UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

Project Management Plan for the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems

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DEDICATION

This research project is dedicated to my dad, Ivan Clarence Joseph, for giving me more than one reason to continue to strive for excellence. To my siblings, Myrick, Desiree, Ellen Sue, and Agnes Ann, for always pushing me to be a better person. And to my colleague at work, you all know how important you are to me, MY SIRDI FAMILY.

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I am indeed grateful to all those individuals who helped me in any way with this project, including my tutor Mr. Juan Camilo Delgado and all the lecturers that influenced my growth during my studies at UCI.

ABSTRACT

The development of this Project Management Plan is based on the standards of the Project Management Institute (PMI) and is to be used to evaluate a cropping system using novel isotope techniques to helps improve productivity and reduce the impact of agro-contaminants in the environment. The country of Belize relies heavily on both tourism and agriculture for foreign income. The cost of producing agricultural crops have increase due to the increased in cost of agricultural inputs such as fertilizers. The application of fertilizers in excess have led to the contamination of soils and waterways, which reaches the reefs that thus affect the tourism industry. Measuring the soil's ability to store and eventually release nutrients to plants (crops) and measuring the elements within the plant tissue is vital in calculating the fertilization rate for crops in different soil types. The use of nuclear isotope technology will facilitate the study of measuring the soil's ability to hold nutrient and the presence within the plant tissue. Calculating the fertilizer dosage and frequency required for each crop based on the soil type. Resulting in the reduction of agricultural runoff into the waterways and increase the efficiency of fertilizer. The infrastructure for testing soil and tissue for agricultural production is limited in Belize, the provision of laboratory implements, and other supplies ensured the enhancement of the national capacity of the technical officers. This document provides a complete project management plan that will ensure a smooth process in executing a project that uses the novel isotope technique to optimize the use of nitrogen fertilizer in rainfed agriculture system.

Keywords: cropping system, nuclear isotope technology, soil testing, tissue testing, agriculture system

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ABBREVIATIONS AND ACRONYMS

ASR	American Sugar Refinery
BSI	Belize Sugar Industry
CARDI	Caribbean Agriculture Research & Development Institute
FFS	Farmer Field School
FGP	Final Graduation Project
PMI	Project Management Institute
NIT	Nuclear and Isotope Technique
SCPC	Sugarcane Production Committee
SIA	Sugar Industry Act
SICB	Sugar Industry Control Board
SIRDI	Sugar Industry Research & Development Institute
SOW	Statement of Work
UB	University of Belize
UCI	Universidad de Cooperación Internacional

EXECUTIVE SUMMARY

The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems is new to Belize and very much needed. No scientific evaluation in the uptake of inorganic fertilizer has been executed in Belize. Sugar Industry Research & Development Institute (SIRDI), a research and development institute that has been researching on soil fertility and nutrient requirements of sugarcane grown in northern Belize, has been tasked with executing this project. SIRDI, which has designed and executed projects in fertilizer application rates, now has a new tool in assessing the movement of fertilizers within the plant and the soil. SIRDI required the application of formal project management practices, in the form of the plan described here to successfully execute the project. The specific objectives are: (i) to create the Project Charter in order to define the key input elements required for the Project Management Plan; (ii) to develop the Scope Management Plan in order to ensure that the project includes all the work required to complete the project successfully; (iii) to develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project; (iv) to develop the Cost Management Plan so costs can be continuously evaluated to ensure funds are spent as required and in a timely fashion; (v) to develop the Quality Management Plan to achieve consistency across the project and to make adjustments as necessary; (vi) to develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training; (vii) to develop the Risk Management Plan to ensure that the mitigation measures associated with identified risks are expressed and effectively addressed; (viii) to develop the Communication Management Plan and stakeholders map to ensure project stakeholders are identified and that they know ‘what’ and ‘when’ at key times during project implementation; and (ix) to develop the Procurement Management Plan to ensure that any entity, that will deliver these tasks or services, have a set of well-defined protocols for doing so.

The methodology selected for the research was experimental. The main sources used to gather information included A Guide to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition and interviews with members from the client and executing

organization. The information was analyzed to create each subcomponent of the required plans used to develop the Project Management Plan for Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems.

The Project Management Plan, developed using the PMBOK® Guide 6th Edition, provided a new methodology for the project team to build a more thorough project management plan for a project, to improve the way the SIRDI would manage the project. It is recommended that the project team of SIRDI consider the use of the planning process outlined and documents developed here for the development of the Project Management Plan for the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer as a methodological framework for implementing similar projects in the future.

1. INTRODUCTION

Background

The research project that will be implemented, under the management plan described here, requires data gathering that would lead to better nutrient use efficiency to enhance soil fertility and water management in rain-fed sugarcane and corn production systems. The Sugar Industry Research and Development Institute (SIRDI) and the Ministry of Agriculture are responsible for the execution of the project.

SIRDI have, on several occasions been selected by government of Belize to lead and execute research projects that would be beneficial to agricultural production, primarily for sugarcane producers, in northern Belize.

SIRDI is an organization established by the Sugar Industry ACT of 2001. A “Board of Directors’’ composed of members appointed by the Minister administers the Institute. The mandate of the SIRDI is well defined in the objectives of the institute under the Sugar Act (2001) and includes the following: to (i) research, develop and adopt technological innovations and production options for the benefit of the industry. And (ii) establish norms and standards and provide technical services to the Sugarcane Production Committee (SCPC) for determining sugarcane quality. SIRDI and the SCPC both fall under the umbrella of the Sugar Industry Control Board (SICB). Its mission is to contribute to the development of a sugar cane industry that is an efficient, globally competitive, and sustainable sugarcane industry, in alliance with its strategic partners. Its vision is to consolidate SIRDI as a center for innovation and technology transfer for a competitive and sustainable sugarcane industry, in alliance with its strategic partners.

1.2. Statement of the problem

At SIRDI, investigation trails on nutrition are ongoing. The application of specified quantities of fertilizers, presently used in sugarcane production, is being tested on various soil types. One of many, limiting factors, in conducting this type of work, is the availability of precise instruments to measure the movement of the applied fertilizer, to quantify the fertilizer being

used and not used (and that potentially pollutes the environment), by the crop. The creation of this Project Management Plan will provide the project with all the required tools, techniques, and concepts to support each management decision for successfully completing of the project.

1.3. Purpose

The success of this project will have huge ramifications on the agricultural sector of Belize. The aim of this Project Management Plan is to detail all aspects of the project implementation methodology in order to significantly enhance the chance of success. Each activity is to be coordinated meticulously with documentation to ensure the proper porject execution processes. The research proposal will relies on the Project Management Institute's (PMI) guide to create Project Management Plan with logical reasoning in the development of the project's Charter, Resource, Scope, Time, Integration, Cost, Quality, Communication, Risk, Procurement and Stakeholder Management Plans.

1.4. General objective

To develop a Project Management Plan to enhance the efficiency of cropping systems,through the use nueclear isotope techniques to improve crop productivity and reduce the impact of agro-contaminants on the environment.

1.5. Specific objectives

- To create the Project Charter to define the key input elements to develop the Project Management Plan.
- To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.
- To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.
- To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.
- To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.

- To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.
- To develop the Risk Management Plan to identify, analyse, respond, and monitor risk on the project.
- To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocols to follow.
- To develop the Communication Management Plan to ensure the stakeholders who need to know ‘what’ information need to be delivered and ‘when’ the information should be delivered before project starts are identified.
- To develop the Stakeholder Management Plan to identify, analyse and manage stakeholder expectations and impact on the project.

2. THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

SIRDI was established by the Sugar Industry Act (herein referred to as the SIA) of 2001, the Institute was activated in 2009 by the Sugar Industry Control Board (SICB) and was officially launched in 2010 with the commencement of the 2010-2011 harvesting season. The SIA established SIRDI as the principal entity for the development of an efficient and productive sugar industry research and extension system, with the aim of increasing productivity and contributing to the industry's efficiency through the adoption of improved cultural practices and technologies in sugarcane production.

SIRDI has a vibrant staff with a combination of agronomist, mechanical engineering in agriculture production, biology, business administration, project management and scientific researcher. Together they have a vast knowledge and experience in extension/transfer of technology through advising sugarcane farmers to adopt the best agronomic practices are some of the primary reasons why the institution was contacted to collaborate on this project.

2.1.2 SIRDI's Mission and vision statements

Mission

SIRDI provides support services to cane farmers throughout the country of Belize. SIRDI also works closely with the Belize Sugar Industry (the mill) and the Sugar industry Control Board. SIRDI's mission statement is: To contribute to the development of a sugar cane industry that is an efficient, globally competitive, and sustainable sugarcane industry, in alliance with its strategic partners.

Vision

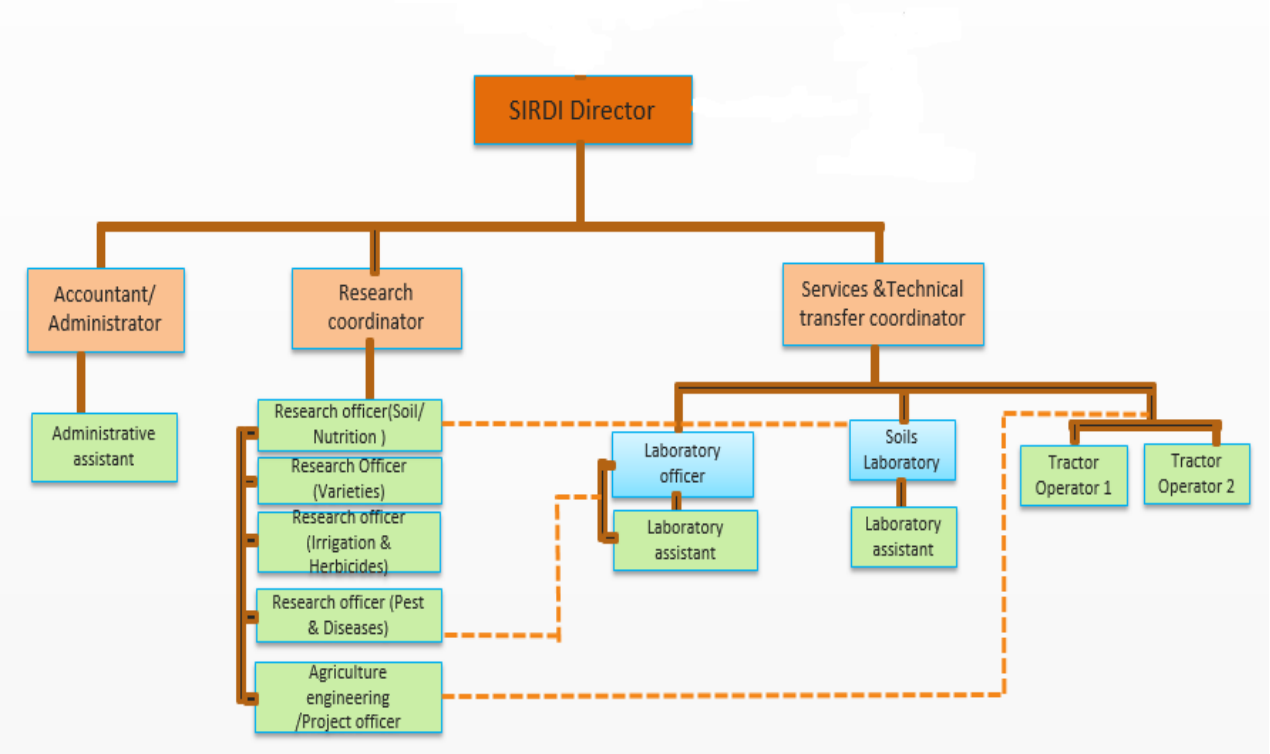
Consolidate SIRDI as center for innovation and technology transfer for a competitive and sustainable sugarcane industry, in alliance with its strategic partners, while discovering avenues that will benefit the environment and increase productivity for farmers to ensure the sustainability of the industry in northern Belize.

