	Consultation Report	$4,000.00	Community Directory	None
4	1.1.1.2	Community Agreement	Signing of community agreement for community-based model	Project Sponsor	Community Agreement	$8,000.00	Agreement Template	Community Agreement
3	1.1.2	Project Management Plan	Completion of project administration, procurement, and monitoring and evaluation activities	Project Manager	Plans and Reports	$17,000.00	Project Management Plan	Project Charter
4	1.1.2.1	Administration	Administration of project activities based on established baselines	Admin. Assistant	Project Administration Report	$5,000.00	Project Management Plan	Project Charter
4	1.1.2.2	Procurement	Procurement processes for required goods and services from external sources outside the project	Finance and Accounting Officer	Project Procurement Report	$6,000.00	Project Management Plan	Project Charter

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
4	1.1.2.3	Monitoring and Evaluation	Implementation of required monitoring and evaluation activities including mid-term and final evaluations	Project Manager	Mid-Term and Final Evaluation Reports	$6,000.00	Project Management Plan	Project Charter
3	1.1.3	Community Management Plan	Completion of community-based training with required materials	Project Manager	Reports	$11,000.00	Community Directory and Literature	Community Agreement
4	1.1.3.1	Training Materials	Procurement of required hard and soft materials to conduct community training	Finance and Accounting Officer	None	$5,000.00	Literature on Hydroponics	Community Agreement
4	1.1.3.2	Community Training	Completion of 2 training workshops for 60% of community members	Contractor	Post-Training Evaluation Report	$6,000.00	Community Directory	Community Agreement
2	1.2	Hydroponics Farm Construction	Completion of materials acquisition, site preparation and farm construction	Project Manager	Reports	$110,000.00	Regulations and Policies	Contract Agreement and Pact
3	1.2.1	Materials Acquisition	Acquisition of construction materials and nutrient solution with seedlings	Finance and Accounting Officer	Sourcing and Expense Report	$50,000.00	Procurement Policy	Sustainability Pact

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
4	1.2.1.1	Construction Materials	Purchasing of required construction materials with at least 50% sustainable sourcing	Finance and Accounting Officer	Sourcing and Expense Report	$40,000.00	Procurement Policy	Sustainability Pact
4	1.2.1.2	Nutrients Solution and Seedlings	Purchasing of the required nutrient solution for water, as well as the seedlings for storage	Finance and Accounting Officer	Sourcing and Expense Report	$10,000.00	BAHA Seed Regulations	None
3	1.2.2	Site Preparation	Foundational works required on the rooftop including safety measures	Contractor	Site Preparation Report	$15,000.00	CBA Regulations	Contract Agreement
3	1.2.3	Construction	Completion of all activities required to construct the hydroponics far including framework, installation, roofing, signing and works.	Contractor	Construction Completion Report	$45,000.00	Construction Drawings, and CBA, DOE and Labor Regulations	Contract Agreement
4	1.2.3.1	PVC Pipeline Framework	Construction of PVC pipe frameworks covering the rooftop of 20 ft x 20 ft	Contractor	Construction Completion Report	$10,000.00	DOE Regulations	Contract Agreement
4	1.2.3.2	Motor Installation	Installation of required pumping motors at designated stations	Contractor	Construction Completion Report	$8,000.00	DOE Regulations	Contract Agreement

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
4	1.2.3.3	Greenhouse Roofing	Construction of Category 3 storm-resistant greenhouse roofing infrastructure	Contractor	Construction Completion Report	$15,000.00	CBA Regulations	Contract Agreement
4	1.2.3.4	Signage	Installation of signage across the farm for usability and security purposes	Contractor	Construction Completion Report	$4,000.00	Labor Regulations	Contract Agreement
4	1.2.3.5	Finishing Works	Finalization of activities related to plumbing, electrical and works	Contractor	Construction Completion Report	$8,000.00	Construction Drawings	Contract Agreement
2	1.3	Quality Standards Certification	Completion of all activities related to obtaining permits and approvals, as well as quality testing for standards certification	Project Manager	Certificates, Permits, Test Results and Audit Reports	$50,000.00	CBA, DOE and Labor Regulations, and National Standards	Contract Agreement
3	1.3.1	Permits and Approvals	Acquisition of all necessary construction, environmental and labor permits	Contractor	Certificates and Permits	$38,000.00	CBA, DOE and Labor Regulations	Contract Agreement
4	1.3.1.1	Construction Permits	Acquisition of required construction permits per CBA regulations	Contractor	Construction Permit	$12,000.00	CBA Regulations	Contract Agreement

WBS Level	WBS Code	Element Name	Description of Work	Owner Assigned	Deliverables	Cost Estimate (BZD)	Technical References	Agreement Information
4	1.3.1.2	Environmental Permits	Acquisition of required environmental clearance per DOE regulations	Contractor	Environmental Clearance Certificate	$18,000.00	DOE Regulations	Contract Agreement
4	1.3.1.3	Labor Permits	Acquisition of required labor permits per Labor Department Regulations	Contractor	Labor Permit	$8,000.00	Labor Regulations	Contract Agreement
3	1.3.2	Quality Testing	Completion of all activities related to quality testing including inspections and standards certification	Project Manager	Test Results, Audit Reports and Certificates	$12,000.00	Regulations and National Standards	Community Agreement
4	1.3.2.1	Inspections	Completion of three (3) quality inspection audits and tests	Project Manager	Test Results and Audit Reports	$5,000.00	Audit Regulations	Community Agreement
4	1.3.2.2	Standards Certification	Completion of necessary documentation for standards certification including testing	Project Manager	Quality Standards Certification	$7,000.00	National BBS Standards	Community Agreement

Note. Own work

4.2.6 Scope Validation

Scope validation is the process of formalizing acceptance of the completed project deliverables bringing objectivity to the acceptance process and increasing the probability that the final product is accepted (PMI, 2017). For WeGrow Ltd., the scope validation process will rest with the Project Steering Committee (PSC) which would meet monthly to review and accept all completed deliverables. The Project Sponsor would represent the decisions of the PSC and would communicate any deliverables that are not accepted to the Project Manager for further corrective action with the deliverable owner assigned. Each deliverable submitted will be verified against the Scope Statement, Requirements Traceability Matrix, WBS and WBS Dictionary for compliance with the stablished scope baseline. Tools that will be deployed include inspection to ensure that the deliverables meet requirements and acceptance criteria, as well as decision making in the form of voting at the PSC level. Once the PSC determines the acceptance of a given deliverable, the Project Sponsor will advise the Project Manager accordingly. Payments will only be completed upon the acceptance of a verified deliverable. Work performance information would also be documented including lessons learned.

4.2.7 Scope Control

Scope control is the process of monitoring the status of the project and product scope and managing changes to the scope baseline (PMI, 2017). One of the main ways in which WeGrow Ltd. would maintain its scope baseline is through a contractual agreement established with the community beneficiaries on the community-based model and project scope. This agreement is referenced under WBS ID 1.1.1.2 and would ensure that stakeholders understand and agree to the scope of the hydroponics farm being constructed thereby avoiding scope creep, or the uncontrolled expansion of project scope without adjustments to time, cost and resources. Any change requests that are received related to scope would need to submit the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

4.3. Schedule Management Plan

SCHEDULE MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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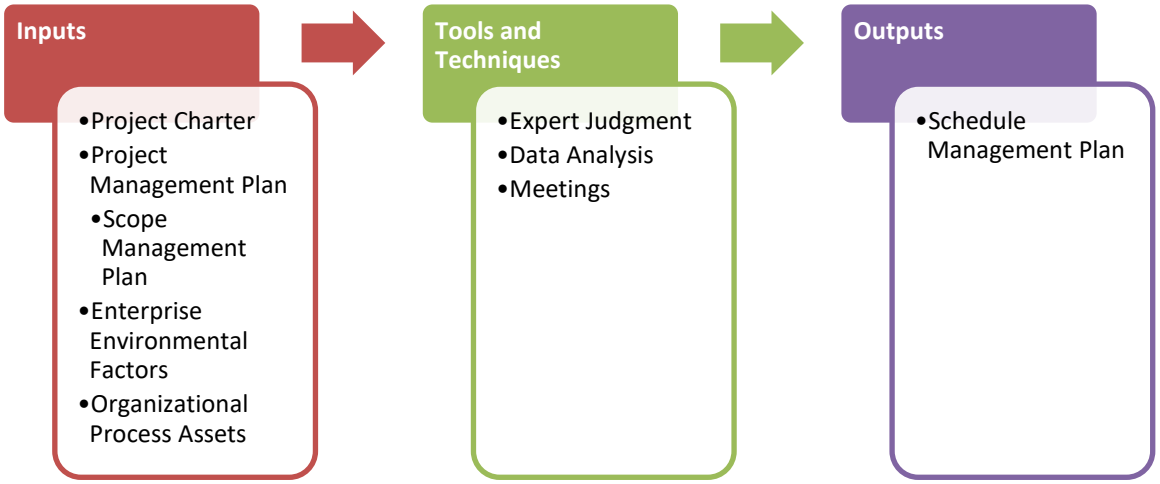
4.3.1 Introduction

Project Schedule Management includes the processes required to manage the timely completion of the project (PMI, 2017). The Plan Schedule Management process creates the Schedule Management Plan that establishes the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule. Managing the schedule for the WeGrow Ltd. urban community-based hydroponics farming project is important to ensure that the project's scope is completed within the established project duration. The inputs, as well as tools and techniques what would be used to reach the output of the Schedule Management Plan are shown in **Figure 19**. A key input is the Project Charter which defines the established project duration based on the scope baseline. The EEFs considered include team resource availability, scheduling software, guidelines for tailoring standard procedures and organizational culture and structure. The OPAs considered are mainly existing formal and informal schedule development management policies, templates and forms, including historical information and lessons learned from previous projects. To obtain information needed to develop the Schedule Management Plan, expert judgement, data analysis and meetings with key stakeholders will also be used. This process supports the development of the

Schedule Management Plan including the Schedule Management Approach, Activity List, Project Schedule and Schedule Control.

Figure 19. Plan Schedule Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 6-3, p. 179 Copyright 2017 by PMI, Inc. Permission not sought.

4.3.2 Schedule Management Approach

Under the WeGrow Ltd. urban community-based hydroponics farming project, schedule management will be the responsibility of the Project Manager. The Project Manager would be supported in managing and closely monitoring the project's schedule by the Project Team, Project Sponsor, and Project Steering Committee (PSC). The Schedule Management Plan is structured to include the activity list, schedule baseline, milestones, project schedule and critical path. The approach will ensure that the schedule baseline is maintained ensuring that schedule variance is kept under control avoiding project delays. Any changes to the schedule received from stakeholders or other parties would undergo the Integrated Change Control Process established in Section 4.1.3 following the process established in **Figure 15** using the change request form established in **Chart 7.** Any changes to the established project schedule would be managed to ensure that the agreed duration agreed with stakeholders is not deviated from significantly. The primary tool that will

be used to manage the schedule is Microsoft Project which provides several features to visualize the project schedule and critical path including through the Gantt Chart and Network Diagram views demonstrated subsequently.

4.3.2.1 Roles and Responsibilities

The Project Sponsor would establish the schedule baseline based on agreement with stakeholders and the Project Steering Committee (PSC). The Project Manager would thereafter play a key role in ensuring adherence to the Schedule Management Plan by the Project Team who remain the main implementors. In ensuring the clarity on the roles related to schedule management, **Chart 13** elaborates the respective roles and responsibilities for WeGrow Ltd.'s project.

Chart 13. Schedule Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Review and analyze schedule change requests • Approve / reject escalated schedule change requests • Convey project schedule updates to the PSC • Tracks project progress based on schedule baseline
Project Steering Committee	• Support Project Sponsor and Project Manager in the review of escalated schedule change requests. • Review and approve schedule change requests
Project Manager	• Review and analyze schedule change requests • Defer / reject / approve / escalate schedule change requests • Evaluate the need for schedule changes • Communicate outcomes of schedule change requests • Update project documents with schedule changes • Monitor compliance with the Schedule Management Plan • Monitor and report on project's performance based on established schedule baseline

Project Team	• Elaborate the need for schedule changes • Participate in the implementation of schedule changes • Ensure compliance with the Schedule Management Plan • Perform established activities based on established sequence • Communicate risks and challenges to the Project Manager

Note. Own work

4.3.3 Activity List

In order to establish the activity list for WeGrow Ltd.'s urban community-based hydroponics farming project, three key steps would need to be completed including defining, sequencing and estimating activity durations. Defining activities refer to identifying and documenting the specific actions to be performed to produce the project deliverables. Sequencing activities identifies and documents the relationships among the project activities. Finally, estimating activity durations refer to the process of estimating the number of work periods needed to complete individual activities (PMI, 2017). In establishing the activity list, sequence and duration of the project, the following techniques would be deployed:

1. **Decomposition** – The work packages established in the WBS in **Figure 18** would be decomposed to the activity level. This technique subdivides the project scope into smaller more manageable parts where activities represent the effort needed to complete a work package.
2. **Dependency Determination and Integration** – Here, activities will be sequenced based on relationships of predecessors and successors. This included mandatory, discretionary, external, and internal dependencies.
3. **Analogous and Bottom-Up Estimating** – In estimating activity durations, a hybrid of the analogous estimating technique using historical data from similar projects, as well as bottom-up estimating aggregating the lower levels of the WBS rolling up to the total project duration would be deployed.

Chart 14 below establishes the activity list for the WeGrow Ltd. urban community-based hydroponics farming project including the duration in number of days, start and end dates, as well as predecessors.

Chart 14. WeGrow Ltd. Activity List

ID	WBS ID	Classification	Activity ID	Task Name	Duration	Start	Finish	Predecessors
1	**1**	**Project**		**WeGrow Ltd. Urban Community-Based Hydroponics Farm Project in Belize City, Belize**	**181 days**	**Sun 1/01/23**	**Fri 6/30/23**	
2	**1.1**	**Deliverable / Component**		**Community - Based Project Management**	**181 days**	**Sun 1/01/23**	**Fri 6/30/23**	
3	**1.1.1**	**Control Account**		**Stakeholder Consultations**	**24 days**	**Sun 1/08/23**	**Tue 1/31/23**	
4	**1.1.1.1**	**Work Package**		**Consultation Report**	**9 days**	**Sun 1/08/23**	**Mon 1/16/23**	
5			1.1.1.1.1	Conduct Community Consultation 1	1 day	Mon 1/09/23	Mon 1/09/23	
6			1.1.1.1.2	Conduct Community Consultation 2	1 day	Wed 1/11/23	Wed 1/11/23	
7			1.1.1.1.3	Conduct Community Consultation 3	1 day	Fri 1/13/23	Fri 1/13/23	
8			1.1.1.1.4	Draft Consultation Report	9 days	Sun 1/08/23	Mon 1/16/23	
9	**1.1.1.2**	**Work Package**		**Community Agreement**	**15 days**	**Tue 1/17/23**	**Tue 1/31/23**	
10			1.1.1.2.1	Draft Community Management Agreement	4 days	Tue 1/17/23	Fri 1/20/23	8
11			1.1.1.2.2	Complete Legal Review of Agreement	10 days	Sat 1/21/23	Mon 1/30/23	10
12			1.1.1.2.3	Sign Community Management Agreement	0 days	Tue 1/31/23	Tue 1/31/23	11
13	**1.1.2**	**Control Account**		**Project Management Plan**	**181 days**	**Sun 1/01/23**	**Fri 6/30/23**	
14	**1.1.2.1**	**Work Package**		**Administration**	**172 days**	**Sun 1/01/23**	**Wed 6/21/23**	
15			1.1.2.1.1	Conduct Project Sponsor and PSC Meetings	3 days	Sun 1/01/23	Tue 1/03/23	
16			1.1.2.1.2	Draft Integrated Project Management Plan	4 days	Wed 1/04/23	Sat 1/07/23	15
17			1.1.2.1.3	Administer Project	164 days	Sun 1/08/23	Tue 6/20/23	16
18			1.1.2.1.4	Complete Project Administration Report	1 day	Wed 6/21/23	Wed 6/21/23	17
19	**1.1.2.2**	**Work Package**		**Procurement**	**52 days**	**Sun 1/08/23**	**Tue 2/28/23**	
20			1.1.2.2.1	Conduct Procurements	51 days	Sun 1/08/23	Mon 2/27/23	
21			1.1.2.2.2	Complete Project Procurement Report	1 day	Tue 2/28/23	Tue 2/28/23	20
22	**1.1.2.3**	**Work Package**		**Monitoring and Evaluation**	**98 days**	**Sat 3/25/23**	**Fri 6/30/23**	

ID	WBS ID	Classification	Activity ID	Task Name	Duration	Start	Finish	Predecessors
23			1.1.2.3.1	Conduct Mid-Term Evaluation	6 days	Sat 3/25/23	Thu 3/30/23	
24			1.1.2.3.2	Complete Mid-Term Evaluation Report	1 day	Fri 3/31/23	Fri 3/31/23	23
25			1.1.2.3.3	Conduct Final Evaluation	6 days	Thu 6/15/23	Tue 6/20/23	
26			1.1.2.3.4	Complete Final Evaluation Report	1 day	Wed 6/21/23	Wed 6/21/23	25
27			1.1.2.3.5	Draft Project Completion Report	9 days	Thu 6/22/23	Fri 6/30/23	24;26
28			1.1.2.3.6	Approve Project Completion Report	0 days	Fri 6/30/23	Fri 6/30/23	
29	**1.1.3**	**Control Account**		**Community Management Plan**	**28 days**	**Wed 2/01/23**	**Tue 2/28/23**	**3**
30	**1.1.3.1**	**Work Package**		**Training Materials**	**10 days**	**Wed 2/01/23**	**Fri 2/10/23**	
31			1.1.3.1.1	Develop Community Management Plan Materials	7 days	Wed 2/01/23	Tue 2/07/23	
32			1.1.3.1.2	Procure Training and Sensitization Materials	3 days	Wed 2/08/23	Fri 2/10/23	31
33	**1.1.3.2**	**Work Package**		**Community Training**	**12 days**	**Fri 2/17/23**	**Tue 2/28/23**	
34			1.1.3.2.1	Conduct Workshop 1	1 day	Fri 2/17/23	Fri 2/17/23	
35			1.1.3.2.2	Conduct Workshop 2	1 day	Fri 2/24/23	Fri 2/24/23	
36			1.1.3.2.3	Draft Post-Training Evaluation Report	4 days	Sat 2/25/23	Tue 2/28/23	34;35
37			1.1.3.2.4	Approve Post-Training Evaluation Report	0 days	Tue 2/28/23	Tue 2/28/23	
38	**1.2**	**Deliverable / Component**		**Hydroponics Farm Construction**	**144 days**	**Sun 1/08/23**	**Wed 5/31/23**	
39	**1.2.1**	**Control Account**		**Materials Acquisition**	**52 days**	**Sun 1/08/23**	**Tue 2/28/23**	
40	**1.2.1.1**	**Work Package**		**Construction Materials**	**24 days**	**Sun 1/08/23**	**Tue 1/31/23**	
41			1.2.1.1.1	Purchase Construction Materials	23 days	Sun 1/08/23	Mon 1/30/23	
42			1.2.1.1.2	Store Construction Materials	1 day	Tue 1/31/23	Tue 1/31/23	41
43	**1.2.1.2**	**Work Package**		**Nutrients Solution and Seedlings**	**28 days**	**Wed 2/01/23**	**Tue 2/28/23**	
44			1.2.1.2.1	Purchase Nutrients Solution and Seedlings	27 days	Wed 2/01/23	Mon 2/27/23	
45			1.2.1.2.2	Store Nutrients Solutions and Seedlings	1 day	Tue 2/28/23	Tue 2/28/23	44
46	**1.2.2**	**Control Account**		**Site Preparation**	**14 days**	**Wed 2/01/23**	**Tue 2/14/23**	**39**
47			1.2.2.1	Clear Project Site	7 days	Wed 2/01/23	Tue 2/07/23	
48			1.2.2.2	Transport Construction Materials to Site	3 days	Wed 2/08/23	Fri 2/10/23	47
49			1.2.2.3	Erect Temporary Storage Room	14 days	Wed 2/01/23	Tue 2/14/23	
50	**1.2.3**	**Control Account**		**Construction**	**92 days**	**Wed 3/01/23**	**Wed 5/31/23**	**19**
51	**1.2.3.1**	**Work Package**		**PVC Pipeline Framework**	**31 days**	**Wed 3/01/23**	**Fri 3/31/23**	
52			1.2.3.1.1	Cut PVC Pipelines	10 days	Wed 3/01/23	Fri 3/10/23	

ID	WBS ID	Classification	Activity ID	Task Name	Duration	Start	Finish	Predecessors
53			1.2.3.1.2	Connect and Install PVC Pipeline Framework	21 days	Sat 3/11/23	Fri 3/31/23	52
54	**1.2.3.2**	**Work Package**		**Motor Installation**	**15 days**	**Sat 4/01/23**	**Sat 4/15/23**	
55			1.2.3.2.1	Assemble Motor	10 days	Sat 4/01/23	Mon 4/10/23	
56			1.2.3.2.2	Test Motor	4 days	Tue 4/11/23	Fri 4/14/23	55
57			1.2.3.2.3	Install Motor	1 day	Sat 4/15/23	Sat 4/15/23	56
58	**1.2.3.3**	**Work Package**		**Greenhouse Roofing**	**47 days**	**Wed 3/15/23**	**Sun 4/30/23**	
59			1.2.3.3.1	Assemble Greenhouse Roofing	25 days	Wed 3/15/23	Sat 4/08/23	
60			1.2.3.3.2	Pour Concrete Reinforcement Framework	22 days	Sun 4/09/23	Sun 4/30/23	59
61	**1.2.3.4**	**Work Package**		**Signage**	**15 days**	**Mon 5/01/23**	**Mon 5/15/23**	**58**
62			1.2.3.4.1	Design and Print Signage	8 days	Mon 5/01/23	Mon 5/08/23	
63			1.2.3.4.2	Install Signage	7 days	Tue 5/09/23	Mon 5/15/23	62
64	**1.2.3.5**	**Work Package**		**Finishing Works**	**16 days**	**Tue 5/16/23**	**Wed 5/31/23**	**61**
65			1.2.3.5.1	Paint Frameworks and Farm Perimeter	5 days	Tue 5/16/23	Sat 5/20/23	
66			1.2.3.5.2	Testing of Water and Electrical Frameworks	5 days	Sun 5/21/23	Thu 5/25/23	65
67			1.2.3.5.3	Clean Farm Perimeter	6 days	Fri 5/26/23	Wed 5/31/23	66
68			1.2.3.5.4	Draft Construction Completion Report	6 days	Fri 5/26/23	Wed 5/31/23	
69			1.2.3.5.5	Approve Construction Completion Report	0 days	Wed 5/31/23	Wed 5/31/23	
70	**1.3**	**Deliverable / Component**		**Quality Standards Certification**	**165 days**	**Sun 1/01/23**	**Thu 6/15/23**	
71	**1.3.1**	**Control Account**		**Permits and Approvals**	**59 days**	**Sun 1/01/23**	**Tue 2/28/23**	
72	**1.3.1.1**	**Work Package**		**Construction Permits**	**28 days**	**Wed 2/01/23**	**Tue 2/28/23**	
73			1.3.1.1.1	Collect Required Documents	20 days	Wed 2/01/23	Mon 2/20/23	
74			1.3.1.1.2	Complete Central Building Authority Inspection	7 days	Tue 2/21/23	Mon 2/27/23	73
75			1.3.1.1.3	Obtain Approved Construction Permit	0 days	Tue 2/28/23	Tue 2/28/23	74
76	**1.3.1.2**	**Work Package**		**Environmental Permits**	**45 days**	**Sun 1/15/23**	**Tue 2/28/23**	
77			1.3.1.2.1	Collect Required Documents	30 days	Sun 1/15/23	Mon 2/13/23	
78			1.3.1.2.2	Complete Department of Environment Inspection	14 days	Tue 2/14/23	Mon 2/27/23	77
79			1.3.1.2.3	Obtain Approved Environmental Clearance Certificate	0 days	Tue 2/28/23	Tue 2/28/23	78
80	**1.3.1.3**	**Work Package**		**Labor Permits**	**10 days**	**Sun 2/19/23**	**Tue 2/28/23**	
81			1.3.1.3.1	Collect Required Documents	8 days	Sun 2/19/23	Sun 2/26/23	

ID	WBS ID	Classification	Activity ID	Task Name	Duration	Start	Finish	Predecessors
82			1.3.1.3.2	Complete Labor Department Inspection	1 day	Mon 2/27/23	Mon 2/27/23	81
83			1.3.1.3.3	Obtain Approved Labor Permit	0 days	Tue 2/28/23	Tue 2/28/23	82
84	**1.3.2**	**Control Account**		**Quality Testing**	**76 days**	**Fri 3/31/23**	**Thu 6/15/23**	
85	**1.3.2.1**	**Work Package**		**Inspections**	**62 days**	**Fri 3/31/23**	**Thu 6/01/23**	
86			1.3.2.1.1	Conduct Quality Inspection 1 (Tests and Audit)	1 day	Fri 3/31/23	Fri 3/31/23	
87			1.3.2.1.2	Conduct Quality Inspection 2 (Tests and Audit)	1 day	Sun 4/30/23	Sun 4/30/23	
88			1.3.2.1.3	Conduct Quality Inspection 3 (Tests and Audit)	1 day	Wed 5/31/23	Wed 5/31/23	
89			1.3.2.1.4	Obtain Final Quality Test Results and Audit Report	0 days	Thu 6/01/23	Thu 6/01/23	86;87;88
90	**1.3.2.2**	**Work Package**		**Standards Certification**	**24 days**	**Mon 5/22/23**	**Thu 6/15/23**	
91			1.3.2.2.1	Collect Required Documents	20 days	Mon 5/22/23	Sat 6/10/23	
92			1.3.2.2.2	Complete Bureau of Standards Inspection	4 days	Sun 6/11/23	Wed 6/14/23	91
93			1.3.2.2.3	Obtain Approved Quality Standards Certification	0 days	Thu 6/15/23	Thu 6/15/23	92

Note. Own work

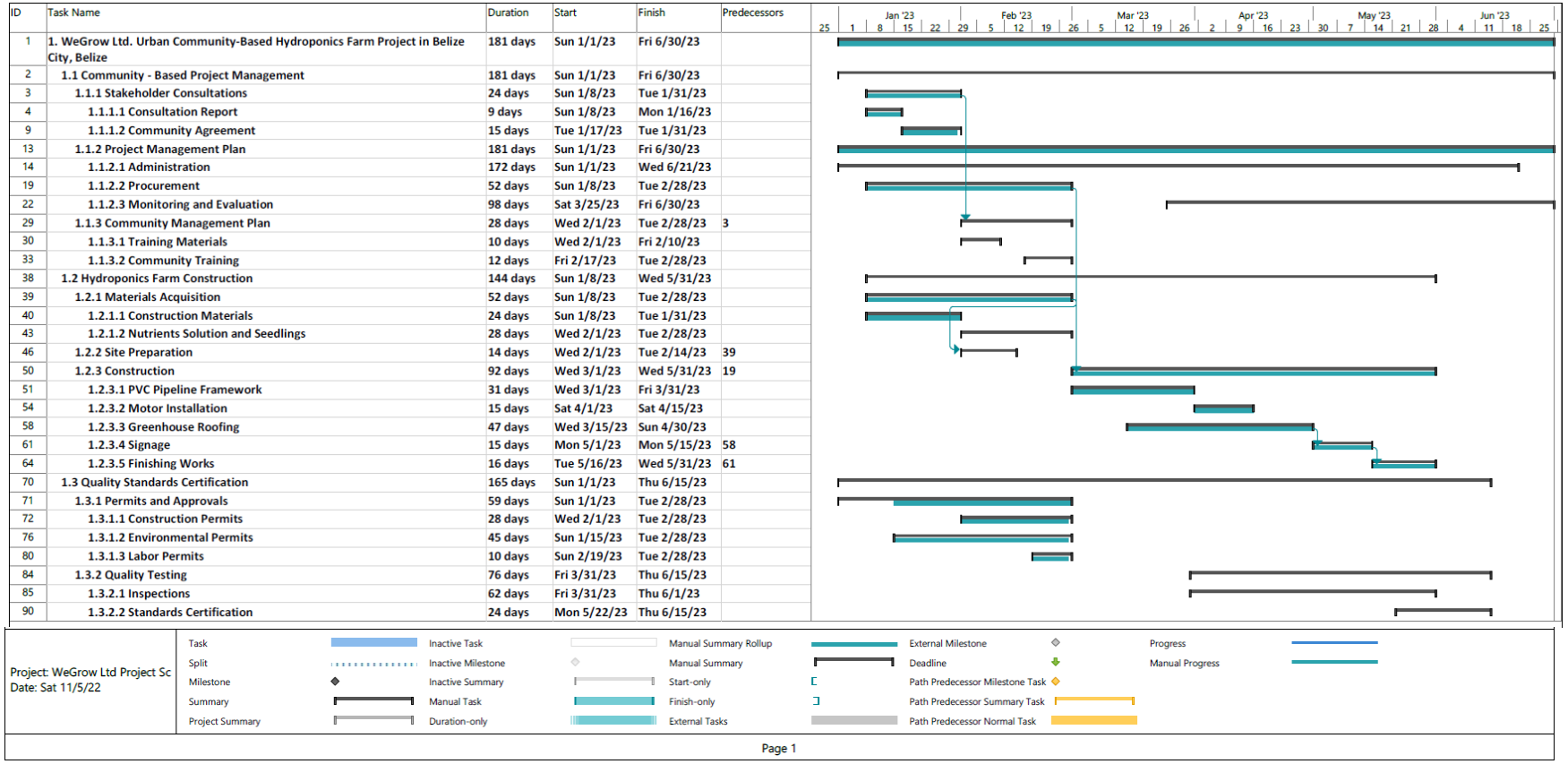
4.3.3.1 Schedule Baseline

Based on the activity list and durations established in **Chart 14**, the schedule baseline for the WeGrow Ltd. urban community-based hydroponics farm can be determined. The schedule baseline refers to the approved version of the schedule that can only be changed through the formal change control procedure and is used as a basis for comparison to actual results. In this case, the schedule baseline for the WeGrow Ltd. project can be established as 181 days with a start date of January 1, 2023 and an end date of January 30, 2023. In essence, the schedule baseline is a total of six (6) months. Based on this baseline, schedule performance measurements such as schedule variance (SV) and schedule performance index (SPI) can be used to assess the magnitude of variation to the original baseline.

4.3.4 Project Schedule

The project schedule presents linked activities with planned dates, durations, and milestones including the planned start date and planned finish date for each activity at minimum. There are several techniques and tools that can be used to present a project schedule. For the WeGrow Ltd. project, Gantt Charts would be used to present the schedule information generated through Microsoft Project. Here, activities are listed on the vertical axis while dates are shown on the horizontal axis with bars placed according to start and finish dates. **Figure 20** highlights the project's Gantt Chart by work package, while **Figure 21** demonstrates the Gantt Chart with a view of the full list of activities encompassing a total of 93 lines.