2.1.3. Organizational structure

The “Board of Directors” (which is composed of members appointed by the Minister responsible for Agriculture, the cane farmers associations, and the manufacturer), administers the Sugar Industry Research and Development Institute (SIRDI). The institute is currently comprised of fourteen (14) full time employees and an additional four (4) employees assigned to an externally funded project presently being executed.

Figure 1 illustrates the institute’s organizational structure. The institute is under the authority of the Sugar Industry Control Board (SICB), and the Director of SIRDI manages the daily operations. The Institute is presently undergoing changes and being under the management of co-interim directors, Ms. Leticia Westby, and Dr. Luciano Chi, until a permanent Director is found. Recently, the post of Project Officer was created to keep day-to-day update on all the projects presently being executed by the institute. There are three main departments Accountant/ Administrator, Research and Service & Technical Transfer.

Figure 1. *Organizational structure (Source: (Westby, 2020))*



2.1.4. Products offered

SIRDI provides the following services:

- Experience in working with ArcGIS software and Arc Editor for developing GIS database, providing digitalized field maps for the sugarcane industry in Northern Belize.
- Sugarcane research both at laboratory and field level, validating agronomic practices, pest and diseases control protocols, development of new varieties and other technology relevant to sugarcane production.
- Develops and implements training programs delivered to cane farmers, associations, and BSI/ASR field workers on crop husbandry practices (which includes pest and disease management and soil and macro invertebrate sampling).
- Capacity to liaise with the Ministry of Agriculture and Fisheries, Farmers' Associations, and other relevant Non-Government Organizations to address issues that arises among key industry stakeholders.
- Integrated Pest and Disease Management Laboratory mass producing the fungus Metarhizium anisopliae to control insect pests in pastures, and in sugarcane, rice, corn, and vegetable plots.
- Land preparation services, advice with planting and fertilization (incorporation) methods, use of pre-emergent herbicides, and cane seed selection.

2.2. Project Management concepts

2.2.1. Project

According to Wikipedia (Creswell, J. W.) research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: pose a question, collect data to answer the question, and present an answer to the question. The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue. The research in the wider scheme of things is a project, that the findings will enhance the proficient use of the element being research.

2.2.2. Project management

According to the PMBOK® Guide Project Management is the "application of knowledge, skills, tools, and techniques to project activities to meet the project requirements". This is realized through meticulous application and incorporation of "47 logically grouped project

management processes, which are categorized into five Process Groups." (Project Management Institute, 2013, p, 5).

Project Management Methodology especially as espoused by the Project Management Institute (PMI) and the Guide to the Project Management Body of Knowledge (PMBOK® Guide) certainly serves as an indispensable reference. This Methodology focuses on the processes that a project goes through namely initiation, planning, executing, monitoring, and controlling, and closing. All projects from the least to the most complex can be broken down into smaller more manageable work packages which, when initiated and implemented can be easily monitored and controlled to obtain the desired results within the constraints of scope, quality, schedule, budget, resources, and risks. Building on the one mentioned in this document may be constructed within the "triple constraints" of time, cost, and quality.

2.2.3. Project life cycle

The *PMBOK® Guide* identifies fives process groups, they are: Initiating, Planning, Executing, Monitoring and Controlling, and Closing. These five groups represent the processes that a typical project will pass through. Project management is done by grouping project activities into groups while project work is done in phases that are usually time bound.

The initiation phase is where project requirement and scope are studied and documented, and a Project Charter is created. This charter is used as a basis for the authorization of project. Having obtained project approval, the project then enters its second phase, Planning. It is at the Planning stage that the project is decomposed into "bit-size pieces" or work packages to which resources and responsibilities are assigned. The planning stages are very important to ensure the project's success and provides clear guidelines for project execution. Planning is also important for setting baselines from which the project will be monitored and controlled. When planning is satisfactorily done, the tasks are then carried out in the process called execution. While the project tasks are performed, and resources are consumed, the project must be monitored for variances in schedule and cost. If variances are observed, they may provide valuable information about the likelihood of success. Project variances may be adjusted by simply assigning more resources to fast track a task and in extreme situations, variances provide a basis for premature project termination. The last of the process groups is the closing phase. This is where formal project termination takes place. If all requirements

are met for a particular delivery, then the delivery is accepted. The process groups interact over the project life cycle as is illustrated by the Figure 2.

Figure 2. *Project life cycle stages of progression. Reprinted from Mastering Project Management Strategy andProcesses (p. 12), by R. Wilson, 2015, FT Press. Copyright 2015 by Randal Wilson.*

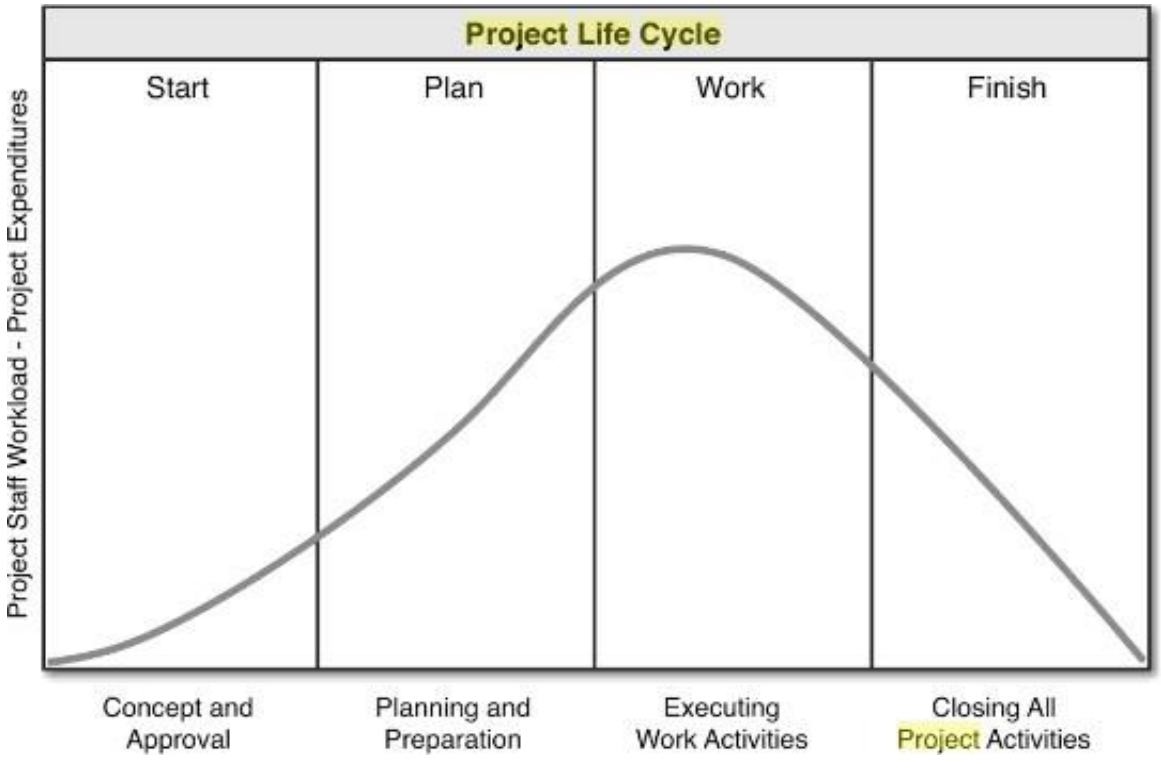
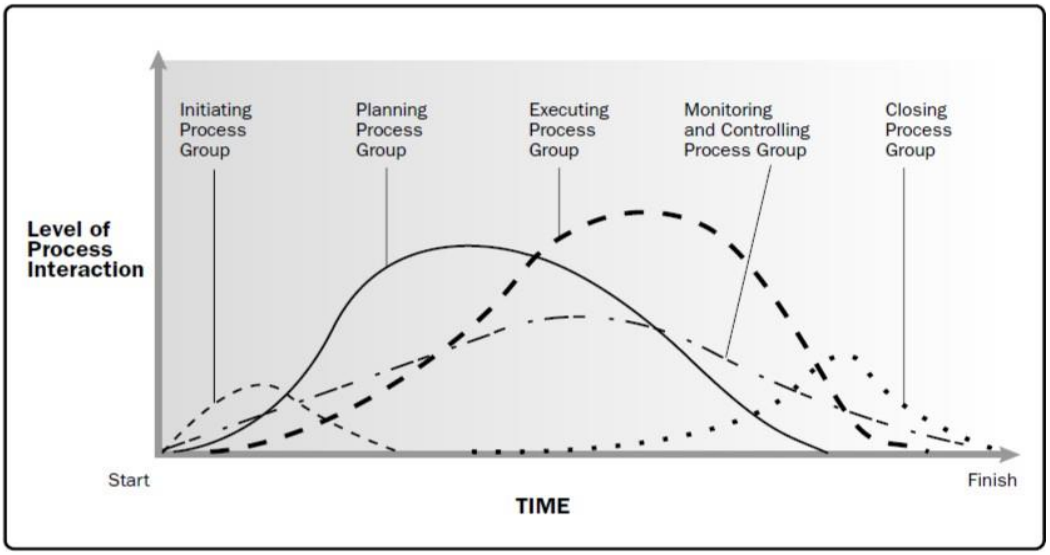


Figure 3. *Process groups interact in a Phase or Project. Reprinted from A Guide to the Project Management Body of Knowledge (p. 51), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*



2.2.4. Project management processes

Only the processes involved in initiating and planning a project will be used to develop the Project Management Plan for the N 15 isotope project. The Project Management Plan will be a compilation of subsidiary documents created for of each initiating and planning process activity. A subsidiary document is a document created to support the main document. See figure 4 below, detailing the processes to be applied during this project.

Figure 4. *Initiating and Planning Processes. Reprinted from A Guide to the Project Management Body of Knowledge(p. 51), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*

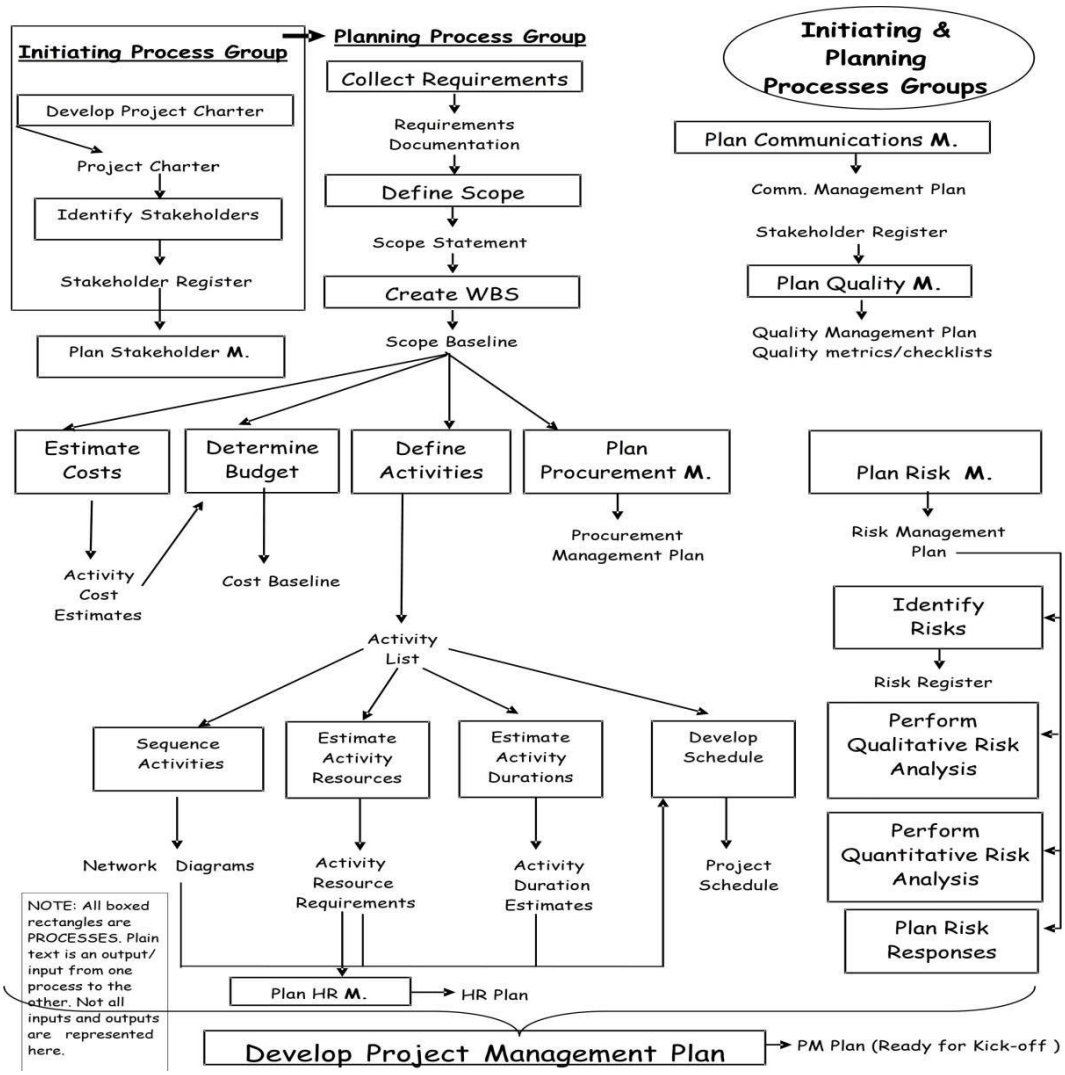
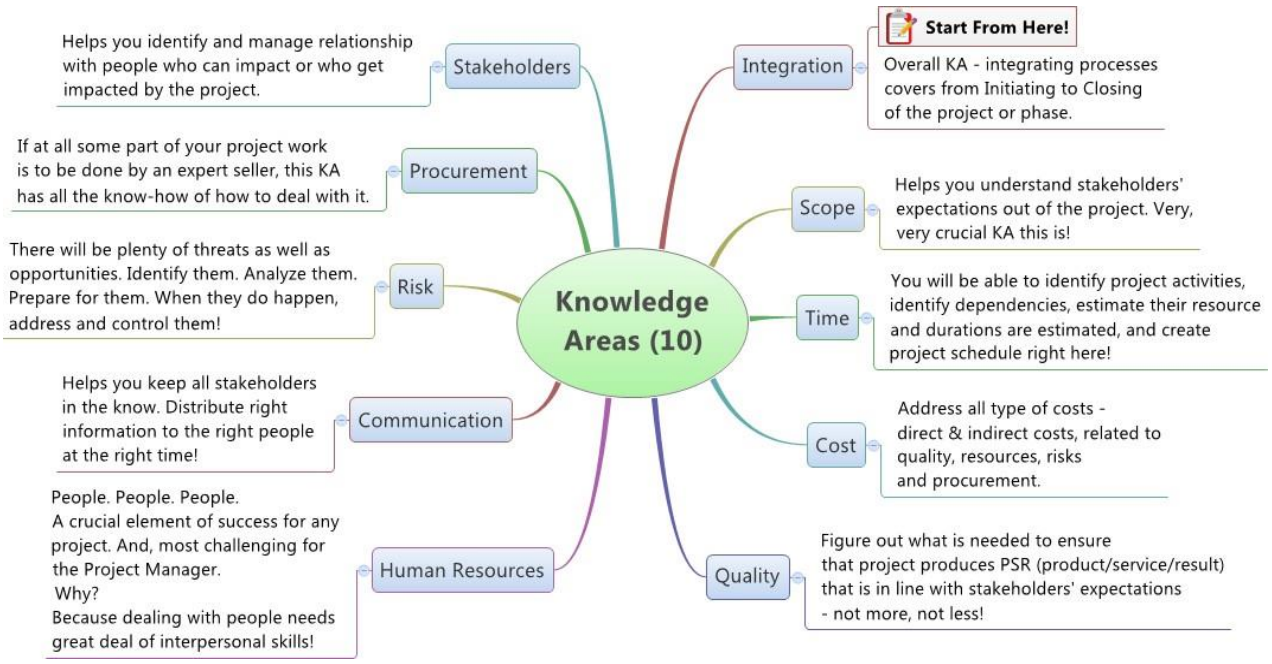


Figure 5. *PMI's PMBOK® Guide 10 Knowledge Areas. Reprinted from PM Exam Smart notes. By S. Shenoy, n.d., Retrieved from http://www.pmexamsmartnotes.com/project-management-body-of-knowledge/. Copyright 2016 by PMExamSmartNotes.com*



2.2.5. Project management knowledge areas

A Knowledge Area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. (Project Management Institute, 2013, p.59). There are ten knowledge areas, which are ten broad heading under which the 47 project management processes are subsets. Processes under each knowledge areas are iterative and may "overlap and interact".

The ten knowledge areas of project management (Project Management Institute, 2016), as defined in figure 5, are as follows:

1. Integration management
2. Scope management
3. Time management
4. Cost management
5. Quality management
6. Human Resources management
7. Communication management
8. Risk management

9. Procurement management
10. Stakeholder management

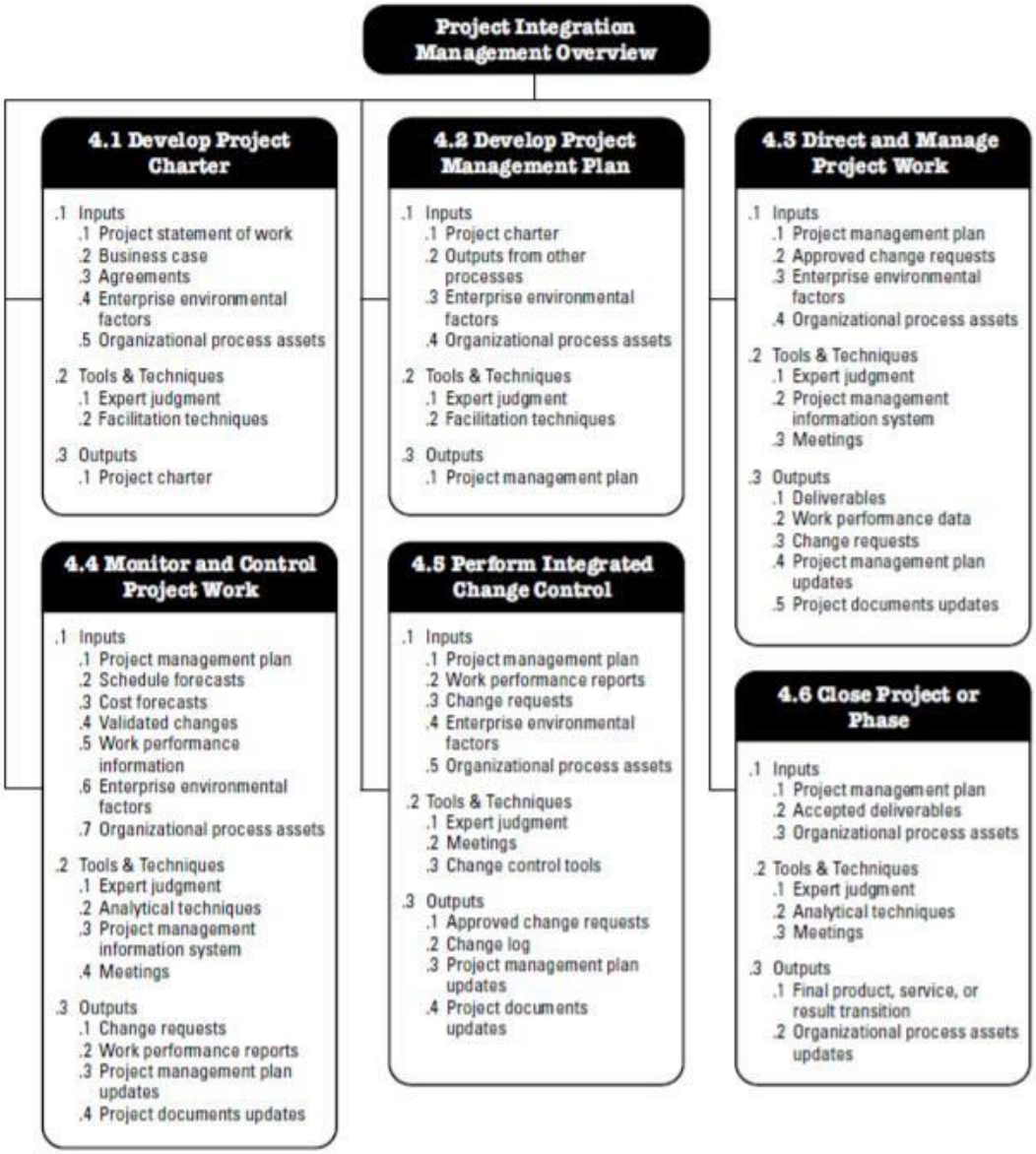
2.2.5.1. Project Integration Management

Project Integration Management contains the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups" (Project Management Institute, 2013, p. 63). The processes involved in Project Integration Management are outlined in figure 6. Process 4.1 will be used to develop the project charter that will begin the development of the Project Management Plan for the N15 Isotope project. Whereas Process 4.2 will be used as a guide throughout the development of the FGP results to develop the Project Management Plan.

Key terms that will be used during project integration management are:

a. Project statement of work or Statement of Work (SOW) is "a narrative description of products, services, or results to be delivered by the project". (Project Management Institute, 2013, p. 564)
b. Business case is "a documented economic feasibility study used to establishvalidity of the benefits of a selected component lacking sufficient definition and that is used as a basis for the authorization of further project management activities". (Project Management Institute, 2013, p. 530)
c. Agreements are "any document or communication that defines the initial intentions of a project". (Project Management Institute, 2013, p. 528)

Figure 6. *PMBOK® Guide Project Integration Management Overview. Reprinted from A Guide to the Project Management Body of Knowledge (p. 65), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



2.2.5.2. Project Scope Management

Project Scope Management comprises the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully (Project Management Institute, 2013, p.105). This means the project manager and his team must determine what is to be included or excluded from the scope. A clearly defined scope may help prevent scope creep from taking place later during the execution phase. The following are scope management processes identified in the *PMBOK® Guide* by

(Project Management Institute, 2013): To accurately capture the necessary scope to successfully complete the N15 Isotope research project, processes 5.1, 5.2, 5.3, and 5.4 of Figure 7, will be applied when developing the Project Management Plan.

Figure 7. *PMBOK® Guide Project Scope Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 105), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*

5.1 **Plan Scope Management**—The process of creating a scope management plan that documents how the project scope will be defined, validated, and controlled.

5.2 **Collect Requirements**—The process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives.

5.3 **Define Scope**—The process of developing a detailed description of the project and product.

5.4 **Create WBS**—The process of subdividing project deliverables and project work into smaller, more manageable components.