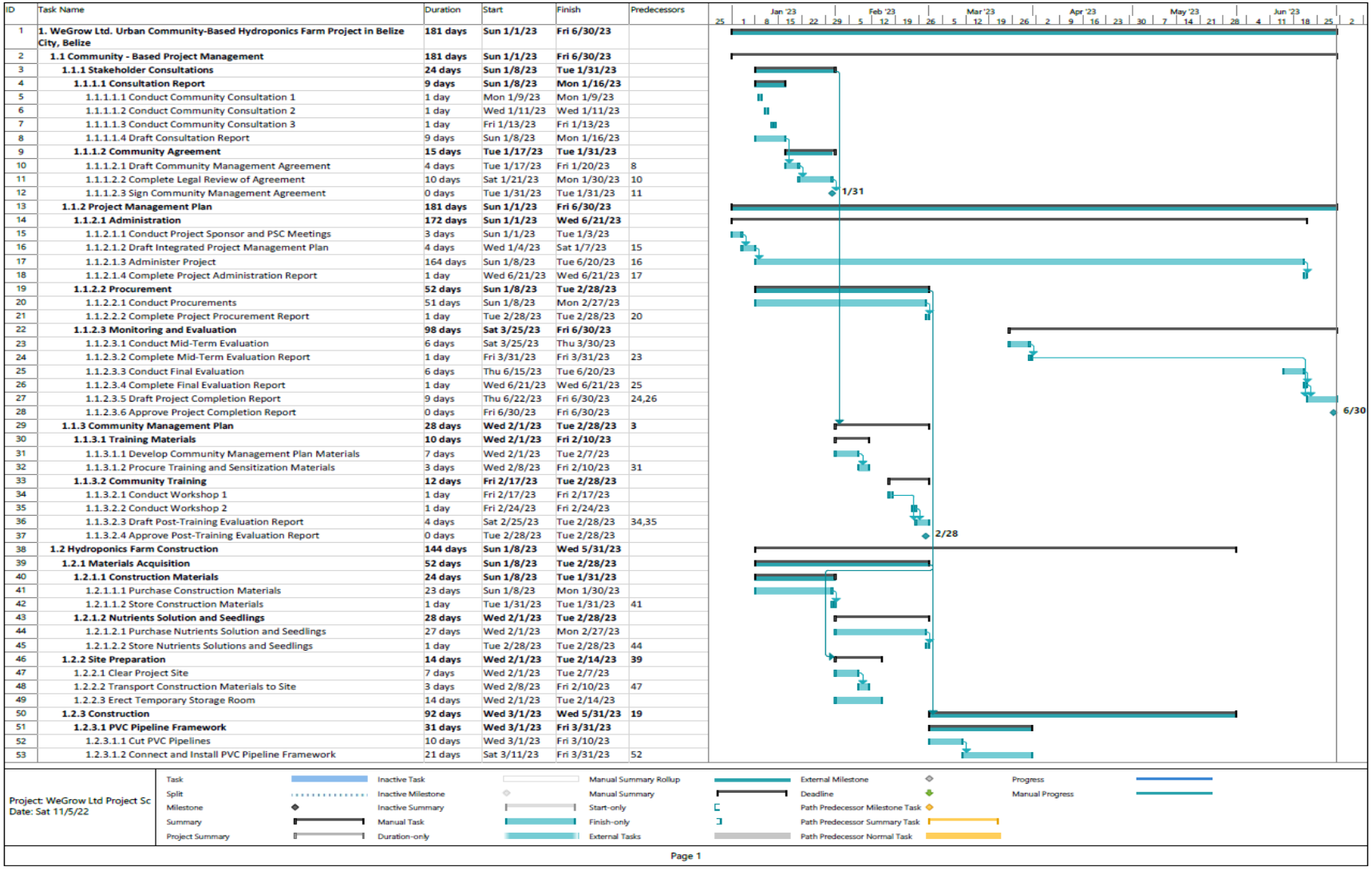
Figure 20. Project Schedule Gantt Chart – Work Package View



ID	Task Name	Duration	Start	Finish	Predecessors
1	1. WeGrow Ltd. Urban Community-Based Hydroponics Farm Project in Belize City, Belize	181 days	Sun 1/1/23	Fri 6/30/23	
2	1.1 Community - Based Project Management	181 days	Sun 1/1/23	Fri 6/30/23	
3	1.1.1 Stakeholder Consultations	24 days	Sun 1/8/23	Tue 1/31/23	
4	1.1.1.1 Consultation Report	9 days	Sun 1/8/23	Mon 1/16/23	
9	1.1.1.2 Community Agreement	15 days	Tue 1/17/23	Tue 1/31/23	
13	1.1.2 Project Management Plan	181 days	Sun 1/1/23	Fri 6/30/23	
14	1.1.2.1 Administration	172 days	Sun 1/1/23	Wed 6/21/23	
19	1.1.2.2 Procurement	52 days	Sun 1/8/23	Tue 2/28/23	
22	1.1.2.3 Monitoring and Evaluation	98 days	Sat 3/25/23	Fri 6/30/23	
29	1.1.3 Community Management Plan	28 days	Wed 2/1/23	Tue 2/28/23	3
30	1.1.3.1 Training Materials	10 days	Wed 2/1/23	Fri 2/10/23	
33	1.1.3.2 Community Training	12 days	Fri 2/17/23	Tue 2/28/23	
38	1.2 Hydroponics Farm Construction	144 days	Sun 1/8/23	Wed 5/31/23	
39	1.2.1 Materials Acquisition	52 days	Sun 1/8/23	Tue 2/28/23	
40	1.2.1.1 Construction Materials	24 days	Sun 1/8/23	Tue 1/31/23	
43	1.2.1.2 Nutrients Solution and Seedlings	28 days	Wed 2/1/23	Tue 2/28/23	
46	1.2.2 Site Preparation	14 days	Wed 2/1/23	Tue 2/14/23	39
50	1.2.3 Construction	92 days	Wed 3/1/23	Wed 5/31/23	19
51	1.2.3.1 PVC Pipeline Framework	31 days	Wed 3/1/23	Fri 3/31/23	
54	1.2.3.2 Motor Installation	15 days	Sat 4/1/23	Sat 4/15/23	
58	1.2.3.3 Greenhouse Roofing	47 days	Wed 3/15/23	Sun 4/30/23	
61	1.2.3.4 Signage	15 days	Mon 5/1/23	Mon 5/15/23	58
64	1.2.3.5 Finishing Works	16 days	Tue 5/16/23	Wed 5/31/23	61
70	1.3 Quality Standards Certification	165 days	Sun 1/1/23	Thu 6/15/23	
71	1.3.1 Permits and Approvals	59 days	Sun 1/1/23	Tue 2/28/23	
72	1.3.1.1 Construction Permits	28 days	Wed 2/1/23	Tue 2/28/23	
76	1.3.1.2 Environmental Permits	45 days	Sun 1/15/23	Tue 2/28/23	
80	1.3.1.3 Labor Permits	10 days	Sun 2/19/23	Tue 2/28/23	
84	1.3.2 Quality Testing	76 days	Fri 3/31/23	Thu 6/15/23	
85	1.3.2.1 Inspections	62 days	Fri 3/31/23	Thu 6/1/23	
90	1.3.2.2 Standards Certification	24 days	Mon 5/22/23	Thu 6/15/23	

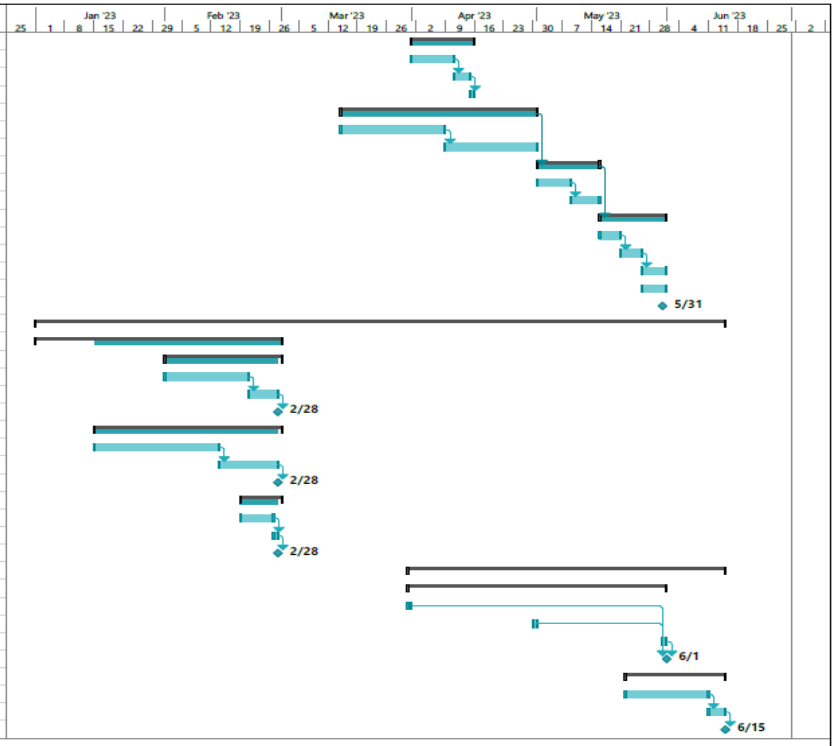
Note. Own work

Figure 21. Project Schedule Gantt Chart – Activity View



ID	Task Name	Duration	Start	Finish	Predecessors
1	**1. WeGrow Ltd. Urban Community-Based Hydroponics Farm Project in Belize City, Belize**	**181 days**	**Sun 1/1/23**	**Fri 6/30/23**	
2	**1.1 Community - Based Project Management**	**181 days**	**Sun 1/1/23**	**Fri 6/30/23**	
3	**1.1.1 Stakeholder Consultations**	**24 days**	**Sun 1/8/23**	**Tue 1/31/23**	
4	**1.1.1.1 Consultation Report**	**9 days**	**Sun 1/8/23**	**Mon 1/16/23**	
5	1.1.1.1.1 Conduct Community Consultation 1	1 day	Mon 1/9/23	Mon 1/9/23	
6	1.1.1.1.2 Conduct Community Consultation 2	1 day	Wed 1/11/23	Wed 1/11/23	
7	1.1.1.1.3 Conduct Community Consultation 3	1 day	Fri 1/13/23	Fri 1/13/23	
8	1.1.1.1.4 Draft Consultation Report	9 days	Sun 1/8/23	Mon 1/16/23	
9	**1.1.1.2 Community Agreement**	**15 days**	**Tue 1/17/23**	**Tue 1/31/23**	
10	1.1.1.2.1 Draft Community Management Agreement	4 days	Tue 1/17/23	Fri 1/20/23	8
11	1.1.1.2.2 Complete Legal Review of Agreement	10 days	Sat 1/21/23	Mon 1/30/23	10
12	1.1.1.2.3 Sign Community Management Agreement	0 days	Tue 1/31/23	Tue 1/31/23	11
13	**1.1.2 Project Management Plan**	**181 days**	**Sun 1/1/23**	**Fri 6/30/23**	
14	**1.1.2.1 Administration**	**172 days**	**Sun 1/1/23**	**Wed 6/21/23**	
15	1.1.2.1.1 Conduct Project Sponsor and PSC Meetings	3 days	Sun 1/1/23	Tue 1/3/23	
16	1.1.2.1.2 Draft Integrated Project Management Plan	4 days	Wed 1/4/23	Sat 1/7/23	15
17	1.1.2.1.3 Administer Project	164 days	Sun 1/8/23	Tue 6/20/23	16
18	1.1.2.1.4 Complete Project Administration Report	1 day	Wed 6/21/23	Wed 6/21/23	17
19	**1.1.2.2 Procurement**	**52 days**	**Sun 1/8/23**	**Tue 2/28/23**	
20	1.1.2.2.1 Conduct Procurements	51 days	Sun 1/8/23	Mon 2/27/23	
21	1.1.2.2.2 Complete Project Procurement Report	1 day	Tue 2/28/23	Tue 2/28/23	20
22	**1.1.2.3 Monitoring and Evaluation**	**98 days**	**Sat 3/25/23**	**Fri 6/30/23**	
23	1.1.2.3.1 Conduct Mid-Term Evaluation	6 days	Sat 3/25/23	Thu 3/30/23	
24	1.1.2.3.2 Complete Mid-Term Evaluation Report	1 day	Fri 3/31/23	Fri 3/31/23	23
25	1.1.2.3.3 Conduct Final Evaluation	6 days	Thu 6/15/23	Tue 6/20/23	
26	1.1.2.3.4 Complete Final Evaluation Report	1 day	Wed 6/21/23	Wed 6/21/23	25
27	1.1.2.3.5 Draft Project Completion Report	9 days	Thu 6/22/23	Fri 6/30/23	24,26
28	1.1.2.3.6 Approve Project Completion Report	0 days	Fri 6/30/23	Fri 6/30/23	
29	**1.1.3 Community Management Plan**	**28 days**	**Wed 2/1/23**	**Tue 2/28/23**	**3**
30	**1.1.3.1 Training Materials**	**10 days**	**Wed 2/1/23**	**Fri 2/10/23**	
31	1.1.3.1.1 Develop Community Management Plan Materials	7 days	Wed 2/1/23	Tue 2/7/23	
32	1.1.3.1.2 Procure Training and Sensitization Materials	3 days	Wed 2/8/23	Fri 2/10/23	31
33	**1.1.3.2 Community Training**	**12 days**	**Fri 2/17/23**	**Tue 2/28/23**	
34	1.1.3.2.1 Conduct Workshop 1	1 day	Fri 2/17/23	Fri 2/17/23	
35	1.1.3.2.2 Conduct Workshop 2	1 day	Fri 2/24/23	Fri 2/24/23	
36	1.1.3.2.3 Draft Post-Training Evaluation Report	4 days	Sat 2/25/23	Tue 2/28/23	34,35
37	1.1.3.2.4 Approve Post-Training Evaluation Report	0 days	Tue 2/28/23	Tue 2/28/23	
38	**1.2 Hydroponics Farm Construction**	**144 days**	**Sun 1/8/23**	**Wed 5/31/23**	
39	**1.2.1 Materials Acquisition**	**52 days**	**Sun 1/8/23**	**Tue 2/28/23**	
40	**1.2.1.1 Construction Materials**	**24 days**	**Sun 1/8/23**	**Tue 1/31/23**	
41	1.2.1.1.1 Purchase Construction Materials	23 days	Sun 1/8/23	Mon 1/30/23	
42	1.2.1.1.2 Store Construction Materials	1 day	Tue 1/31/23	Tue 1/31/23	41
43	**1.2.1.2 Nutrients Solution and Seedlings**	**28 days**	**Wed 2/1/23**	**Tue 2/28/23**	
44	1.2.1.2.1 Purchase Nutrients Solution and Seedlings	27 days	Wed 2/1/23	Mon 2/27/23	
45	1.2.1.2.2 Store Nutrients Solutions and Seedlings	1 day	Tue 2/28/23	Tue 2/28/23	44
46	**1.2.2 Site Preparation**	**14 days**	**Wed 2/1/23**	**Tue 2/14/23**	**39**
47	1.2.2.1 Clear Project Site	7 days	Wed 2/1/23	Tue 2/7/23	
48	1.2.2.2 Transport Construction Materials to Site	3 days	Wed 2/8/23	Fri 2/10/23	47
49	1.2.2.3 Erect Temporary Storage Room	14 days	Wed 2/1/23	Tue 2/14/23	
50	**1.2.3 Construction**	**92 days**	**Wed 3/1/23**	**Wed 5/31/23**	**19**
51	**1.2.3.1 PVC Pipeline Framework**	**31 days**	**Wed 3/1/23**	**Fri 3/31/23**	
52	1.2.3.1.1 Cut PVC Pipelines	10 days	Wed 3/1/23	Fri 3/10/23	
53	1.2.3.1.2 Connect and Install PVC Pipeline Framework	21 days	Sat 3/11/23	Fri 3/31/23	52

ID	Task Name	Duration	Start	Finish	Predecessors
54	**1.2.3.2 Motor Installation**	**15 days**	**Sat 4/1/23**	**Sat 4/15/23**	
55	1.2.3.2.1 Assemble Motor	10 days	Sat 4/1/23	Mon 4/10/23	
56	1.2.3.2.2 Test Motor	4 days	Tue 4/11/23	Fri 4/14/23	55
57	1.2.3.2.3 Install Motor	1 day	Sat 4/15/23	Sat 4/15/23	56
58	**1.2.3.3 Greenhouse Roofing**	**47 days**	**Wed 3/15/23**	**Sun 4/30/23**	
59	1.2.3.3.1 Assemble Greenhouse Roofing	25 days	Wed 3/15/23	Sat 4/8/23	
60	1.2.3.3.2 Pour Concrete Reinforcement Framework	22 days	Sun 4/9/23	Sun 4/30/23	59
61	**1.2.3.4 Signage**	**15 days**	**Mon 5/1/23**	**Mon 5/15/23**	**58**
62	1.2.3.4.1 Design and Print Signage	8 days	Mon 5/1/23	Mon 5/8/23	
63	1.2.3.4.2 Install Signage	7 days	Tue 5/9/23	Mon 5/15/23	62
64	**1.2.3.5 Finishing Works**	**16 days**	**Tue 5/16/23**	**Wed 5/31/23**	**61**
65	1.2.3.5.1 Paint Frameworks and Farm Perimeter	5 days	Tue 5/16/23	Sat 5/20/23	
66	1.2.3.5.2 Testing of Water and Electrical Frameworks	5 days	Sun 5/21/23	Thu 5/25/23	65
67	1.2.3.5.3 Clean Farm Perimeter	6 days	Fri 5/26/23	Wed 5/31/23	66
68	1.2.3.5.4 Draft Construction Completion Report	6 days	Fri 5/26/23	Wed 5/31/23	
69	1.2.3.5.5 Approve Construction Completion Report	0 days	Wed 5/31/23	Wed 5/31/23	
70	**1.3 Quality Standards Certification**	**165 days**	**Sun 1/1/23**	**Thu 6/15/23**	
71	**1.3.1 Permits and Approvals**	**59 days**	**Sun 1/1/23**	**Tue 2/28/23**	
72	**1.3.1.1 Construction Permits**	**28 days**	**Wed 2/1/23**	**Tue 2/28/23**	
73	1.3.1.1.1 Collect Required Documents	20 days	Wed 2/1/23	Mon 2/20/23	
74	1.3.1.1.2 Complete Central Building Authority Inspection	7 days	Tue 2/21/23	Mon 2/27/23	73
75	1.3.1.1.3 Obtain Approved Construction Permit	0 days	Tue 2/28/23	Tue 2/28/23	74
76	**1.3.1.2 Environmental Permits**	**45 days**	**Sun 1/15/23**	**Tue 2/28/23**	
77	1.3.1.2.1 Collect Required Documents	30 days	Sun 1/15/23	Mon 2/13/23	
78	1.3.1.2.2 Complete Department of Environment Inspection	14 days	Tue 2/14/23	Mon 2/27/23	77
79	1.3.1.2.3 Obtain Approved Environmental Clearance Certificate	0 days	Tue 2/28/23	Tue 2/28/23	78
80	**1.3.1.3 Labor Permits**	**10 days**	**Sun 2/19/23**	**Tue 2/28/23**	
81	1.3.1.3.1 Collect Required Documents	8 days	Sun 2/19/23	Sun 2/26/23	
82	1.3.1.3.2 Complete Labor Department Inspection	1 day	Mon 2/27/23	Mon 2/27/23	81
83	1.3.1.3.3 Obtain Approved Labor Permit	0 days	Tue 2/28/23	Tue 2/28/23	82
84	**1.3.2 Quality Testing**	**76 days**	**Fri 3/31/23**	**Thu 6/15/23**	
85	**1.3.2.1 Inspections**	**62 days**	**Fri 3/31/23**	**Thu 6/1/23**	
86	1.3.2.1.1 Conduct Quality Inspection 1 (Tests and Audit)	1 day	Fri 3/31/23	Fri 3/31/23	
87	1.3.2.1.2 Conduct Quality Inspection 2 (Tests and Audit)	1 day	Sun 4/30/23	Sun 4/30/23	
88	1.3.2.1.3 Conduct Quality Inspection 3 (Tests and Audit)	1 day	Wed 5/31/23	Wed 5/31/23	
89	1.3.2.1.4 Obtain Final Quality Test Results and Audit Report	0 days	Thu 6/1/23	Thu 6/1/23	86,87,88
90	**1.3.2.2 Standards Certification**	**24 days**	**Mon 5/22/23**	**Thu 6/15/23**	
91	1.3.2.2.1 Collect Required Documents	20 days	Mon 5/22/23	Sat 6/10/23	
92	1.3.2.2.2 Complete Bureau of Standards Inspection	4 days	Sun 6/11/23	Wed 6/14/23	91
93	1.3.2.2.3 Obtain Approved Quality Standards Certification	0 days	Thu 6/15/23	Thu 6/15/23	92



Project: WeGrow Ltd Project Sc
Date: Sat 11/5/22

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

Page 2

Note. Own work

4.3.4.1 Milestones

A milestone is a significant point or event in a project which has zero duration. Following the established schedule generated in **Figures 20** and **21**, key milestones can also be identified as significant events in the project that define schedule targets for performance measurement (PMI, 2017). Between the project start date and end date, there are nine (9) key milestones that can be identified throughout the project. For WeGrow Ltd., this represents the key targets that would need to be achieved throughout the project's execution in determining successful implementation. The milestone list highlighted in **Chart 15** below summarizes the milestone list for the project including the dates expected under the project schedule.

Chart 15. WeGrow Ltd. Milestone List

Milestone:	**Start Date:**	**End Date:**
Project Start	January 1, 2023	January 1, 2023
Community Agreement Signed	January 8, 2023	January 31, 2023
Post-Training Evaluation Report	February 1, 2023	February 28, 2023
Approved Construction Permit	February 1, 2023	February 28, 2023
Approved Environmental Clearance	January 15, 2023	February 28, 2023
Approved Labor Permit	February 19, 2023	February 28, 2023
Construction Completion Report	March 1, 2023	May 31, 2023
Quality Test Results and Audit Report	March 31, 2023	June 1, 2023
Quality Standards Certification	May 22, 2023	June 15, 2023
Project Completion Report	January 1, 2023	June 30, 2023
Project End	June 30, 2023	June 30, 2023

Note. Own work

4.3.4.2 Critical Path

One of the main ways in which the project schedule is managed is through the critical path method. This method is used to estimate the minimum project duration and determine the amount of schedule flexibility on the logical network paths within the schedule model (PMI, 2017). It is essentially the sequence of activities that represents the longest path through a project which determines the shortest possible project duration. For the WeGrow Ltd. hydroponics farming project, the critical path can be determined as 181 days. Using Microsoft Project, the critical path can also be demonstrated based on the sequence of activities, as well as dependencies established based on predecessors and successors. **Figure 22** highlights the critical path along the Gantt Chart where a total of 44 critical activities out of 93 are identified. **Figure 23** subsequently demonstrates the critical path highlighted in red along a Network Diagram generated through Microsoft Project.

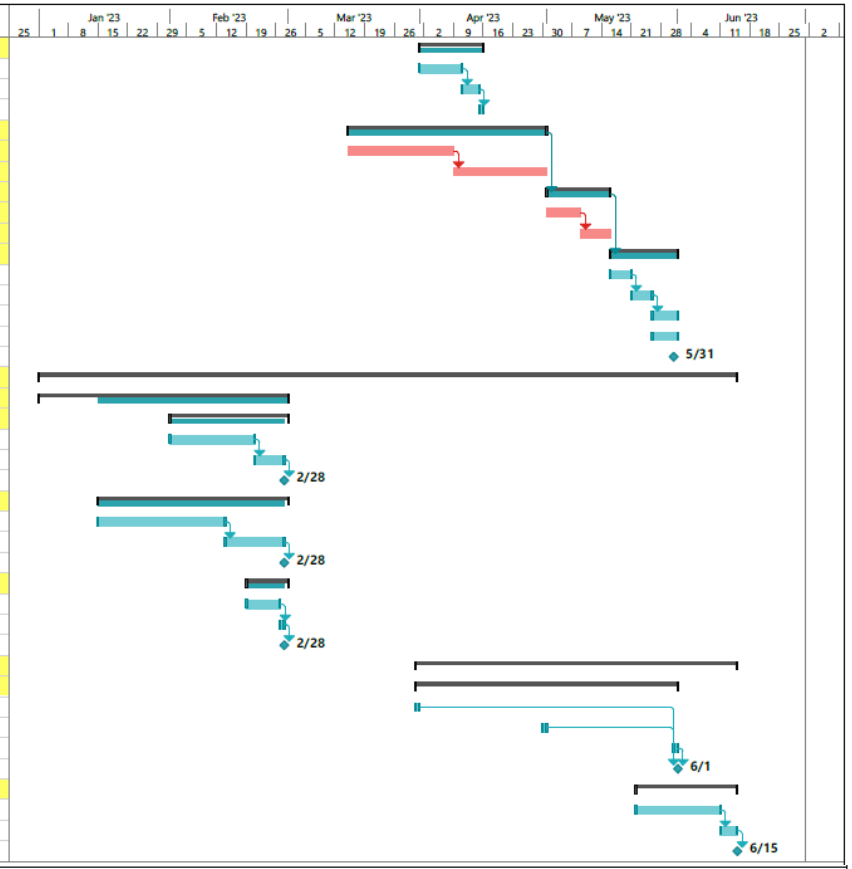
4.3.5 Control Schedule

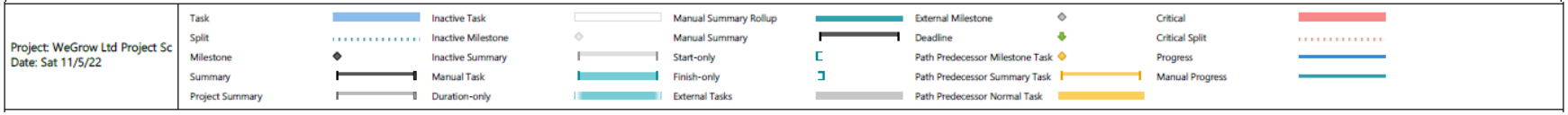
Schedule control is the process of monitoring the status of the project to update the project schedule managing changes to the schedule baseline (PMI, 2017). One of the main ways in which WeGrow Ltd. would maintain its schedule baseline is through periodic reviews using the Earned Value Management (EVM) technique. Here, schedule performance measurements such as schedule variance (SV) and schedule performance index (SPI) would be used to assess the magnitude of variation to the original schedule baseline. Under the project, this review would be conducted at 30%, 50% and 70% of project schedule execution. During each period, performance reviews would be conducted to measure, compare, and analyze schedule performance against the schedule baseline based using information on the amount of work remaining as well as the remaining duration for work in progress. Based on the EVM results, a determination would be made on whether any crashing or fast tracking would be required in meeting the schedule baseline established of 181 days. Any change requests that are subsequently received related to the project's schedule would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

Figure 22. Project Critical Path - Gantt Chart View

ID	Task Name	Duration	Start	Finish	Predecessors
1	**1. WeGrow Ltd. Urban Community-Based Hydroponics Farm Project in Belize City, Belize**	181 days	Sun 1/1/23	Fri 6/30/23	
2	1.1 Community - Based Project Management	181 days	Sun 1/1/23	Fri 6/30/23	
3	1.1.1 Stakeholder Consultations	24 days	Sun 1/8/23	Tue 1/31/23	
4	1.1.1.1 Consultation Report	9 days	Sun 1/8/23	Mon 1/16/23	
5	1.1.1.1.1 Conduct Community Consultation 1	1 day	Mon 1/9/23	Mon 1/9/23	
6	1.1.1.1.2 Conduct Community Consultation 2	1 day	Wed 1/11/23	Wed 1/11/23	
7	1.1.1.1.3 Conduct Community Consultation 3	1 day	Fri 1/13/23	Fri 1/13/23	
8	1.1.1.1.4 Draft Consultation Report	9 days	Sun 1/8/23	Mon 1/16/23	
9	1.1.1.2 Community Agreement	15 days	Tue 1/17/23	Tue 1/31/23	
10	1.1.1.2.1 Draft Community Management Agreement	4 days	Tue 1/17/23	Fri 1/20/23	8
11	1.1.1.2.2 Complete Legal Review of Agreement	10 days	Sat 1/21/23	Mon 1/30/23	10
12	1.1.1.2.3 Sign Community Management Agreement	0 days	Tue 1/31/23	Tue 1/31/23	11
13	1.1.2 Project Management Plan	181 days	Sun 1/1/23	Fri 6/30/23	
14	1.1.2.1 Administration	172 days	Sun 1/1/23	Wed 6/21/23	
15	1.1.2.1.1 Conduct Project Sponsor and PSC Meetings	3 days	Sun 1/1/23	Tue 1/3/23	
16	1.1.2.1.2 Draft Integrated Project Management Plan	4 days	Wed 1/4/23	Sat 1/7/23	15
17	1.1.2.1.3 Administer Project	164 days	Sun 1/8/23	Tue 6/20/23	16
18	1.1.2.1.4 Complete Project Administration Report	1 day	Wed 6/21/23	Wed 6/21/23	17
19	1.1.2.2 Procurement	52 days	Sun 1/8/23	Tue 2/28/23	
20	1.1.2.2.1 Conduct Procurements	51 days	Sun 1/8/23	Mon 2/27/23	
21	1.1.2.2.2 Complete Project Procurement Report	1 day	Tue 2/28/23	Tue 2/28/23	20
22	1.1.2.3 Monitoring and Evaluation	98 days	Sat 3/25/23	Fri 6/30/23	
23	1.1.2.3.1 Conduct Mid-Term Evaluation	6 days	Sat 3/25/23	Thu 3/30/23	
24	1.1.2.3.2 Complete Mid-Term Evaluation Report	1 day	Fri 3/31/23	Fri 3/31/23	23
25	1.1.2.3.3 Conduct Final Evaluation	6 days	Thu 6/15/23	Tue 6/20/23	
26	1.1.2.3.4 Complete Final Evaluation Report	1 day	Wed 6/21/23	Wed 6/21/23	25
27	1.1.2.3.5 Draft Project Completion Report	9 days	Thu 6/22/23	Fri 6/30/23	24,26
28	1.1.2.3.6 Approve Project Completion Report	0 days	Fri 6/30/23	Fri 6/30/23	
29	1.1.3 Community Management Plan	28 days	Wed 2/1/23	Tue 2/28/23	3
30	1.1.3.1 Training Materials	10 days	Wed 2/1/23	Fri 2/10/23	
31	1.1.3.1.1 Develop Community Management Plan Materials	7 days	Wed 2/1/23	Tue 2/7/23	
32	1.1.3.1.2 Procure Training and Sensitization Materials	3 days	Wed 2/8/23	Fri 2/10/23	31
33	1.1.3.2 Community Training	12 days	Fri 2/17/23	Tue 2/28/23	
34	1.1.3.2.1 Conduct Workshop 1	1 day	Fri 2/17/23	Fri 2/17/23	
35	1.1.3.2.2 Conduct Workshop 2	1 day	Fri 2/24/23	Fri 2/24/23	
36	1.1.3.2.3 Draft Post-Training Evaluation Report	4 days	Sat 2/25/23	Tue 2/28/23	34,35
37	1.1.3.2.4 Approve Post-Training Evaluation Report	0 days	Tue 2/28/23	Tue 2/28/23	
38	1.2 Hydroponics Farm Construction	144 days	Sun 1/8/23	Wed 5/31/23	
39	1.2.1 Materials Acquisition	52 days	Sun 1/8/23	Tue 2/28/23	
40	1.2.1.1 Construction Materials	24 days	Sun 1/8/23	Tue 1/31/23	
41	1.2.1.1.1 Purchase Construction Materials	23 days	Sun 1/8/23	Mon 1/30/23	
42	1.2.1.1.2 Store Construction Materials	1 day	Tue 1/31/23	Tue 1/31/23	41
43	1.2.1.2 Nutrients Solution and Seedlings	28 days	Wed 2/1/23	Tue 2/28/23	
44	1.2.1.2.1 Purchase Nutrients Solution and Seedlings	27 days	Wed 2/1/23	Mon 2/27/23	
45	1.2.1.2.2 Store Nutrients Solutions and Seedlings	1 day	Tue 2/28/23	Tue 2/28/23	44
46	1.2.2 Site Preparation	14 days	Wed 2/1/23	Tue 2/14/23	39
47	1.2.2.1 Clear Project Site	7 days	Wed 2/1/23	Tue 2/7/23	
48	1.2.2.2 Transport Construction Materials to Site	3 days	Wed 2/8/23	Fri 2/10/23	47
49	1.2.2.3 Erect Temporary Storage Room	14 days	Wed 2/1/23	Tue 2/14/23	
50	1.2.3 Construction	92 days	Wed 3/1/23	Wed 5/31/23	19
51	1.2.3.1 PVC Pipeline Framework	31 days	Wed 3/1/23	Fri 3/31/23	
52	1.2.3.1.1 Cut PVC Pipelines	10 days	Wed 3/1/23	Fri 3/10/23	
53	1.2.3.1.2 Connect and Install PVC Pipeline Framework	21 days	Sat 3/11/23	Fri 3/31/23	52

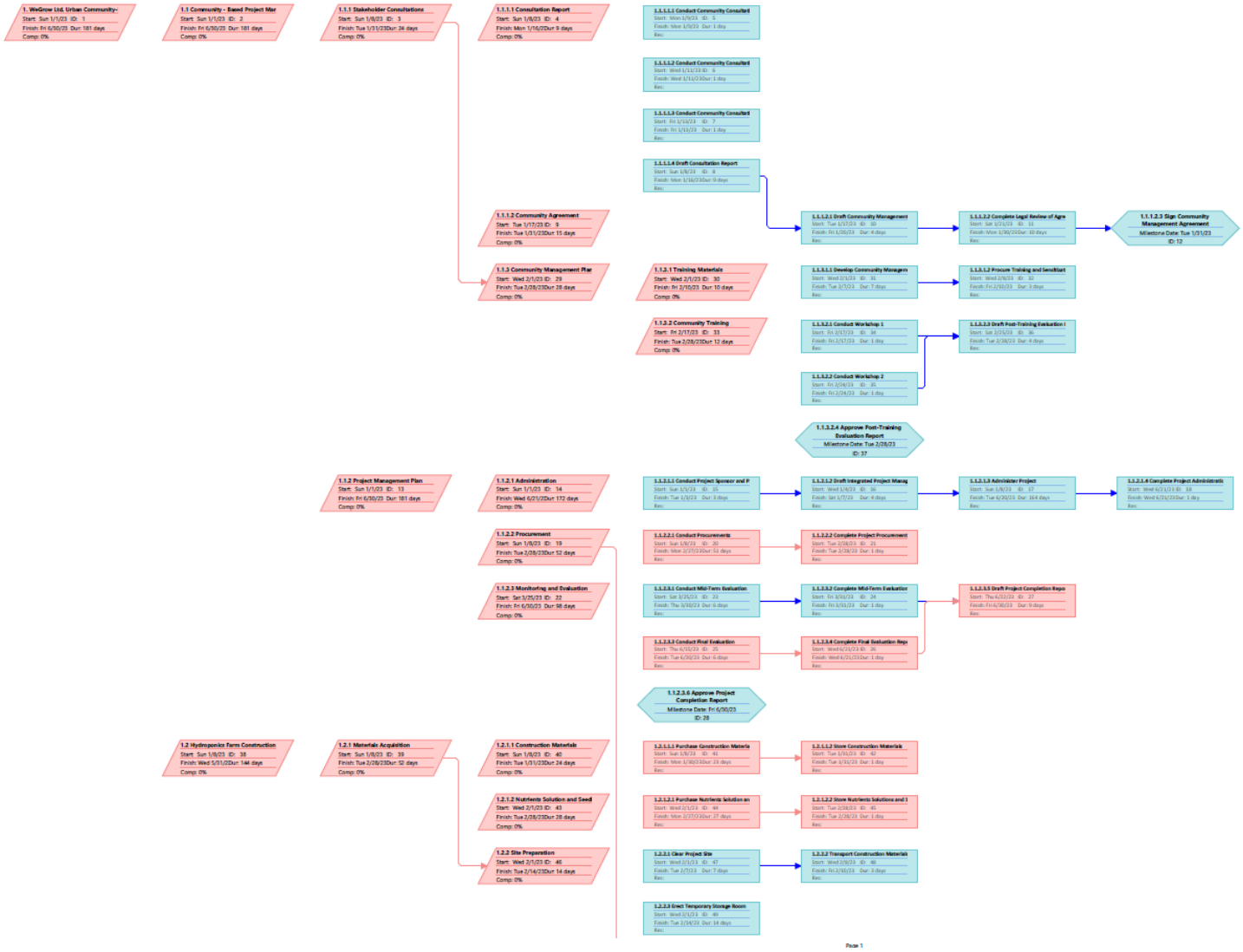
ID	Task Name	Duration	Start	Finish	Predecessors
54	1.2.3.2 Motor Installation	15 days	Sat 4/1/23	Sat 4/15/23	
55	1.2.3.2.1 Assemble Motor	10 days	Sat 4/1/23	Mon 4/10/23	
56	1.2.3.2.2 Test Motor	4 days	Tue 4/11/23	Fri 4/14/23	55
57	1.2.3.2.3 Install Motor	1 day	Sat 4/15/23	Sat 4/15/23	56
58	1.2.3.3 Greenhouse Roofing	47 days	Wed 3/15/23	Sun 4/30/23	
59	1.2.3.3.1 Assemble Greenhouse Roofing	25 days	Wed 3/15/23	Sat 4/8/23	
60	1.2.3.3.2 Pour Concrete Reinforcement Framework	22 days	Sun 4/9/23	Sun 4/30/23	59
61	1.2.3.4 Signage	15 days	Mon 5/1/23	Mon 5/15/23	58
62	1.2.3.4.1 Design and Print Signage	8 days	Mon 5/1/23	Mon 5/8/23	
63	1.2.3.4.2 Install Signage	7 days	Tue 5/9/23	Mon 5/15/23	62
64	1.2.3.5 Finishing Works	16 days	Tue 5/16/23	Wed 5/31/23	61
65	1.2.3.5.1 Paint Frameworks and Farm Perimeter	5 days	Tue 5/16/23	Sat 5/20/23	
66	1.2.3.5.2 Testing of Water and Electrical Frameworks	5 days	Sun 5/21/23	Thu 5/25/23	65
67	1.2.3.5.3 Clean Farm Perimeter	6 days	Fri 5/26/23	Wed 5/31/23	66
68	1.2.3.5.4 Draft Construction Completion Report	6 days	Fri 5/26/23	Wed 5/31/23	
69	1.2.3.5.5 Approve Construction Completion Report	0 days	Wed 5/31/23	Wed 5/31/23	
70	1.3 Quality Standards Certification	165 days	Sun 1/1/23	Thu 6/15/23	
71	1.3.1 Permits and Approvals	59 days	Sun 1/1/23	Tue 2/28/23	
72	1.3.1.1 Construction Permits	28 days	Wed 2/1/23	Tue 2/28/23	
73	1.3.1.1.1 Collect Required Documents	20 days	Wed 2/1/23	Mon 2/20/23	
74	1.3.1.1.2 Complete Central Building Authority Inspection	7 days	Tue 2/21/23	Mon 2/27/23	73
75	1.3.1.1.3 Obtain Approved Construction Permit	0 days	Tue 2/28/23	Tue 2/28/23	74
76	1.3.1.2 Environmental Permits	45 days	Sun 1/15/23	Tue 2/28/23	
77	1.3.1.2.1 Collect Required Documents	30 days	Sun 1/15/23	Mon 2/13/23	
78	1.3.1.2.2 Complete Department of Environment Inspection	14 days	Tue 2/14/23	Mon 2/27/23	77
79	1.3.1.2.3 Obtain Approved Environmental Clearance Certificate	0 days	Tue 2/28/23	Tue 2/28/23	78
80	1.3.1.3 Labor Permits	10 days	Sun 2/19/23	Tue 2/28/23	
81	1.3.1.3.1 Collect Required Documents	8 days	Sun 2/19/23	Sun 2/26/23	
82	1.3.1.3.2 Complete Labor Department Inspection	1 day	Mon 2/27/23	Mon 2/27/23	81
83	1.3.1.3.3 Obtain Approved Labor Permit	0 days	Tue 2/28/23	Tue 2/28/23	82
84	1.3.2 Quality Testing	76 days	Fri 3/31/23	Thu 6/15/23	
85	1.3.2.1 Inspections	62 days	Fri 3/31/23	Thu 6/1/23	
86	1.3.2.1.1 Conduct Quality Inspection 1 (Tests and Audit)	1 day	Fri 3/31/23	Fri 3/31/23	
87	1.3.2.1.2 Conduct Quality Inspection 2 (Tests and Audit)	1 day	Sun 4/30/23	Sun 4/30/23	
88	1.3.2.1.3 Conduct Quality Inspection 3 (Tests and Audit)	1 day	Wed 5/31/23	Wed 5/31/23	
89	1.3.2.1.4 Obtain Final Quality Test Results and Audit Report	0 days	Thu 6/1/23	Thu 6/1/23	86,87,88
90	1.3.2.2 Standards Certification	24 days	Mon 5/22/23	Thu 6/15/23	
91	1.3.2.2.1 Collect Required Documents	20 days	Mon 5/22/23	Sat 6/10/23	
92	1.3.2.2.2 Complete Bureau of Standards Inspection	4 days	Sun 6/11/23	Wed 6/14/23	91
93	1.3.2.2.3 Obtain Approved Quality Standards Certification	0 days	Thu 6/15/23	Thu 6/15/23	92