5.5 **Validate Scope**—The process of formalizing acceptance of the completed project deliverables.

5.6 **Control Scope**—The process of monitoring the status of the project and product scope and managing changes to the scope baseline.

2.2.5.3. Project Time Management

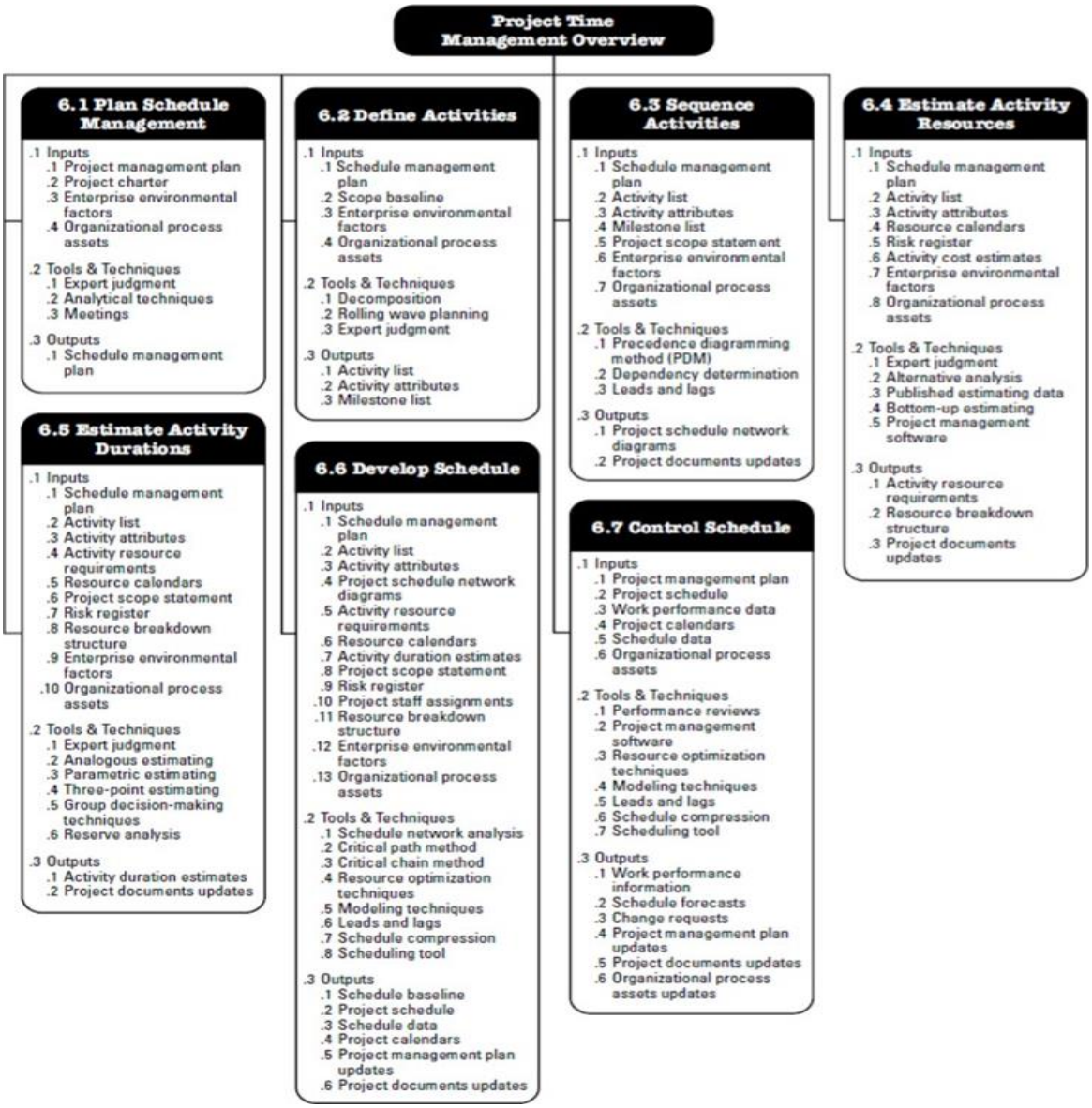
Project Time Management includes the processes required to manage the timely completion of the project (Project Management Institute, 2013, p. 141). Figure 8 is an overview of the processes of this knowledge area. Processes include plan schedule management, defining activities, arranging activities in sequence, estimating activity resources, estimating activity durations, and developing schedule control.

Plan Schedule Management Process is an important part of the Time Management Plan and is used for “establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule” (Project Management Institute, 2013, p. 145). The key benefit of this process is that is provides guidance for schedule management as the project is undertaken.

The Input is any source that contains vital information that is needed to produce the intended “output” and there are four key inputs to the plan schedule management process: Project Management Plan

- Project Charter
- Enterprise Environmental Factors Organizational Process Assets
- Tools and Techniques: Expert Judgment
- Analytical Techniques Meetings

Figure 8. *PMBOK® Guide Project Scope Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 143), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*



2.2.5.4. Project Cost Management

One of the most important knowledge areas is the Project Cost Management. Cost management includes processes that will enable the development of methodology for "planning, estimating, budgeting, financing, funding, managing, and controlling costs" (Project Management Institute, 2013, p. 193). These activities are necessary for the approved budget to be tracked, monitored, and controlled. The main aim of the cost management activities is to ensure that the project cost, which may include debt, can be accepted and the cost associated risks and all other project costs are properly planned, and a management strategy is developed and approved. 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" (Project Management Institute, 2013, p. 193). Figure 9 provides an overview of the PMI's Project Cost Management Processes.

Figure 9. *PMBOK® Guide Project Scope Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 143), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*

7.1 Plan Cost Management—The process that establishes the policies, procedures, and documentation for planning, managing, expending, and controlling project costs.

7.2 Estimate Costs—The process of developing an approximation of the monetary resources needed to complete project activities.

7.3 Determine Budget—The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.

7.4 Control Costs—The process of monitoring the status of the project to update the project costs and managing changes to the cost baseline.

2.2.5.5. Project Quality Management

Quality management depends on the use of existing policies and procedures that forms part of the performing organization's process assets. In the absence of these the performing organization might find it difficult to plan, implement and verify that the quality standards have been achieved. Quality management can be applied to all project deliverables regardless of type, complexity, or scope. Failure to plan for and meet quality standards may result in a

dissatisfied customer, increased cost for rework, increased attrition rate of workers, and even the cost that is not usually measured as potential business lost due to a dissatisfied customer branding the performing organization as a poor-quality performer. According to PMI, the processes for the management of Quality are identified in figure 10. Only process 8.1 will be used during project planning to produce the Quality Management Plan that will guide the project's Quality Assurance.

Figure 10. *PMBOK® Guide Project Quality Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 227), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*

8.1 Plan Quality Management—The process of identifying quality requirements and/or standards for the project and its deliverables and documenting how the project will demonstrate compliance with quality requirements and/or standards.

8.2 Perform Quality Assurance—The process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

8.3 Control Quality—The process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.

2.2.5.6. Project Human Resource Management

Project Human Resource Management includes the processes that organize, manage, and lead the project team." (Project Management Institute, 2013, p.255). For the research activities to be successfully planned and carried out, the participation of the project team at all stages of the planning process is necessary. Figure 11 outlines the processes for project Human Resource Management according to PMI. Only process 9.1 will be used during project planning to develop the Human Resource Management Plan.

Figure 11. *PMBOK® Guide Project Human Resource Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 255), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*

9.1 Plan Human Resource Management—The process of identifying and documenting project roles, responsibilities, required skills, reporting relationships, and creating a staffing management plan.

9.2 Acquire Project Team—The process of confirming human resource availability and obtaining the team necessary to complete project activities.

9.3 Develop Project Team—The process of improving competencies, team member interaction, and overall team environment to enhance project performance.

9.4 Manage Project Team—The process of tracking team member performance, providing feedback, resolving issues, and managing changes to optimize project performance.

2.2.5.7. Project Communications Management

According to (Project Management Institute, 2013, p. 258) Plan Human Resource Management is the process of "identifying and documenting project roles, responsibilities, required skills, reporting relationships, and creating a staffing management plan. As such, only process 10.1 will be referenced during project planning to develop the project's Communication Plan.

Figure 12. *PMBOK® Guide Project Communications Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 287), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*

10.1 Plan Communications Management—The process of developing an appropriate approach and plan for project communications based on stakeholder's information needs and requirements, and available organizational assets.

10.2 Manage Communications—The process of creating, collecting, distributing, storing, retrieving and the ultimate disposition of project information in accordance with the communications management plan.

10.3 Control Communications—The process of monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met.

2.2.5.8. Project Risk Management

All projects are exposed to risk in one way or another. Some events are positive and should be explored while negative events are to be prevented or managed if prevention is not possible. According to (Project Management Institute, 2013, p. 309) “Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project”. The following six Project Risk Management processes have been identified by (Project Management Institute, 2013): The description for each of PMI’s Risk Management Processes can be seen in figure 13. For the development of the Project Management Plan only processes 11.1, 11.2, 11.3 and 11.5 will be used during project planning.

Figure 13. *PMBOK® Guide Project Risk Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 287), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*.

11.1 Plan Risk Management—The process of defining how to conduct risk management activities for a project.

11.2 Identify Risks—The process of determining which risks may affect the project and documenting their characteristics.

11.3 Perform Qualitative Risk Analysis—The process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact.

11.4 Perform Quantitative Risk Analysis—The process of numerically analyzing the effect of identified risks on overall project objectives.

11.5 Plan Risk Responses—The process of developing options and actions to enhance opportunities and to reduce threats to project objectives.

11.6 Control Risks—The process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

2.2.5.9. Project Procurement Management

Project Procurement Management includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team (Project Management Institute, 2013, p. 355). Figure 14 outlines PMI’s Procurement Management Processes. Only

process 12.1 from the processes detailed below will be used to develop the Procurement Management Plan during project planning.

Figure 14. *PMBOK® Guide Project Risk Management Processes. Reprinted from A Guide to the Project Management Body of Knowledge (p. 287), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*

12.1 Plan Procurement Management—The process of documenting project procurement decisions, specifying the approach, and identifying potential sellers.

12.2 Conduct Procurements—The process of obtaining seller responses, selecting a seller, and awarding a contract.

12.3 Control Procurements—The process of managing procurement relationships, monitoring contract performance, and making changes and corrections as appropriate.

12.4 Close Procurements—The process of completing each project procurement.

2.2.5.10. Project Stakeholder Management

Project stakeholder management involves steps taken to identify the people, groups, or organizations that may influence the project positively or negatively and those who might be affected by the project. Once stakeholders are identified, they are then analyzed to determine their level of impact or influence on the project to effectively manage and communicate with them. According to (Project Management Institute, 2013) "Project stakeholders are individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project."

The four Project Stakeholder Management processes are outlined in the PMBOK® Guide in figure 15. However, only the first two processes are required to develop the project management plan, which will in turn be used to manage and control stakeholder engagement during the project execution and monitoring and controlling processes.

Key terms that will be utilized to classify the stakeholders and their level of classification in the Stakeholder Management plan are:

a. Power: stakeholder's level of authority regarding project outcome (Project Management Institute, 2013, p. 396).

b. Interest: stakeholder's level of concern regarding project outcome (Project Management Institute, 2013, p. 396).
c. Influence: stakeholder's level of involvement in the project (Project Management Institute, 2013, p. 396).
d. Impact: stakeholder's ability to effect changes to the project's planning or execution (Project Management Institute, 2013, p. 396).
e. Communication – "connecting with people by sending information" (Articulous Communications, 2015).
f. Engagement – dialoguing with stakeholders to find out what matters most to them and incorporating their needs into the project (Articulous Communications, 2015).
g. One-way communication – information sent in a straight line from the sender to the receiver. In this case, feedback is not given or required.
h. Two-way engagement – communication between senders and receivers that involves listening by both parties. This dialogue occurs as a means of working together to solve a problem in a manner that both parties can benefit from.

Figure 15. *PMBOK® Guide Project Stakeholder Management Overview. Reprinted from A Guide to the Project Management Body of Knowledge (p. 392), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*

13.1 Identify Stakeholders—The process of identifying the people, groups, or organizations that could impact or be impacted by a decision, activity, or outcome of the project; and analyzing and documenting relevant information regarding their interests, involvement, interdependencies, influence, and potential impact on project success.

13.2 Plan Stakeholder Management—The process of developing appropriate management strategies to effectively engage stakeholders throughout the project life cycle, based on the analysis of their needs, interests, and potential impact on project success.

13.3 Manage Stakeholder Engagement—The process of communicating and working with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle.

13.4 Control Stakeholder Engagement—The process of monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders.

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

2.3.1. Sustainability

Sustainability is ensuring that the present needs of the society are met by consuming resources in a responsible way, while all the time endeavoring to avoid precluding future posterity of their ability to meet their own needs. (Mineral Products Association (MPA), 2016).

2.3.2. Sustainable Production

The creation of goods and services using processes and systems that are: Non-polluting. Conserving of energy and natural resources. Economically viable. Safe and healthful for workers, communities, and consumers.

2.3.3. Environment and Climate Change

One of the direct consequences of climate change (including rising temperature and variations in precipitation), and of soil degradation is the pressure they create and exert on food security, causing a reduction in the world food supply and leading to higher prices. Climate change has created challenges for the agricultural sector – and will continue to do so. Climate change induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressures on global agricultural and food systems. To support the objectives of sustainable, climate-friendly, and productive agriculture, reforms are needed at the international, national and sector levels to correct misaligned incentives and redirect policy efforts to specific investments in pursuit of these explicit objectives.

3. METHODOLOGICAL FRAMEWORK

3.1. Information sources

According to the Concise Oxford English Dictionary, information is “facts or knowledge provided or learned” (Information, 2011, p. 729) and a source is “a place, person, or thing from which something originates” (Source, 2011, p. 1380). Therefore, it can be concluded that an information source is a place, person or thing from which facts or knowledge are provided or learned.

There are many places for information to be obtained. One can use library sources, internet sources, organizational sources, government agencies as sources, pictorial sources, sources from bibliographies, a colleague or sometimes even one’s personal account as a source. Information sources can be printed or presented in an electronic format. Basically, it can be taken from almost anywhere that is deemed reputable.

No matter where information originates from, there are only three types of information sources – primary, secondary, and tertiary (Schmidt, 2013). To develop the Final Graduation Project, primary and secondary sources will be used.

3.1.1. Primary sources

A primary source is information taken directly from a person, event, location, or material at the point of the occurrence (Schmidt, 2013, p. 62). Examples of primary source will be the trainers executing the project, the project document and the stated deliverable of the project, the results obtained from the application of the NIT within the production of corn and sugarcane.

- NIT project executed by the IAEA
- Training of Officers in application and tracking od N15 Isotopes

3.1.2. Secondary sources

A secondary source is information that a person provides after receiving the information from a primary source (Schmidt, 2013, p. 62). In this case, the person providing the information did not participate in or is not furnishing first-hand knowledge about the incident. A few examples of secondary source will be the analysis of the results from the soil and leaf tissue sample from the laboratory, the laboratory technician is also a secondary source where

information can be gathered. The of literature reviews, soil analysis results and fertilizer rate recommendations.

- Information received from officers trained by IAEA experts
- Literature review,
- Soil and tissue analysis results

For the development of the Final Graduation Project, secondary sources such as the *PMBOK® Guide*, library databases, and the PMI database will be used. Refer to **Chart 1** for the list of secondary sources used for each specific objective.

Chart 2. *Information sources. (Source: (J. Joseph, May 2021))*

Objectives	**Information sources**	
	Primary	**Secondary**
• To create the Project Charter to define the key input elements to develop the Project Management Plan.	Meeting minutes, personal interview with IAEA (expert)	PMBOK Guide and laboratory department heads and PMI database
• To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	Consultation with the ministry of agriculture and personal interview with IAEA (expert).	PMBOK Guide, and literature review on pass NIT projects. PMI database and the Internet
• To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	Interview with lead project manager and IAEA Trainers (expert)	PMBOK Guide, and the Internet, Laboratory technician
• To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	Personal interview with lead project manager (expert) and meeting minutes	PMBOK Guide, and PMI database
• To develop the Quality Management Plan to identify the requirements and ensure the successful completion of	Personal interview with lead project manager, IAEA	PMBOK Guide, Laboratory technician, literature review.

the project.	(expert)	
• To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.	Personal interview with lead project manager and IAEA Trainer (expert)	PMBOK Guide, laboratory technician.
• To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.	Communicate with lead project manager, ministry of agriculture and IAEA (expert)	PMBOK Guide and PMI database, laboratory technician.
• To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol for doing so.	Business institutions, communication with IAEA (expert)	PMBOK Guide and PMI database
• To develop the Communication Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.	Personal interview with lead project manager AND IAEA (expert)	PMBOK Guide
• To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.	Interviews with lead project manager, IAEA (expert) and the stakeholders	PMBOK Guide and literature review

3.2. Research methods

Fellows & Liu (2008) define methodology as the “principles of the methods by which the research can be carried out”. Methods are operational approaches and techniques that are selected and used to source data, to collect data and to analyze the data collected.

This project has been undertaken to confirm the importance of planning in everyday activities as a tool that will investigate, identify, and analyze alternate paths toward project goal. The most viable path is chosen based on the current best practices (knowledge or theory) with empirical support. This project is done in the context of Project Management with the area of focus being research and therefore uses Experiments as the primary methodology.

3.2.1. Experimental method

In an experiment, an independent variable (the cause) is manipulated, and the dependent variable (the effect) is measured; any extraneous variables are controlled. An advantage is that experiments should be objective. The views and opinions of the researcher should not affect the results of a study. The experimental method is a systematic and scientific approach to research in which the researcher manipulates one or more variables, and controls and measures any change in other variables.

Fellows & Liu (2008) identified two types of research: applied and pure. Academics tend towards the ‘pure’ research. However, practitioners often tend undertake “development work and applications”. Projects are of an applied nature and are generally done with the guidance of practitioners such as Project Managers. Fellows & Liu (2008) noted that in “contexts like experiments, most of the research is a combination of ‘pure’ and ‘applied’ research – of theory and applications.

3.2.2. Analytical method

In research the role of this method is to elaborate on the reason why something is true. Researching why something occurs isn’t easy. The use of critical thinking skills and careful assessment of the information available, is required. Analytical research brings together subtle details to create more provable assumptions. This type of data helps establish the relevance of an idea or confirm a hypothesis. It helps identify a claim and find out whether it is true or

false (Omair, 2015). Thus, analytical research can save lives, save money, and help people and project meet their goals.

3.2.3. Descriptive method

This method describes the characteristics of the population or phenomenon studied. It focuses more on the ‘what’ of the research subject than the ‘why’ of the research subject.

Describing the nature of a demographic segment, without focusing on ‘why’ a certain phenomenon occurs. The term descriptive research refers to research questions, design of the study, and data analysis conducted on the topic. Observational research is what it is generally called because none of the research study variables are influenced in any capacity.

Descriptive methods can be used in multiple ways and for various reasons, before beginning surveys, for example. Survey goals and design are critical and need to be carefully constructed. There are three distinctive methods to conduct descriptive research: by observation, case study, and survey.

Chart 2. *Research methods. (Source: (J. Joseph, May 2021))*

Objectives	Research methods
	Experimental, Analytical and Descriptive
• To create the Project Charter to define the key input elements to develop the Project Management Plan.	• The experimental method will be used to get data in Chart 1 and drive decision making.
• To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	• The experimental and analytical methods will be employed by using information derived from the sources identified in Chart 1 objective 2 above, to drive decision making when creating the documents that will comprise the scope management plan.
• To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	• The experimental and descriptive methods will be employed by using data from the sources identified in Chart 1 objective 3 above, to drive decision making when creating the documents which comprise the time management plan
• To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	• A budget will be developed from data observed from data and documents as well as interviews with experts and stakeholders.
• To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.	• A Quality Management Plan will be developed from data observed from research documents as well as interviews with experts and stakeholders.
• To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.	• A schedule will be developed from data observed from data and documents as well as interviews with experts and stakeholders.
• To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.	• A Risk Management Plan will be developed from data observed from research documents as well as interviews with experts and stakeholders.
• To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.	• A Procurement Management Plan will be developed from data observed from research documents as well as interviews with experts and stakeholders.
• To develop the Communication	• A Communication Management Plan will be

Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.	developed from data observed from research documents as well as interviews with experts and stakeholders.
• To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.	• A Stakeholder Management Plan will be developed from data observed from research documents as well as interviews with experts and stakeholders.

3.3 Tools

Agreeing with the PMBOK® Guide, a tool is defined as "something tangible, such as a template or software program, used in performing an activity to produce a product or result" (Project Management Institute, 2013, p. 565).

Each tool used in the Management Plan is identified, explained, and summarized in Chart 3.

- Project charter template, which guides the development of the project charter.
- Project requirement's traceability matrix template, which ensures that project requirements are necessary and will be met.
- Work Breakdown Structure (WBS) online generator, which breaks down the project into smaller components so it can be more easily managed.
- Requirements Management Plan template, which describes how the requirements will be analyzed, documented, and managed.
- Requirement's documentation template, which captures the requirements documentation.
- Scope Management Plan template - guides the development of the scope management plan and all its subcomponents.
- Project Management Plan template guides the development and organization of the project management plan and all its subcomponents.
- Schedule Management Plan template - guides the development of the project management plan and all its subcomponents.
- Scheduling tool – developed in Microsoft Project 2016 to create the Project Schedule using Schedule network analysis.
- Activity List template – captures the list of activities for the project.

- Cost Management Plan template – develops the cost management plan that will guide the project team during the project's lifecycle.
- Project Budgeting template – created in Microsoft Excel 2016, develops the project budget, and track financial transactions throughout the project's lifecycle.
- Cost Baseline template – outlines the development of the cost baseline.
- Quality Management Plan template – outlines the development of the Quality Management Plan.
- Quality Management tools – examples include cause-and-effect diagrams, flowcharts, check sheets and control charts to be used throughout the project. The use of these tools will be outlined in the Quality Management plan.
- Human Resource Management Plan template – guides the planning of human resource management.
- Responsibility Assignment Matrix – identifies team members and assigns them responsibilities.
- Communications Management Plan template – guides the development of the communications management plan.
- Communication Matrix, which is created in Microsoft Excel 2016, lays out planned communications between project team and stakeholders.
- Risk Management Plan and Risk Register template – developed in Microsoft Excel 2016, identifies, and classifies risks, and plans risk responses.
- Procurement Management Plan template – aids in identification of contracts and purchasing decisions.
- Stakeholder Management Plan template – aids in identification and classification of stakeholders and plans stakeholder management.
- Stakeholder Analysis Chart – aids in analysis and classification of project stakeholders.
- Stakeholder Register template, which aids in identification of project stakeholders.
- Stakeholder Engagement Assessment Matrix – details how each project stakeholder should be engaged with, based on their level of involvement in the project.