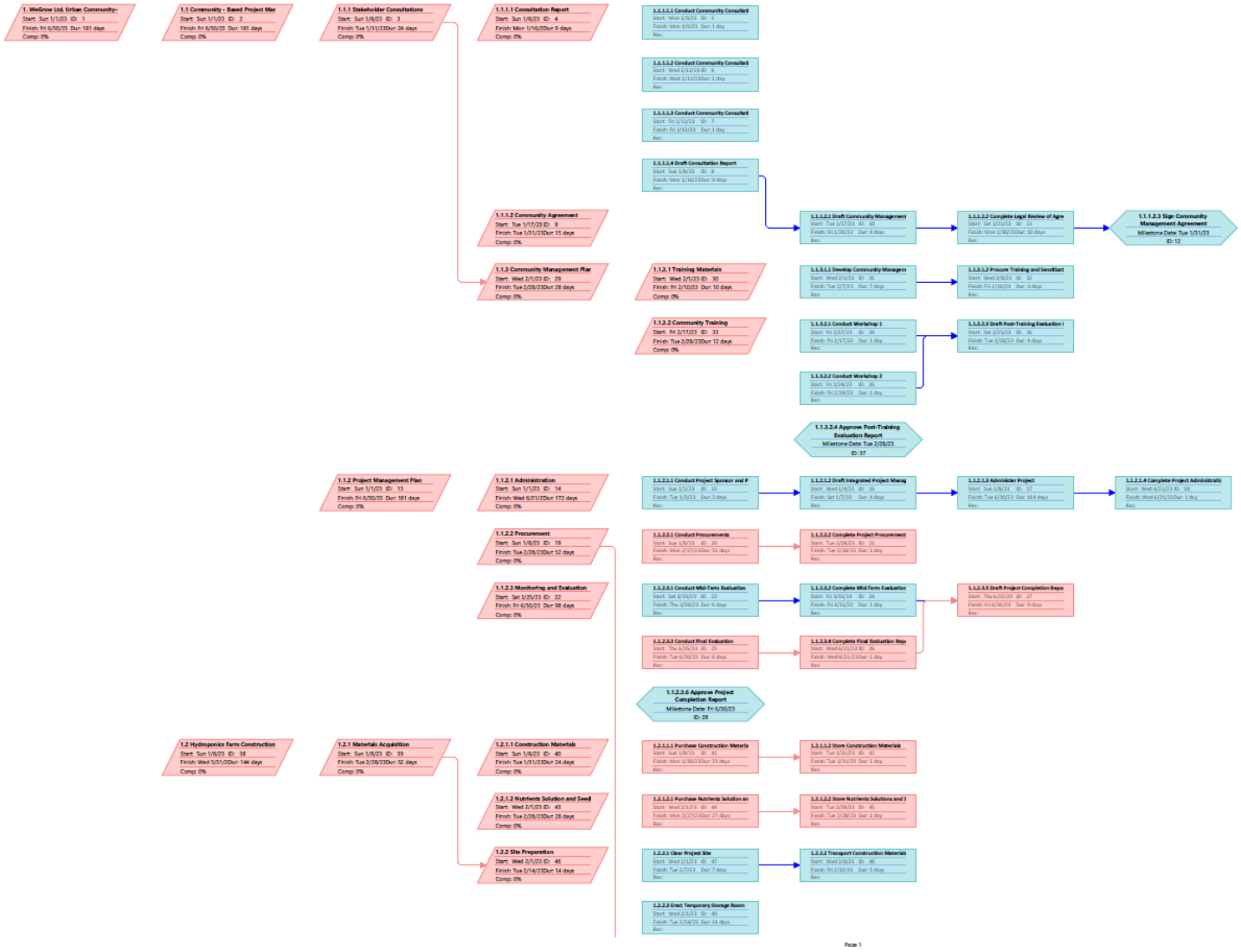


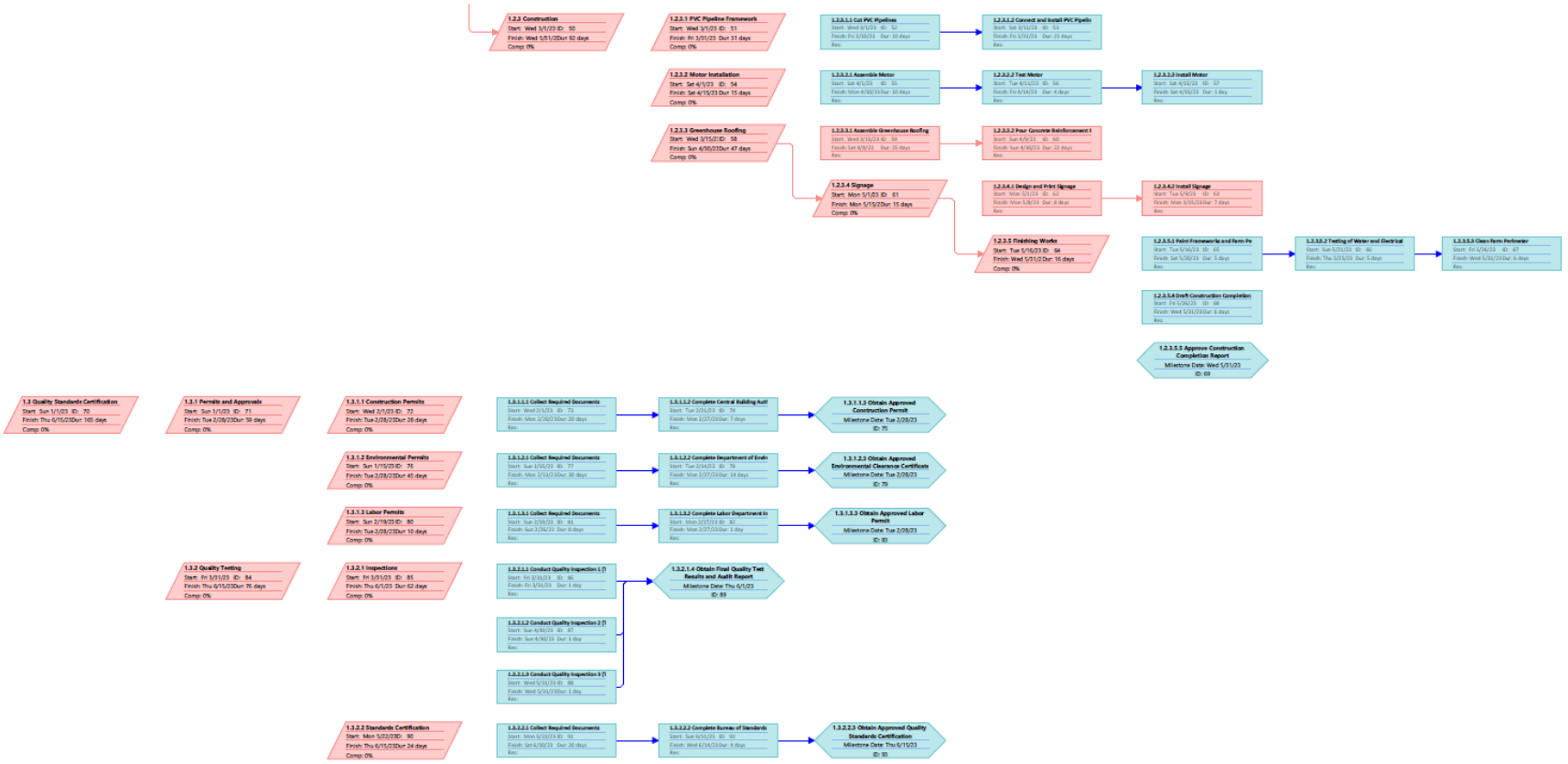


Note. Own work

Figure 23. Project Critical Path - Network Diagram View




1. WeGrow Ltd. Urban Community-
Start: Sun 1/1/23 ID: 1
Finish: Fri 6/30/23 Dur: 181 days
Comp: 0%
1.1 Community - Based Project Mar
Start: Sun 1/1/23 ID: 2
Finish: Fri 6/30/23 Dur: 181 days
Comp: 0%
1.1.1 Stakeholder Consultations
Start: Sun 1/8/23 ID: 3
Finish: Tue 1/31/23Dur: 24 days
Comp: 0%
1.1.1.1 Consultation Report
Start: Sun 1/8/23 ID: 4
Finish: Mon 1/16/23Dur: 9 days
Comp: 0%
1.1.1.1.1 Conduct Community Consultat
Start: Mon 1/9/23 ID: 5
Finish: Mon 1/9/23 Dur: 1 day
Res:
1.1.1.1.2 Conduct Community Consultat
Start: Wed 1/11/23 ID: 6
Finish: Wed 1/11/23Dur: 1 day
Res:
1.1.1.1.3 Conduct Community Consultat
Start: Fri 1/13/23 ID: 7
Finish: Fri 1/13/23 Dur: 1 day
Res:
1.1.1.1.4 Draft Consultation Report
Start: Sun 1/8/23 ID: 8
Finish: Mon 1/16/23Dur: 9 days
Res:
1.1.1.2 Community Agreement
Start: Tue 1/17/23 ID: 9
Finish: Tue 1/31/23Dur: 15 days
Comp: 0%
1.1.1.2.1 Draft Community Management
Start: Tue 1/17/23 ID: 10
Finish: Fri 1/20/23 Dur: 4 days
Res:
1.1.1.2.2 Complete Legal Review of Agre
Start: Sat 1/21/23 ID: 11
Finish: Mon 1/30/23Dur: 10 days
Res:
1.1.1.2.3 Sign Community Management Agreement
Milestone Date: Tue 1/31/23
ID: 12
1.1.1.3 Community Management Plan
Start: Wed 2/1/23 ID: 29
Finish: Tue 2/28/23Dur: 28 days
Comp: 0%
1.1.2.1 Training Materials
Start: Wed 2/1/23 ID: 30
Finish: Fri 2/10/23 Dur: 10 days
Comp: 0%
1.1.3.1.1 Develop Community Managem
Start: Wed 2/1/23 ID: 31
Finish: Tue 2/7/23 Dur: 7 days
Res:
1.1.3.1.2 Procure Training and SendStart
Start: Wed 2/8/23 ID: 32
Finish: Fri 2/10/23 Dur: 3 days
Res:
1.1.2.2 Community Training
Start: Fri 2/17/23 ID: 33
Finish: Tue 2/28/23Dur: 12 days
Comp: 0%
1.1.3.2.1 Conduct Workshop 1
Start: Fri 2/17/23 ID: 34
Finish: Fri 2/17/23 Dur: 1 day
Res:
1.1.3.2.3 Draft Post-Training Evaluation I
Start: Sat 2/25/23 ID: 36
Finish: Tue 2/28/23 Dur: 4 days
Res:
1.1.3.2.2 Conduct Workshop 2
Start: Fri 2/24/23 ID: 35
Finish: Fri 2/24/23 Dur: 1 day
Res:
1.1.3.2.4 Approve Post-Training Evaluation Report
Milestone Date: Tue 2/28/23
ID: 37
1.1.2 Project Management Plan
Start: Sun 1/1/23 ID: 13
Finish: Fri 6/30/23 Dur: 181 days
Comp: 0%
1.1.2.1 Administration
Start: Sun 1/1/23 ID: 14
Finish: Wed 6/21/23Dur: 172 days
Comp: 0%
1.1.2.1.1 Conduct Project Sponsor and P
Start: Sun 1/1/23 ID: 15
Finish: Tue 1/3/23 Dur: 3 days
Res:
1.1.2.1.2 Draft Integrated Project Manag
Start: Wed 1/4/23 ID: 16
Finish: Sat 1/7/23 Dur: 4 days
Res:
1.1.2.1.3 Administer Project
Start: Sun 1/8/23 ID: 17
Finish: Tue 6/20/23 Dur: 164 days
Res:
1.1.2.1.4 Complete Project Administrativ
Start: Wed 6/21/23 ID: 18
Finish: Wed 6/21/23 Dur: 1 day
Res:
1.1.2.2 Procurement
Start: Sun 1/8/23 ID: 19
Finish: Tue 2/28/23Dur: 52 days
Comp: 0%
1.1.2.2.1 Conduct Procurements
Start: Sun 1/8/23 ID: 20
Finish: Mon 2/27/23Dur: 51 days
Res:
1.1.2.2.2 Complete Project Procurement
Start: Tue 2/28/23 ID: 21
Finish: Tue 2/28/23 Dur: 1 day
Res:
1.1.2.3 Monitoring and Evaluation
Start: Sat 3/25/23 ID: 22
Finish: Fri 6/30/23 Dur: 98 days
Comp: 0%
1.1.2.3.1 Conduct Mid-Term Evaluation
Start: Sat 3/25/23 ID: 23
Finish: Thu 3/30/23 Dur: 6 days
Res:
1.1.2.3.2 Complete Mid-Term Evaluation
Start: Fri 3/31/23 ID: 24
Finish: Fri 3/31/23 Dur: 1 day
Res:
1.1.2.3.5 Draft Project Completion Repo
Start: Thu 6/22/23 ID: 27
Finish: Fri 6/30/23 Dur: 9 days
Res:
1.1.2.3.3 Conduct Final Evaluation
Start: Thu 6/15/23 ID: 25
Finish: Tue 6/20/23 Dur: 6 days
Res:
1.1.2.3.4 Complete Final Evaluation Repo
Start: Wed 6/21/23 ID: 26
Finish: Wed 6/21/23 Dur: 1 day
Res:
1.1.2.3.6 Approve Project Completion Report
Milestone Date: Fri 6/30/23
ID: 28
1.2 Hydroponics Farm Construction
Start: Sun 1/8/23 ID: 38
Finish: Wed 5/31/23Dur: 144 days
Comp: 0%
1.2.1 Materials Acquisition
Start: Sun 1/8/23 ID: 39
Finish: Tue 2/28/23Dur: 52 days
Comp: 0%
1.2.1.1 Construction Materials
Start: Sun 1/8/23 ID: 40
Finish: Tue 1/31/23Dur: 24 days
Comp: 0%
1.2.1.1.1 Purchase Construction Materia
Start: Sun 1/8/23 ID: 41
Finish: Mon 1/30/23Dur: 23 days
Res:
1.2.1.1.2 Store Construction Materials
Start: Tue 1/31/23 ID: 42
Finish: Tue 1/31/23 Dur: 1 day
Res:
1.2.1.2 Nutrients Solution and Seed
Start: Wed 2/1/23 ID: 43
Finish: Tue 2/28/23Dur: 28 days
Comp: 0%
1.2.1.2.1 Purchase Nutrients Solution an
Start: Wed 2/1/23 ID: 44
Finish: Mon 2/27/23Dur: 27 days
Res:
1.2.1.2.2 Store Nutrients Solutions and S
Start: Tue 2/28/23 ID: 45
Finish: Tue 2/28/23 Dur: 1 day
Res:
1.2.2 Site Preparation
Start: Wed 2/1/23 ID: 46
Finish: Tue 2/14/23Dur: 14 days
Comp: 0%
1.2.2.1 Clear Project Site
Start: Wed 2/1/23 ID: 47
Finish: Tue 2/7/23 Dur: 7 days
Res:
1.2.2.2 Transport Construction Materials
Start: Wed 2/8/23 ID: 48
Finish: Fri 2/10/23 Dur: 3 days
Res:
1.2.2.3 Erect Temporary Storage Room
Start: Wed 2/1/23 ID: 49
Finish: Tue 2/14/23 Dur: 14 days
Res:
Page 1



Note. Own work

4.4. Cost Management Plan

COST MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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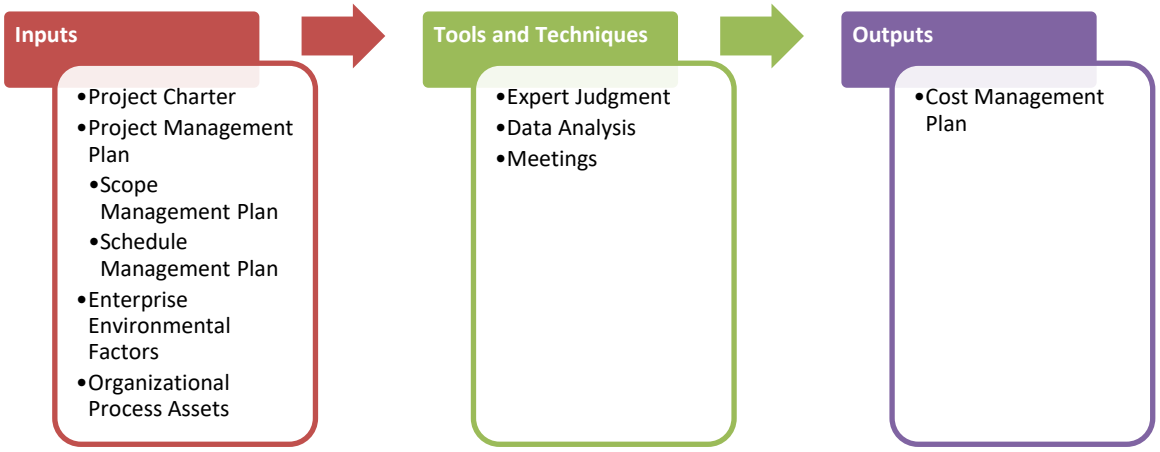
4.4.1 Introduction

Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing and controlling costs so that the project can be completed within the approved budget (PMI, 2017). The Plan Cost Management process creates the Cost Management Plan which defines how the project costs will be estimated, budgeted, managed, monitored and controlled. Given the limited resources allocated by the Project Sponsor to invest in the WeGrow Ltd. urban community-based hydroponics farming project, the management of costs remains critical to ensure that the budget is not exceeded. The inputs, as well as tools and techniques that would be used to create the Cost Management Plan are shown in **Figure 24**. A key input is the Project Charter which defines the approved project cost based on the cost baseline. The EEFs considered include organizational culture and structure and market conditions which influence the availability of resources needed in national and regional markets. The OPAs considered are mainly financial control procedures, financial databases, existing formal and informal cost estimating and budgeting guidelines and policies, as well as historical information and lessons learned from past projects. To obtain information needed to develop the Cost Management Plan, expert judgement, data analysis and meetings with key stakeholders would also be used. This process supports the development of the Cost

Management Plan including the Project Cost Estimate, Project Budget and Cost Control.

Figure 24. Plan Cost Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 7-2, p. 235 Copyright 2017 by PMI, Inc. Permission not sought.

4.4.2 Cost Management Approach

The total project budget for the WeGrow Ltd. urban community-based hydroponics farming project based on the Project Charter in **Chart 6** is BZD $216,300.00 inclusive of the contingency reserve and management reserve. Under the project, cost management will be the responsibility of the Project Manager. The Project Manager would be supported in managing and closely monitoring the project's cost by the Project Team, Project Sponsor, and Project Steering Committee (PSC). The Cost Management Plan is structured to include the project cost estimate, total project budget including the contingency reserve, cost baseline, and management reserve, as well as Earned Value Management (EVM) scenarios. The approach will ensure that the cost baseline is maintained ensuring that cost variance is kept under control avoiding project cost overruns. Any changes to the cost received from project stakeholders or other parties would undergo the Integrated Change Control Process established in Section 4.1.3 following the process established in **Figure 15** using the

change request form established in **Chart 7.** Any changes to the established project cost would be managed to ensure that the cost agreed with stakeholders is not deviated from significantly. The primary tools that will be used to manage costs include Microsoft Project and Microsoft Excel which provide several features to calculate and visualize project budgets.

4.4.2.1 Roles and Responsibilities

The Project Sponsor would establish the cost baseline based on agreement with stakeholders and the Project Steering Committee (PSC). A key consideration is also the total amount of resources available to execute the project based on the Project Sponsor's allocated budget as the initial investor under WeGrow Ltd. The Project Manager would thereafter play a key role in ensuring adherence to the Cost Management Plan by the Project Team who remain the main implementors. In ensuring the clarity on the roles related to schedule management, **Chart 13** elaborates the respective roles and responsibilities for WeGrow Ltd.'s project.

Chart 16. Cost Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Review and analyze cost change requests • Approve / reject escalated cost change requests • Convey project cost updates to the PSC • Tracks project progress based on cost baseline
Project Steering Committee	• Support Project Sponsor and Project Manager in the review of escalated cost change requests. • Review and approve cost change requests
Project Manager	• Review and analyze cost change requests • Defer / reject / approve / escalate cost change requests • Evaluate the need for cost changes • Communicate outcomes of cost change requests • Update project documents with cost changes

	• Monitor compliance with the Cost Management Plan • Monitor and report on project's performance based on established cost baseline using Earned Value Management
Project Team	• Elaborate the need for cost changes • Participate in the implementation of cost changes • Ensure compliance with the Cost Management Plan • Perform established activities within allocated budgets • Communicate risks and challenges to the Project Manager

Note. Own work

4.4.3 Project Cost Estimate

Estimate costs is the process of developing an approximation of the cost of resources needed to complete project work based on the scope baseline (PMI, 2017). To determine the total project budget for the WeGrow Ltd. urban community-based hydroponics farm, several techniques would be used including:

1. **Expert Judgment** – Where expertise within the project team is considered to determine costs based on experience within the industry.
2. **Analogous Estimating** – In estimating the costs of the project, values of a previous hydroponics project would be used being similar to the current project being executed by WeGrow Ltd.
3. **Bottom-Up Estimating** – The main technique that would be used to derive the total costs over the period of project execution is bottom-up estimating. Here, the costs of each deliverable or component would be calculated at the activity and work package level and "rolled up" to the higher levels in determining the total.

Chart 17 highlights the total cost to deliver all deliverables, control accounts and work packages under the project as BZD $200,000.00 once all the activities are costed and rolled up to the aggregated total. The various costs are also disaggregated based on the schedule baseline of six (6) months for execution.

Chart 17. Project Cost Estimate

ID	WBS ID	Activity ID	Task Name	Cost (BZD)	January	February	March	April	May	June
1	**1**		**WeGrow Ltd. Urban Community-Based Hydroponics Farm Project in Belize City, Belize**	**$ 200,000.00**						
2	**1.1**		**Community - Based Project Management**	**$ 40,000.00**						
3	**1.1.1**		**Stakeholder Consultations**	**$ 12,000.00**						
4	**1.1.1.1**		**Consultation Report**	**$ 4,000.00**						
5		1.1.1.1.1	Conduct Community Consultation 1		$ 1,000.00					
6		1.1.1.1.2	Conduct Community Consultation 2		$ 1,000.00					
7		1.1.1.1.3	Conduct Community Consultation 3		$ 1,000.00					
8		1.1.1.1.4	Draft Consultation Report		$ 1,000.00					
9	**1.1.1.2**		**Community Agreement**	**$ 8,000.00**						
10		1.1.1.2.1	Draft Community Management Agreement		$ 2,000.00					
11		1.1.1.2.2	Complete Legal Review of Agreement		$ 5,000.00					
12		1.1.1.2.3	Sign Community Management Agreement		$ 1,000.00					
13	**1.1.2**		**Project Management Plan**	**$ 17,000.00**						
14	**1.1.2.1**		**Administration**	**$ 5,000.00**						
15		1.1.2.1.1	Conduct Project Sponsor and PSC Meetings		$ 200.00					
16		1.1.2.1.2	Draft Integrated Project Management Plan		$ 800.00					
17		1.1.2.1.3	Administer Project		$ 600.00	$ 600.00	$ 600.00	$ 600.00	$ 600.00	$ 600.00
18		1.1.2.1.4	Complete Project Administration Report							$ 400.00
19	**1.1.2.2**		**Procurement**	**$ 6,000.00**						
20		1.1.2.2.1	Conduct Procurements		$ 2,750.00	$ 2,750.00				
21		1.1.2.2.2	Complete Project Procurement Report			$ 500.00				
22	**1.1.2.3**		**Monitoring and Evaluation**	**$ 6,000.00**						
23		1.1.2.3.1	Conduct Mid-Term Evaluation				$ 1,500.00			
24		1.1.2.3.2	Complete Mid-Term Evaluation Report				$ 500.00			
25		1.1.2.3.3	Conduct Final Evaluation							$ 1,500.00
26		1.1.2.3.4	Complete Final Evaluation Report							$ 500.00
27		1.1.2.3.5	Draft Project Completion Report							$ 2,000.00
28		1.1.2.3.6	Approve Project Completion Report							$ -
29	**1.1.3**		**Community Management Plan**	**$ 11,000.00**						
30	**1.1.3.1**		**Training Materials**	**$ 5,000.00**						

ID	WBS ID	Activity ID	Task Name	Cost (BZD)	January	February	March	April	May	June
31		1.1.3.1.1	Develop Community Management Plan Materials			$ 2,000.00				
32		1.1.3.1.2	Procure Training and Sensitization Materials			$ 3,000.00				
33	**1.1.3.2**		**Community Training**	**$ 6,000.00**						
34		1.1.3.2.1	Conduct Workshop 1			$ 2,500.00				
35		1.1.3.2.2	Conduct Workshop 2			$ 2,500.00				
36		1.1.3.2.3	Draft Post-Training Evaluation Report			$ 1,000.00				
37		1.1.3.2.4	Approve Post-Training Evaluation Report			$ -				
38	**1.2**		**Hydroponics Farm Construction**	**$ 110,000.00**						
39	**1.2.1**		**Materials Acquisition**	**$ 50,000.00**						
40	**1.2.1.1**		**Construction Materials**	**$ 40,000.00**						
41		1.2.1.1.1	Purchase Construction Materials		$ 38,000.00					
42		1.2.1.1.2	Store Construction Materials		$ 2,000.00					
43	**1.2.1.2**		**Nutrients Solution and Seedlings**	**$ 10,000.00**						
44		1.2.1.2.1	Purchase Nutrients Solution and Seedlings			$ 9,000.00				
45		1.2.1.2.2	Store Nutrients Solutions and Seedlings			$ 1,000.00				
46	**1.2.2**		**Site Preparation**	**$ 15,000.00**						
47		1.2.2.1	Clear Project Site			$ 5,000.00				
48		1.2.2.2	Transport Construction Materials to Site			$ 2,000.00				
49		1.2.2.3	Erect Temporary Storage Room			$ 8,000.00				
50	**1.2.3**		**Construction**	**$ 45,000.00**						
51	**1.2.3.1**		**PVC Pipeline Framework**	**$ 10,000.00**						
52		1.2.3.1.1	Cut PVC Pipelines				$ 3,000.00			
53		1.2.3.1.2	Connect and Install PVC Pipeline Framework				$ 7,000.00			
54	**1.2.3.2**		**Motor Installation**	**$ 8,000.00**						
55		1.2.3.2.1	Assemble Motor					$ 3,500.00		
56		1.2.3.2.2	Test Motor					$ 1,500.00		
57		1.2.3.2.3	Install Motor					$ 3,000.00		
58	**1.2.3.3**		**Greenhouse Roofing**	**$ 15,000.00**						
59		1.2.3.3.1	Assemble Greenhouse Roofing				$ 6,000.00	$ 1,000.00		
60		1.2.3.3.2	Pour Concrete Reinforcement Framework					$ 8,000.00		
61	**1.2.3.4**		**Signage**	**$ 4,000.00**						
62		1.2.3.4.1	Design and Print Signage						$ 3,500.00	

ID	WBS ID	Activity ID	Task Name	Cost (BZD)	January	February	March	April	May	June
63		1.2.3.4.2	Install Signage						$ 500.00	
64	**1.2.3.5**		**Finishing Works**	**$ 8,000.00**						
65		1.2.3.5.1	Paint Frameworks and Farm Perimeter						$ 2,500.00	
66		1.2.3.5.2	Testing of Water and Electrical Frameworks						$ 2,000.00	
67		1.2.3.5.3	Clean Farm Perimeter						$ 1,500.00	
68		1.2.3.5.4	Draft Construction Completion Report						$ 2,000.00	
69		1.2.3.5.5	Approve Construction Completion Report						$ -	
70	**1.3**		**Quality Standards Certification**	**$ 50,000.00**						
71	**1.3.1**		**Permits and Approvals**	**$ 38,000.00**						
72	**1.3.1.1**		**Construction Permits**	**$ 12,000.00**						
73		1.3.1.1.1	Collect Required Documents			$ 7,000.00				
74		1.3.1.1.2	Complete Central Building Authority Inspection			$ 5,000.00				
75		1.3.1.1.3	Obtain Approved Construction Permit			$ -				
76	**1.3.1.2**		**Environmental Permits**	**$ 18,000.00**						
77		1.3.1.2.1	Collect Required Documents		$ 8,000.00	$ 5,000.00				
78		1.3.1.2.2	Complete Department of Environment Inspection			$ 5,000.00				
79		1.3.1.2.3	Obtain Approved Environmental Clearance Certificate			$ -				
80	**1.3.1.3**		**Labor Permits**	**$ 8,000.00**						
81		1.3.1.3.1	Collect Required Documents			$ 5,000.00				
82		1.3.1.3.2	Complete Labor Department Inspection			$ 3,000.00				
83		1.3.1.3.3	Obtain Approved Labor Permit			$ -				
84	**1.3.2**		**Quality Testing**	**$ 12,000.00**						
85	**1.3.2.1**		**Inspections**	**$ 5,000.00**						
86		1.3.2.1.1	Conduct Quality Inspection 1 (Tests and Audit)				$ 1,500.00			
87		1.3.2.1.2	Conduct Quality Inspection 2 (Tests and Audit)					$ 1,500.00		
88		1.3.2.1.3	Conduct Quality Inspection 3 (Tests and Audit)						$ 1,500.00	
89		1.3.2.1.4	Obtain Final Quality Test Results and Audit Report							$ 500.00
90	**1.3.2.2**		**Standards Certification**	**$ 7,000.00**						
91		1.3.2.2.1	Collect Required Documents						$ 3,000.00	$ 1,000.00
92		1.3.2.2.2	Complete Bureau of Standards Inspection							$ 2,500.00
93		1.3.2.2.3	Obtain Approved Quality Standards Certification							$ 500.00
			Total Cost Estimate	**$ 200,000.00**	**$ 64,350.00**	**$ 69,850.00**	**$ 20,100.00**	**$ 19,100.00**	**$ 17,100.00**	**$ 9,500.00**

ID	WBS ID	Activity ID	Task Name	Cost (BZD)	January	February	March	April	May	June
			Contingency (5%)	**$ 10,000.00**		**$ 2,000.00**	**$ 2,000.00**	**$ 2,000.00**	**$ 2,000.00**	**$ 2,000.00**
			Cost Baseline	**$ 210,000.00**	**$64,350.00**	**$71,850.00**	**$22,100.00**	**$21,100.00**	**$19,100.00**	**$11,500.00**
			Cumulative Cost Estimate (per month)		**$64,350.00**	**$136,200.00**	**$158,300.00**	**$179,400.00**	**$198,500.00**	**$210,000.00**
			Management Reserve (3%)	**$ 6,300.00**						
			Total Project Budget	**$ 216,300.00**						

Note. Own work

4.4.4 Project Budget

Based on the established project cost estimate in **Chart 17**, the total project budget can thereafter be determined. Determine budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline (PMI, 2017). The cost estimates are aggregated by work packages in accordance with the project's WBS established in **Figure 18**. In determining the cost baseline, a contingency reserve of 5% or $10,000.00 would be added to the total project cost estimate. Contingency reserves are the budget within the cost baseline that is allocated for identified risks often intended to address the known unknowns that can affect a project (PMI, 2017). This contingency reserve is effective after month 1 distributed accordingly. Hence, the cost baseline for the WeGrow Ltd. hydroponics farming project can be established as BZD $210,000.00. Subsequently, management reserves are added to the cost baseline to produce the total project budget. The management reserve is allocated for management control purposes reserved for unforeseen work that is within the scope of the project. In determining the total project budget, a management reserve of 3% of BZ $6,300.00 would be added to the cost baseline yielding a total project budget of BZD $216,300.00. **Chart 18** below demonstrates the total project budget for the WeGrow Ltd. project including the contingency reserve, cost baseline, and management reserve.

Chart 18. Project Budget

WBS ID	WBS Deliverable	Est. Cost (BZD)
1.1	**Community - Based Project Management**	**$ 40,000.00**
1.1.1	Stakeholder Consultations	$ 12,000.00
1.1.1.1	Consultation Report	$ 4,000.00
1.1.1.2	Community Agreement	$ 8,000.00
1.1.2	Project Management Plan	$ 17,000.00
1.1.2.1	Administration	$ 5,000.00
1.1.2.2	Procurement	$ 6,000.00
1.1.2.3	Monitoring and Evaluation	$ 6,000.00
1.1.3	Community Management Plan	$ 11,000.00
1.1.3.1	Training Materials	$ 5,000.00
1.1.3.2	Community Training	$ 6,000.00

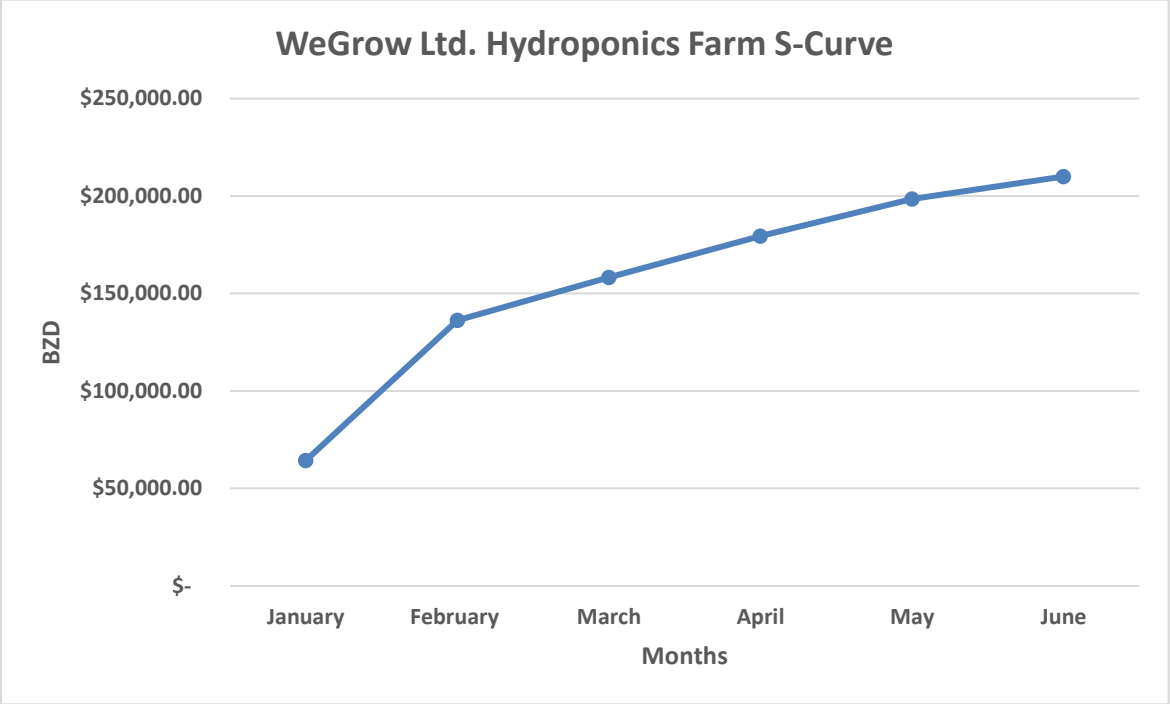
1.2	**Hydroponics Farm Construction**	**$**	**110,000.00**
1.2.1	Materials Acquisition	$	50,000.00
1.2.1.1	Construction Materials	$	40,000.00
1.2.1.2	Nutrients Solution and Seedlings	$	10,000.00
1.2.2	Site Preparation	$	15,000.00
1.2.3	Construction	$	45,000.00
1.2.3.1	PVC Pipeline Framework	$	10,000.00
1.2.3.2	Motor Installation	$	8,000.00
1.2.3.3	Greenhouse Roofing	$	15,000.00
1.2.3.4	Signage	$	4,000.00
1.2.3.5	Finishing Works	$	8,000.00
1.3	**Quality Standards Certification**	**$**	**50,000.00**
1.3.1	Permits and Approvals	$	38,000.00
1.3.1.1	Construction Permits	$	12,000.00
1.3.1.2	Environmental Permits	$	18,000.00
1.3.1.3	Labor Permits	$	8,000.00
1.3.2	Quality Testing	$	12,000.00
1.3.2.1	Inspections	$	5,000.00
1.3.2.2	Standards Certification	$	7,000.00
	Total - Cost Estimate	**$**	**200,000.00**
	Contingency (5%)	$	10,000.00
	Total - Cost Baseline	**$**	**210,000.00**
	Management Reserve (3%)	$	6,300.00
	Total - Project Budget	**$**	**216,300.00**

Note. Own work

4.4.4.1 Project Cost Baseline S-Curve

Based on the cost baseline established as BZD $210,000.00, the project's S-Curve can be determined which is a time-phased view of the cost baseline. The S-Curve establishes the way in which Earned Value Management (EVM) can be used to measure the project's progress and performance often referred to as the performance measurement baseline. In the case of the WeGrow Ltd. hydroponics project, the project's S-Curve can be established as shown in **Figure 25**. It is clear that the project's peak expenditures would occur in month 1 and 2 based on the cash flows indicated in **Chart 17**. This is also aligned to the schedule baseline which indicates that a majority of the procurement of construction materials needed for the project takes place in the first two months attributed to the higher expenditures.