Chart 3. *Tools (Source: (J. Joseph, May 2021))*

Objectives	Tools
• To create the Project Charter to define the key input elements to develop the Project Management Plan.	• Expert judgment • Meetings • Data gathering • Interviews
• To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	• Brainstorming • Interviews • Expert judgment • Data gathering
• To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	• Gantt Chart, • PERT Critical Path Method, • Critical Chain Method
• To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	• Cost-benefit analysis, • Cost of quality • Benchmarking • Design of experiments, • Statistical sampling, • Additional quality planning tools,
• To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.	• Expert judgment • Decision-making techniques • Meetings • Benchmarking
• To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.	• Meetings • Interviews • Focus groups • Facilitated workshops • Groupdecision-making techniques • Questionnaires and surveys • Document analysis
• To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.	• Risk Management Planning • Risk Identification • Risk response

	• Monitoring and Control • Expert judgment • Documentation reviews
• To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.	• Make-or-buy analysis • Expert judgment • Market research • Meetings
• To develop the Communication Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.	• Meetings • Communication methods • Information management systems • Performance reporting
• To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.	• Meetings • Market research • Influence and impact • Power urgency and legitimacy

3.4 Assumptions and constraints

PMI defines an assumption as “a factor in the planning process considered to be true, real, or uncertain, without proof or demonstration” (Project Management Institute, 2016, p. 1). It also defines a constraint as “a limiting factor that affects the execution of a project, program, portfolio, or process” (Project Management Institute, 2016, p. 2). The assumptions and constraints considered on the Final Graduation Project for each specific objective are set out in Chart 4.

Chart 3. *Assumptions and constraints. (Source: (J. Joseph, May 2021))*

Objectives	**Assumptions**	**Constraints**
To create the Project Charter to define the key input elements to develop	A fully integrated project plan will be developed.	Some project phases may not be completed due to

Objectives	Assumptions	Constraints
the Project Management Plan.		insufficient funding.
To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	The project scope will be defined.	The scope may change as the project progresses.
To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	A government willing to allocate it portion of the funding	The available expert judgment is not sufficient to provide expert guidance.
To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	The cost of the items for project execution are withing the same price range.	Lack of resources and project information to complete a detailed budget.
To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.	All stakeholder requirements will be collected and analyzed.	Stakeholders' requirements may change as well as their level of interest
To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.	All roles and responsibilities will be identified, and someone will be assigned to own those roles and responsibilities.	Some resources may not be available.
To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.	All risk will be appropriately budgeted for.	Some risk may occur because of other constraints.

Objectives	Assumptions	Constraints
To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.	Not all good and services will be procured locally	Some suppliers may not have the required goods available locally.
To develop the Communication Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.	All line of command and authority will be documented.	Some methods of communication may not be available because of lack of budget
To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.	All stakeholder requirements will be identified along with their level of interest.	Stakeholder requirements and level of interest may change during the project

3.5 Deliverables

A deliverable is defined as “any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project” (Project Management Institute, 2013, p. 537).

Chart 5. *Deliverables. (Source: (J. Joseph, May 2021))*

Objectives	Deliverables

To create the Project Charter to define the key input elements to develop the Project Management Plan.	Project Charter
To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	Scope Management Plan Requirements Management Plan Requirements Document Requirements Traceability Matrix
To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	Time Management Plan, Activity List Time Schedule Network Diagram Resource assignments and activity durations Time in Gantt chart
To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	Cost Management Plan Cost Baseline Project Funding Requirements
To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.	Quality Management Plan
To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.	Human Resource Management Plan
To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.	Risk Management Plan Risk Register
To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.	Procurement Management Plan
To develop the Communication Management Plan to ensure the stakeholders who need to know what	Communication Management Plan Communications Matrix

and when before the project starts are identified.	
To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.	Stakeholder Management Plan Stakeholder Analysis Chart Stakeholder Register

4. RESULTS

4.1. PROJECT CHARTER

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

According to PMBOK® Guide, to develop the Project Charter the following inputs, and tools and techniques were required. See figure 16. (Project Management Institute, 2017, p. 75).
In developing the Project Management Plan for the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems, a Project Charter, specific objective one (1), was the first process in the Project Integration Management knowledge area. This was accomplished using interviews, meeting minutes and the PMBOK® Guide as sources. These were then used as the decision-making drivers together with the application of the analytical research methodology. A template from the PMI database was used as a tool to develop the Project Charter that formally authorized the project and provided the Project Manager with the authority to apply organizational resources to the project to produce the Project Management Plan.

The development of the Project Management Plan is the second process in the Project Integration Management Knowledge area comprised of the subsidiary plans developed during the Final Graduation Project. A template was used to guide the compilation of the plan.

The Project Charter consisted of the project's purpose, objectives, description, high level risks, stakeholder list, high-level requirements, assumptions and constraints, identification of deliverables, a summary milestone schedule, overall project budget, criteria necessary for project approval, the identification of the project manager, and the sponsor's authorization. (Project Management Institute, 2017, p. 79).

Date:	Project Name:
January 1, 2022	The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems.
Knowledge Areas / PM Processes:	**Application Area (Sector / Activity):**
Knowledge areas: Integration, Scope, Time, Cost, Quality, Resource, Communication, Risk, Procurement and Stakeholder. **Process groups:** Initiation, Planning, Execution, Monitoring & controlling, Closing	Agricultural water and soil management
Project Start Date:	**Project Finish date:**
January 1, 2022	December 29, 2023

Project Objectives (General and Specific):

General Objective:

To develop a Project Management Plan for efficient cropping systems through the adoption of novel isotope techniques that helps to improve productivity and reduce the impact of agro-contaminants in the environment.

Specific Objectives:

1. To create the Project Charter to define the key input elements to develop the Project Management Plan.
2. To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.
3. To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.
4. To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.
5. To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.
6. To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.
7. To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.

8. To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.

9. To develop the Communication Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.

10. To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.

Project purpose or justification (merit and expected results):

The aim of this Final Graduation Project (FGP) is to create a Project Management Plan that will eventually guide the project execution to maximize its success chances. Given that the Institute has had successful project experiences in the past with hiring of outside personnel to manage the project, the creation and use of the project management plan will develop in house personnel to better define project objectives, success criteria, resources allocation, and in general plan everything that is needed for the project success. In addition, this Project Management Plan will become the Institute's organizational asset for use as the basis for future project plans.

The project for the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems is critical for the country's agricultural development and the reduction of agricultural contaminants into the soil and waterways. This Project management plan must be professionally managed to fulfil the social, economic, environmental, and cultural needs of the country's agricultural stakeholders. A precise and well-developed Project Management Plan for the Final Graduation Project can eventually be used for the actual project and its execution.

Description of Product or Service to be generated by the Project – Project final deliverables:

The Final Graduation Project (FGP) will provide a comprehensive project management plan with all its subsidiary management plans. The Project Management Plan will address all good practices recommended in appropriate bibliographical sources such as the Project Management Body of Knowledge (PMBOK 6th Edition). Specific Deliverable Associated with each specific objective include: 1. Project Charter, 2. Scope Management Plan, 3. Time Management Plan, 4. Cost Management Plan, 5. Quality Management Plan, 6. Resource Management Plan, 7. Risk Management Plan, 8. Procurement Management, 9. Communication Management Plan, 10. Stakeholder Management Plan. The complete development of these deliverables will ensure that the FGP criteria are met in the creation of a project charter. However, implementing this Management Plan into the project will drastically reduce crisis management and move the project into forward thinking and proactive decision-making. Refining and iterating them into the project will enhance the ability of managing the project and the people involved in them.

Assumptions:

1. It is assumed that all the required information to complete this FGP will be available when requested.

2. It is assumed that the Institute will provide all the project specific information on a timely manner and without any significant restriction to create the Project Management Plan.

3. It is assumed that the project is still deemed as urgent (Priority) by the newly elected political party and there will be no delay in the project's execution.

4. It is assumed that the project meets the qualifications and requirements set for being a part of the FGP.

5. It is assumed that by 2022 travel band due to the global pandemic will be lessen and the project will start on the stated date for initiation.

Constraints:

1. Time: the pre-established timeframe stated by UCI for each one of the FGP development phases.

2. Quality: The material (project document) being used to create the FGP is incomplete and awaiting the final and complete project document.

3. Scope: the project is wide reaching and entails information both technical and scientific that may not become evident.

4. Project execution date is planned for January 2022, and the final project document has not been shared to all stakeholders.

5. The pandemic is restricting international travel and the experts for the training are in countries that are banned from entering international travel hubs.

Preliminary Risks:

1. If all the information needed to complete the FGP is not made available, it might cause the FGP not to be completed, influencing the final grade for the course.

2. If the institute does not provide the information in a timely manner, it might lead to not being able to develop an insightful Project Management Plan affecting the quality of work produce.

3. If the newly elected government does not see the benefit of implementing this project and remove its agricultural department from the project.

4. Project start date can be delayed to a later date due to the pandemic.

Budget:

The four-month timeframe in the development of the Project Management Pan for the FGP in relation to the project has a value of $5000.00 (five thousand US dollars).

Cost for developing each management plan $400.00 totaling to $4000.00.

Cost for writing and developing the project management Plan $1000.00 (literature review, communication, transportation, data collection and analysis).

Milestones and dates:

Milestone	**Start date**	**End date**
Final Graduation Project Start	May 10th, 2021	September 30th, 2021

Graduation Seminar	May 10th, 2021	June 6th, 2021
FGP Deliverables	May 10th, 2021	June 6th, 2021
Annexes	May 17th, 2021	June 6th, 2021
Tutoring Process	June 7th, 2021	August 8th, 2021
Reading by reviewers	August 9th, 2021	August 22nd, 2021
Reviewer's work	August 23rd, 2021	September 5th, 2021
Adjustments	September 6th, 2021	September 25th, 2021
Presentation to Board of Exams	September 26th, 2021	September 30th, 2021

Relevant historical information:

The Sugar Industry Research and Development Institute (SIRDI) is an organization established by the Sugar Industry ACT of 2001. A "Board of Directors'' composed of members appointed by the Minister administers the Institute. The mandate of the SIRDI is well defined in the objectives of the institute under the Sugar Act (2001) and includes the following: research, develop and adopt technological innovations and production options for the benefit of the industry. Establish norms and standards and provide technical services to the Sugarcane Production Committee (SCPC) for determining sugarcane quality. SIRDI and the SCPC both fall under the umbrella of the Sugar Industry Control Board (SICB).

Improving Productivity: Participatory methods as tools – Farmer Field Schools is one of the many projects SIRDI have work on with huge success. The Sugar Industry Research Institute of Belize (SIRDI) has developed the Farmer Field School (FFS) program (the "Program") on the principles of learning through practical example and application. The flow of information in FFS is shared via theory (presentation or flip charts) and is reworked in practical exercises where there is fluid interchange of experience between farmers-farmers, farmers-Field Officers and Field Officers-farmers. These exchanges are the strength behind the FFS modules. With the use of the FFS as a method, SIRDI has evolved from a linear technology transfer model to a participatory implementation of sustainable sugarcane management, based on ecology and participation. The process must be participatory because each farmer not only has valuable knowledge to contribute, but also has critical knowledge gaps to fill. The group prioritizes thematic areas where they recognize weaknesses and use the exchanges as the avenue to solution identification. They test their new ideas in demonstration plots where they could learn new techniques and skills as a group.