Figure 25. Project S-Curve



Note. Own work

4.4.5 Cost Control

Cost control is the process of monitoring the status of the project to update the project costs and manage changes to the cost baseline (PMI, 2017). One of the main ways in which WeGrow Ltd. would maintain its cost baseline is through periodic reviews using the Earned Value Management (EVM) technique. Here, cost performance measurements such as cost variance (CV) and cost performance index (CPI) would be used to assess the magnitude of variation to the original cost baseline. Under the project, this review would be conducted at 30%, 50% and 70% of project cost execution. During each period, performance reviews would be conducted to measure, compare, and analyze cost performance against the cost baseline based using information on the amount of work remaining as well as the remaining budget for work in progress. Based on the EVM results, a determination would be made on whether any corrective actions would be needed in order to keep the project within budget. The EVM analysis completed would also enable a forecast of the Budget at Completion (BAC) and the Estimate Time to Complete (ETC) which

would help to determine whether the project would require additional time and if it would need to utilize its established contingency or management reserves. In monitoring EVM performance, the EVM performance management scorecard in **Chart 19** would be used in each scenario. Indices ranking in yellow would be reported to the Project Manager, while those in red would be escalated to the Project Steering Committee (PSC). Any change requests that are subsequently received related to the project's cost would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

Chart 19. EVM Performance Management Scorecard

EVM Measure	Formula	Green	Yellow	Red
Schedule Performance index (SPI)	Earned Value (EV) / Planned Value (PV)	Equal to 1 Project work completed is equal to planned work	Between 1 and 0.8 – slightly less work completed than planned (delayed) or Between 1 and 1.2 – slightly more work completed than planned	Less Than 0.8 – significantly less work completed than planned (delayed) or Greater than 1.2 – significantly more work completed than planned
Cost Performance Index (CPI)	Earned Value (EV) / Actual Cost (AC)	Equal to 1 Project work completed is on planned cost	Between 1 and 0.8 – slight cost overrun (over-budget) or Between 1 and 1.2 – slight cost underrun (under-budget)	Less Than 0.8 – high cost overrun (over-budget) or Greater than 1.2 – high cost underrun (under-budget)

Note. Own work

4.4.5.1 Earned Value Management Analysis and Scenarios

In demonstrating how the Earned Value Management (EVM) indicators would be used within the WeGrow Ltd. project, the following hypothetical scenarios were created. The two (2) scenarios have been created for the performance reviews to occur at 50% (90 days) and 70% (127 days) of project implementation from the total project execution period of 181 days. For each scenario, the EVM indicators would be analyzed collectively to determine the respective corrective actions to be taken. The indicators that will be calculated and analyzed have been defined below:

1. **Planned Value (PV)** - is the authorized budget assigned to scheduled work. It is the authorized budget planned for the work to be accomplished for an activity or Work Breakdown Structure component, not including management reserve.

2. **Earned Value (EV)** – is the measure of the work performed expressed in terms of the budget authorized for the work. It is the budget associated with the authorized work that has been completed.

3. **Actual Cost (AC)** – is the realized cost incurred for the work performed on an activity during a specific time period, that is the cost actually incurred for the work completed by a specified date.

4. **Schedule Variance (SV)** – this is the measure of schedule performance expressed as the difference between the earned value (EV) and the planned value (PV). It is the amount by which the project is ahead or behind the planned delivery date, at a given point in time. Schedule Variance is calculated using the following equation: SV = EV – PV. A positive SV is ahead of schedule while a negative is behind schedule.

5. **Cost Variance (CV)** – is the amount of budget deficit or surplus at a given point in time, expressed as the difference between earned value (EV) and actual cost (AC). It is equal to the earned value minus the actual cost, that is:

CV = EV – AC. The cost variance at the end of a project will be the difference between the budget at completion (BAC) and the actual amount spent. A positive CV is under budget, while a negative is over budget.

6. **Schedule Performance Index (SPI)** – is the measure of schedule efficiency expressed as the ratio of earned value to planned value. It measures how efficiently the project team is accomplishing the work. SPI can be calculated using the equation: SPI = EV/PV. An SPI value less than (<) 1.0 indicates that less work was completed than was planned. An SPI value greater than (>) 1.0 indicates that more work was completed than planned. An SPI value equal (=) to 1.0 means that the work completed is equal to the planned work.

7. **Cost Performance Index (CPI)** – is the measure of cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost. It measures the cost efficiency for the work completed. The CPI is equal to the ratio of the earned value (EV) to the actual cost (AC) and is calculated using the equation: CPI = EV/AC. A CPI value less than (<) 1.0 indicates a cost overrun for the work completed, that is over budget. A CPI value greater than (>) than 1.0 indicates a cost underrun of performance to date, that is under budget. A CPI value equal (=) to 1.0 means the project is on planned cost.

8. **Budget at Completion (BAC)** – The sum of all budgets established for the work to be performed. This is also known as the total project planned value.

9. **Estimated Cost at Completion (EAC)** – is the total expected cost at completing all work expressed as the sum of the actual cost to date and the estimate to complete. EAC is equal to the approved budget for the project minus the cost variance for the work done to date for an activity. This is calculated as: EAC = Budget at Completion (BAC) + Actual Cost (AC) – Earned Value (EV). It can also be calculated as: EAC = BAC / CPI.

10. **Estimated Time to Complete (ETC)** – is the estimated cost to finish all the remaining work. Estimated Time to Complete is calculated using the following equation: ETC = EAC – AC.

11. **Time Estimate at Completion (TEAC)** – The forecasting of time at completion is known as the time estimate at completion (TEAC) whereas the forecast of time to complete the remaining work is known as the Time at Completion (TAC). TEAC = TAC / SPI

Scenario 1 – 50% (90 days)

Under scenario 1, 50% of the total project duration has elapsed occurring at 90 days into the project. The total planned value (PV) at this point based on the cost baseline is BZD $158,300.00. The current cost status is an Earned Value (EV) of BZD $145,000.00 with an Actual Cost (AC) of BZD $152,000.00. In this scenario that both the EV and AC are less than the PV. It is also noted that the EV is less than the AC incurred at this time. Based on this scenario and the assumptions below, the EVM indicators can be calculated and analyzed for the project at this hypothetical stage. Subsequently, some recommendations have also been proposed.

Assumptions:

- The project commenced smoothly in its initial stages but has started to experience some challenges due to several factors.
- There were some delays with obtaining materials due to logistical challenges both nationally and internationally. Additional costs were incurred to pay for express shipping and handling.
- There were also delays in obtaining the construction permit from the Central Building Authority to commence works on the rooftop hydroponics farm due to a late inspection completed. This also added to the costs since express fees were paid to obtain the permit quickly.
- Some of the contractors also caught COVID-19 and missed a few days of work on the project delaying construction.

EVM Indicators:

(1) Schedule variance status - SV calculation

Formula: SV = EV-PV

Calculation: BZD $145,000.00 - BZD $158,300.00

Total SV = - BZD $13,300.00

(2) Cost variance status - CV calculation

Formula: CV = EV-AC

Calculation: BZD $145,000.00 - BZD $152,000.00

Total CV = - BZD $7,000.00

(3) Schedule Performance Index (SPI) calculation

Formula: SPI = EV/PV

Calculation: BZD $145,000.00 / BZD $158,300.00

Total SPI = 0.92

(4) Cost Performance Index (CPI) calculation

Formula: CPI = EV/AC

Calculation: BZD $145,000.00 / BZD $152,000.00

Total CPI = 0.95

(5) Project duration forecast calculation

Formula: TEAC = TAC / SPI

Calculation: 181 days / 0.92

Total TEAC = 192 days

(6) Total cost forecast calculation

Formula: EAC = BAC / CPI

Calculation: US $210,000.00 / 0.95

Total EAC = US $220,137.93

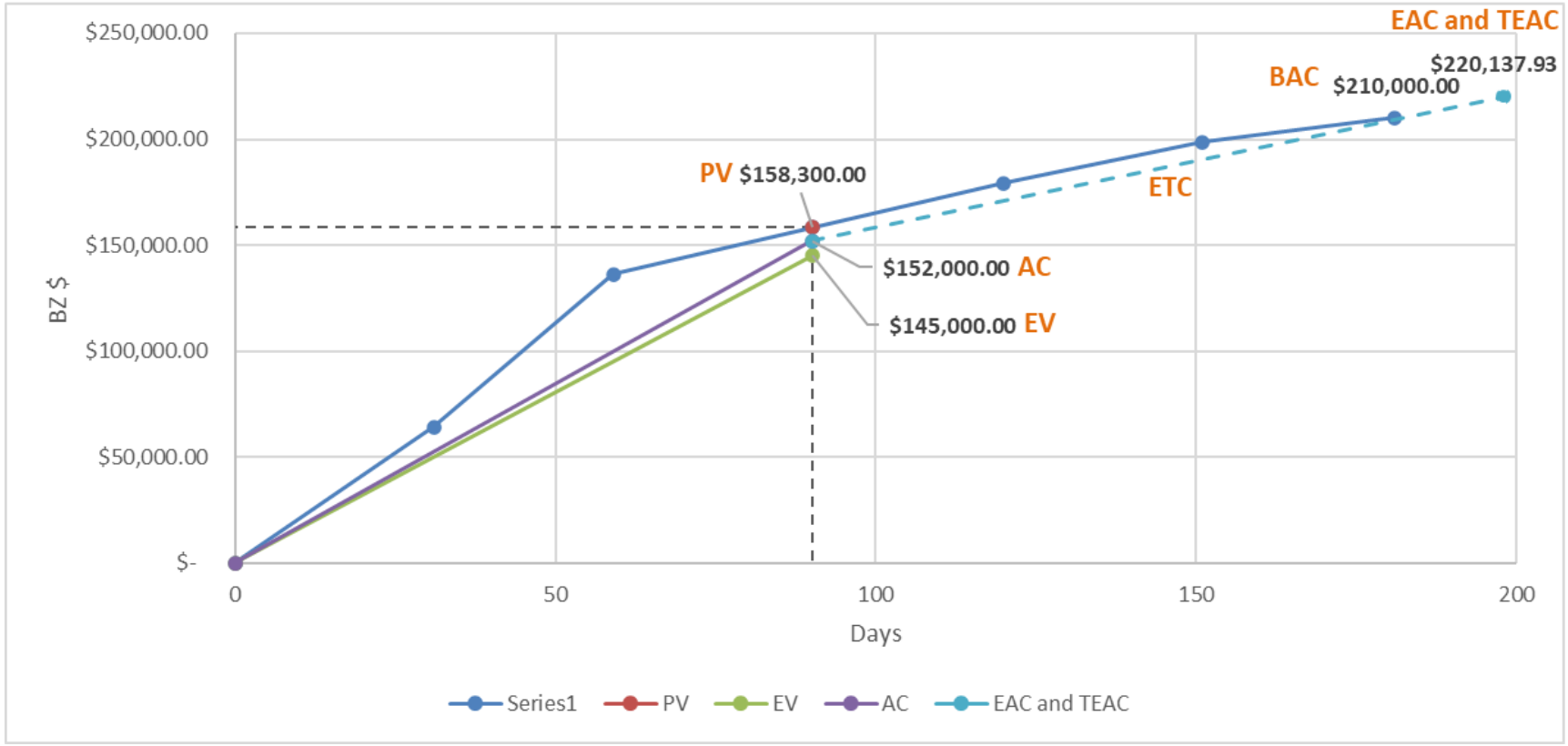
EVM Analysis:

Based on the calculations of the indicators above, the status of the project at 50% of implementation can be analyzed to determine potential recommendations. In this scenario, the SV was a negative - BZD $13,300.00. This shows that the project is behind schedule. The CV was also negative at – BZD $7,000.00 which indicates that the EV is less than the AC spent in the project so far. This would mean there is a cost overrun of actual costs versus the earned value at that time, meaning the project is over budget. The SPI was <1 at 0.92 which means that less work was completed during the period than that which was planned for. The CPI was also <1 at 0.95 indicating a cost overrun for the work completed during the period. It would mean that costs were higher than budgeted for. Based on these indicators, the project duration and cost forecasts were also calculated. The Time Estimate at Completion (TEAC) was calculated as 198 which is 17 days over the schedule baseline of 181 days. This shows that the project will run over schedule if it continues in this manner. The Estimate at Completion (EAC) was also calculated as BZD $220,137.93 which is BZD $10,137.93 over the initially established cost baseline of BZD $210,000.00. This shows that the project will run over its budgeted cost baseline and even beyond the total project budget of BZD $216,300.00. This would deplete both the contingency and management reserves established if the project were to continue in this manner. **Figure 26** highlights the EVM S-Curve for the WeGrow Ltd. project under scenario 1 demonstrating the various indicators analyzed.

Recommendations for Scenario 1

Given that under scenario 1, the project is both behind schedule and over budget, one of the proposed corrective actions that can be proposed is fast tracking. This is a schedule compression technique in which activities or phases, normally done in sequence, are performed in parallel for at least a portion of the duration (PMI, 2017). However, the WeGrow Ltd. project would need to ensure that risks are managed thoroughly so that quality does not suffer. Some additional actions that can be taken include the preordering of any additional materials needed well before the procurement schedule dates to avoid delays. Lastly, having backup contractors should any others catch COVID-19 would also be recommended to continue works.

Figure 26. WeGrow Ltd. Scenario 1 (90 days) EVM S-Curve



Note. Own work

Scenario 2 – 70% (127 days)

Under scenario 2, 70% of the total project duration has elapsed occurring at 127 days into the project. The total planned value (PV) at this point based on the cost baseline is BZD $183,712.00. The current cost status is an Earned Value (EV) of BZD $198,500.00 with an Actual Cost (AC) of BZD $191,263.00. In this scenario that both the EV and AC are greater than the PV. It is also noted that the EV is more than the AC incurred at this time. Based on this scenario and the assumptions below, the EVM indicators can be calculated and analyzed for the project at this hypothetical stage. Subsequently, some recommendations have also been proposed.

Assumptions:

- The project had some challenges; however, due to some corrective actions implemented, the project is now generally on track.
- Despite some delays with obtaining materials due to logistical challenges both nationally and internationally, the Project Manager was able to frontload procurement to obtain materials with less delays.
- The remaining environmental and labor permits were acquired smoothly as all requirements were met based on early consultations with the Department of Environment and Labour Department.
- Implementation of COVID-19 health protocols on site, and the use of backup contractors, supported work to be done continuously without absences.
- The project team has also advanced through all the stages team development including forming, storming and norming now within the stage of performing at optimal efficiencies.

EVM Indicators:

(1) Schedule variance status - SV calculation

Formula: SV = EV-PV

Calculation: BZD $198,500.00 - BZD $183,712.00

Total SV = BZD $14,788

(2) Cost variance status - CV calculation

Formula: CV = EV-AC

Calculation: BZD $198,500.00 - BZD $191,263.00

Total CV = BZD $7,237.00

(3) Schedule Performance Index (SPI) calculation

Formula: SPI = EV/PV

Calculation: BZD $198,500.00 / BZD $183,712.00

Total SPI = 1.08

(4) Cost Performance Index (CPI) calculation

Formula: CPI = EV/AC

Calculation: BZD $198,500.00 / BZD $191,263.00

Total CPI = 1.04

(5) Project duration forecast calculation

Formula: TEAC = TAC / SPI

Calculation: 181 days / 1.08

Total TEAC = 168 days

(6) Total cost forecast calculation

Formula: EAC = BAC / CPI

Calculation: US $210,000.00 / 1.04

Total EAC = US $202,343.73

EVM Analysis:

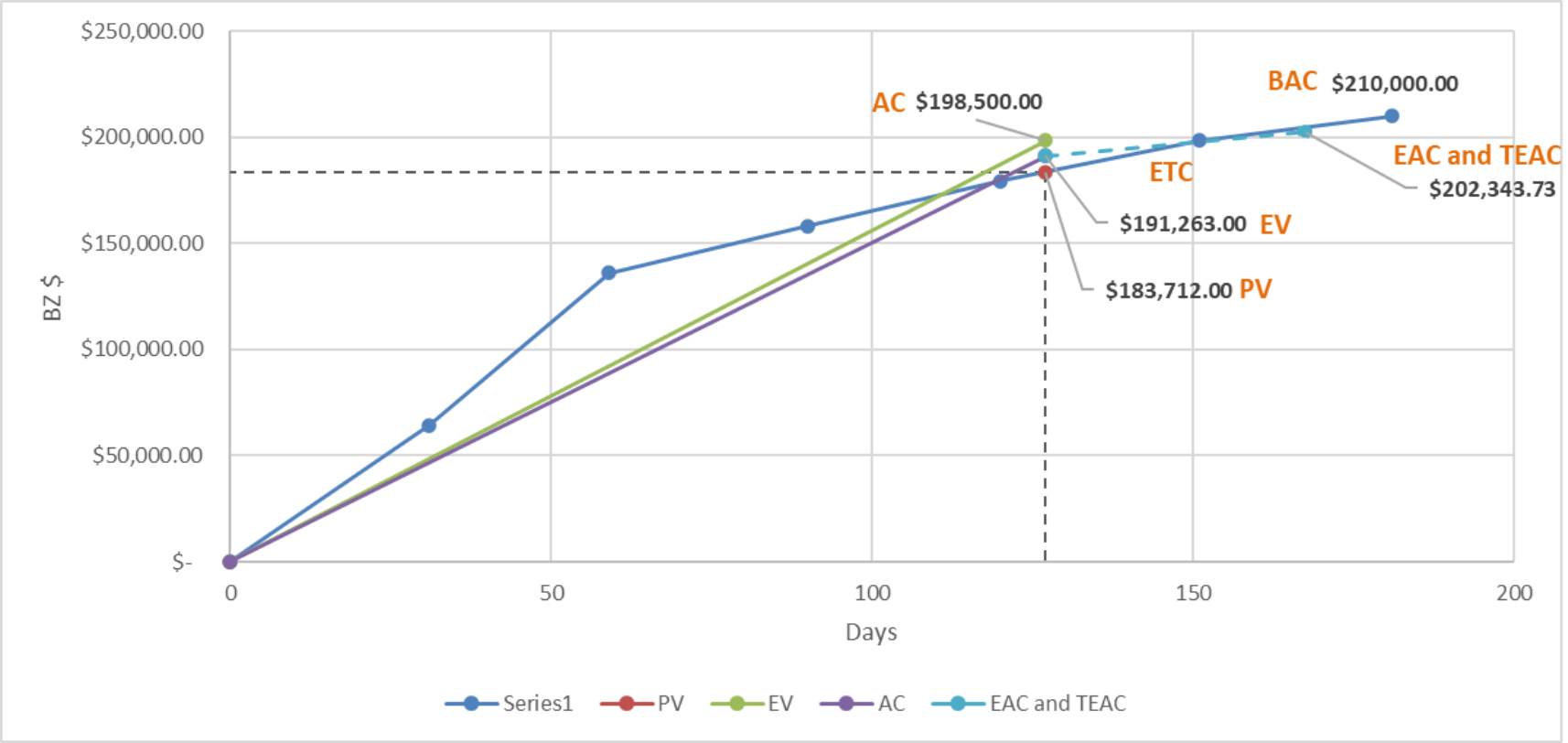
Based on the calculations of the indicators above, the status of the project at 70% of implementation can be analyzed to determine potential recommendations. In this scenario, the SV was a positive BZD $14,788.00. This shows that the project is ahead of schedule. The CV was also positive at BZD $7,237.00 which indicates that

the EV is more than the AC spent in the project so far. This would mean there is a cost underrun of actual costs versus the earned value at that time, meaning the project is under budget. The SPI was >1 at 1.08 which means that more work was completed during the period than that which was planned for. The CPI was also >1 at 1.04 indicating a cost underrun for the work completed during the period. It would mean that costs were less than budgeted for. Based on these indicators, the project duration and cost forecasts were also calculated. The Time Estimate at Completion (TEAC) was calculated as 168 days which is 13 days under the schedule baseline of 181 days. This shows that the project will finish ahead of time if it continues in this manner. The Estimate at Completion (EAC) was also calculated as BZD $202,343.73 which is BZD $7,656.27 under the initially established cost baseline of BZD $210,000.00. This savings show that the project will run under its budgeted cost baseline well below the total project budget of BZD $216,300.00. This would mean that the project would only use BZD $2,343.73 from its total contingency reserve and would not need to use its management reserve if the project were to continue in this manner. **Figure 27** highlights the EVM S-Curve for the WeGrow Ltd. project under scenario 2 demonstrating the various indicators analyzed.

Recommendations for Scenario 2

Given that under scenario 2, the project is both ahead of schedule and under budget, there would not be many recommendations for corrective actions to be taken. This is particularly because the project is expected to be completed early with savings from the cost baseline. However, one of the cautions in this scenario is to ensure that quality does not suffer. Though in this scenario, the project seems to be moving at a fast pace with cost savings, it is critical that the Project Manager analyzes the quality of each deliverable produced based on the WBS established. PMI (2017) cautions that though fast tracking a project can shorten a project's duration, it can increase risks and may result in rework with additional costs. One recommendation is to ensure that the mid-term and final evaluations under work package 1.1.2.3. analyze the quality of the hydroponics farm. Additionally, the quality standards certification built into the project from the Belize Bureau of Standards would also support this quality assurance check outside of the quality assurance plan alone.

Figure 27. WeGrow Ltd. Scenario 2 (127 days) EVM S-Curve



Note. Own work

4.5. Quality Management Plan

QUALITY MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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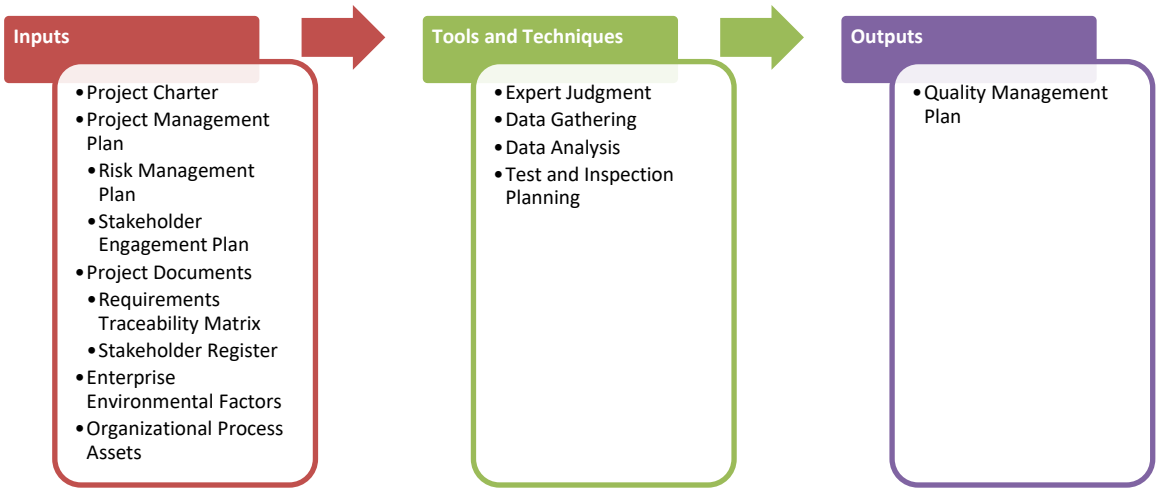
4.5.1 Introduction

Project Quality Management includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements in order to meet stakeholders' objectives (PMI, 2017). The Plan Quality Management process identifies quality requirements and / or standards for the project and its deliverables, documenting how the project will demonstrate compliance with quality requirements and / or standards. For the WeGrow Ltd. hydroponics farming project, quality remains a key element with an entire deliverable itself being dedicated to quality standards certification, namely component 1.3. The inputs, as well as tools and techniques that would be used to create the Quality Management Plan are highlighted in **Figure 28**. A key input is the requirements traceability matrix which is a tool that helps to define quality requirements for the project based on priority. The EEFs considered include government agency regulations, marketplace conditions, as well as rules, standards, and guidelines specific to hydroponic farming. The OPAs considered are mainly organizational quality management policies, as well as quality management templates. Tools and techniques include expert judgement, data gathering through benchmarking and interviews, cost of quality data analysis, and test and inspection planning. This process supports the development of the Quality Management Plan including Quality Assurance and Quality Control.

Figure 28. Plan Quality Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 7-2, p. 235 Copyright 2017 by PMI, Inc. Permission not sought.

4.5.2 Quality Management Approach

For the WeGrow Ltd. urban community-based hydroponics farming project, the quality management approach will commence with defining quality requirements. Quality requirements for the project would be defined based on the consultations conducted with residents of the target location, namely, the Kings Park Area community, in determining the requirements for each deliverable. The Project Manager would lead the definition and documentation of quality requirements based on the consultations held including inputs from the Project Sponsor and Project Steering Committee (PSC). Apart from planning quality management, the subsequent processes include managing and controlling quality throughout the project. The Project Manager would ensure that the Project Team is aware of all quality requirements established, while continuously measuring and documenting the process to meet quality requirements based on metrics identified. The project also encompasses several tools including quality inspections, evaluations, audits, permits and standards certifications to ensure verified deliverables and quality reports focusing on customer satisfaction and continuous improvement.

4.5.2.1 Roles and Responsibilities

In ensuring that quality is maintained throughout the project, the responsibilities would be shared across all stakeholders involved in the project since quality is considered the work of everybody (PMI, 2017). The Project Manager would play a key role in ensuring that quality requirements received from the Project Sponsor, Project Steering Committee (PSC), and stakeholders, are well-documented and share with the Project Team for monitoring and implementation. As shared by PMI (2017), prevention is preferred over inspection since the cost of preventing mistakes is generally much less than the cost of correcting mistakes found by inspection. This prevention of non-conforming work to quality requirements is a key shared responsibility. **Chart 20** further elaborates the respective roles and responsibilities for WeGrow Ltd.'s project related to quality management.

Chart 20. Quality Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Support the definition of quality expectations • Review and analyze quality change requests • Approve / reject escalated quality change requests • Convey project quality updates to the PSC • Support tracking progress based on quality requirements • Provide support to audits and inspections when needed
Project Steering Committee	• Support the definition of quality expectations • Support Project Sponsor and Project Manager in the review of escalated quality change requests. • Review and approve quality change requests
Project Manager	• Consolidate all quality expectations and requirements • Review and analyze quality change requests • Defer / reject / approve / escalate quality change requests • Evaluate the need for changes in quality requirements • Communicate outcomes of quality change requests

	• Update project documents with quality changes • Monitor compliance with the Quality Management Plan • Monitor and report on project's performance based on established quality requirements • Lead audits, quality inspections and quality reports as defined
Project Team	• Elaborate the need for quality changes • Participate in the implementation of quality changes • Ensure compliance with the Quality Management Plan • Perform work in conformance to quality requirements • Support the provision of information for audits and inspections • Communicate risks and challenges to the Project Manager

Note. Own work

4.5.3 Quality Assurance

In ensuring that quality objectives are met under the WeGrow Ltd. hydroponics farming project, all the quality assurance activities concerned with the project's design and process improvements would be considered as a part of conformance work. Quality assurance would ensure that project processes are managed effectively to meet standards while assuring stakeholders that the final product will meet needs, expectations and requirements. In order to manage quality effectively, WeGrow Ltd. would establish its quality control measurements to analyze and evaluate the quality of processes and deliverables of the project against established requirements. It would also establish quality metrics as the basis for the development of test scenarios for the project and its deliverables to determine improvement initiatives. Quality testing and audits is one of the key tools included in the project which would be conducted by an external team to determine if project activities comply with quality standards and specifications both at the process and deliverable levels. **Chart 21** highlights the project's quality assurance plan as the primary approach to managing quality. It includes the requirements and quality objectives for each work package, including quality assurance activities, frequency of measurement, metrics, and persons responsible

Chart 21. Quality Assurance Plan

WBS ID	Work Package	General Requirements Description	Quality Objectives	Quality Assurance Activities	Quality Metrics	Frequency of Measurement	Responsible
1.1.1	Stakeholder Consultations	Community is sensitized with all documents written in simple English, being easy to read and available digitally and in hard copy	To ensure at least 60% community buy-in and participation in the project with readable versions of the consultation report and community agreement.	Post Consultation Evaluation Questionnaire	% of stakeholders rating consultation as effective and understandable	Three times based on project schedule	Project Manager
				Consultation Report Quality Review Checklist	% of report checklist completed	Once	Admin Assistant
				Community Agreement Quality Review Checklist	# of legal issues raised % of agreement checklist completed	Once	Project Sponsor
1.1.2	Project Management Plan	Project Management Plan includes all knowledge areas from PMI	To ensure effective project administration, procurement, and monitoring and evaluation by including all 10 PMI knowledge areas in the Project Management Plan.	Project Management Plan Review Checklist	# of knowledge areas included	Once	Project Manager
				Administration and Procurement Reports Review Checklists	# of issues raised % of reports checklist completed	Monthly	Admin. Assistant and Finance and Accounting Officer
				Mid-Term Evaluation, Final Evaluation, and Project Completion Reports Review Checklists	# of issues raised % of evaluation checklist passed	Three times based on project schedule	Project Manager

WBS ID	Work Package	General Requirements Description	Quality Objectives	Quality Assurance Activities	Quality Metrics	Frequency of Measurement	Responsible
1.1.3	Community Management Plan	Community is sensitized and the plan is written in simple English, being easy to read and available digitally and in hard copy	To ensure at least 60% community buy-in and participation in the project's community-based model with guaranteed understanding by community members.	Community Management Plan Review Checklist	% of checklist completed # of errors identified	Once	Project Manager
				Training Materials Checklist Review	% of training materials checklist completed	Once	Finance and Accounting Officer
				Post Training Workshop Evaluation Survey	% of training satisfaction rating % of participants that understand the plan	Two times based on project schedule	Contractor
1.2.1	Materials Acquisition	Materials should be sustainable where possible	To ensure that sustainable sourcing is practiced for at least 50% of the construction materials, nutrients solutions and seedlings sourced	Verification of suppliers' sustainability certification and alternatives analysis	# of suppliers with sustainability certification	Once	Finance and Accounting Officer
				Sourcing and Expense Report Review Checklist	% of report checklist completed % of materials sustainably sourced	Once	Finance and Accounting Officer
1.2.2	Site Preparation	Secure location that is easily accessible by community	To ensure 100% safety and security of contractors and community	Site Preparation Report Review Checklist	% of report checklist completed	Once	Contractor
				Site inspections	% of non-conformance # of injuries reported	Monthly	Project Manager

WBS ID	Work Package	General Requirements Description	Quality Objectives	Quality Assurance Activities	Quality Metrics	Frequency of Measurement	Responsible
1.2.3	Construction	Farm must be fully functional covering 20 ft x 20 ft with clear signage being built within budget by June 30, 2022	To maintain the construction schedule established within budget meeting 100% of the size, and functional requirements	Testing of Motors, Pipelines, Water and Electrical Equipment	# of defects detected # of failed tests % of success rates	Weekly	Contractor / Project Manager
				Construction Completion Report Review Checklist	% of report checklist completed % of construction plan compliance # of construction issues	Once	Contractor / Project Manager
1.3.1	Permits and Approvals	All required construction, labor and environmental permits are approved and kept on site	To ensure 100% compliance to local building, environmental and labor regulations with visibility.	Construction Permit Requirements Review Checklist	# of requirements completed % of permit compliance	Bi-weekly for compliance	Contractor / Project Manager
				Environmental Permit Requirements Review Checklist	# of requirements completed % of permit compliance	Bi-weekly for compliance	Contractor / Project Manager
				Labor Permit Requirements Review Checklist	# of requirements completed % of permit compliance	Bi-weekly for compliance	Contractor / Project Manager
1.3.2	Quality Testing	Materials used meet minimum quality standards and farm is build	To ensure that the farm can meet 100% minimum quality standards and	Quality Tests and Audits	# of quality tests passed # of issues identified during audits % of audit report checklist completed	Three times based on project schedule	Contractor / Project Manager

WBS ID	Work Package	General Requirements Description	Quality Objectives	Quality Assurance Activities	Quality Metrics	Frequency of Measurement	Responsible
		according to plans	functional testing requirements	Quality Standards Requirements Review Checklist	# of requirements completed # of issues identified during inspections % of standards compliance	Once for Standards Certification	Project Manager

Note. Own work.

4.5.4 Quality Control

Quality control is the process of monitoring and recording results of executing the quality management activities in order to assess performance and ensure the project outputs are complete, correct and meet customer expectations (PMI, 2017). During this process, WeGrow Ltd. would be able to ensure that the project's deliverables and work meet the requirements specified by key stakeholders and beneficiaries for final acceptance. In terms of controlling the quality of the project management processes itself, the project builds in a mid-term and final evaluation under work package 1.1.2.3. Additionally, component 1.3 itself is dedicated to quality standards certification. Since the project relies on several permits, the process of obtaining the permits from regulatory authorities would also allow the WeGrow Ltd. project to ensure it is built to minimum quality standards. This would include the construction permit from the Central Building Authority, the environmental permit from the Department of Environment, and the labor permit from the Labor Department. Additionally, three (3) quality inspection tests and audits are also included in the project in order to ensure that the hydroponics farm is fully functional based on standards specifications and quality requirements established in the requirements traceability matrix. Another way that quality would be controlled is also through the quality standards certification that would be obtained from the Belize Bureau of Standards (BBS). Through these mechanisms, the aim is for the project to meet the established quality requirements. Any change requests that are received related to quality management would need to submit the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

4.6. Resource Management Plan

RESOURCE MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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4.6.1 Introduction

Project Resource Management includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project (PMI, 2017). The Plan Resource Management process defines how team and physical resources are estimated, acquired, managed and used establishing the approach and level of management effort needed. The WeGrow Ltd. urban community-based hydroponics farming project will prioritize both human resources, as well as the physical resources including equipment, materials, facilities and infrastructure, needed to realize the project successfully. This is particularly given the requirement to source at least 50% of construction materials, nutrient solutions and seedlings from sustainable sources. The inputs, as well as tools and techniques that will be used to reach the output of the Resource Management Plan are highlighted in **Figure 29**. A key input is the quality management plan defining the level of resources required to achieve and maintain the defined level of quality standards and metrics. The EEFs considered include organizational culture and structure, geographic distribution, marketplace conditions and existing resources competencies and availability. The OPAs considered mainly include policies and procedures to manage

human and physical resources, safety and security policies, and historical lessons learned from similar projects. Tools and techniques used include expert judgement, data representation through hierarchical charts and a responsibility assignment matrix, as well as organizational theory and meetings. This process supports the creation of the Resource Management Plan defining the approach including Resource Estimates, Acquisition, Development, Management and Control.

Figure 29. Plan Resource Management

Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 9-2, p. 312 Copyright 2017 by PMI, Inc. Permission not sought.

4.6.2 Resource Management Approach

The resource management approach for WeGrow Ltd. will ensure that sufficient resources are available for the successful completion of the project. It will also plan for the availability of, or competition of scarce resources. It will determine what resources can be obtained internally within the organization, and what would need to be obtained externally through a procurement process. The resource management approach of WeGrow Ltd. is one that keenly considers the requirements established in the Requirements Traceability Matrix in **Chart 11**, as well as the quality metrics established in the Quality Assurance Plan presented in

Chart 21. The Project Manager would lead the management of team and physical resources based on the expectations and inputs of the Project Sponsor and Project Steering Committee (PSC). Critical to the success is also the continued empowerment and capacity building of the human resources behind the project. The approach also leverages several tools to manage resources including the Resource Breakdown Structure (RBS) and the RACI Chart specifically.

4.6.2.1 Roles and Responsibilities

In ensuring that the management of team and physical resources are well optimized, WeGrow Ltd. will ensure that roles and responsibilities are clearly outlined across the project. For WeGrow Ltd., the Project Manager is both the leader and manager to the Project Team, while simultaneously being responsible for the allocation of physical resources in an efficient and effective way to ensure the successful completion of the urban community-based hydroponics farm in Belize City. **Chart 22** further elaborates the respective roles and responsibilities for WeGrow Ltd.'s project related to resource management.

Chart 22. Resource Management Roles and Responsibilities

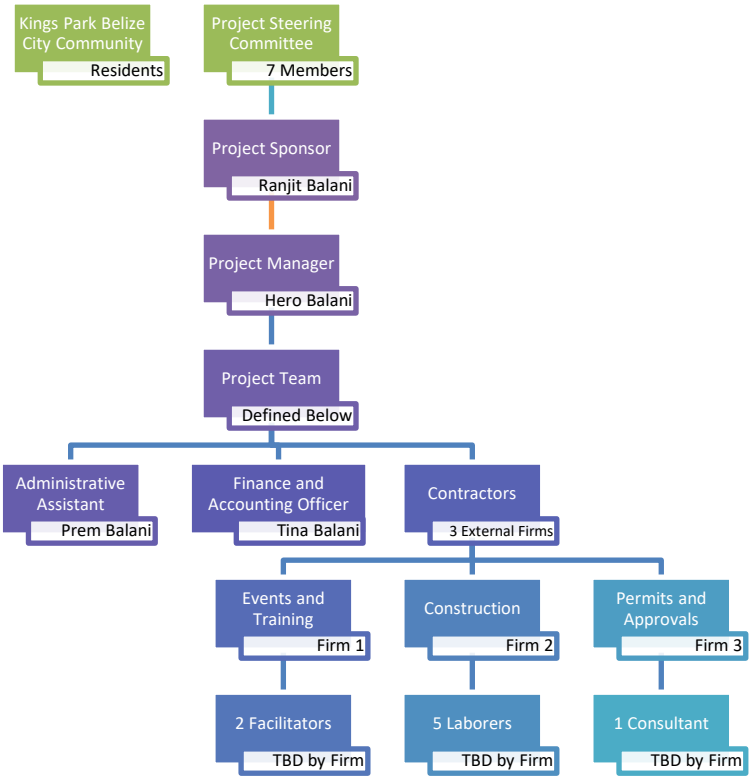
Role	Responsibilities
Project Sponsor	• Ensure that resources needed are available for the project • Support the definition of resource management expectations • Resolve any issues related to resource management • Review and analyze resource change requests • Approve / reject escalated resource change requests • Convey project resource management updates to the PSC • Ensure that project resources are managed transparently
Project Steering Committee	• Support the definition of resource management expectations • Support Project Sponsor and Project Manager in the review of escalated resource management change requests. • Review and approve resource change requests

Project Manager	• Consolidate all resource management expectations • Review and analyze resource management change requests • Defer / reject / approve / escalate resource change requests • Evaluate the need for changes in resources • Communicate outcomes of resource change requests • Update project documents with resource changes • Monitor compliance with the Resource Management Plan • Report on project's performance based on available resources • Ensure efficient and effective use of resources by project team
Project Team	• Elaborate the need for resource changes • Participate in the implementation of resource changes • Ensure compliance with the Resource Management Plan • Use resources in conformance with management requirements • Participate in team and capacity building activities • Communicate risks and challenges to the Project Manager

Note. Own work

Additionally, **Figure 30** presents the project organizational structure for the WeGrow Ltd. project which demonstrates the hierarchy and roles. This utilizes the theory of a hierarchical chart which shows positions and relationships in a graphical, top-down format (PMI, 2017). As referenced initially, the four (4) specific personnel listed under WeGrow Ltd.'s company organizational chart in **Figure 2** would form a part of the initial project team. The Project Steering Committee (PSC) and its seven (7) internal and external members defined in **Figure 16** would provide oversight, leadership and direction to the community-based project with the Project Sponsor as its main liaison. The Project Manager is shown to oversee the Project Team which comprises of the two (2) internal technical positions of the Administrative Assistant and the Finance and Accounting Officer. The project organizational structure also highlights the need for three (3) external contractors as consulting firms for specific functions including events and training, construction, and permits and approval facilitation.

Figure 30. WeGrow Ltd. Project Organizational Structure



Note. Own work.

4.6.2.2 RACI Matrix

Another tool that will be used by the WeGrow Ltd. project to support resource management is a Responsibility Assignment Matrix (RAM) which illustrates the connections between work packages and project team members. The specific type of matrix that will be used is the RACI matrix as a useful tool to ensure there is clear assignment of roles and responsibilities across internal and external team resources. This tool assigns a specific code to each role across four (4) categories including:

1. R – Responsible
2. A – Accountable
3. C – Consulted
4. I – Informed.

Chart 23 presents the RACI Matrix for the WeGrow Ltd. urban community-based hydroponics farming project at the work package level of the WBS.

Chart 23. RACI Matrix

WBS Code	Work Package Name	Project Steering Committee	Project Sponsor	Project Manager	Admin. Assistant	Finance and Accounting Officer	Contractor 1 (Events and Training)	Contractor 2 (Construction)	Contractor 3 (Permits and Approvals)	Kings Park Belize City Community
1.1.1	**Stakeholder Consultations**	C	C	R	C	C	A	I	I	C
1.1.2	**Project Management Plan**	C	C	R	C	A	I	I	I	I
1.1.3	**Community Management Plan**	C	C	R	C	C	A	C		C
1.2.1	**Materials Acquisition**	I	I	R	C	A	C	C		C
1.2.2	**Site Preparation**	I	I	A	C	C		R	C	I
1.2.3	**Construction**	I	I	A	C	C		R	C	I
1.3.1	**Permits and Approvals**	I	C	R	C	C	C	C	A	I
1.3.2	**Quality Testing**	I	C	R	C	C	C	A	C	I

Note. Own work.

4.6.3 Resource Estimates

Estimating activity resources is the process of estimating team resources, and the type and quantities of materials, equipment, and supplies necessary to perform project work (PMI, 2017). WeGrow Ltd. would deploy several estimating techniques in order to determine what team and physical resources would be needed to complete the hydroponics farm. Some techniques would include:

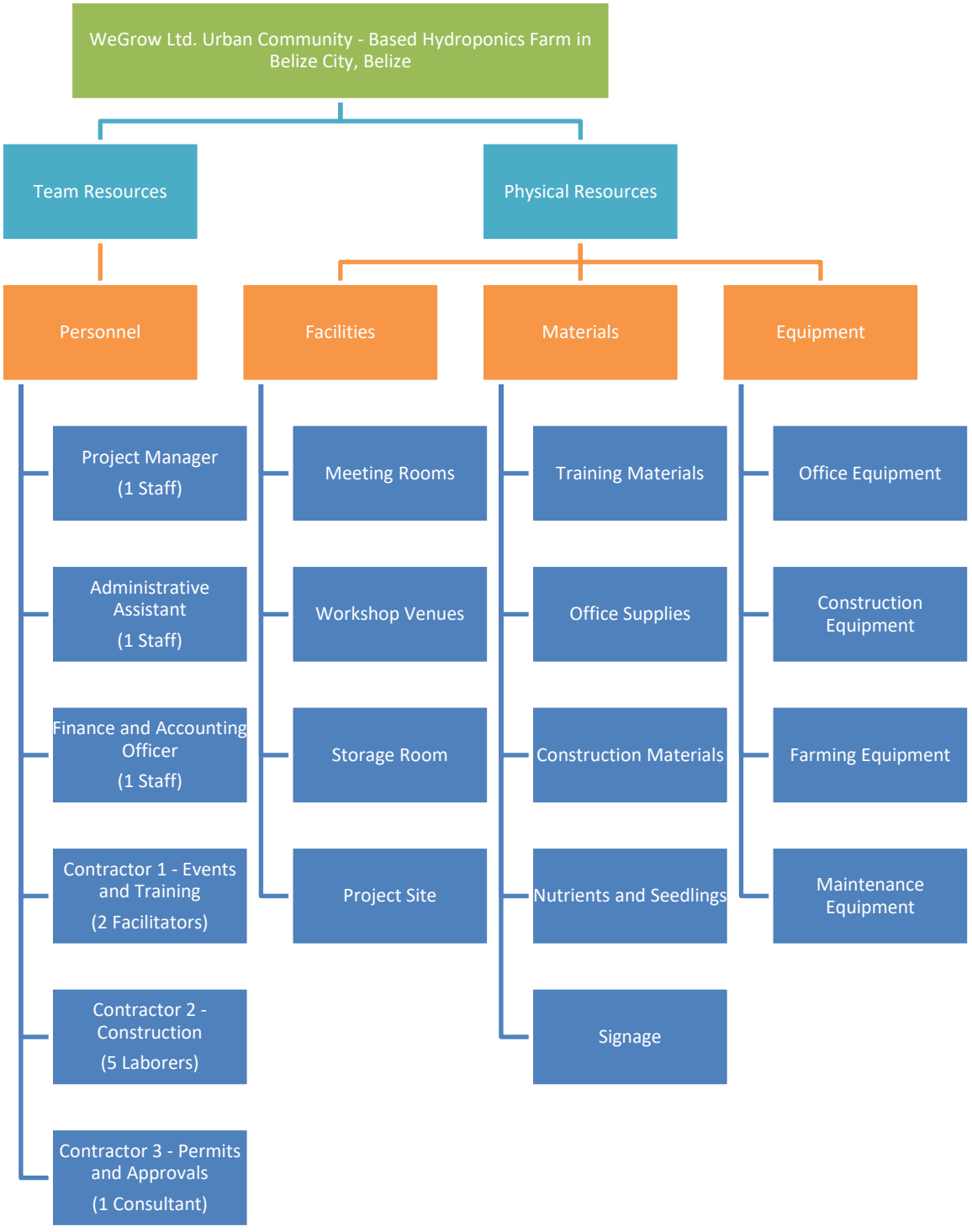
1. **Bottom-Up Estimating** – Similar to the practice of decomposition under the WBS, the team and physical resources would be estimated at the activity level and aggregated to the total required. For each activity, WeGrow Ltd. would estimate the human and physical resource requirements.
2. **Analogous Estimating** – Here, information regarding resources from a similar hydroponics project would be used as a basis for estimating the resources required. There are examples identified of existing hydroponics projects in Belize where this information can be sourced including global sources (Channel5 News, 2017).

A resource calendar would also be established at project inception to manage the availability of team and physical resources based on the established project schedule of 181 days. The project would follow the standard working hours in Belize of eight (8) hours with a one (1) hour break for lunch. Given the short timeline for project implementation within a six (6) month timeframe, the project assumes that the consulting firms hired would be available for works 7 days a week rotating the necessary laborers. This is also since site would remain accessible 7 days a week.

4.6.3.1 Resource Breakdown Structure

Another tool that WeGrow Ltd. would deploy as part of its Resource Management Plan is the Resource Breakdown Structure (RBS). The RBS is a hierarchical representation of resources by category and type including for example labor, material, equipment, and supplies (PMI, 2017). **Figure 31** depicts the RBS for the project including the personnel, facilities, materials and equipment that would be required to successfully complete urban community-based hydroponics farm.

Figure 31. Resource Breakdown Structure



Note. Own work.

4.6.4 Resource Acquisition

Acquiring resources entails the process of obtaining team members, facilities, equipment, materials, supplies and other resources necessary to complete project work (PMI, 2017). Since the WeGrow Ltd. urban community-based hydroponics project is a social enterprise start-up, some resources would be pre-assigned by the Project Sponsor. Here, the Project Manager (Mr. Hero Balani), the Finance and Accounting Officer (Ms. Tina Balani), and the Administrative Assistant (Mr. Prem Balani) would not need to be hired since these members form a part of the core staff under the WeGrow Ltd. company itself. Similarly, since the site for the farm has already been identified on the residential rooftop at 3 Corner Hopkins and First Street in Belize City, some physical resources that are already internal would become available for the project. However, external resources would need to be procured accordingly. **Chart 24** establishes the acquisition plan for the team and physical resources identified in the RBS under **Figure 31**.

Chart 24. Resource Acquisition Plan

ID	Resources	Source	Type of Acquisition
1	Project Manager	Internal	Pre-assigned
2	Administrative Assistant	Internal	Pre-assigned
3	Finance and Accounting Officer	Internal	Pre-assigned
4	Contractor 1 - Events and Training (2 Facilitators)	External	Short-term Contract, CVs, Interviews
5	Contractor 2 - Construction (5 Laborers)	External	Short-term Contract, CVs, Interviews, Portfolio
6	Contractor 3 - Permits and Approvals (1 Consultant)	External	Short-term Contract, CVs, Interviews
7	Meeting Rooms	Internal	Pre-assigned
8	Workshop Venues	External	Rental
9	Storage Room	External	Short-term Contract, CVs
10	Project Site	Internal	Pre-assigned
11	Training Materials	External	Local Purchase
12	Office Supplies	External	Local Purchase
13	Construction Materials	External	Local Purchase
14	Nutrients and Seedlings	External	Local Purchase
15	Signage	External	Local Purchase
16	Office Equipment	Internal	Pre-assigned
17	Construction Equipment	External	Local Hire
18	Farming Equipment	External	Local Purchase
19	Maintenance Equipment	External	Local Hire

Note. Own work

4.6.5 Team Development

Team development is the process of improving competencies, team member interaction, and the overall team environment to enhance project performance (PMI, 2017). WeGrow Ltd. would prioritize team development in ensuring that both internal and external team members are able to communicate and work effectively together. Colocation will be one of the techniques used at the Project Sponsor's premises where an office location would be available to the project team and contractors to meet and collaborate. Virtual communication technology would also be used to facilitate communications including a Google shared drive, Google Meet teleconferencing, email, and a WhatsApp chat group for the project. The Project Manager would also organize monthly team building activities as a sponsored lunch with the Project Sponsor as a part of recognizing and rewarding the team's effort to realizing the project within a short timeframe. Additionally, while community training is built into the project under work package 1.1.3, WeGrow Ltd.'s would also benefit from practical hydroponic farming capacity-building from the contractors hired onsite.

4.6.6 Team Management

Managing the team entails tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project performance (PMI, 2017). The Project Manager under WeGrow Ltd. comes with a background in both leadership and management which remain critical to managing a high-performance team. One of the main ways that performance would be managed is through weekly meetings to review progress, as well as monthly performance appraisals completed for each project team member. This preventive action would support the mitigation against future corrective actions. Additionally, at the project's inception, the project team would collectively develop a Team Charter which establishes its values, agreements, and operating guidelines. This early collectively agreed understanding and guideline would help to increase productivity and decrease misunderstandings. Nevertheless, if conflicts arise within the project team causing disruptions to the project, the relevant conflict responses would be triggered by personnel accordingly such as avoiding, accommodating, reconciling, directing or problem solving.

4.6.7 Resource Control

Resource control is the process of ensuring that the physical resources assigned and allocated to the project are available as planned, as well as monitoring the planned versus actual utilization of resources taking corrective action as necessary (PMI, 2017). Without the deployment of project resources at the right time and place, the project's success could become jeopardized. While the team would be managed based on performance appraisals, the facilities, materials and equipment required by the WeGrow Ltd. project would require timely utilization, release and control. One of the main ways that resources will be controlled is through the use of contractual agreements which would be made, particularly for resources procured externally to the organization. For example, the three (3) contractors as firms anticipated under the project would be resources that are controlled through short-term contracts. The RBS, RACI Matrix and Acquisition Plan would also support resource control and utilization. Particularly, the Team Charter to be established collectively at project commencement would also be critical in ensuring that each project team member is clear on its role, authority, competence and responsibility. Nevertheless, for any resource issues that arise, the Project Manager would deploy problem solving techniques, including negotiation and influence, to take corrective actions. The information received from work performance data and team performance appraisals would also support resource control and management. Any change requests that are received related to resource management, whether changes in physical or team resources, would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

4.7. Communication Management Plan

COMMUNICATIONS MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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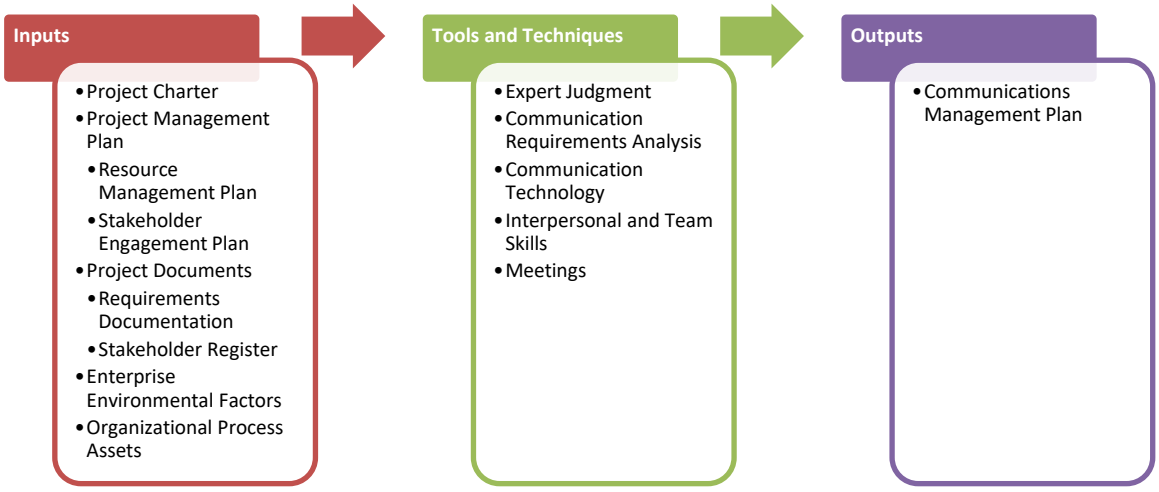
4.7.1 Introduction

Communications remains critical to the success of any project. Project Communications Management includes the processes necessary to ensure that the information needs of the project and its stakeholders are met (PMI, 2017). The Plan Communications Management process entails the development of appropriate approaches for communication activities based on information needs of each stakeholder or group, as well as available organizational assets and the needs of the project. The WeGrow Ltd. urban community-based hydroponics farming project will develop its internal and external communications strategy based on the needs of the project team and stakeholders. A keen focus would remain on ensuring community buy-in given the community-based management model of the urban hydroponics farm being critical to long-term sustainability. The inputs, as well as tools and techniques that will be used to reach the output of the Communications Management Plan are highlighted in **Figure 32**. Key inputs include the Resource Management and Stakeholder Engagement Plans. The EEFs considered include organizational culture, geographic distribution, and established communication channels, tools and systems. The OPAs considered mainly include organizational policies on social media, communication requirements, standardized guidelines for information management, and lessons learned from previous projects. Core tools and techniques used include expert judgement, communications requirements analysis,

technology, interpersonal and team skills, as well as meetings. This process supports the development of the Communications Management Plan defining the approach including Communications Management and Monitoring.

Figure 32. Plan Communications Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 10-2, p. 366 Copyright 2017 by PMI, Inc. Permission not sought.

4.7.2 Communications Management Approach

The communications management approach for WeGrow Ltd. will ensure that all dimensions of communication within the project are managed with clearly defined guidelines. This includes communications that are internal, external, formal, informal, official, unofficial, upward, downward, horizonal, written or oral. Each member of the project team will ensure that the general approach taken to any type of communication regarding the project is one that has a clear purpose being shared in a format that can be understood by the receiver in an effective manner. Key to the successful communications management approach is the use of technology and multiple channels based on the type and purpose of information being shared. WeGrow Ltd. will also place keen emphasis on two-way communications between the project team and stakeholders choosing the appropriate communication style based on political and cultural awareness of all involved.

4.7.2.1 Roles and Responsibilities

In guaranteeing that communications remain effective and meaningful across the project, WeGrow Ltd. will ensure that the roles and responsibilities related to communications are clearly documented and shared. The Project Manager holds a keen responsibility in ensuring that all communications are well documented where required, while also understanding and managing the nuances of communications between team members and stakeholders. Nevertheless, the WeGrow Ltd. project emphasizes that communication is a cross-cutting role and responsibility across all team members. **Chart 25** further summarizes the respective roles and responsibilities for the project related to communications management.

Chart 25. Communications Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Clarifies communications management expectations • Resolve any issues related to communications management • Review and analyze communication change requests • Approve / reject escalated communication change requests • Convey project communication updates to the PSC • Approve communication reports for updates to the PSC
Project Steering Committee	• Defines communication management expectations • Support Project Sponsor and Project Manager in the review of escalated communication management change requests. • Review and approve communication change requests • Review communication reports for external dissemination • Ensure that stakeholders are aware of project updates
Project Manager	• Consolidate all communication management expectations • Review and analyze communication change requests • Defer / reject / approve / escalate communication change requests • Evaluate the need for changes in communication tools

	• Communicate outcomes of change requests • Update project documents with communication changes • Monitor compliance with Communications Management Plan • Lead the compilation of project communication reports • Manage and resolve issues related to project communications • Ensure thorough documentation of communications
Project Team	• Elaborate the need for communication changes • Participate in the implementation of communication changes • Comply with the Communications Management Plan • Support documentation and communication products • Participate in team communication activities and meetings • Communicate risks and challenges to the Project Manager

Note. Own work

4.7.3 Communications Management

Communications management is the process of ensuring timely and appropriate collection, creation, distribution, storage, retrieval, management, monitoring and the ultimate disposition of project information (PMI, 2017). Here, the roles and responsibilities previously established for the WeGrow Ltd. project in **Chart 25** remains central to the success of effective communications within the project. One of the primary tools that would be deployed by WeGrow Ltd. in managing communications for the development of the urban community-based hydroponics farming project is that of a Communications Matrix. The matrix, as presented in **Chart 26** would define the specific audience, purpose, frequency, owner and channel for each type of communication to be used within the project. The matrix will also incorporate both internal and external audiences for each communication type where relevant ranging from personal communication, meetings, reports, presentations and signage. The specific reports as deliverables under the project would remain as established in **Chart 12** and would occur under the frequency of the project schedule as established in **Chart 14**

Chart 26. Communications Matrix

Communication Type	Audience	Purpose	Frequency	Responsible	Channel
Personal Communication	Project Sponsor, Project Manager and Project Team.	Facilitate project management activities	Daily	Project Manager	Telephone Calls, SMS Messages, Email, Meetings, Teleconference
Meetings	Project Steering Committee	Provide oversight and review deliverables	Monthly	Project Sponsor	In-person Meetings or Teleconference
	Project Manager and Project Team	Ensure completion of works based on plans	Weekly	Project Manager	In-person Meetings or Teleconference
	Project Sponsor, Project Manager, Project Team, Kings Park Belize City Community	Provide project updates and consult with community members for buy-in	Monthly	Project Manager	In-person Meetings, Workshops and Consultations, Webinars
	Project Sponsor, Project Manager, Project Team, Government Authorities	Ensure compliance with required permits and standards	Bi-Weekly	Project Manager	In-person Meetings or Teleconference
Reports	Project Sponsor	Weekly updates on project progress	Weekly	Project Manager	Email
	Project Steering Committee	Monthly updates on project progress	Monthly	Project Sponsor	Email and Printed Hardcopy

Communication Type	Audience	Purpose	Frequency	Responsible	Channel
	Project Steering Committee, Project Sponsor, Project Manager, Project Team, Kings Park Belize City Community, Government Authorities	Provide relevant updates on deliverables accomplished under the project based on the WBS established	As defined in project schedule	Project Manager	Email, Printed Hardcopy (only if requested)
Presentations	Project Steering Committee	Monthly updates on project progress	Monthly	Project Sponsor	In-person Powerpoint Presentation, Teleconference
	Project Sponsor, Project Manager, Project Team, Kings Park Belize City Community	Provide project updates and consult with community members for buy-in	Monthly	Project Manager	In-person Powerpoint Presentation, Webinars
Signage	Project Sponsor, Project Manager, Project Team, Kings Park Belize City Community	Ensure understanding of project site, guidelines and directions	Once at the start of construction	Project Manager	Printed Signs, Stickers, Billboards, and Infographics

Note. Own work

4.7.4 Monitoring Communications

Monitoring communications is the process of ensuring that the information needs of the project and its stakeholders are met (PMI, 2017). It enables an optimal flow of information throughout the project. WeGrow Ltd.'s project communication strategy would ensure that the right message with the right content is delivered to the right audience through the right channel and at the right time as established in the Communications Matrix within **Chart 26**. One of the main ways in which communications would be managed and monitored throughout the project is also through project reporting that has been built into the project's WBS itself. The milestone list established in **Chart 15** summarizes some of the key project reports that would support the monitoring of communications as communication products themselves. These include the signed Community Agreement, the Post-Training Evaluation Report, approved Construction, Environmental and Labor Permits, the Construction Completion Report, Quality Test Results and Audit Reports, Quality Standards Certification and the Project Completion Report. The daily personal communications, as well as the monthly, weekly and bi-weekly meetings and reports would also support monitoring of communications within the project. In order to define how issues or challenges are communicated within the project, the Communications Escalation Matrix established in **Chart 27** would be used by the WeGrow Ltd. project in ensuring that communications are channeled accurately to the relevant decision-making authorities. This Communications Escalation Matrix also established the timeframes within which such issues would ideally need to be addressed, as well as examples of triggers under three (3) priority levels. Any change requests that are received related to communications management would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

Chart 27. Communications Escalation Matrix

	Priority 1	Priority 2	Priority 3
Definition	Major impact to the project that could significantly affect the project's scope, schedule or cost.	Medium impact that could cause some impact to the project's scope, schedule or cost.	Minor or little to no impact that would not impact the project's scope, schedule or cost.
Decision Authority	Project Steering Committee	Project Sponsor	Project Manager
Resolution Timeframe	Within 1 day	Within 1-2 days	Within 2-3 days.
Triggers	• Significant Community Resistance • Extreme Natural Disasters • COVID-19 Shutdowns • Long Shipping Delays • Major Injuries and Accidents • Complete Site Closure	• Heavy Rains / Weather Events • Moderate Shipping Delays • Moderate Injuries and Accidents • Temporary Site Closure	• Low Rains / Weather Events • Minor Shipping Delays • Some Staff Sickness without Injuries or Accidents

Note. Own work

4.8. Risk Management Plan

RISK MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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4.8.1 Introduction

In every project, there are risks that must be managed or mitigated against in ensuring success. Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project (PMI, 2017). The Plan Risk Management defines how to conduct risk management activities for a project based on the risks identified. The WeGrow Ltd. urban community-based hydroponics farming project will ensure that it identifies and manages its risks to exploit or enhance positive risks (opportunities) while avoiding or mitigating against negative risks (threats). The inputs, as well as tools and techniques that will be used to reach the output of the Risk Management Plan are highlighted in **Figure 33**. Key inputs include all components of the Project Management Plan itself and the Stakeholder Register. The main EEF considered includes the overall risk threshold set by the organization and key stakeholders. The OPAs considered mainly include organizational risk policies, definitions of risk concepts and terms, templates, authority levels for decision-making, and lessons learned from previous projects. Core tools and techniques used include expert judgement, data analysis and meetings. This process supports the development of the Risk Management Plan

defining the approach including Risk Identification, Qualitative Risk Analysis, Risk Response Planning and Implementation, and Risk Monitoring and Control.

Figure 33. Plan Risk Management

Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 11-2, p. 401 Copyright 2017 by PMI, Inc. Permission not sought.

4.8.2 Risk Management Approach

Key to the approach of WeGrow Ltd. when managing risk is to increase the probability and / or impact of positive risks, and to decrease the probability and / or impact of negative risks. This shows that WeGrow Ltd. would acknowledge that not all risks are negative and that some can actually be opportunities which the urban community-based hydroponics farm can capitalize on. It will also ensure that it gauges the stakeholder risk appetite, particularly focused on the thresholds amenable to the Project Sponsor and the Community members of the Kings Park Residential Area in Belize City. This approach would allow WeGrow Ltd. to understand how much levels of probability and impact are acceptable thresholds for project risk exposure allowing efficient and effective assessments and prioritization of project risks. Two of the key tools that will be used in WeGrow Ltd.'s risk management approach include the Risk Breakdown Structure and a Risk Register to support risk identification, risk management and response planning.

4.8.2.1 Roles and Responsibilities

The WeGrow Ltd. Project Team would also ensure that roles and responsibilities related to risk management are clearly defined, documented and communicated with each member of the team. All levels of authority under the WeGrow Ltd. project, would have a key role to play when managing different levels of risks. This would include the Project Steering Committee (PSC), the Project Sponsor, the Project Manager, and the Project Team itself. In order to manage risks effectively, WeGrow Ltd. will ensure that risks are prioritized and categorized with specific owners based on the thresholds of probability and impact levels established. **Chart 28** further summarizes the respective roles and responsibilities for the project related to communications management.

Chart 28. Risk Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Clarifies risk management expectations and thresholds • Resolve any issues related to risk management • Review and analyze risk management change requests • Approve / reject escalated risk management change requests • Approve Risk Reports for updates to the PSC • Convey project Risk Report updates to the PSC • Provide guidance on escalated risk management matters
Project Steering Committee	• Defines risk management expectations and thresholds • Support Project Sponsor and Project Manager in the review of escalated risk management change requests. • Review and approve risk management change requests • Review Risk Reports from the Project Sponsor • Ensure stakeholders are aware of significant project risks
Project Manager	• Consolidate all risk management expectations and thresholds • Review and analyze risk management change requests

	• Defer / reject / approve / escalate risk management change requests • Evaluate the need for changes in risk management tools • Communicate outcomes of risk management change requests • Update project documents with risk changes • Monitor compliance with Risk Management Plan • Lead the compilation of project Risk Reports • Manage and resolve issues related to project risks • Ensure thorough documentation of risks
Project Team	• Elaborate the need for risk management changes • Participate in the implementation of risk management changes • Comply with the Risk Management Plan • Support the identification and documentation of risks • Participate in risk mitigation activities and meetings • Communicate risks and challenges to the Project Manager

Note. Own work

4.8.3 Risk Identification

Risk identification is the process of defining individual project risks, as well as sources of overall project risk, and documenting their characteristics (PMI, 2017). In the process of identifying risks, the WeGrow Ltd. project would acknowledge that risks exist at two levels, at the individual project level where uncertain events or conditions have a positive or negative impact on one or more project objectives, or at the overall project risk level, which is the effect of uncertainty on the project as a whole arising from all sources of uncertainty. The process would be performed throughout the project life cycle in consultation with the project team and appropriate stakeholders. The Risk Breakdown Structure presented in **Chart 29** will be used in the identification of risks under the various risk categories of the project. This technique provides a hierarchical representation of potential sources of risk. Here, the WeGrow Ltd. project team would consider technical risks, management risks, commercial risks, and external risks to the project as presented.

Chart 29. Risk Breakdown Structure

Level 0	Level I	Level 2	Level 3
0. All Sources of Project Risk	1.0 Technical Risk	1.1 Technical Processes	1.1.1 Permits and Standards Certification
		1.2 Technology	1.2.1 Availability
	2.0 Management Risk	2.1 Project Management	2.1.1 Planning
		2.2 Operations Management	2.2.1 Knowledge Transfer
		2.3 Organization	2.3.1 Organizational Culture
	3.0 Commercial Risk	3.1 Contractual Terms and Conditions	3.1.1 Compliance
		3.2 Suppliers and Vendors	3.2.1 Market Availability
		3.3 Partnerships and Joint Ventures	3.3.1 Community Agreement
	4.0 External Risk	4.1 Legislation / Regulatory	4.1.1 Construction Laws
			4.1.2 Environmental Laws
			4.1.3 Labor Laws
		4.2 Environmental / Weather	4.2.1 Weather Conditions
			4.2.2 Natural Disasters
		4.3 Social	4.3.1 COVID-19 Pandemic

Note. Own work

4.8.4 Qualitative Risk Analysis

Conducting a Qualitative Risk Analysis entails the prioritization of individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics (PMI, 2017). This process is critical to ensure that preventive or corrective actions are taken based on the context. The primary tool that would be sued by the WeGrow Ltd. urban community-based hydroponics project is that of a probability (P) and impact (I) matrix. This would support in the project's mapping and qualitative prioritization of each risk based the probability of each risk occurring and its impact on project objectives if that risk occurs. Here, WeGrow Ltd. would focus its mitigation and response efforts on those risks that rank as a high or medium risk on the matrix based on the scales established. In conducting the qualitative risk analysis, a score of 1 to 5 would be allocated per risk based on the interpretations and definitions established in the Probability and Impact Scale in **Chart 30**. The Probability Impact Matrix in **Chart 31** thereafter highlights the three main categories that risks would be classified under as high, medium or low based on the PxI formula. The PxI Matrix is subsequently presented in **Chart 32**.

Chart 30. Probability and Impact Scale

Score	Scale	Probability	+ / - Impact on Project Objectives		
			Time	Cost	Quality
1	Very Low	1-10%	1 day	>$1,000	Minor impact on secondary functions of the farm
2	Low	11-30%	2-3 days	$1,001-1,500	Minor impact on overall farm functionality
3	Medium	31-50%	4-7 days	$1,501-$2,500	Some impact in key functional areas of the farm
4	High	51-70%	8-14 days	$2,501-$5,000	Significant impact on overall functionality of the farm
5	Very High	>70%	>14 days	>$5,000K	Very significant impact on overall functionality of the farm

Note. Own work

Chart 31. Probability and Impact Matrix

Probability										
	5	10	15	20	25	25	20	15	10	5
	4	8	12	16	20	20	16	12	8	4
	3	6	9	12	15	15	12	9	6	3
	2	4	6	8	10	10	8	6	4	2
	1	2	3	4	5	5	4	3	2	1
	Threats (Negative)					Opportunities (Positive)				
	Impact									

Key:

	High	Risk that can significantly impact the project
	Medium	Risk that can moderately impact the project
	Low	Risk that can minimally impact the project

Note. Own work

4.8.5 Risk Response Planning and Implementation

Based on the Probability and Impact Scale and Matrix established in **Charts 30** and **31**, each identified risk would now be able to fit within one of the three (3) main risk classifications based on the scores received after running the qualitative probability (P) x impact (I) analysis. The results of the Qualitative Risk Analysis, Plan Risk Response, Implement Risk Response, and Monitor Risks are all recorded in the Risk Register. **Chart 32** presents the Risk Register for the WeGrow Ltd. project which lists the identified risks under the project. The Risk Register also highlights the cause and consequence of each risk, and subsequently calculates the PxI score for each based on the Probability and Impact Scale assigning the respective classification color code of high, medium or low. It thereafter propose potential strategies as a part of the risk responses for overall project risks defined by PMI (2017) as avoid, exploit, transfer/share, mitigate/ enhance, or accept. Finally, a risk owner is also identified to lead the implementation of the response.