Stakeholders:

Direct stakeholders:

International Atomic Energy Agency,

Ministry of Agriculture, Food Security & Enterprise,

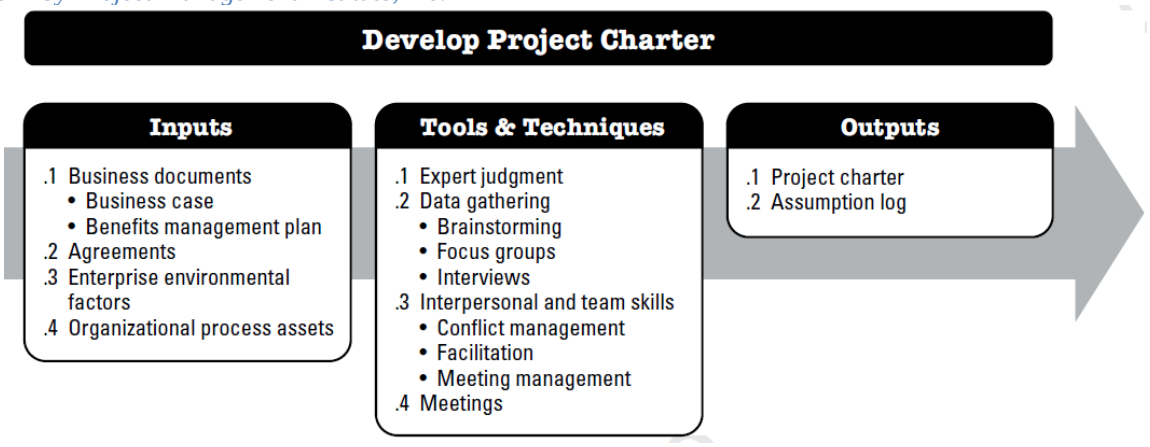
Sugar Industry Research and Development Institute,

Caribbean Agricultural Research and Development Institute.

Indirect stakeholders:
University of Belize,

Sugarcane Associations of Belize, Belize Grain Producers Association	
Approval:	
Project Manager: Jeffery Joseph	Signature:
Authorized by:	Signature:

Figure 16. *Develop Project Charter: Inputs, Tools & Techniques, and Outputs. Reprinted from A Guide to theProject Management Body of Knowledge (p. 75), Project Management Institute, 2017, Project Management Institute. Copyright 2017 by Project Management Institute, Inc.*



Since SIRDI did not create the project concept and is only one of the executing agencies, the project's statement of work, business case, agreements, enterprise environmental factors and organizational process assets were the recognized inputs for the development of the Project Charter, none of these documents would be made available for use by any of the representatives from the Institute. Essentially, there were no organizational process assets (OPA) and due to the lack of a formal project management team or project management office (PMO) the enterprise environmental factors (EEF) were limited to understanding that the project was of the upmost importance to the Institute and the Agricultural sector and that SIRDI, the Project Officer, would be the only person responsible for the development of the Project Management Plan.

Project Purpose/Justification

Business Need/Case

The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems arises from soil and water management

and crop nutrition. Isotope and nuclear techniques are employed to measure and monitor the interactions between soil, water, and nutrients to ensure that these are used efficiently in various cropping systems. Such techniques underpin the development of best soil–water–nutrient management practices.

Business Objectives

Currently, SIRDI does not have a well-defined organizational strategic plan. Nevertheless, for the execution of the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer a project management unit to manage project will be developed to guide the execution of the project:

a. To train agriculture technical officers on the use of and application of stable isotopes.

b. To strengthen technical officers' capacity in water management particularly in promoting the use of water efficient methods.

c. To improve the physical infrastructure to attain in-country testing capacity for plant tissue and soil analysis and interpretation.

d. To create an environmental unit that can recommend fertilizer usage within the agriculture sector of Belize.

e. To ensure that the project is self-sustainable and has growth potential for application throughout the entire agricultural sector of Belize.

Project Description

Stakeholders

International Atomic Energy Agency

- Trainers
- Consultants

Belize Ministry of Agriculture, Food Security & Enterprise

- Director of water management and Climate Change
- Coordinator Research and Innovation Program
- Extension Officers

Sugar Industry Research and Development Institute

- Research Coordinator
- Project Management Officer
- Research Field Officers
- Laboratory Technician

Caribbean Agricultural Research and Development Institute

- Director
- Research Officer

Measurable Project Objectives and Success Criteria

Requirements

- The training of technical officers in identifying the movement of nuclear isotopes within plant tissues and the soil. This should lead to the correct fertilizer application dosage based on soil type and the overall availability of requirements for nutrients in corn and sugarcane production.

Constraints

- The project is financed for two years by the funding agency (IAEA) by which time all the deliverables are expected to have been completed. Therefore, time for executing the project is very critical and the government of Belize will need to provide its financial contribution on schedule to ensure timely project initiation.

Assumptions

- The project outcome remains a national priority and has support at the most senior field officer level and stakeholders remain interested in the project.

- Farmers adopt the-new technological practices and keep cultivating sugarcane and corn. Trained technical staff remain in their respective roles and promote the technological practices and recommendations. The Ministry of Agriculture, Food Security and Enterprise and SIRDI supervisors release staff for training.

- Technical staff trained remain at post and continue working to build capacity using nuclear technologies Field demonstration plots are not destroyed by natural phenomenon.

- All stakeholders give priority to the project and are willing to participate.

- Sufficient resources are provided for the high number of participants.
- Lab materials and equipment are procured on time for conducting analysis and training.
- Full time competent personnel are trained and specifically assigned to complete the laboratory aspects of the project.
- Farmers have the capacity to understand the scope of the project and have the willingness to participate
- Collection sites are permanent; geospatial coordinates are recorded and minimal interference occurs from natural hazards
- Technicians are properly trained and data is properly collected and stored within one database.

Preliminary Scope

- The project includes the training of technical officers in the use of nuclear isotopes to evaluate the use of nitrogen fertilizers in sugarcane and corn crop cultivation.
- The procurement of laboratory supplies and equipment for the testing /analyzing soil nutrients

Risks

Financial

- Increases in material prices over time
- Government of Belize doesn't have funds to invest in project
- Stakeholders cannot meet their in-kind contributions

Stakeholders

- The availability of the suitable field officers to train.
- The willingness of the farmers to apply the new technology.

Scheduling delays

- Travelling delays by trainers due to the pandemic
- Shipping / procurement delays.

Project Deliverables

- At least 500 sugar cane and corn farmers will reduce N fertilizer use. Water quality, tested within the surrounding areas, will improve.
- Sugar cane and corn farmers adopt NIT technology.
- Equipped and functional leaf tissue, soil and water testing / analysis laboratory.
- Establishment demonstration trials in Northern and Western Belize. Field technicians from SIRDI and The Ministry of Agriculture, Food Security and Enterprise trained in water management and NIT technology.

Chart 6. *Summary Milestone Schedule. (Source: (J. Joseph, May 2021))*

Project kick-off meeting will be held with the MoAFSE and other stakeholders who will be an integral part of this project	January, 2022
Procurement of basic equipment for soil-water-plant analysis (pH meter, conductivity meter, Kjedhal digestion and distillation apparatus, spectrophotometer, weighing balances, refrigerators, drying ovens etc).	January, 2022
Procurement of field equipment (soil water monitoring equipment, field weighing balances, drones etc.	January, 2022
Procurement of N-15 stable isotope fertilisers for field demonstration in sugarcane and corn to trace the fate of N in soil and water system	January, 2022
Procurement of inoculants for field demonstration on sugarcane N fixation	January, 2022
Procurement of inoculants for field demonstration on sugarcane N fixation	January, 2022
Experts will be brought in country to administer training in use of N15 isotope, fertilizer use efficiency and water use efficiency.	January, 2022
Expert/Technical officer to train counterparts on field experimental layout and demonstration on the use of N-15 fertilisers	February, 2022
3 experts to conduct training on N-15 methodology to evaluate crops for nitrogen fixation and crop fertiliser use efficiency	April, 2022
Fellowship for 2 months on Nitrogen 15 stable isotope methodology to evaluate crops for nitrogen fixation and fertiliser use efficiency	April, 2022
Fellowship for 2 months on crop water use efficiency	May, 2022
Expert to conduct training on sampling techniques to assess water quality and environmental impacts	June, 2022
Expert to train counterparts on sampling techniques to identify agro contaminants	August, 2022
Expert to document and package guidelines for improving productivity and water, and nutrient use efficiency of sugarcane and corn	October, 2022
Two SVs to visit advance laboratories to learn soil and nutrient analyses	January,2023

Expert to conduct training on AQUACROP	April, 2023
Two SVs to attend International Conference on soil-water management for climate-smart agriculture	June,2023
Expert to assist in Farmer Field Day	June, 2023
Expert to assist to document and package guidelines for improving productivity of sugarcane and corn	July, 2023
End of Project	December, 2023

Chart 7. *Project Budget*. (*Source. Project document, (February 2020))*

Description	Project Costs
Human Resource Components	
Experts	€ 53,250.00
Fellowships	€ 22,680.00
Scientific Visits	€ 6,300.00
Procurement Components	
Equipment	€ 183,000.00
Monitory & Evaluation Components	
Project evaluation	€ 18,300.00
Contingency Components	
Risk Management cost	€ 18,000.00
GRAND TOTAL	**€ 301,530.00**

Project Approval

For the project to be approved, the financial contribution from the government of Belize should be summited before November 2021.

Project Manager

The Project Manager will be a representative from the Ministry of Agriculture, Food Security and Enterprise. The Assistant Project Manager, Mr. Jeffery Joseph will be responsible for the sugarcane portion of the overall project.

Authorization

Approved by: Ministry of Agriculture, Food Security and Enterprise.

Date: November 2021.

4.2. PROJECT SCOPE MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAINFED AGRICULTURE SYSTEMS

MINISTRY OF AGRICULTURE
BELMOPAN, BELIZE

10 September 2021

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4.2.1. Introduction

The Scope Management Plan provides the scope framework for this project. This plan documents the scope management approach; roles and responsibilities as they pertain to project scope; scope definition; verification and control measures; scope change control; and the project's work breakdown structure. Any project communication which pertains to the project's scope should adhere to the Scope Management Plan.

This project's objective is to evaluate the use of Nitrogen Isotope Technology in determining the necessary dosages of inorganic (synthetic) fertilizers required for the efficient production of sugarcane and maize while reducing the level of agricultural nitrogen pollution contaminating soils, waterways, and the ocean. The building of local technical capacity in understanding the movement of soil applied amendments (fertilizer) within the soil and the overall ecosystem is paramount to the preservation of Belize's natural resources. Developing the tools and

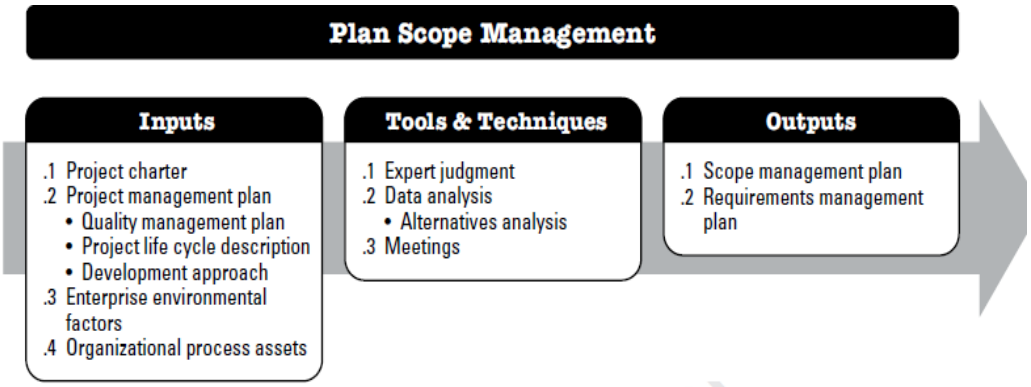
infrastructure to garner such a level of understanding in the application rates of synthetic soil amendments will ensure the preservation or recovery of ecosystems that have been affected by the past indiscriminate use of such products in agricultural production.