Chart 32. Risk Register

RBS Code	Cause	Risk	Consequence	Threat or Opportunity	Probability	Impact	PxI	Strategy	Risk Owner
1.1.1	Improper management of technical processes for permitting and standards certification	Permits and standards certification are not obtained	Project can be halted or closed due to lack of permits and standards certification	Threat	4	4	16	**Mitigate:** Ensure that the consultant hired to obtain all permits and approvals (Contractor 3) is briefed by all relevant Government Authorities on all requirements for compliance	Finance and Accounting Officer
1.2.1	Lack of hydroponics technology availability in Belize	Required technology is unavailable	Project is delayed due to the lack of required technology equipment in Belize	Threat	3	3	9	**Avoid:** Check whether the required technology equipment needed for the project is available in Belize before the project's commencement determining the need for importation early	Finance and Accounting Officer
2.1.1	Inexperienced Project Manager and Project Team with lack of training	Poor project planning and implementation	Project delays and cost overruns due to poor planning and implementation	Threat	2	3	6	**Mitigate:** Hire a competent Project Manager and Project Team based on a competitive process	Project Sponsor
2.2.1	Poor knowledge transfer methodologies used for training and capacity development	Community opposition to project	Project's community-based model becomes unsustainable	Opportunity	3	3	9	**Share:** Work with Contractor 1 to build a community-led training program using methodologies accepted by majority.	Project Manager

RBS Code	Cause	Risk	Consequence	Threat or Opportunity	Probability	Impact	PxI	Strategy	Risk Owner
2.3.1	Unfavorable organizational culture with poor working conditions	High project staff turnover	Project delays and increased cost to re-train new project staff	Threat	2	2	4	**Escalate:** Provide early notification to the Project Steering Committee (PSC) and Project Sponsor of the unfavorable working conditions to implement selected improvements	Project Manager
3.1.1	Poorly written contractor contracts with ambiguous scope of works	Full scope of work is not achieved	Project can face contractual compliance lawsuits from contractors causing delays and increased costs	Threat	3	4	12	**Transfer:** Ensure that the attorney drafting each contract clearly includes the required scope of works for all three contractors	Project Manager
3.2.1	Unavailability of required construction materials from suppliers and vendors in Belize	Unavailability of required materials	Project is delayed with increased costs due to the lack of required construction materials in the Belizean market	Threat	4	4	16	**Mitigate:** Place orders for required materials from the start of the project to determine availability and the need for any supplier or vendor changes.	Finance and Accounting Officer
3.3.1	Failed community consultations due to universal messaging and approach adopted	Community does not buy-in to the Project	Project is unable to complete the community-based management agreement under the project's scope	Threat	3	5	15	**Escalate:** Advise the Project Steering Committee (PSC) of the lack of buy-in and the potential need to determine scope adjustments.	Project Sponsor

RBS Code	Cause	Risk	Consequence	Threat or Opportunity	Probability	Impact	PxI	Strategy	Risk Owner
4.1.1	Deviation from approved farm construction design	Non-compliance with national building regulations	Project can be halted or closed due to lack of construction compliance	Threat	3	4	12	**Mitigate:** Ensure that Contractor 3 informs the Central Building Authority of any construction changes for approval.	Finance and Accounting Officer
4.1.2	Excessive construction waste	Higher costs of waste disposal	Project can face fines if waste is not disposed correctly	Opportunity	3	3	9	**Exploit**: Determine any construction waste that can be recycled for supporting infrastructure.	Finance and Accounting Officer
4.1.3	Poor and unfair treatment of laborers by Contractor	Non-compliance with labor laws	Project can face labor fines and can be halted due to worker protests	Threat	2	4	8	**Avoid:** Ensure that the Labor Department informs all Contractors of required Labor Laws.	Finance and Accounting Officer
4.2.1	Heavy rainfalls cause floods in Belize City	Project site is inaccessible	Project work is temporarily disrupted causing schedule delays	Threat	4	2	8	**Mitigate:** Ensure that site is secured before storm. **Transfer:** Obtain Project insurance for materials.	Admin. Assistant
4.2.2	Tropical storm or hurricane hits Belize	Project site is damaged and inaccessible	Project is delayed and faces higher costs from damages	Threat	4	5	20	**Mitigate:** Ensure that site is secured before storm. **Transfer:** Obtain Project insurance for materials.	Admin. Assistant
4.3.1	COVID-19 outbreak amongst laborers and Project Team	Closure of project activities	Project work is delayed due to quarantine period with the consequence of health issues among workers and project staff.	Threat	5	5	25	**Mitigate:** Enforce strict COVID-19 safety protocols on project site including mask wearing, hand sanitizing, social distancing and conduct temperature tests before project work days.	Admin. Assistant

Note. Own work.

4.8.6 Risk Monitoring and Control

Risk monitoring and control entails ensuring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project (PMI, 2017). The Risk Register established for the WeGrow Ltd. project in **Chart 32** would be the primary tool to define the specific risk response strategies and risk owners. The risk owners would be responsible for implementation of risk response strategies with a particular focus on high and medium ranked risks within the Risk Register. The WeGrow Ltd. project would also continuously monitor project work for new, changing and outdated project risks so that the Project Team and stakeholders are aware of the levels of risk exposure. Meetings would also be a key tool to conduct risk reviews and generate risk reports. This would particularly include the weekly, bi-weekly and monthly project meetings established within the Communications Matrix in **Chart 26**. Another tool that would be used to monitor project risks include audits and evaluations. Under Control Account 1.1.2, the project includes the mid-term which would provide an opportunity for the Project Manager and Project Team to review the status of project risks, including any corrective or preventive actions that need to be taken. Subsequently, Control Account 1.3.2 also includes inspections for quality and audits which would also provide WeGrow Ltd. with the opportunity to conduct a risk audit for the hydroponics farm. The Project Manager would be responsible to ensure that the risk audits occur at the appropriate time and frequency. Any change requests that are received related to risk management would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

4.9. Procurement Management Plan

PROCUREMENT MANAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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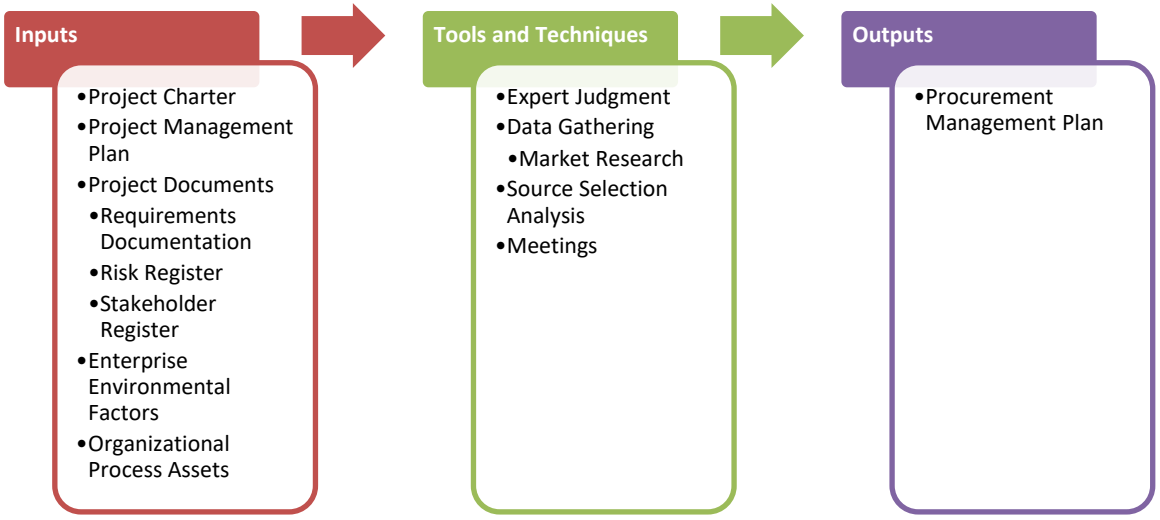
4.9.1 Introduction

Projects may often require the procurement of external resources. Project Procurement Management includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team (PMI, 2017). The Plan Procurement Management process is critical as it specifies the procurement approach, documents project procurement decisions, and identifies potential sellers. The WeGrow Ltd. urban community-based hydroponics farming project as the buyer will ensure that it carefully manages all procurement agreements and relationships with sellers of goods or services required. The inputs, as well as tools and techniques that will be used to reach the output of the Procurement Management Plan are highlighted in **Figure 34**. Key inputs include the Project Management Plan itself, particularly the Scope, Quality, and Resource Management Plans. The main EEFs considered include marketplace conditions, availability, sellers track records, local regulatory requirements, and standard terms and conditions. The OPAs considered include the preapproved list of sellers, formal procurement policies, procedures and guidelines, and contract types. Core tools and techniques used include expert judgement, market research, source selection analysis and meetings. This process supports the development of the Procurement Management Plan defining the approach including Conducting Procurements and Procurement Control.

Figure 34. Plan Procurement Management



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 12-2, p. 466 Copyright 2017 by PMI, Inc. Permission not sought.

4.9.2 Procurement Management Approach

The WeGrow Ltd. project would require the procurement of some external goods and services. Its approach for external procurements would mainly use direct contracting with service providers or direct purchases with vendors using quotation comparisons. Additionally, rentals or short-term hires for equipment would also be used. The main contract type would be fixed-price contracts where a fixed total price would be defined for the services or products to be provided. The specific contract type would be the Firm Fixed Price (FFP) where the price of goods or services are set at the outset and not subject to change unless the scope of work changes (PMI, 2017). WeGrow Ltd. would utilize its scope and cost baselines established for each work package when conducting its procurements. Key to the sustainability elements of the urban hydroponics farm is its commitment to 50% sustainable sourcing of construction materials, including its nutrients and seedlings. Additionally, WeGrow Ltd. would prioritize 100% local sourcing to support local vendors in Belize City. This procurement approach would also save on transportation and importation costs.

4.9.2.1 Roles and Responsibilities

In ensuring transparency and accountability in its procurement processes, the WeGrow Ltd. project would clearly define the roles and responsibilities related to procurement management. The decision-making authority of procurements would be divided based on contract size thresholds. The Project Manager would be able to make decisions regarding procurements below BZD $5,000, while any procurement over BZD $5,000 would require the approval of the Project Sponsor and Project Steering Committee (PSC). The Finance and Accounting Officer under the project team would play a key role in ensuring that procurements are conducting transparently following WeGrow Ltd.'s internal procurement policies, as well as national procurement requirements. **Chart 33** further summarizes the respective roles and responsibilities for the project related to procurement management.

Chart 33. Procurement Management Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Clarifies procurement expectations and thresholds • Resolve escalated issues related to procurement management • Review and analyze procurement change requests • Approve / reject escalated procurement change requests • Approve Procurement Reports for updates to the PSC • Convey project Procurement Report updates to the PSC • Approves Terms of References (TORs) and contracts • Approves contracts over BZD $5,000 with PSC
Project Steering Committee	• Defines procurement expectations and thresholds • Support Project Sponsor and Project Manager in the review of escalated procurement management change requests. • Review and approve procurement change requests • Review Procurement Reports from the Project Sponsor

	• Ensure stakeholders are aware of procurement decisions • Approves contracts over BZD $5,000 with Project Sponsor
Project Manager	• Consolidate all procurement expectations and thresholds • Review and analyze procurement change requests • Defer / reject / approve / escalate procurement management change requests • Evaluate the need for changes in procurement tools • Communicate outcomes of procurement change requests • Update project documents with procurement changes • Monitor compliance with Procurement Management Plan • Lead the compilation of project Procurement Reports • Manage and resolve issues related to procurement • Ensure thorough documentation of procurement processes • Reviews and edits Terms of References (TORs) and contracts • Approves contracts under BZD $5,000 with documentation of all expenses for the Project Sponsor and PSC revision
Project Team	• Elaborate the need for procurement management changes • Participate in the implementation of approved procurement management changes • Comply with the Procurement Management Plan • Support the documentation of procurement processes • Participate in procurement related activities and meetings • Drafts Terms of References (TORs) and contracts • Monitor and support contract implementation and monitoring • Communicate procurement challenges to the Project Manager

Note. Own work

4.9.3 Conduct Procurement

Conduct Procurements is the process of obtaining seller responses, selecting a seller, and awarding a contract (PMI, 2017). Here, WeGrow Ltd. would be able to select qualified sellers of products and services required for the implementation of the urban community-based hydroponics farming project in Belize City. The focus for the WeGrow Ltd. project would be on external resource requirements maintaining its commitment to 50% sustainable sourcing of construction materials, nutrients and seedlings with 100% local sourcing as the Belize market would allow. One of the primary procurement tools that would be deployed when conducting procurements is that of a clearly elaborated Statement of Work (SOW) developed from the project's scope baseline established in the Scope Statement under **Chart 6**. Here, the SOWs would be elaborated as Terms of References (TORs) given that some contracts would also be services related. The TORs would cover the specific work packages to be delivered under the project's scope. It would include a detailed list of all products and services to be delivered by the contractor including a definition of the schedule for delivery and all tasks to be completed.

4.9.3.1 Source Selection Analysis and Criteria

The source selection analysis methodology and criteria would be predefined when selecting a seller as the source to obtain products or services required for the WeGrow Ltd. hydroponics project. The source selection methods that would be deployed by the WeGrow Ltd. project include:

1. **Least Cost** – The procurement of low-cost or repetitive goods and services would use this method often through the shopping or direct purchasing method with a Request for Quotation (RFQ).
2. **Quality and Cost-Based** – This selection method would be used for higher-costing goods and services factoring in the element of quality procurement.
3. **Fixed Budget** – The fixed-budget method would be utilized by the project since the available budget under each work package would be disclosed to invited sellers in the Request for Proposal (RFP) process often through a national competitive bidding process.

The specific source selection criteria for each procurement under the project would be established and clearly defined once the Terms of References (TORs) are drafted and advertised. Each TOR would be advertised in a minimum of two widely circulated local Newspapers, namely the Amandala and the Guardian Newspaper, in order to ensure wide circulation and application to the procurement processes by potential sellers. Additionally, the TORs for open RFQs or RFPs would be shared with the Ministry of Agriculture, Food Security and Enterprise, the Belize Agricultural Health Authority (BAHA), and the Belize City Council for onward sharing to potential sellers. Each advertised RFQ and RFP would define the specific source selection criteria for the evaluation of bids received under the procurement of the specific work package. Some of the general source selection criteria that would be used by the WeGrow Ltd. project include:

1. Product / service cost
2. Capability and capacity
3. Technical expertise and approach
4. Specific relevant experience
5. Track record and financial stability of the firm
6. Staff qualifications and competence
7. Management experience
8. Portfolio of past projects

Lists of pre-approved vendors or sellers for Agriculture from the Ministry of Agriculture, Food Security and Enterprise, as well as the Belize Agricultural Health Authority (BAHA) would also be considered when selecting vendors and establishing national track records. Additionally, to ensure its commitment to 100% local sourcing and 50% sustainable sourcing, an early notice would be provided to suppliers at the start of the project to check availability of the required materials to determine the need for any importation. Based on the experience of previous hydroponics farms in Belize, the market demonstrates maturity to supply the required materials and products needed to establish the farm (Channel5 News, 2017).

4.9.3.2 Procurement Plan

Another tool that would be used by the WeGrow Ltd. project would be a Procurement Plan which would support the management of all external procurements, including products and services, that would be needed for the project. **Chart 34** presents a potential Procurement Plan for the WeGrow Ltd. project. It defines a total of thirteen (13) procurement processes.

Chart 34. Procurement Plan

ID	WBS ID(s)	Products or Services	Type	Acquisition Type	Procurement Method	Source Selection Method	Bid Documents	Agreement Type	Allocated Budget BZD	Approver
1	1.1.1.1 1.1.1.2 1.1.3.2.3	Contractor 1 - Events and Training (2 Facilitators)	Services	Short-term Contract, CVs, Interviews	National Competitive Bidding	Fixed Budget; Quality and Cost Based	Request for Proposals (RFP)	Direct Fixed Firm Price Contract	$13,000	Project Sponsor and PSC
2	1.2.3.1 1.2.3.2 1.2.3.3 1.2.3.4.2 1.2.3.5.3 1.2.3.5.4	Contractor 2 - Construction (5 Laborers)	Services	Short-term Contract, CVs, Interviews, Portfolio	National Competitive Bidding	Fixed Budget; Quality and Cost Based	Request for Proposals (RFP)	Direct Fixed Firm Price Contract	$37,000	Project Sponsor and PSC
3	1.1.2.3 1.3.1.1 1.3.1.2 1.3.1.3	Contractor 3 - Permits and Approvals (1 Consultant)	Services	Short-term Contract, CVs, Interviews	National Competitive Bidding	Fixed Budget; Quality and Cost Based	Request for Proposals (RFP)	Direct Fixed Price Contract	$44,000	Project Sponsor and PSC
4	1.1.3.2.1 1.1.3.2.2	Workshop Venues	Services	Rental	Direct Hiring	Fixed Budget; Least Cost	Request for Quotations (RFQs) – 3 Quotes	Rental Agreement	$5,000	Project Manager
5	1.2.2	Storage Room	Services	Short-term Contract, CVs	Direct Hiring	Fixed Budget; Least Cost	Request for Quotations (RFQs) – 3 CVs	Direct Fixed Price Contract	$15,000	Project Sponsor and PSC

ID	WBS ID(s)	Products or Services	Type	Acquisition Type	Procurement Method	Source Selection Method	Bid Documents	Agreement Type	Allocated Budget BZD	Approver
6	1.1.3.1	Training Materials	Products	Local Purchase	Shopping	Fixed Budget; Least Cost	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$5,000	Project Manager
7	1.1.2.1.1 1.1.2.1.2	Office Supplies	Products	Local Purchase	Shopping	Fixed Budget; Least Cost	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$1,000	Project Manager
8	1.2.1.1.1	Construction Materials	Products	Local Purchase	Shopping	Fixed Budget; Quality and Cost Based	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$30,000	Project Sponsor and PSC
9	1.2.1.2.1	Nutrients and Seedlings	Products	Local Purchase	Shopping	Fixed Budget; Quality and Cost Based	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$5,000	Project Manager
10	1.2.3.4.1	Signage	Products	Local Purchase	Shopping	Fixed Budget; Least Cost	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$3,500	Project Manager
11	1.2.1.1.1	Construction Equipment	Products	Local Hire	Direct Hiring	Fixed Budget; Quality and Cost Based	Request for Quotations (RFQs) – 3 Quotes	Direct Fixed Price Contract	$8.000	Project Sponsor and PSC
12	1.2.1.2.1	Farming Equipment	Products	Local Purchase	Shopping	Fixed Budget; Quality and Cost Based	Request for Quotations (RFQs) – 3 Quotes	Purchase Order	$4,000	Project Manager
13	1.2.3.5.1 1.2.3.5.2	Maintenance Equipment	Products	Local Hire	Direct Hiring	Fixed Budget; Quality and Cost Based	Request for Quotations (RFQs) – 3 Quotes	Direct Fixed Price Contract	$4,500	Project Manager

Note. Own work

4.9.4 Control Procurement

Controlling procurements is the process of managing procurement relationships, monitoring contract performance, making changes and corrections as appropriate, and closing out contracts (PMI, 2017). The Procurement Plan established in **Chart 34** for the WeGrow Ltd. project would form the main basis of controlling and monitoring procurements. The Finance and Accounting Officer would use the Procurement Plan as the tool to monitor all procurements with the project's scope, schedule and cost baselines. The Finance and Accounting Officer would also monitor contractual performance and report any issues to the Project Manager for any further escalation to the Project Sponsor and Project Steering Committee where relevant. To ensure that sellers meet all obligations of direct fixed price contracts, purchase orders or rental agreements, the WeGrow Ltd. project would only pay upon a review of work performance. For this reason, performance reviews would remain a key tool in controlling procurements. The Project Manager and Project Team would review contracts to monitor the required performance indicated for each work package and activity specified within contractual Terms of References (TORs). Additional tools that would be used to monitor and control the performance of procurement agreements include project evaluations, as well as quality audits and inspections built into the project. Work Package 1.1.2.3 would allow the mid-term and final evaluations to measure performance of all contracts to take any necessary corrective or preventive actions. Work Package 1.3.2.1 would also allow for the relevant quality audits and inspections to be completed against each procurement contract with three (3) specific inspections scheduled throughout the project's schedule. Any change requests that are received related to procurement management would need to utilize the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

4.10. Stakeholder Engagement Plan

STAKEHOLDER ENGAGEMENT PLAN

WeGrow Ltd. Urban Community-Based Hydroponics Farm

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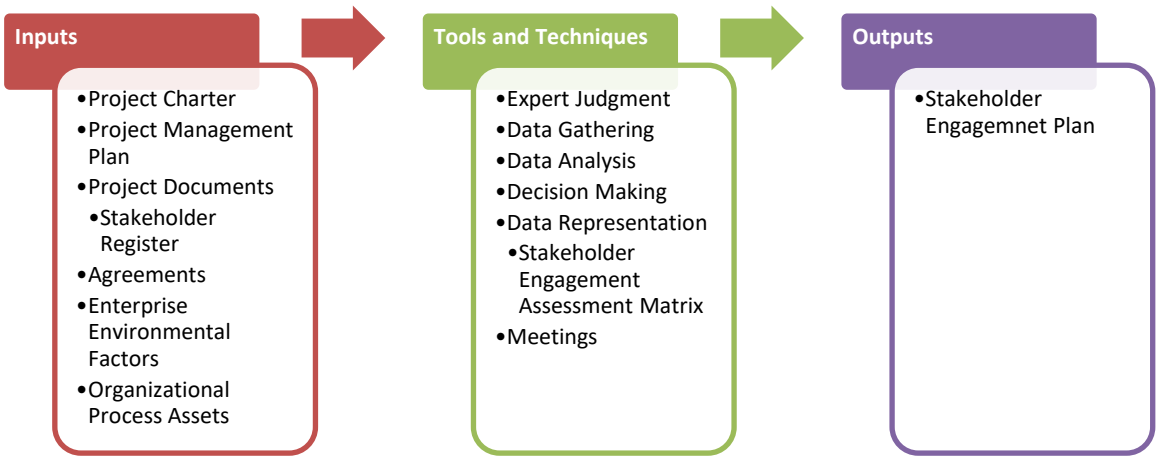
4.10.1 Introduction

Every project has stakeholders who are impacted by or can impact the project in a positive or negative way. Project Stakeholder Management includes the processes required to identify the people, groups or organizations that could impact or be impacted by the project, to analyze stakeholder expectations, and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution (PMI, 2017). Given the important role stakeholders play in projects, the Plan Stakeholder Engagement process remains key to develop approaches to involve stakeholders based on needs, expectations, interests, and potential impact on the project. The WeGrow Ltd. urban community-based hydroponics farming project has identified a total of sixteen (16) stakeholders, 7 direct and 9 indirect, that would have varying degrees of impact and influence. The inputs, as well as tools and techniques that will be used to reach the output of the Stakeholder Engagement Plan are highlighted in **Figure 35**. Key inputs include the Project Management Plan itself, particularly the Stakeholder Register and Agreements with external stakeholders. The main EEFs considered include organizational culture, stakeholder risk appetites and established communication channels. The OPAs considered include corporate policies on social media, ethics and security, organizational communication requirements, and lessons

learned from past projects. Core tools and techniques used include expert judgement, data analysis and representation. This process supports the development of the Stakeholder Engagement Plan defining the approach including identifying, managing and monitoring stakeholder engagement.

Figure 35. Plan Stakeholder Engagement



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition*. Project Management Institute (PMI), 2017 Figure 13-4, p. 516 Copyright 2017 by PMI, Inc. Permission not sought.

4.10.2 Stakeholder Engagement Approach

Stakeholders would have a critical role to play in the success of the WeGrow Ltd. urban community-based hydroponics project. This is particularly since the project itself is dependent on community buy-in for the community-based management model to be effective. Furthermore, several components of the project require approvals and permits from Government Authorities who would also be key stakeholders. The WeGrow Ltd. project would deploy a structured approach to the identification, prioritization and engagement of all stakeholders. Its approach would be to facilitate continuous communications with all stakeholders including the Project Team, in order to understand needs and expectations, address any issues or conflicts that may arise, and foster the appropriate level of stakeholder engagement in project decisions. The WeGrow Ltd. project would also deploy an iterative

approach to stakeholder engagement continuously analyzing any new players and determining the engagement strategy accordingly. Several tools would be used to manage stakeholder engagement including the Stakeholder Register, Power Interest Grid and Stakeholder Engagement Assessment Matrix.

4.10.2.1 Roles and Responsibilities

In ensuring that stakeholders are effectively engaged throughout the project life cycle, the WeGrow Ltd. project would clearly define the roles and responsibilities related to stakeholder engagement. Some of the core principles that the WeGrow Ltd. project would adopt include ensuring that all Project Team members are involved in stakeholder engagement activities. The project would also continuously review the stakeholder community regularly in parallel with project risk reviews. Lastly, WeGrow Ltd. would ensure that it consults with any stakeholders most affected by the outcomes of the hydroponics farming project, while determining any opportunities for co-creation, particularly with the residents of the Kings Park Area in Belize City. The Project Manager would play a key role in managing stakeholder engagement along with the PSC, Project Sponsor and Project Team. **Chart 35** further summarizes the respective roles and responsibilities for the project related to stakeholder engagement.

Chart 35. Stakeholder Engagement Roles and Responsibilities

Role	Responsibilities
Project Sponsor	• Clarifies stakeholder engagement framework and expectations • Resolve escalated issues related to stakeholder engagement • Review and analyze stakeholder engagement change requests • Approve / reject escalated stakeholder change requests • Convey project stakeholder engagement updates to the PSC • Ensure that adequate stakeholder buy-in is achieved • Ensure proper communication strategies and protocols are followed when engaging stakeholders at various levels

Project Steering Committee	• Approves stakeholder engagement strategies • Support Project Sponsor and Project Manager in the review of escalated stakeholder engagement change requests. • Review and approve stakeholder change requests • Review stakeholder reports from the Project Sponsor • Review the level of stakeholder buy-in and engagement • Support high-level and political stakeholder engagement
Project Manager	• Consolidate stakeholder engagement expectations • Review and analyze stakeholder change requests • Defer / reject / approve / escalate stakeholder engagement change requests • Evaluate the need for changes in stakeholder communication and engagement tools • Communicate outcomes of stakeholder change requests • Update project documents with stakeholder changes • Monitor compliance with Stakeholder Engagement Plan • Lead the compilation of project stakeholder reports • Manage and resolve issues or conflicts related to stakeholders • Ensure thorough documentation of stakeholder engagement • Identifies and prioritizes stakeholders based on project needs • Keeps stakeholders abreast of project updates
Project Team	• Elaborate the need for stakeholder engagement changes • Participate in the implementation of approved stakeholder engagement changes • Comply with the Stakeholder Engagement Plan • Participate in stakeholder related activities and meetings • Maintain records of stakeholder communications • Communicate stakeholder challenges to the Project Manager

Note. Own work

4.10.3 Identify Stakeholders

One of the first steps to stakeholder engagement is to identify the stakeholders that are involved in the project. Identify Stakeholders includes the identification of project stakeholders, as well as the regular analysis and documentation of relevant information regarding interests, involvement, interdependencies, influence and potential impact on project success (PMI, 2017). Through this process, the WeGrow Ltd. project would be able to determine the appropriate level of focus and engagement required for each stakeholder based on stakeholder expectations. One of the primary tools that would be deployed by the project is the Stakeholder Register. This document contains information about identified stakeholders including identification information, assessment information, and stakeholder classification. For the WeGrow Ltd. project, a unique stakeholder ID is given to each stakeholder from the sixteen (16) identified. Thereafter, the Stakeholder Register identifies the stakeholder's functional role, the type of stakeholder, main expectations, modes of communication and level of power and interest. **Chart 36** presents a Stakeholder Register for the WeGrow Ltd. project which provides an analysis of the key stakeholders identified under the project. The scale below was used when classifying the level of power and interest of each stakeholder:

1. **High** – The stakeholder wields a significant level of direct power or interest over the project.

2. **Medium** – The stakeholder wields a moderate level of direct power or interest over the project.

3. **Low** – The stakeholder wields a minimal level of direct power or interest over the project.

Chart 36. Stakeholder Register

ID	Stakeholder	Functional Role	Type	Main Expectations	Modes of Communication	Power	Interest
1	Project Sponsor	Sponsorship	Direct / Internal	Successful completion of the project within scope, schedule and cost with a positive return on investment.	Calls, SMS Messages, Emails, Meetings, Teleconference, Printed and Digital Reports and Presentations	High	High
2	Project Manager	Project Management	Direct / Internal	Successful completion of the project within scope, schedule and cost with project management excellence.	Calls, SMS Messages, Emails, Meetings, Teleconference, Printed and Digital Reports and Presentations	Medium	High
3	Project Team	Project Management	Direct / Internal	Successful completion of the project within scope, schedule and cost with efficient and effective project leadership.	Calls, SMS Messages, Emails, Meetings, Teleconference, Printed and Digital Reports and Presentations	Low	Medium
4	Project Steering Committee	Project Management	Direct / Internal and External	Successful completion of the project within scope, schedule and cost with quality standards and community buy-in.	Emails, Meetings, Teleconference, Printed and Digital Reports and Presentations	High	High
5	WeGrow Ltd. Shareholders	Sponsorship	Direct / External	Being kept abreast of updates on the project's progress and implementation.	Emails, Meetings, Teleconference, Printed and Digital Reports and Presentations	High	Low
6	Contractors	Service Providers	Direct / External	Clearly defined Scope of Work within Terms of References (TORs) and Contracts with timely payments for services.	Calls, SMS Messages, Emails, Meetings, and Teleconference	Medium	Low
7	Community Members	End Users	Direct / External	Fully functional urban hydroponics farm with a simplified community-based management model.	Calls, Emails, Meetings, Workshops, Consultations, Webinars, Printed and Digital Reports and Presentations	Medium	Medium
8	Suppliers	Sellers	Indirect / External	Clearly outlined purchase orders with timely payment for goods.	Calls, SMS Messages, Emails, Meetings, and Teleconference	Low	Low
9	Central Building Authority (CBA)	Government Authority	Indirect / External	Project follows all national building regulations and guidelines.	Calls, Emails, Meetings and Teleconference	Medium	Low

ID	Stakeholder	Functional Role	Type	Main Expectations	Modes of Communication	Power	Interest
10	Department of Environment (DOE)	Government Authority	Indirect / External	Project follows all national environmental regulations and guidelines.	Calls, Emails, Meetings and Teleconference	Medium	Low
11	Belize Agricultural Health Authority (BAHA)	Government Authority	Indirect / External	Project follows all national agricultural regulations and guidelines.	Calls, Emails, Meetings and Teleconference	Medium	Low
12	Labor Department	Government Authority	Indirect / External	Project follows all national labor regulations and guidelines.	Calls, Emails, Meetings and Teleconference	Medium	Low
13	Belize City Council (BCC)	Government Authority	Indirect / External	Project follows building codes within the City and is a successful model of an urban community-based hydroponics farm that can be replicated in other areas.	Calls, Emails, Meetings and Teleconference	High	High
14	Ministry of Agriculture, Food Security and Enterprise (MAFSE)	Government Authority	Indirect / External	Project follows all national agricultural regulations and guidelines and is a successful model of an urban community-based hydroponics farm that can be replicated in other areas.	Calls, Emails, Meetings and Teleconference	High	Medium
15	Belize Marketing and Development Corporation (BMDC)	Government Authority	Indirect / External	Project is able to meet quality standards to produce high-quality produce for the Belizean market.	Calls, Emails, Meetings and Teleconference	Low	Medium
16	Belize Bureau of Standards (BBS)	Government Authority	Indirect / External	Project is able to meet all national quality standards and certifications required for the hydroponics farm.	Calls, Emails, Meetings and Teleconference	Medium	Low

Note. Own work

4.10.4 Manage Stakeholder Engagement

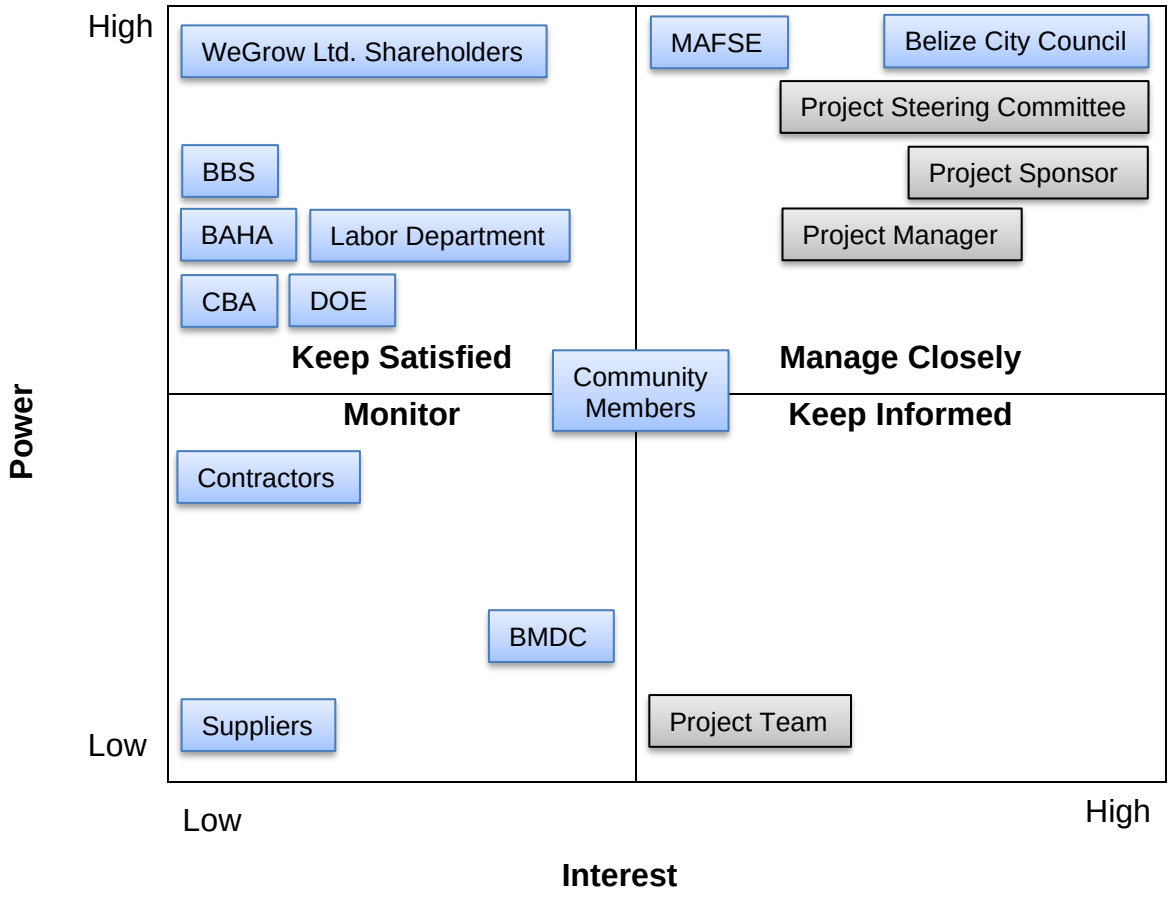
Managing stakeholder engagement once stakeholders have been identified is also critical to project success. Managing stakeholder engagement includes the process of communicating and working with stakeholders to meet their needs and expectations, address issues, and foster appropriate levels of stakeholder engagement and involvement in the project (PMI, 2017). Since the WeGrow Ltd. project itself hinges on a community-based management model for the urban hydroponics farm, it requires keen attention to managing stakeholders in order to achieve the project's objectives. As shown in the Stakeholder Register in **Chart 36**, each stakeholder under the project has varying levels of expectations, as well as levels of power and interest. It is important to consider these differences when engaging with stakeholders. The WeGrow Ltd. project would deploy two (2) main tools to support the management of stakeholder engagement. These tools as defined by PMI (2017) include the Stakeholder Power / Interest Matrix and the Stakeholder Engagement Assessment Matrix.

4.10.4.1 Stakeholder Power / Interest Matrix

Though several methods exist to map and prioritize stakeholders, the power/interest grid was used in the case of the WeGrow Ltd. project. Here, each stakeholder identified in the Stakeholder Register would be mapped according to the level of authority (power) and level of concern about the project's outcomes (interest) (PMI, 2017). **Figure 36** presents a map that highlights the position of each stakeholder under the WeGrow Ltd. project. It classifies each stakeholder by a high, medium or low level of power and interest as established within the Stakeholder Register in **Chart 36**. The mapping would enable the project to determine the management strategy for stakeholder engagement with four (4) categories including:

1. **Latents** – High Power, Low Interest. Strategy: Keep Satisfied
2. **Apathetics** – Low Power, Low Interest. Strategy: Monitor
3. **Defenders** – Low Power, High Interest. Strategy: Keep Informed
4. **Promoters** – High Power, High Interest. Strategy: Manage Closely

Figure 36. Stakeholder Power / Interest Matrix



Note. Own work

4.10.4.2 Stakeholder Engagement Assessment Matrix

The project would also develop a Stakeholder Engagement Assessment Matrix to support its stakeholder management strategy. This matrix supports a comparison between the current engagement level of stakeholders and the desired engagement levels required for successful project delivery (PMI, 2017). Here, the sixteen (16) stakeholders identified are mapped based on five (5) categories of engagement levels which include: Unaware, Resistant, Neutral, Supportive and Leading. In the matrix, “C” represents the current engagement level of each stakeholder while “D” represents the level that would be desired to ensure project success. **Chart 37** presents the Stakeholder Engagement Assessment Matrix for the WeGrow Ltd. project where the focus remains on closing stakeholder engagement level gaps.

Chart 37. Stakeholder Engagement Assessment Matrix

ID	Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
1	Project Sponsor					C, D
2	Project Manager					C, D
3	Project Team				C	D
4	Project Steering Committee				C	D
5	WeGrow Ltd. Shareholders				C, D	
6	Contractors			C	D	
7	Community Members	C			D	
8	Suppliers	C			D	
9	Central Building Authority (CBA)	C			D	
10	Department of Environment (DOE)	C			D	
11	Belize Agricultural Health Authority (BAHA)	C			D	
12	Labor Department	C			D	
13	Belize City Council (BCC)	C				D
14	Ministry of Agriculture, Food Security and Enterprise (MAFSE)	C				D
15	Belize Marketing and Development Corporation (BMDC)		C		D	
16	Belize Bureau of Standards (BBS)	C			D	

Key:	
Unaware	Unaware of the project and potential impacts.
Resistant	Aware of the project and potential impacts but resistant to any changes that may occur as a result of the work or outcomes of the project. (Unsupportive)
Neutral	Aware of the project, but neither supportive nor unsupportive
Supportive	Aware of the project and potential impacts and supportive of the work and its outcomes.
Leading	Aware of the project and potential impacts and actively engaged in ensuring that the project is a success.

Note. Own work

4.10.5 Monitor Stakeholder Engagement

Monitoring stakeholder engagement is the process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through modification of engagement strategies and plans (PMI, 2017). The Stakeholder Register, Stakeholder Power / Interest Matrix and Stakeholder Engagement Assessment Matrix would all be used by the WeGrow Ltd. project to monitor stakeholder relationships. In particular, the Stakeholder Engagement Assessment Matrix presented in **Chart 37** would also be reviewed monthly to determine changes in stakeholder engagement levels. This continuous monitoring would also support the project in deploying the relevant communication strategies to move stakeholders to the desired state of engagement. Additionally, several project activities build feedback loops into the project. For example, a post-training evaluation report would be developed following surveys deployed under activity 1.1.3.2 as a means of obtaining feedback from stakeholders in the community on the hydroponics farming model. Presentations and community consultations would also be key mechanisms used in the project to obtain stakeholder feedback and to ensure that stakeholders remain abreast on the project's progress. Any change requests that are received related to stakeholder engagement would need to use the Change Request Form in **Chart 7** following the Integrated Change Control Process established in **Figure 15**.

5 CONCLUSIONS

In conclusion, this FGP was completed to address the issue of a lack of a thoroughly researched integrated Project Management Plan template for an urban community-based hydroponics farm. It was able to meet its general objective of developing an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. The plan was able to incorporate all ten (10) knowledge areas under PMI (2017) including Integration Management, Scope Management, Schedule Management, Cost Management, Quality Management, Resource Management, Communications Management, Risk Management, Procurement Management and Stakeholder Engagement. Based on the specific objectives established, the following conclusions were drawn:

1. The Project Charter was created to formally authorize the urban hydroponics farming project and provide the Project Manager with the authority to utilize resources for project completion. It was able to unify all other parts of the Project Management Plan establishing the business case for the project. Critically, the Integrated Change Control Process was also established which was applied throughout the project.
2. The Scope Management Plan was developed to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements. Several tools were used to clearly establish the project's scope including the Project Scope Statement, Requirements Traceability Matrix, WBS and WBS Dictionary. This clear definition supported the avoidance of scope creep in the project.
3. The Schedule Management Plan was able to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe. The Activity List established the Schedule Baseline as 181 days. The Milestone List, Gantt Charts and Critical Path were also established for Schedule Management.

4. The Cost Management Plan was able to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources. The Project Cost Estimate was established at the activity level generating the total project budget as BZD $216,300 including a 5% contingency and 3% management reserve. The project's S-Curve was also developed along with an Earned Value Management (EVM) Performance Management Scorecard to support Cost Control throughout the project against the Cost Baseline.
5. The Quality Management Plan established the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project. The Quality Assurance Plan that was developed for the WeGrow Ltd. project was able to establish specific quality metrics for each work package to ensure that the project meets stakeholder quality expectations.
6. The Resource Management Plan outlined how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project. The Project's Organizational Structure was developed including the RACI Matrix to assign team roles and responsibilities. The RBS and Resource Acquisition Plan also represented the team and physical resources that would be needed for the project, including the type of acquisition.
7. The Communications Management Plan was able to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated. The Communications Matrix outlined the various types of communication channels, audiences, purposes, frequencies, and responsibilities. Critically, the Communications Escalation Matrix provided a framework for communications based on triggers and decision-making authority.
8. The Risk Management Plan established how risk management activities will be structured and performed for the urban hydroponics farming project. The Risk Breakdown Structure was created including the Qualitative Risk Methodology with a Probability and Impact Scale and Matrix. The project was able to prioritize all identified risks in its Risk Register as high, medium or low. The respective risk response strategies for threats and opportunities were also established.

9. The Procurement Management Plan highlighted how external goods and services will be acquired through procurement processes under the urban hydroponics farming project. Importantly, the Source Selection Analysis and Criteria for the project was established focusing on least cost, quality and cost-based, and fixed budget selection. The Procurement Plan was also created for the WeGrow Ltd. project focusing on all external resources required identifying thirteen (13) procurement processes including the respective methods, bid documents, agreement types and allocated budgets.
10. The Stakeholder Engagement Plan established the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project. A total of sixteen (16) stakeholders were identified in the project's Stakeholder Register including the main expectations for each. The Stakeholder Power / Interest Matrix and the Stakeholder Engagement Assessment Matrix were also developed as tools to manage stakeholder engagement to reach the desired levels of participation.
11. Finally, the analysis completed determined that the the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project. Based on the SDG Analysis completed, the project showed compliance to 12 out of the 17 SDGs. Additionally, based on the subcategories of the GPM P5 ontology, the project is in compliance to 15 out of 16 subcategories. Based on the regenerative development analysis completed using the six (6) dimensions by Muller (2017), the project is in compliance with 4 out of 6 dimensions. The analysis shows that the project can generally be classified as sustainable and regenerative.

6 RECOMMENDATIONS

1. The Project Manager should ensure that the authorized Project Charter is maintained throughout the project and that any changes utilize the Integrated Change Control Process established. This would ensure that changes are fully documented and undergo the respective channels of approval required before implementation in the project itself.
2. The Project Manager should ensure that the project's Scope Baseline is agreed and signed by the Project Sponsor and Project Steering Committee in order to avoid scope creep. Additionally, the Project Manager should ensure that the Requirements Traceability Matrix is used when defining the project's WBS and WBS Dictionary to ensure that stakeholder requirements are met.
3. The Project Team should follow the established Schedule Baseline and number of days per activity within the Activity List. This is to ensure that the project can be completed within the established timeframe. It is strongly recommended that any delays to works are communicated to the Project Manager promptly.
4. The Finance and Accounting Officer in the Project Team should ensure that all costs are monitored regularly based on the established Cost Baseline. It is strongly recommended that the established checkpoints for Earned Value Management (EVM) analysis be followed at 30%, 50% and 70% of project execution to determine any significant cost variances early in the project.
5. The Project Manager should ensure that the Ministry of Agriculture, Food Security and Enterprise, the Belize Agricultural Health Authority, and Belize Bureau of Standards provide all the nationally required quality standards for a hydroponics farm. It is recommended that the guidelines be provided before project commencement to ensure thorough awareness among the Project Team.
6. The Project Sponsor should ensure that the Project Manager and Project Team have all physical and team resources required to successfully execute the project. It is recommended that required resources are preidentified through the Resource Breakdown Structure (RBS) before project execution, particularly those available internally to WeGrow Ltd. in determining any cost savings.

7. The Project Manager should ensure that there is constant communications across all levels of the project including vertically and horizontally. It is recommended that the Project Manager continuously facilitate communications across all the identified channels in the Communications Matrix. A recommendation is also for the Project Manager to practice elements from Agile Project Management such as having short daily stand-ups with the Project Team to gauge the status of works.
8. The Project Team should collectively monitor and identify any new risks to project execution briefing the Project Manager, Project Sponsor and Project Steering Committee where appropriate. It is recommended that the Project Manager continuously reviews and updates the Risk Register taking any preventive or corrective actions needed to ensure that project risks do not derail the success of the project. The Project Manager should also ensure that the risk response strategies identified are thoroughly researched and feasible.
9. The Finance and Accounting Officer from the Project Team should ensure that all identified procurement processes are conducted transparently following the established source selection criteria, as well as national procurement laws under the Ministry of Finance. It is recommended that each contract is reviewed by a competent legal advisor to avoid any costly legal issues to the project.,
10. The Project Manager should ensure that all stakeholders are actively engaged and aware of the implementation of the community-based hydroponics farm. It is recommended that the feedback from surveys and evaluations received from stakeholders before and during the project are taken into consideration. Stakeholder engagement should also remain a collective responsibility of the entire Project Team, including the Project Sponsor and PSC at the higher levels.
11. The residents of the Kings Park Community in Belize City, as well as the Belize City Council, should ensure that the WeGrow Ltd. project maintains its commitment to sustainability and regenerative development. It is recommended that a symbolic PACT is signed with the community by the firm to formalize this commitment to sustainability and sustainable project management, particularly since the project has built in 50% sustainable sourcing of its materials.

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

This Chapter aims to complete a sustainability analysis in fulfilling specific objective number 11 under the FGP. The objective is to develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project. The section will deploy three (3) theoretical frameworks to complete this analysis including (1) the Sustainable Development Goals (SDGs), (2) GPM Global's P5 Sustainability Analysis, and (3) Regenerative Development Analysis. For each, the analysis will determine the project's relationship or compliance, as well as whether there are any positive or negative effects. If there are negative effects, the subsequent mitigation measures will be summarized. Additionally, indicators to measure sustainability results are also identified for each.

7.1 Sustainable Development Goals (SDGs) Analysis

Since September 2015, world leaders under the United Nations collectively agreed on 17 Sustainable Development Goals (SDGs) and 169 targets under the 2030 Sustainable Development Agenda to tackle issues focusing on people, planet and prosperity (United Nations, 2015). According to Gabel (2015, p.1), sustainable development is defined as the "use of resources to improve society's wellbeing in a way that does not destroy or undermine the support systems needed for future growth." The SDGs shown in **Figure 13** are critical as a universally shared language across the world focusing on *Realizing the Future We Want* through harmonizing environmental (planet), social (people), and economic (prosperity) factors along with peace and partnership (Carboni et al., 2018). Based on the SDG analysis completed in **Chart 38**, it is clear that this project is in compliance being related to 12 out of 17 goals. From these, the project has positive effects on 10 goals with negative effects on 2. Nevertheless, the mitigation measures are indicated including indicators to measure progress. Overall, this shows that the community-based urban hydroponics project in Belize City will contribute significantly to the SDGs.

Chart 38. SDG Analysis

SDG	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
1. No Poverty	Yes	**Positive** – Through self-sustainable food production at the household and community level, basic produce would become more accessible to the most vulnerable	None	% Reduction in Cost of Produce Purchasing Power Parity
2. Zero Hunger	Yes	**Positive** – Through self-sustainable food production at the household and community level, basic produce would become more accessible to the most vulnerable	None	% of Persons with Food Security No. of Persons Accessing Produce
3. Good Health and Well-Being	Yes	**Positive** – Through the production of organic and healthy fruits and vegetables promoting healthy eating habits	None	% Growth in Fruit and Vegetable Consumption
4. Quality Education	No	None Directly	None	None
5. Gender Equality	No	None Directly	None	None
6. Clean Water and Sanitation	No	None Directly	None	None

SDG	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
7. Affordable and Clean Energy	Yes	**Negative** – The high cost of electricity to maintain a hydroponics farm can contribute to higher costing produce and operational expenses	Implement use of clean energy sources such as solar panels.	% Reduction of Total Electricity Costs for Operations
8. Decent Work and Economic Growth	Yes	**Positive** – Through the replication of the urban community-based hydroponics farm, additional produce and jobs can be created spurring economic growth	None	No. of New Jobs Created % Growth in Yields of Produce
9. Industry, Innovation and Infrastructure	Yes	**Positive** – The project is an innovation never implemented in Belize City before creating new infrastructure that can be replicated in other areas	None	No. of New Farms Created in Other Communities
10. Reduced Inequalities	Yes	**Negative** – By focusing on one neighborhood initially in Kings Park, Belize City, the project may cause inequality between communities to increase since some will not have access	Ensure that the project is quickly replicated once determined as successful.	No. of New Farms Created in Other Communities

SDG	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
11. Sustainable Cities and Communities	Yes	**Positive** – The project aims to allow for self-sustainable agricultural production in cities and communities which rely on rural areas for produce	None	No. of Cities with Hydroponics % of Community Member Participation
12. Responsible Consumption and Production	Yes	**Positive** – Through encouraging hydroponics production, the project promotes responsible production using less water and land	None	% Reduction of Water Usage % Reduction of Land Usage
13. Climate Action	Yes	**Positive** – Through hydroponics farming, the project promotes climate smart agriculture using less soil and water generating less GHG emissions	None	% Reduction in GHG Emissions % of Water Conserved
14. Life Below Water	No	None Directly	None	None
15. Life on Land	Yes	**Positive** – Hydroponics farming promotes responsible production using less water and land resulting in less biodiversity loss	None	% of Land Conserved % of Biodiversity Growth

SDG	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
16. Peace, Justice and Strong Institutions	No	None Directly	None	None
17. Partnerships for the Goals	Yes	**Positive** – Through being a community-based solution, the project encourages community participation and partnerships for success	None	% of Community Member Participation

Note. Own work. Green = Positive Effects, Orange = Negative Effects, Red = None

7.2 GPM Global's P5 Sustainability Analysis

In 2019, Green Project Management (GPM) Global established the P5 Standard for Sustainability in Project Management which aims to "identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation" (GPM, 2019, p.3). Though it is not a methodology, completing the P5 Sustainability Analysis for the project supports the principles and foundations providing a mechanism to measure sustainability linked to the SDGs (Carboni et al., 2018). By completing the P5 analysis, the project team would ensure that the Project Management Plan for WeGrow Ltd. is holistic in minimizing negative impacts to sustainability. The P5 stands for Product, Process, People (Social), Planet (Environmental), and Prospertity (Economic). The categories, subcategories, and elements under each area of the P5 are summarized in the P5 Ontology in **Figure 13.** However, for the purposes of this high-level analysis, the project is analyzed at the level of the category and subcategory only. An analysis at the level of each element would be considered in a full Sustainability Management Plan. Based on the P5 Sustainability Impact Analysis completed in **Chart 39**, it is clear that this project is in compliance being related to 15 out of 16 subcategories of the P5 ontology. From these, the

project has positive effects on 11 subcategories with negative effects on 4. Nevertheless, the mitigation measures for each negative effect are indicated including indicators to measure progress. Overall, this shows that the hydroponics project in Belize City is generally in compliance with the P5 sustainability ontology.

Chart 39. P5 Sustainability Impact Analysis

C.	Subcategory	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
(1) Product Impacts	1. Lifespan of the Product	Yes	**Positive** – Generally, a hydroponics farm can have a long lifespan with quick and high yields along with the recycling of water	None	Duration of product life
	2. Servicing of Product	Yes	**Negative** – Servicing and maintenance of the urban hydroponics farm may be difficult due to technical capacity limitations in Belize	Conduct trainings or potential international apprenticeships to support capacity building.	No. of service issues resolved successfully locally
(2) Process Impacts	3. Effectiveness of Project Processes	Yes	**Positive** – The project follows the PMI standards of project processes	None	% of Scope completed on time and within budget
	4. Efficiency of Project Processes	Yes	**Positive –** The project follows the	None	% of Scope completed on

C.	Subcategory	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
			PMI standards of project processes		time and within budget
	5. Fairness of Project Processes	Yes	**Positive –** The project follows the PMI standards of project processes as well as the PMI Code of Ethics and Professional Conduct	None	No. of complaints received from local vendors regarding procurement processes
(3) People (Social) Impacts	6. Labor Practices and Decent Work	Yes	**Positive** – The project will follow the locally established Labor Laws in Belize for Compliance	None	No. of New Jobs Created % of Employee Attrition
	7. Society and Customers	Yes	**Positive** – The project's consumers are also its producers from the community creating a dual synergistic role.	None	% of Community Member Participation
	8. Human Rights	No	None Directly	None	None
	9. Ethical Behavior	Yes	**Positive** – Procurement Practices would be determined based	None	No. of complaints received from local vendors

C.	Subcategory	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
			on PMI Standards following local anti-corruption and fairness policies		regarding procurement processes
(4) Planet (Environmental) Impacts	10. Transport	Yes	**Positive** – Through having the hydroponics farm located within the city itself, the transportation costs would be reduced also reducing GHG emissions	None	% Reduction in GHG Emissions
	11. Energy	Yes	**Negative** – The high cost of fossil fuel-based electricity to maintain a hydroponics farm can cause excess electricity usage and higher costs	Implement alternative sources of clean and renewable energy such as solar panels	% Reduction of Total Electricity Costs % of Electricity From Renewable Sources
	12. Land, Air and Water	Yes	**Positive** – Through soilless hydroponics farming, less land and water usage are required contributing positively to air quality through urban gardening	None	% of Water Conserved % of Land Conserved % Improvement in Air Quality

C.	Subcategory	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
	13. Consumption	Yes	**Positive** – The circular nature of hydroponics allows for the reuse of water and less land or soil usage generally contributing to less waste generation by the project.	None	% Reduction of Water Usage % Reduction of Land Usage % Reduction in Waste Generation
(5) Prosperity (Economic) Impacts	14. Business Case Analysis	Yes	**Negative** – Given that the project is a new and innovative venture, it is to be determined whether the business case is feasible and overall profitable for the sponsor (investor) and the community beneficiaries identified in Belize City	Ensure that a thorough business case analysis is conducted including modeling and simulation, present value analysis, direct financial benefits analysis, return on investment (ROI), benefit-cost ratio, and internal rate of return (IRR).	Present Value Return on Investment (ROI) Benefit-Cost Ratio Internal Rate of Return Direct and Indirect Financial Benefits

C.	Subcategory	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
	15. Business Agility	Yes	**Negative** – The flexibility / optionality of the business model is limited given that only approximately 40 types of produce can be grown using hydroponics (Velazquez-Gonzalez, 2022).	Ensure that the produce grown is demand driven to ensure market satisfaction. Determine alternative sources for produce that is not able to be grown.	No. of Produce Grown No. of Alternative Market Sources
	16. Economic Stimulation	Yes	**Positive** – Local economic impact through high yield produce and increased job creation including indirect health and environmental benefits	None	% of GDP Growth No. of New Jobs Created % Growth in Yields of Produce

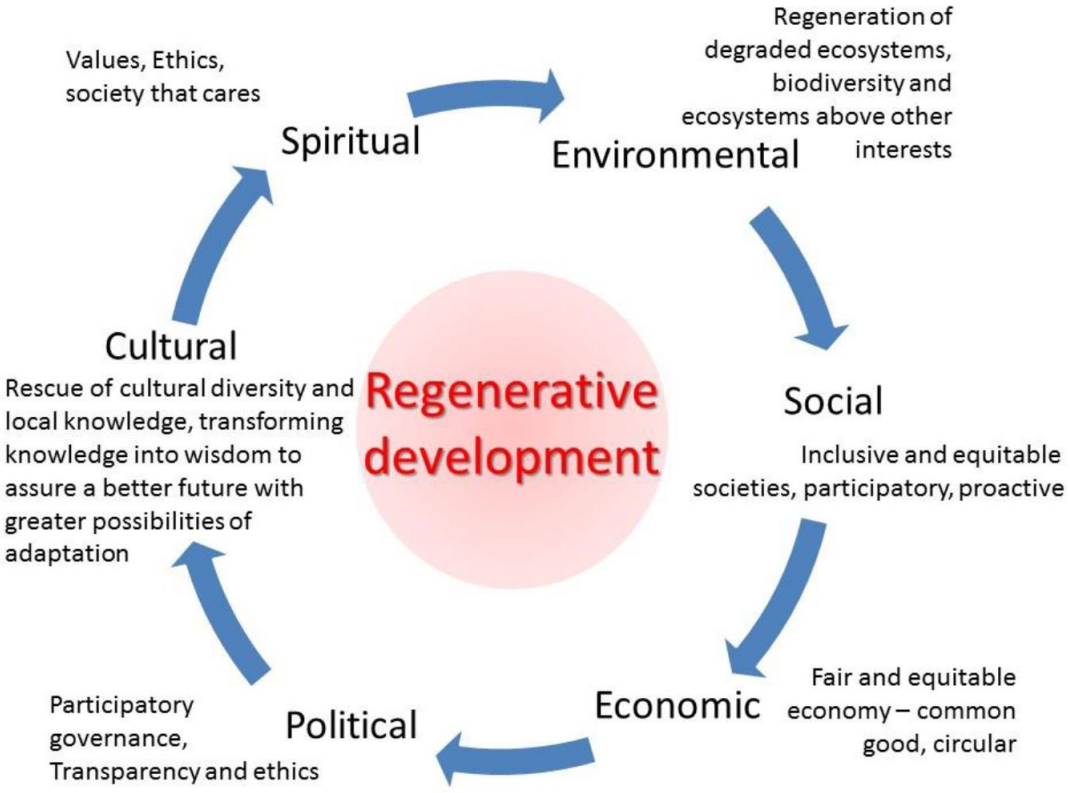
Note. Own work. Green = Positive Effects, Orange = Negative Effects, Red = None

7.3 Regenerative Development Analysis

As many debates continue between sustainable development and regenerative development, it is key that a project completes an analysis of both to determine its standing within these contexts. Regenerative development is defined as the “use of resources to improve society’s wellbeing in a way that builds the capacity of the support systems needed for future growth” (Gabel, 2015, p.1). It is seen as a more

holistic circular approach to development over the linear approaches of sustainable development. It ultimately focuses on enhancing capacity and reversing humanity's damage on the planet. Muller (2017) proposes that in order to reverse the damage done, humanity needs to implement regenerative development based on a holistic approach that integrates six (6) dimensions. These include: (1) Environmental, (2) Social, (3) Economic, (4) Political, (5) Cultural, and (6) Spiritual dimensions. **Figure 37** below summarizes the six dimensions of regenerative development according to Muller (2017) which is utilized in the subsequent analysis.

Figure 37. Six Dimensions of Regenerative Development



Note. Reprinted from *Regenerative Development, the Way Forward to Saving Our Civilization*. Muller, 2017 Figure 7, p. 13 Copyright 2017, San Jose, Costa Rica. Permission not sought.

Based on the Regenerative Development Analysis completed in **Chart 40**, it is clear that this project is in compliance being related to 4 out of 6 dimensions of Regenerative Development (Muller, 2017). From these, the project generally has positive effects on each of the 4 dimensions identified with no negative effects identified. This shows that when taken from the lens of Regenerative Development, the hydroponics project is a good example of its application. However, the lack of the clear evidence and presence of political and spiritual dimensions under the project, shows that more needs to be done in order to ensure that the project can holistically be called a regenerative project in full compliance with all 6 dimensions.

Chart 40. Regenerative Development Analysis

Dimension	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
1. Environmental	Yes	**Positive** – Climate smart urban hydroponics takes into consideration regenerative elements since it uses less water and less land, while also reusing water contributing to less GHG emissions and increased biodiversity conservation	None	% Reduction of Water Usage % Reduction of Land Usage % Reduction in GHG Emissions % of Water and Land Conserved % of Biodiversity Growth

Dimension	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
2. Social	Yes	**Positive** – The community-based urban hydroponics farm aims to ensure that there is equitable access to produce in a participatory and proactive manner tackling food security and self-sustainability	None	% of Persons with Food Security No. of Persons Accessing Produce Purchasing Power Parity
3. Economic	Yes	**Positive** – Generally, the community-based urban hydroponics farm will generate several positive economic benefits including jobs, yields of produce, as well as innovation within the circular economy	None	% Reduction in Cost of Produce No. of New Jobs Created % Growth in Yields of Produce
4. Political	No	None Directly – There is not much evidence of the political dimension under this project dealing with participatory governance, transparency, and ethics	None	None

Dimension	Relationship / Compliance	Positive or Negative Effects	Mitigation Measures	Indicators
5. Cultural	Yes	**Positive** – The community-based nature of the project would enable a cultural shift of participatory cooperation and collaboration while ensuring knowledge transfer and the promotion of healthy eating habits	None	% of Community Member Participation % Growth in Fruit and Vegetable Consumption
6. Spiritual	No	None Directly – There is not much evidence of the spiritual elements of the project since it does not directly influence the values or ethics of society	None	None

Note. Own work. Green = Positive Effects, Orange = Negative Effects, Red = None

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9 APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED FINAL GRADUATION PROJECT (FGP)

1. Student name

Hero Ranjit Balani

2. FGP name

PROJECT MANAGEMENT PLAN FOR THE CONSTRUCTION OF THE FIRST URBAN HYDROPONICS FARM WITHIN THE RESIDENTIAL COMMUNITY IN THE KING'S PARK AREA OF BELIZE CITY, BELIZE

3. Application Area (Sector or activity)

Urban Agriculture

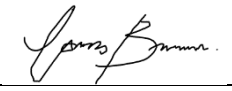
4. Student signature

Hero Ranjit Balani

5. Name of the Graduation Seminar facilitator

Carlos Brenes Mena

6. Signature of the facilitator



7. Date of charter approval

September 4, 2022

8. Project start and finish date

September 19, 2022	February 2, 2023

9. Research question

What elements are required to develop an integrated Project Management Plan for the construction of an urban hydroponics farm within the Kings Park residential community in Belize City that meets national health and building standards for small-scale agricultural production?

10. Research hypothesis

Is it possible to develop an integrated Project Management Plan for the construction of an urban hydroponics farm within the Kings Park residential community in Belize City that meets national health and building standards for small-scale agricultural production?

11. General objective

To develop an integrated Project Management Plan, framed within the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize.

12. Specific objectives

1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable and realistic timeframe.
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.
10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.

13. FGP purpose or justification

According to the United Nations World Cities Report 2022 "Envisaging the Future of Cities," it is expected that the world will continue to urbanize over the next three decades from 56% in 2021 to 68% in 2050 (UN-HABITAT, 2022). This translates to an increase of 2.2 billion additional people living in cities. With such growth, the sustainability of cities continues to be at the forefront of global policy discussions as the threat of increased poverty continues following the COVID-19 pandemic. One solution is to potentially analyze regenerative development innovations that can be deployed in cities which includes a holistic approach to environmental, social, economic, political, cultural, and spiritual factors (Muller, 2017). In this philosophy, the nation state is no longer the only player to develop solutions on the global stage (Gabel, 2015). Global corporations, cities, nations, NGOs, and private citizens all need to work together to develop and deploy solutions to tackle the current development challenges being faced globally.

One of the main challenges facing cities, including Belize City today, is the reliance on rural areas or imports to obtain produce or other agricultural products for food security. This proved to be challenging with supply chain disruptions from the COVID-19 lockdowns. Belize City was also affected with supply shortages when farmers were not able to deliver produce to the City, especially when borders were shut for imports. According to an FAO report in 2016, it was estimated that Belize experienced 'moderate or severe food insecurity' at 28% with approximately 9% of this group experiencing 'severe food insecurity' going an entire day without eating due to a lack of money or other resources (Stevenson et al., 2021). In Belize City today, such challenges remain with many households benefitting from Government-led pantry programs or NGO-led feeding programs. Additionally, the latest consumer price index (CPI) data for Belize shows that Belize City experienced higher food prices with a 6.5 % inflation rate being the fourth highest of all cities and towns in the country (SIB, 2022). This shows a need for greater self-sustainability by families and households in Belize City for food security.

For this reason, this FGP is important as it aims to develop an integrated Project Management Plan for the construction of an urban hydroponics farm within the Kings Park residential community in Belize City that meets national health and building standards for small-scale agricultural production. There are several benefits that can result from the project. First, the project is one of the first community-based hydroponics farm being considered for development in Belize City. This provides a learning experience for community members in the Kings Park Area to create an innovation to tackle high food prices and food security challenges. Second, the project will support efficiency in land use within cities, as well as water resources since hydroponics technology uses 90% less water than traditional farming (CityZen, 2021). Third, the project would help to promote healthy eating and sustainable farming in urban areas using the environmentally friendly methodologies under the circular economy. Apart from these benefits, the project also aims to become a case study of regenerative development in Belize City that can be duplicated in other communities, towns, and cities. This FGP would help to set the baseline and framework for these project benefits to be realized.

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

1. Final Graduation Project (FGP) – Project Management Plan for an Urban Hydroponics Farm in Belize City, Belize
1.1 Graduation Seminar
1.1.1 FGP Deliverables
1.1.1.1 FGP Charter
1.1.1.2 FGP WBS
1.1.1.3 Chapter 1 – Introduction
1.1.1.4 Chapter 2 – Theoretical Framework
1.1.1.5 Chapter 3 – Methodological Framework
1.1.1.6 Annexes
1.1.1.6.1 Bibliography
1.1.1.6.2 Schedule
1.1.2 Graduation Seminar Approval
1.2 Tutoring Process
1.2.1 Tutor
1.2.1.1 Tutor Assignment
1.2.1.2 Communication
1.2.2 Adjustments of Previous Chapters (if needed)
1.2.3 Chapter 4 – Development (Results)
1.2.3.1 Signed FGP Charter
1.2.3.2 Scope Management Plan
1.2.3.3 Schedule Management Plan
1.2.3.4 Cost Management Plan
1.2.3.5 Quality Management Plan
1.2.3.6 Resource Management Plan
1.2.3.7 Communication Management Plan
1.2.3.8 Risk Management Plan
1.2.3.9 Procurement Management Plan
1.2.3.10 Stakeholder Engagement Plan
1.2.3.11 Sustainability Analysis
1.2.4 Chapter 5 – Conclusions
1.2.5 Chapter 6 – Recommendations
1.3 Reading by Reviewers
1.3.1 Reviewers Assignment Request
1.3.1.1 Assignment of Two Reviewers
1.3.1.2 Communication
1.3.1.3 FGP Submission to Reviewers
1.3.2 Reviewers Work
1.3.2.1 Reviewer 1
1.3.2.1.1 FGP Reading
1.3.2.1.2 Reader 1 Report
1.3.2.2 Reviewer 2

1.3.2.2.1 FGP Reading
1.3.2.2.2 Reader 2 Report
1.4 Adjustments
1.4.1 Report for Reviewers
1.4.2 FGP Update
1.4.3 Second Review by Reviewers
1.5 Presentation to Board of Examiners
1.5.1 Final Review by Board
1.5.2 FGP Grade Report

15. FGP budget

The budget estimated to develop and complete the FGP document is outlined below for a total of BZD $422.50 (USD $211.25). The key costs identified include the printing of twenty-five (25) community stakeholder surveys, the facilitation of two (2) stakeholder meetings, food and transportation expenses for two (2) site visits to existing hydroponics farms in Belize, and the printing, binding and delivery of the final FGP to the Universidad para la Cooperación Internacional (UCI), in Costa Rica. The preliminary costs have been estimated using the researcher's expert judgment and analogous estimating based on historical cost data and online references.

Description	**Unit Price**	**Quantity**	**Total**
Printing of Community Stakeholder Surveys	$0.50	25	$12.50
Facilitation of Stakeholder Meetings	$50.00	2	$100.00
Site Visits to Hydroponics Farms (Food and Transportation)	$75.00	2	$150.00
Printing and Binding of FGP in Costa Rica	$160.00	1	$160.00
Total			**$422.50**

All currencies are estimated in Belize Dollars (BZD).

16. FGP planning and development assumptions

Assumptions

1. It is assumed that the relevant research data and information to complete each specific objective of the FGP is readily available and accessible in Belize.
2. It is assumed that other successful cases of hydroponics farming projects in Belize will be receptive to share background information required for the FGP completion.
3. It is assumed that the Sponsor will remain committed and provide necessary information throughout the development of the FGP.
4. It is assumed that the relevant project management software, such as Microsoft Project among others, will be accessible to the researcher for the development of the FGP.
5. It is assumed that the researcher will dedicate a minimum of 15 hours per week to develop the FGP within the allocated schedule for completion.

17. FGP constraints

Constraints

1. Fixed time available to complete the FGP set at 12 weeks.
2. Limited human resources available with only one researcher (the student) required to complete all deliverables under the specific objectives.
3. Constrained financial resources based on available budget of the researcher (the student) at the time of expenses incurred during the FGP
4. The template provided to complete the FGP Project Management Plan restricts the scope of work within the chapters indicated.
5. Lack of successful examples of urban hydroponic farms in Belize given that the project is a novel prototype.

18. FGP development risks

Risks

1. If the researcher contracts COVID-19 or another major illness, this would significantly delay the timely submission of deliverables according to the expected quality standards.
2. If the priorities in the researcher's professional career or workload shift, this may reduce the time dedicated to complete the FGP resulting in lower quality deliverables.
3. If a natural disaster or hurricane occurs during the FGP timeline, this may hinder the researcher's ability to complete the planned site visit to a functioning hydroponics farm in Belize impacting quality and timely submission of deliverables.
4. If the tutor or reviewers do not provide timely feedback in a clear manner, it may cause late adjustments and a misinterpretation of feedback leading to delays in the FGP timeline and poor-quality submissions.

19. FGP main milestones

The main FGP milestones below have been defined as related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS indicated in section 14 and Appendix 2. The deliverables for the specific objectives, including the times for the tutorship reviews and readership have also been included.

Deliverable	Estimated Start Date	Estimated Finish Date
1.1 Graduation Seminar	**July 18, 2022**	**September 19, 2022**
1.1.1 FGP Deliverables (FGP Charter, WBS, Chapter 1 Introduction, Chapter 2 Theoretical Framework, and Chapter 3 Methodological Framework, Annexes, Bibliography and Schedule)	July 18, 2022	September 4, 2022
1.1.2 Graduation Seminar Approval	September 4, 2022	September 19, 2022
1.2 Tutoring Process	**September 19, 2022**	**December 17, 2022**
1.2.1 Tutor (Assignment and Communication)	September 19, 2022	September 26, 2022
1.2.2 Adjustments of Previous Chapters (if needed)	September 27, 2022	September 30, 2022
1.2.3 Chapter 4 – Development (Results)	September 19, 2022	December 9, 2022
1.2.3.1 Signed FGP Charter	September 19, 2022	September 30, 2022
1.2.3.2 Scope Management Plan	October 1, 2022	October 7, 2022
1.2.3.3 Schedule Management Plan	October 8, 2022	October 14, 2022

1.2.3.4 Cost Management Plan	October 15, 2022	October 21, 2022
1.2.3.5 Quality Management Plan	October 22, 2022	October 28, 2022
1.2.3.6 Resource Management Plan	October 29, 2022	November 4, 2022
1.2.3.7 Communication Management Plan	November 5, 2022	November 11, 2022
1.2.3.8 Risk Management Plan	November 12, 2022	November 18, 2022
1.2.3.9 Procurement Management Plan	November 19, 2022	November 25, 2022
1.2.3.10 Stakeholder Engagement Plan	November 26, 2022	December 2, 2022
1.2.3.11 Sustainability Analysis	December 3, 2022	December 9, 2022
1.2.4 Chapter 5 - Conclusions	December 10, 2022	December 17, 2022
1.2.5 Chapter 6 - Recommendations	December 10, 2022	December 17, 2022
1.3 Reading by Reviewers	**January 4, 2023**	**January 12, 2023**
1.3.1 Reviewers Assignment Request (Assignment, Communication and Submission)	January 4, 2023	January 5, 2023
1.3.2 Reviewers Work (Reviewer 1 and 2)	January 5, 2023	January 12, 2023
1.4 Adjustments	**January 12, 2023**	**January 26, 2023**
1.4.1 Report for Reviewers	January 12, 2023	January 15, 2023
1.4.2 FGP Update	January 15, 2023	January 19, 2023
1.4.3 Second Review by Reviewers	January 19, 2023	January 26, 2023
1.5 Presentation to Board of Examiners	**January 26, 2023**	**February 2, 2023**
1.5.1 Final Review by Board	January 26, 2023	January 31, 2023
1.5.2 FGP Grade Report	February 2, 2023	February 2, 2023

20. Theroretical framework

20.1 Estate of the “matter”

In summarizing the theoretical framework for the FGP elaborated in Section 2.3, it is important to note that it crosses several themes including the current context of sustainable development and food security; an overview of community-based hydroponics projects including success stories, lessons learned, challenges and risks; and considerations around sustainable project management. First, since September 2015, world leaders under the United Nations collectively agreed on 17 Sustainable Development Goals (SDGs) and 169 targets under the 2030 Sustainable Development Agenda to tackle issues focusing on people, planet and prosperity (United Nations, 2015). Goal number 1 is No Poverty while Goal number 2 is Zero Hunger, both of which this FGP seeks to support as well as Goal 3 Good Health and Well-being, Goal 9 Industry, Innovation and Infrastructure, and Goal 12 Responsible Consumption and Production. The main problem that this FGP aims to support is that of sustainability and food security challenges currently being faced globally. Cities and urbanization continue to grow with 2.2 billion new people forecasted to urbanize by 2050 putting pressures on the sustainability of cities (UN-HABITAT, 2022). According to an FAO report in 2016, it was estimated that Belize experienced ‘moderate or severe food insecurity’ at 28% with approximately 9% of this group experiencing ‘severe food insecurity’ going an entire day without eating due to a lack of money or other resources (Stevenson et al., 2021). For this reason, the FGP would also support food security and sustainability efforts in Belize City.

One of the solutions that literature has pointed to is the development of community-based urban hydroponics farms. Hydroponics is defined as a method to produce agricultural products with a soilless means of production (Nerantzis et al., 2018). It is where crops are grown in water composed of mineral nutrients supported by medium (Gumisirriza et al., 2022). Literature suggests that there have been case studies where cities have been able to contribute to biodiversity through green spaces, rooftop gardens and community gardens with examples from India, Japan, Tanzania and Uganda (CityZen, 2022;

Galloway, 2022; Gumisiriza et al., 2022; UN-HABITAT, 2022). It is also noted that several technologies and cultivation techniques are possible under soilless hydroponics as inputs for this FGP. Several benefits of hydroponics were also noted being climate smart, with high yield products, using no soil, having no pests or diseases, and using 90% less water with efficient land use. However, several disadvantages were also noted in the theoretical literature reviewed such as the high cost of capital, technical expertise needed, and the potential for pollution if waste is not disposed correctly (Gumisiriza et al., 2022).

Finally, theory around sustainable project management is also relevant given its linkage to the FGP's theme and topic area. Carboni (et al., 2018) defines sustainable project management as moving beyond the traditional focus of time, cost and scope, towards delivering the objectives in the business case. It is where projects adopt a sustainability ethos which does not come at the expense of the planet and its limited resources. For this reason, the FGP will also be using the Green Project Management (GPM) P5 Standard for Sustainability as a way to identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation (GPM, 2019). Lastly, factors regarding regenerative development will also be analyzed. According to Gabel (2015), regenerative development is the use of resources to improve society's wellbeing in a way that builds the capacity of the support systems needed for future growth. Muller's (2017) six dimensions of regenerative development will also factor into the analysis on sustainability including environmental, social, economic, political, cultural and spiritual factors.

20.2 Basic conceptual framework

There are several core concepts that are covered under this FGP. In ensuring that readers are able to comprehend the core concepts, the basic conceptual framework of key terms is listed below as included within the document.

Project Management – the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (PMI, 2017)

Project Management Plan – the document that describes how the project will be executed, monitored and controlled, and closed (PMI, 2017)

Sustainable Development – the use of resources to improve society's wellbeing in a way that does not destroy or undermine the support systems needed for future growth (Gabel, 2015).

Regenerative Development – the use of resources to improve society's wellbeing in a way that builds the capacity of the support systems needed for future growth (Gabel, 2015).

Food Security – certain availability or access to high quality nutritious food (Stevenson et al., 2021)

Hydroponics – a method to produce agricultural products with a soilless means of production.

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
1. To create a Project Charter to formally authorize the urban hydroponics farming project and provide the project manager with the authority to utilize resources for project completion.	Project Charter	**Primary:** Meetings and Interviews; Correspondences **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	FGP Charter Template Templates, Guidelines and Models Microsoft Word, Excel and Project .	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
2. To create the Scope Management Plan to describe how the scope for the construction of the urban hydroponics farm will be defined, developed, monitored, controlled and validated to meet stakeholder requirements.	Scope Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, Conference Proceedings; Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Scope Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
3. To create a Schedule Management Plan to establish how the project schedule will be developed, monitored and controlled for the construction of the urban hydroponics farm within an approved, reasonable	Schedule Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Schedule Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize

and realistic timeframe.					
4. To create a Cost Management Plan to describe how the costs for the construction of the urban hydroponics farm will be planned, structured, and controlled to complete the project within the available resources.	Cost Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Cost Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Constrained Financial Resources; Lack of cases of successful urban hydroponics in Belize
5. To create a Quality Management Plan to establish the policies, procedures and guidelines to be implemented to achieve the quality objectives of the urban hydroponics farming project.	Quality Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, Conference Proceedings; Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Quality Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
6. To create a Resource Management Plan to establish how project resources will be acquired, allocated, monitored, and controlled to complete the urban hydroponics farming project.	Resource Management Plan	**Primary:** Meetings and Interviews; Correspondences; Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Resource Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Constrained Financial Resources; Lack of cases of successful urban

					hydroponics in Belize
7. To create a Communications Management Plan to establish how, when, and by whom information about the urban hydroponics farming project will be administered and disseminated.	Communications Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Communications Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
8. To create a Risk Management Plan to establish how risk management activities will be structured and performed for the urban hydroponics farming project.	Risk Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Risk Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
9. To create a Procurement Management Plan to establish how external goods and services will be acquired through procurement processes under the urban hydroponics farming project.	Procurement Management Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, Conference Proceedings; Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Procurement Management Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Constrained Financial Resources; Lack of cases of successful urban hydroponics in Belize

10. To create a Stakeholder Engagement Plan to establish the strategies and actions for productive involvement of stakeholders in decision making and execution of the urban hydroponics farming project.	Stakeholder Engagement Plan	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, Conference Proceedings; Photographs **Secondary:** *PMBOK® Guides* 6th & 7th, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Stakeholder Engagement Plan Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Lack of cases of successful urban hydroponics in Belize
11. To develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project.	Sustainability Analysis	**Primary:** Meetings and Interviews; Correspondences; Surveys, Focus Groups, Conference Proceedings; Photographs **Secondary:** UN Sustainable Development Goals, GPM Reference Guide, P5 Standard, Regenerative Development Sources, Books, Journals, Articles and Commentaries	Analytic-Synthetic Analysis	Sustainability Analysis Template Templates, Guidelines and Models Microsoft Word, Excel and Project	Stringent Template; Fixed Time; Limited Human Resources; Constrained Financial Resources; Lack of cases of successful urban hydroponics in Belize

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

The FGP research is validated in the field of regenerative and sustainable development to fulfill specific objective number 11 as relayed in Chapter 7. The objective is to develop an analysis which determines whether the implementation of the urban hydroponics farming project is in compliance with the principles of sustainable development and regenerative development in order to support and promote sustainability considerations under the project. In completing this assessment, three theoretical frameworks were used including (1) the United Nations Sustainable Development Goals, (2) GPM Global's P5 Sustainability Analysis, and (3) Regenerative Development Analysis. For each, the analysis determined the project's relationship or compliance, as well as whether there are any positive or negative effects. If there were negative effects, the subsequent mitigation measures were summarized. Additionally, indicators to measure sustainability under each theoretical framework used were also identified as outlined and elaborated in Charts 6, 7 and 8 within Chapter 7.

Overall, the project can be said to contribute to both sustainable development and regenerative development through its implementation. When analyzed under the SDGs, the project was in compliance and related to 12 out of 17 goals (United Nations, 2015). From these, 10 goals had positive effects while 2 had negative effects. When analyzed under the P5 Sustainability Impact Analysis, the project was in compliance and related to 15 out of 16 subcategories of the P5 ontology (GPM, 2019). From these, the project had positive effects on 11 subcategories with negative effects on 4. Finally, when it comes to regenerative development, the six dimensions proposed by Muller (2017) were used to analyze the project including environmental, social, economic, political, cultural and spiritual factors. When completing this analysis, the project was noted to be in compliance and related to 4 out of 6 dimensions of regenerative development having a positive effect on all 4. However, there was a lack of clear evidence and presence of political and spiritual dimensions under the project.

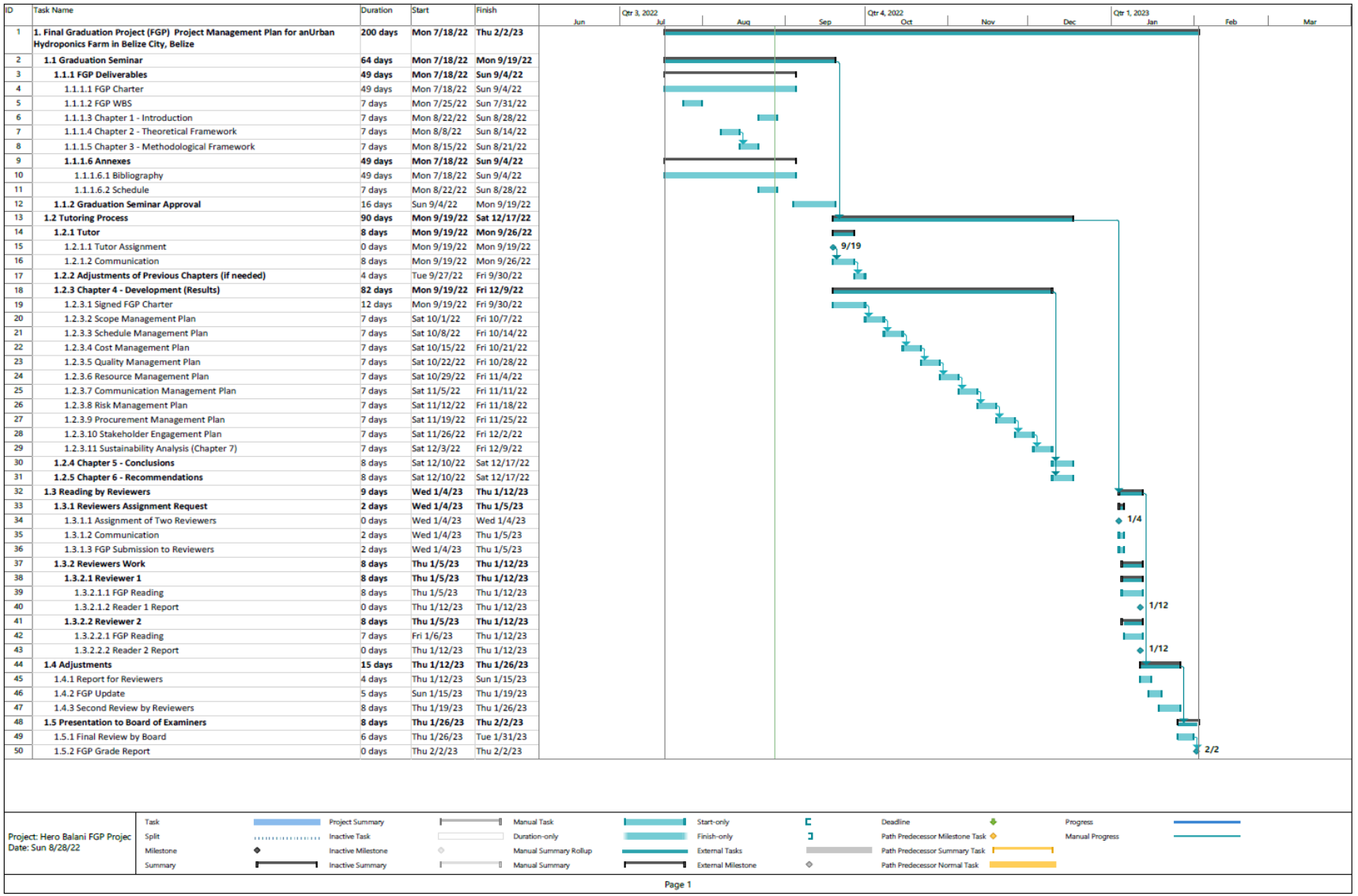
Overall, this sustainability analysis shows that the community-based urban hydroponics project in Belize City will contribute significantly to both sustainable development and regenerative development as shown through the examination of the SDGs, the P5 Ontology and the dimensions of regenerative development. Additional details on the analysis, including impacts and indicators can be found in Chapter 7.

Appendix 2: FGP WBS

Final Graduation Project (FGP) Work Breakdown Structure (WBS)

Appendix 3: FGP Schedule

ID	Task Name	Duration	Start	Finish
1	**1. Final Graduation Project (FGP) Project Management Plan for anUrban Hydroponics Farm in Belize City, Belize**	**200 days**	**Mon 7/18/22**	**Thu 2/2/23**
2	**1.1 Graduation Seminar**	**64 days**	**Mon 7/18/22**	**Mon 9/19/22**
3	**1.1.1 FGP Deliverables**	**49 days**	**Mon 7/18/22**	**Sun 9/4/22**
4	1.1.1.1 FGP Charter	49 days	Mon 7/18/22	Sun 9/4/22
5	1.1.1.2 FGP WBS	7 days	Mon 7/25/22	Sun 7/31/22
6	1.1.1.3 Chapter 1 - Introduction	7 days	Mon 8/22/22	Sun 8/28/22
7	1.1.1.4 Chapter 2 - Theoretical Framework	7 days	Mon 8/8/22	Sun 8/14/22
8	1.1.1.5 Chapter 3 - Methodological Framework	7 days	Mon 8/15/22	Sun 8/21/22
9	**1.1.1.6 Annexes**	**49 days**	**Mon 7/18/22**	**Sun 9/4/22**
10	1.1.1.6.1 Bibliography	49 days	Mon 7/18/22	Sun 9/4/22
11	1.1.1.6.2 Schedule	7 days	Mon 8/22/22	Sun 8/28/22
12	**1.1.2 Graduation Seminar Approval**	16 days	Sun 9/4/22	Mon 9/19/22
13	**1.2 Tutoring Process**	**90 days**	**Mon 9/19/22**	**Sat 12/17/22**
14	**1.2.1 Tutor**	**8 days**	**Mon 9/19/22**	**Mon 9/26/22**
15	1.2.1.1 Tutor Assignment	0 days	Mon 9/19/22	Mon 9/19/22
16	1.2.1.2 Communication	8 days	Mon 9/19/22	Mon 9/26/22
17	**1.2.2 Adjustments of Previous Chapters (if needed)**	4 days	Tue 9/27/22	Fri 9/30/22
18	**1.2.3 Chapter 4 - Development (Results)**	**82 days**	**Mon 9/19/22**	**Fri 12/9/22**
19	1.2.3.1 Signed FGP Charter	12 days	Mon 9/19/22	Fri 9/30/22
20	1.2.3.2 Scope Management Plan	7 days	Sat 10/1/22	Fri 10/7/22
21	1.2.3.3 Schedule Management Plan	7 days	Sat 10/8/22	Fri 10/14/22
22	1.2.3.4 Cost Management Plan	7 days	Sat 10/15/22	Fri 10/21/22
23	1.2.3.5 Quality Management Plan	7 days	Sat 10/22/22	Fri 10/28/22
24	1.2.3.6 Resource Management Plan	7 days	Sat 10/29/22	Fri 11/4/22
25	1.2.3.7 Communication Management Plan	7 days	Sat 11/5/22	Fri 11/11/22
26	1.2.3.8 Risk Management Plan	7 days	Sat 11/12/22	Fri 11/18/22
27	1.2.3.9 Procurement Management Plan	7 days	Sat 11/19/22	Fri 11/25/22
28	1.2.3.10 Stakeholder Engagement Plan	7 days	Sat 11/26/22	Fri 12/2/22
29	1.2.3.11 Sustainability Analysis (Chapter 7)	7 days	Sat 12/3/22	Fri 12/9/22
30	**1.2.4 Chapter 5 - Conclusions**	8 days	Sat 12/10/22	Sat 12/17/22
31	**1.2.5 Chapter 6 - Recommendations**	8 days	Sat 12/10/22	Sat 12/17/22
32	**1.3 Reading by Reviewers**	**9 days**	**Wed 1/4/23**	**Thu 1/12/23**
33	**1.3.1 Reviewers Assignment Request**	**2 days**	**Wed 1/4/23**	**Thu 1/5/23**
34	1.3.1.1 Assignment of Two Reviewers	0 days	Wed 1/4/23	Wed 1/4/23
35	1.3.1.2 Communication	2 days	Wed 1/4/23	Thu 1/5/23
36	1.3.1.3 FGP Submission to Reviewers	2 days	Wed 1/4/23	Thu 1/5/23
37	**1.3.2 Reviewers Work**	**8 days**	**Thu 1/5/23**	**Thu 1/12/23**
38	**1.3.2.1 Reviewer 1**	**8 days**	**Thu 1/5/23**	**Thu 1/12/23**
39	1.3.2.1.1 FGP Reading	8 days	Thu 1/5/23	Thu 1/12/23
40	1.3.2.1.2 Reader 1 Report	0 days	Thu 1/12/23	Thu 1/12/23
41	**1.3.2.2 Reviewer 2**	**8 days**	**Thu 1/5/23**	**Thu 1/12/23**
42	1.3.2.2.1 FGP Reading	7 days	Fri 1/6/23	Thu 1/12/23
43	1.3.2.2.2 Reader 2 Report	0 days	Thu 1/12/23	Thu 1/12/23
44	**1.4 Adjustments**	**15 days**	**Thu 1/12/23**	**Thu 1/26/23**
45	1.4.1 Report for Reviewers	4 days	Thu 1/12/23	Sun 1/15/23
46	1.4.2 FGP Update	5 days	Sun 1/15/23	Thu 1/19/23
47	1.4.3 Second Review by Reviewers	8 days	Thu 1/19/23	Thu 1/26/23
48	**1.5 Presentation to Board of Examiners**	**8 days**	**Thu 1/26/23**	**Thu 2/2/23**
49	1.5.1 Final Review by Board	6 days	Thu 1/26/23	Tue 1/31/23
50	1.5.2 FGP Grade Report	0 days	Thu 2/2/23	Thu 2/2/23



Appendix 4: Preliminary Bibliographical Research

Carboni, J., Duncan, W., Gonzalez, M., Milsom, P., & Young, M. (2018). *Sustainable Project Management: The GPM Reference Guide.* Novi MI, USA: GPM Global.

Justification: The reference above was selected given the project's linkage to Sustainable Development. Green Project Management (GPM) Global advocates for sustainability and planet regeneration through sustainable project methods and standards. Through the integration of this resource, the project would not only apply the standards from Project Management Institute (PMI, 2017), but also those indicated by GPM (Carboni et al., 2018) including the P5 Standard of People, Planet, Prosperity, Product and Process.

Channel5 News. (2017, December 29). A Greenhouse in Your Backyard: Couple Practices Hydroponics. Retrieved July 16, 2022, from Edition.Channel5Belize.com: https://edition.channel5belize.com/archives/158201

Justification: The reference above was chosen as a part of the market analysis regarding the current situation of Hydroponics Farming in Belize. The article provides additional details on a current business enterprise that is undergoing Hydroponics Farming to produce various items including different types of lettuce, sweet basil, swiss chard, collard greens, and other leafy greens. This reference helps with the development of the Project Management Plan, particularly the Stakeholder Engagement Plan determining which players are currently in the market having experience with such types of farming in Belize.

CityZen. (2021, May 10). *Hydroponics and its Role in Urban Agriculture*. Retrieved July 22, 2022, from Interregeurope.EU: https://projects2014-2020.interregeurope.eu//cityzen/news/news-article/11981/hydroponics-and-its-role-in-urban-agriculture/

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The reference provides additional details on how hydroponics farming can enhance urban farming activities in areas where citizens have limited access to land, or where climate conditions are not favorable. It provides a case study from Japan where lessons learned can be applied in the development of the Project Management Plan for the Urban Hydroponics Farming Project in Belize City, Belize.

Gabel, M. (2015). Regenerative Development: Going Beyond Sustainability. *Kosmos Journal for Global Transformation*. Retrieved from https://www.kosmosjournal.org/article/regenerative-development-going-beyond-sustainability/

Justification: The reference above was selected to ensure that the Project Management Plan is developed to meet the standards of Regenerative Development. As the world moves beyond Sustainable Development, it is important that the project determines its fit and contribution to Regenerative Development efforts in Belize which take a holistic systematic approach to Development. Gabel (2015) provides important information on the definition of

Regenerative Development which aims to improve society's well being in a way that builds the capacity of support systems needed for future growth. The Urban Hydroponics Farming Project is an example of Regenerative Development which makes this reference helpful in establishing the context making a case for the project.

Galloway, J. (2022). *Urban Hydroponics*. Retrieved July 22, 2022, from MyWaterEarth&Sky - MyWaterEarth.com: https://mywaterearth.com/urban-hydroponics/

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The article shares additional details on what Urban Hydroponics is, defined as a method of growing plants without soil, usually on rooftops of apartment dwellers of densely populated urban areas where there is limited green space to grow healthy, affordable, quality vegetables. The article also differentiates between vertical farming technology, and rooftop hydroponic gardens, both of which would be key when determining the types of systems that can be procured under the Procurement Management Plan for the Urban Hydroponics Farming Project in Belize City, Belize.

Ghafoor, H. Q. (2017). Content Analysis of Mission Statements - A Case of Cement Sector Companies of Pakistan. International Journal of Accounting, Finance and Risk Management, 2(1), 31-38. Retrieved from https://article.sciencepublishinggroup.com/html/10.11648.j.ijafrm.20170201.15.html

Justification: The reference above was chosen to provide a methodology to derive a mission and vision statement. It uses nine (9) elements that are recommended when generating a vision or mission statement. These include (1) customers, (2) products, (3) markets, (4) technology, (5) concern for survival, growth, and profitability, (6) philosophy, (7) self-concept, (8) concern for public image, and (9) concern for employees. Each of these elements remain key when defining the mission and vision for We Grow Ltd. in ensuring that all areas are covered.

GPM. (2019). *The P5 Standard for Sustainability in Project Management.* U.S.A.: Green Project Management (GPM).

Justification: The reference above was selected given the project's clear linkage to Sustainable Development. Green Project Management (GPM) Global advocates for sustainability and planet regeneration through sustainable project methods and standards. In ensuring that such principles are applied in project management, GPM developed the P5 Standard for Sustainability in Project Management which includes parameters under People, Planet, Prosperity, Product and Process. The use of the P5 Standard would ensure that the Project Management Plan being developed for the Urban Hydroponics Farming Project in Belize City would be able to identify potential impacts to sustainability, whether positive or negative, in each area. This can then be analyzed to determine any key decisions that need to be made to minimize project impacts on sustainability.

Gumisiriza, M. S., Kabirizi, J. M., Mugerwa, M., Ndakidemi, P. A., & Mbega, E. R. (2022). Can Soilless Farming Feed Urban East Africa? An Assessment of the Benefits and Challenges of Hydroponics in Uganda and Tanzania. *Environmental Challenges, 6*, 1-8.

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The article shares additional details on the potential for urban food production through the adoption of soilless farming techniques such as hydroponics. It provides details of case studies in East Africa which assess the benefits and drawbacks allied with hydroponic vegetable farming among urban and peri-urban farms in Northern Tanzania and Central Uganda. The lessons learned would provide key pieces of information that can be used for the Urban Hydroponics Farming Project in Belize City, Belize, particularly under the Risk Management Plan.

IGI Global. (2022). What is Information Sources? Retrieved August 16, 2022, from IGI-Global.com: https://www.igi-global.com/dictionary/information-sources/14512

Justification: The reference above was selected to support the establishment of the methodological framework. It allowed for the definition of information sources when defining which types of information sources would be used for this FGP.

Kissflow. (2022). The Basics of Project Management. Retrieved August 10, 2022, from Kissflow.com: https://kissflow.com/project/project-management-basics/

Justification: The reference above was chosen to ensure that the Project Management Plan is developed according to the standards set by the project management industry. This reference supported comparisons between the definitions set by Project Management Institute (PMI) along with other project sources in maintaining a nuanced argument. It supported the development of the theoretical framework to ensure that different perspectives on project management terminologies were taken into consideration.

LifePersona. (2022). The 9 Most Common Types of Research Methods. Retrieved August 16, 2022, from LifePersona.com: https://www.lifepersona.com/the-9-most-common-types-of-research-methods

Justification: The reference above was selected to establish the methodological framework Having an understanding of the various types of research methods is key to ensure that the right method is selected for the FGP. The reference provides a broad overview of of the various types of research methods for selection.

Muller, E. (2017). Regenerative Development, The Way Forward to Saving our Civilization. *University for International Cooperation, Costa Rica*, 1-39.

Justification: The reference above was selected to ensure that the Project Management Plan is developed to meet the standards of Regenerative Development. As the world moves beyond Sustainable Development, it is important that the project determines its fit and contribution to Regenerative Development efforts in Belize which take a holistic systematic

approach to Development. Muller (2017) provides a thorough analysis of Regenerative Development including the need for projects to take a holistic approach that considers the six layers of Environmental, Social, Economic, Political, Cultural and Spiritual elements of development. The Urban Hydroponics Farming Project is an example of Regenerative Development which makes this reference helpful in establishing the context making a case for the project. It also helps to ensure that the Project Management Plan considers each of these elements.

Nerantzis, E. T., Koliopoulos, T. K., & Sharma, S. K. (2018). Urban Vertical Hydroponics. *Emerging Environmental Technologies and Health Protection*, 13-18.

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The article shares additional details on how Urban Vertical Hydroponics can contribute to provide safe qualitative food while protecting the environment and public health. It contextualizes the emerging vertical indoor farming technologies in urban environments. It also provides additional details on how vertical hydroponic technological systems work which remains key when determining the types of systems that can be procured under the Procurement Management Plan for the Urban Hydroponics Farming Project in Belize City, Belize.

PMI. (2017). *A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Sixth Edition.* Newtown Square, P.A.: Project Management Institute (PMI).

Justification: The reference above was chosen to ensure that the Project Management Plan is developed according to the standards set by the Project Management Institute (PMI, 2017), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. PMI's *PMBOK® Guide* is a set of globally recognized standard terminology and guidelines for project management. The current sixth edition of the *PMBOK® Guide* defines five (5) process groups and ten (10) knowledge areas which form the basis of the structure for the Final Graduation Project (FGP) report. Using the *PMBOK® Guide* will ensure that all aspects of the recommended project management inputs, tools and techniques, and outputs, are considered for each knowledge area.

PMI. (2021). A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Seventh Edition and The Standard for Project Management. Newtown Square, P.A.: Project Management Institute (PMI).

Justification: The reference above was chosen to ensure that the Project Management Plan is developed according to the standards set by the Project Management Institute (PMI, 2021), to effectively and efficiently manage the construction of an urban hydroponics farm within the residential community in the Kings Park Area of Belize City, Belize. PMI's *PMBOK® Guide* is a set of globally recognized standard terminology and guidelines for project management. The current seventh edition of the *PMBOK® Guide* defines eight (8) project performance domains which are different from the ten (10) knowledge areas of the sixth edition. Although the FGP will focus on the sixth edition, it is important to consider the project management principles and system for value delivery concepts introduced in the

seventh edition along with the project performance domains. This would help to ensure that the Project Management Plan is taking the current context of the project management industry and profession into consideration.

ProjectManager.com. (2022). Project Management. Retrieved August 10, 2022, from ProjectManager.com: https://www.projectmanager.com/guides/project-management

Justification: The reference above was chosen to ensure that the Project Management Plan is developed according to the standards set by the project management industry. This reference supported comparisons between the definitions set by Project Management Institute (PMI) along with other project sources in maintaining a nuanced argument. It supported the development of the theoretical framework to ensure that different perspectives on project management terminologies were taken into consideration.

SIB. (2022). Consumer Price Index (CPI) Release for the Month of May 2022. City of Belmopan: Statistical Institute of Belize (CIB).

Justification: The reference above was chosen to ensure that the Project Management Plan uses the latest data to justify the benefits and impact of the project in Belize City. This is important, particularly for the Stakeholder Management Plan to ensure that beneficiaries understand the impact that the project will be able to have on the community. The Statistical Institute of Belize (SIB) would be a key resource for baseline data when measuring results from the project. For this reason, its reports will be monitored regularly. The Consumer Price Index (CPI) data shows the increasing inflation rates experienced across the country providing support to the justification of the hydroponics farming project in Belize City for food security.

Stevenson, L. D., Reznar, M. M., Onye, E., Amor, L. B., Lopez, A. J., & DeFour, R. (2021). A Qualitative Inquiry of Food Insecurity in Belize. Public Health Nutrition, 24(4), 977-986.

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The journal article provides additional details on the context of food security in Belize based on a recent qualitative inquiry completed. The results show that Belize suffers from a moderate to severe rate of food insecurity. For this reason, the report further justifies the need for and importance of the hydroponics farming project in Belize City since urban gardens can potentially help to solve food security challenges faced by cities globally. The report cites several barriers to food access and affordability in Belize including employment, education, income, family structure, and distance / transportation. The hydroponics farm would support solving some of these challenges to food access in Belize City.

UCI. (2021). Why Projects Fail? Section 8 - Introduction to Project Management. University for International Cooperation (UCI). Retrieved May 13, 2021

Justification: The reference above was selected to ensure that the most common reasons for project failure are considered. In order to ensure that this FGP was able to facilitate project

success, having an understanding of why projects fail is key. For this reason, the reference was used to understand the 10 most common reasons why projects fail to learn from these lessons within this project.

UN-HABITAT. (2022). World Cities Report 2022 - Envisaging the Future of Cities. Nairobi, Kenya: United Nations Human Settlements Program (UN-Habitat).

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The report provides the global context of urbanization and the need to harness the power of sustainable urbanization to achieve the global goals of peaceful, prosperous societies on a healthy planet as set by the United Nations. The World Cities Report 2022 stresses that building resilience must be at the heart of cities of the future which depend on policies that protect and sustain all, leaving no one behind. The report calls for green investment and sustainable patterns of consumption citing several case studies of cities creating greens spaces including through the use of urban gardens and hydroponics. The lessons learned from the case studies would provide information that can be used for the Urban Hydroponics Farming Project in Belize City, Belize, particularly under the Risk Management Plan.

United Nations. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. New York: United Nations.

Justification: The reference above was selected to ensure that the Project Management Plan is developed to meet the standards of sustainability set by the United Nations. It aims to ensure that the targets of the project can be aligned with the 17 Sustainable Development Goals and 169 targets established in September 2015 by global world leaders to advance sustainable development universally leaving no one behind.

University of Minnesota Crookston. (2022). Primary, Secondary and Tertiary Sources. Retrieved August 16, 2022, from Crk.Umm.edu: https://crk.umn.edu/library/primary-secondary-and-tertiary-sources

Justification: The reference above allowed for the definition of the methodological framework for the FGP. It provides a definition of primary, secondary and tertiary resources in order to ensure that the research is all encompassing.

Velazquez-Gonzalez, R. S., Garcia-Garcia, A. L., Ventura-Zapata, E., Barceinas-Sanchez, J. D., & Sosa-Savedra, J. C. (2022). A Review on Hydroponics and the Technologies Assocaited for Medium- and Small- Scale Operations. *Agriculture MDPI, 12*(646), 1-21.

Justification: The reference above was chosen to provide additional background on the topic and to guide research around the development of the Project Management Plan. The reference specifically analyzes hydroponics and the technologies associated for médium and small scale operations. It also analyzes the benefits and challenges stating that although hydroponics has proveen its effectiveness on a large scale, there are still challenges in implementing this technique on a small scale, specifically in urban and suburban settings.

The information on technologies, benefits and challenges of urban hydroponics farming would help to inform several sections of the Project Management Plan for the Urban Hydroponics Farming Project in Belize City, Belize, particularly the Procurement Management Plan, and the Risk Management Plan.

Appendix 5: Philological Dictum

Stephanie Flores Bradshaw
Lot 18 – 13½ Miles Philip Goldson Highway
Belize District, Belize

26 January 2023

Academic Advisor
Master's Degree in Project Management
Universidad para la Cooperación Internacional (UCI)

Dear Academic Advisor,

Re: Philological Review of Final Graduation Project Submitted by Master's Degree Candidate Hero Balani

This letter serves to certify that I have reviewed the Final Graduation Project for master's degree candidate Hero Balani. I hereby confirm that Hero Balani has made all the corrections to the Final Graduation Project document as I have advised. It is my professional opinion that the document meets the standards in written English as required for the Master's in Project Management (MPM) Degree by the Universidad para la Cooperación Internacional.

Sincerely yours,

Stephanie Flores Bradshaw
M.A. in English

Valdosta State University

This Certifies That

The Board of Regents of the University System of Georgia Upon Recommendation of the Faculty of Valdosta State University

Has Conferred on

Stephanie Denise Flores-Bradshaw

the Degree of

Master of Arts

English

with all the Rights, Privileges, and Honors thereunto appertaining.

Whereof the seal of the University and the signatures of its duly authorized officers are hereto affixed.

Given this thirtieth day of July, in the year of our Lord two thousand and eleven

Henry M. Huckaby
Chancellor of the University System of Georgia

Louis A. Levy
President of the University

Dean, Division of Graduate Studies

Stanley Jones
Registrar

VALDOSTA STATE UNIVERSITY VALDOSTA GEORGIA 1906