4.2.2. Tools and technique for scope management

Plan scope management process tools and techniques transforms inputs into outputs. Plan Scope Management is the process, where you determine how to perform the rest of the processes in the scope management knowledge area. All the knowledge areas in PMBOK follows the same structure. First the planning on how stakeholders desire it to perform the rest of the processes in that knowledge area. The primary inputs of plan's scope management process are the outputs from the project's charter.

The plan scope management process tools and techniques convert the inputs to outputs. Plan scope management process tools and techniques are expert judgement, data analysis and meetings. Expert Judgement involves receiving help from experts who dealt with the similar process of creating the scope management plans in other projects. Meetings with stakeholders may help to reach an agreement on your approach and how to manage the rest of the scope management processes.

Figure 17. *PMBOK® Guide Plan Scope Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.2.3. Scope Management Approach

For this project, scope management will be under the responsibility of two entities, the Ministry of Agriculture and the IAEA, Project Manager. The scope for this project is defined by the Scope Statement, Work Breakdown Structure (WBS) and WBS Dictionary. The Project Manager, Sponsor and Stakeholders will establish and approve documentation for measuring project scope which includes deliverable quality checklists and work performance measurements. Proposed scope changes may be initiated by the Project Manager, Stakeholders, or any member of the project team. All change requests will be submitted as change orders to the Project Manager who will then evaluate the requested scope change. Upon acceptance of the scope change request, the Project Manager will submit the scope change request to the stakeholders and sponsor who, in this instance, is also the executing agency. The Project Manager is responsible for the approval of scope changes that are strictly technical in nature. Whereas the Project Sponsor is responsible for the approval of scope changes that affect time and costs parameters. Upon approval of scope changes, the Project Manager will update all project documents and communicate the scope change to all stakeholders through a change directive. Based on feedback and input from the Project Manager and Stakeholders, the Project Sponsor is responsible for the acceptance of the final project deliverables and project scope.

4.2.4. Roles and Responsibilities

The Project Manager, Sponsor (IAEA), Field Officers and Laboratory Technician will all play key roles in managing the scope of this project. As such, the project sponsor, manager, and team members must be aware of their responsibilities to ensure that training performed on the project is within the established scope throughout the duration of the project. The table below defines the roles and responsibilities for the scope management of this project.

Chart 8. *Scope management roles and responsibilities. (Source: (J. Joseph, May 2021))*

Name	Role	Responsibilities
IAEA	Project Sponsor	a. Approve or deny scope change requests as appropriate
		b. Evaluate need for scope change requests
		c. Accept project deliverables
Jeffery Joseph	Project Manager	a. Measure and verify project scope
		b. Facilitate scope change requests
		c. Facilitate impact assessments of scope change requests
		d. Organize and facilitate scheduled change control meetings
		e. Communicate outcomes of scope change requests
		f. Update project documents upon approval of all scope changes
Assistant Project and Project Team	Coordinators of Institutions	a. Participate in defining change resolutions
		b. Evaluate the need for scope changes and communicate them to the project manager as necessary
Stakeholders	Field Officers, Laboratory technicians	a. Can propose scope changes
		b. Will execute change directives issued by Project Manager

4.2.5. Scope Definition

The scope for this project was defined through a comprehensive requirements collection process. First, a thorough analysis of all the agriculture sectors and their needs to become more eco-friendly was conducted after reviewing documentations, relative to industry standards, the scope was defined. From this information, the project manager developed the requirements management plan, requirements for documentation and the requirements for traceability matrix, according to project specifications.

The project deliverables were based on the requirements, collection process, and inputs, from experts on Belize's agricultural sector, and IAEA experts. This process of expert judgement provided feedback on the most effective, safe, and cost-efficient ways to meet the original requirements of NIT application and the training requirements to increase the national capacity in environmentally safe agriculture production methods.

4.2.6. Project Scope Statement

The project scope statement provides a detailed description of the project, deliverables, constraints, exclusions, assumptions, and acceptance criteria. Additionally, the scope statement includes what work should not be performed to eliminate any implied but unnecessary work which falls outside the project's scope.

4.2.7. Scope Description, Product Acceptance Criteria and Project Deliverables

The project includes technology transfer, the upgrading of the SIRDI laboratory and use NIT in observing the movement of fertilizer (N-15 Isotopes) within plants (sugarcane and corn crops), soil, and water. The practice of using inorganic fertilizer in the mono-cropping systems have led to the improper use of such chemicals. Excess application of these fertilizers has caused environmental issues with water contamination and reef coral bleaching. This project will enable the correct field application of fertilizers, based on soil and tissue analysis, and knowing the capacity of the soil to hold the nutrient being added. The project will procure modern equipment for soil and tissue analysis: conduct N-15 isotope (fertilizer) application and tracing; build laboratory technician capacity, to analyse tissue and soil samples; and establish technician capacity to make accurate recommendations on fertilizing regimes required for efficient corn and sugarcane production in Belize.

4.2.8. Project Constraints

The Fund donor has requested that the project should not exceed the allotted budget. In addition, the project duration should not exceed twenty-four (24) months to completion. Obtaining all the necessary information, during the requested two-year project implementation is not possible. Therefore, the collection of data will be ongoing for several years after the donor agency funding has ended. The government of Belize will, therefore, be to fund the project's continuation. The present state of the world under the covid pandemic might become an additional constraint in the movement and gathering of large group for on hand training/capacity building. The length of the project affects participants ability to be present during the entire execution phase of the project.

4.2.9. Project Assumptions

- Weather:

- It is assumed that rainfall conditions will be normal, during project execution, to ensure sufficient soil moisture.

- It is assumed that there will be hurricanes and flood conditions; therefore, to mitigate such impacts research sites have been selected that are less prone to flooding.

- It is assumed that temperatures will be high; therefore, this will determine the type of fertilizer application method used to prevent volatilization.

- Finances

- It is assumed that the project is funded sufficiently

- Field Officer

- It is assumed that sufficient skilled field officers competent in understanding the importance of this training, are assigned to the project.

- Schedule

- It is assumed that the project will be substantially completed in twenty-four (24) months, with an additional three years (3) allocated for the remaining work needed.

- Budget

- It is assumed that the project can be accomplished using the allocated funds.

- Planning

- It is assumed that the MoAFSE will approve all the project components as indicated on the project document and schedule

4.2.10. Work Breakdown Structure

The project is broken down into five phases: the initiation phase, the planning phase, execution phase, control phase, and the project closure phase. Each of these phases is then subdivided further down to work packages each requiring no more than 40 hours of work and no less than 4 hours of work.

Figure18. *WBS for the N15 Isotope project. (Source: (J. Joseph, May 2021))*

To define the necessary work, more clearly, for project completion, the WBS Dictionary is used. The WBS Dictionary includes an entry for each WBS element. The WBS Dictionary includes a

detailed description of work for each element and the deliverables, budget, and resource needs for that element. The project team will use the WBS Dictionary as a statement of work for each WBS element.

Chart 9. *WBS Dictionary for the N15 Isotope project. (Source: J. Joseph, (May 2021))*

Level	WBS Code	Element Name	Description of Work	Deliverables	Budget	Resources
1	1.1	**Initiation Phase**	**commencement of conceptualization**		**$68,250.00**	
2	1.1.1	Collect Country's requirements	Meetings held to compile available data	Initial requirement documentation	$25,000.00	
2	1.1.2	Briefing with the Ministry of Agriculture	Meeting with the government officials	Initial requirement documentation	$5,000.00	
2	1.1.3	Research Materials and Methods	Developing of research protocols	IAEA experiences	$30,000.00	
2	1.1.4	Determine Initial Budget and perform Cost analysis	Calculating the present rate of inflation to accommodate for the procurement process	Cost evaluation	$8,250.00	
1	1.2	**Pre-Execution Phase**	**Collaborative Effort of Consultations**		**$6,300**	
2	1.2.1	Experimental Design	Meeting with MoAFSE and SIRDI	IAEA experiences	$2,500.00	
2	1.2.2	Selection of Personnel for training	Selection of experience and dedicated personnel	Dedicated participants	$500.00	
2	1.2.3	Site selection Corozal and Orange Walk District	Meeting with Sugarcane Producers and Stakeholders	Representation of predominant soils within the industry	$1,300.00	
2	1.2.4	Site preparation for training	Executing all the necessary procedures for project initiation	Accessible for participants from both districts	$2,000.00	
1	1.3	**Execution Phase**	**Phase where project execution occurs**		**$186,000.00**	

2	1.3.1	Procurement of material and equipment	Cost evaluation from prospected vendors	high quality effective and efficient equipment	$150,000.00	
2	1.3.2	Introduction to NIT	Theoretical introduction to NIT	Office/ indoor learning	$4,000.00	
2	1.3.3	Capacity building /training of officers	Field execution of project testing	field work hands on experience	$20,000.00	
2	1.3.4	Recording and reporting on project	Data collection and report writing	Weekly and bimonthly reports	$12,000.00	
1	1.4	**Monitoring Phase**	**The management of the planning, execution, monitoring & controlling**		**$22,680**	
2	1.4.1	Monitoring and evaluation of Project	Data collection and report writing	Weekly and bimonthly reports	$8,000.00	
2	1.4.2	Quality assurance exercise	Data collection from participants interviewed	Weekly and bimonthly reports	$8,000.00	
2	1.4.3	Evaluation of participants	Interview of participants	Weekly and bimonthly reports	$4,000.00	
2	1.4.4	Evaluation of training process	Interview of participant and trainers	Bimonthly reports	$2,680.00	
1	1.5	**Close Phase**	**Phase that signifies completion of project**		**$18,300.00**	
2	1.5.1	Project evaluation	Report writing	Weekly and bimonthly reports	$5,000.00	
2	1.5.2	Evaluation of participants	interview and report writing	Bimonthly reports	$5,000.00	
2	1.5.3	Evaluation of procurement procedure	cost analysis	Quarterly reports	$3,300.00	
2	1.5.4	Final report	data collection and interview	End of project	$5,000.00	

4.2.11. Scope Verification

As this project progresses, the Project Manager will verify interim project deliverables against the original scope as defined in the scope statement, WBS and WBS Dictionary. Once the Project Manager verifies that the scope meets the requirements defined in the project plan, the Project Manager and Sponsor will meet for formal acceptance of the deliverable. During this meeting, the Project Manager will present the deliverable to the Project Sponsor for formal acceptance. The Project Sponsor will accept the deliverable by signing a project deliverable acceptance document. This will ensure that project work remains within the scope of the project on a consistent basis throughout the life of the project.

4.2.12 Scope Control

The Project Manager and the project team will work together to control the scope of the project. The project team will leverage the WBS Dictionary by using it as a statement of work for each WBS element. The project team will ensure that they perform only the work described in the WBS dictionary and generate the defined deliverables for each WBS element. The Project Manager will oversee the project team and the progression of the project to ensure that the scope control process is followed.

If a change to the project scope is needed, the process for recommending changes to the scope of the project must be carried out. Any project team member or sponsor can request changes to the project scope. All change requests must be submitted to the Project Manager in the form of a project change order. The Project Manager will then review the suggested change to the scope of the project. The Project Manager will then either deny the change request if it does not apply to the intent of the project or convene a change control meeting between the project team and Sponsor to review the change request further and perform an impact assessment of the change. If the change request receives approval by the Project Manager and Sponsor, the Project Manager will then formally submit the change request to the Project Sponsor who will then formally accept the change by signing the change order. Upon acceptance of the scope change by the Project Manager and Project Sponsor, the Project Manager will update all project documents and communicate the scope directive to all project team members and stakeholders.

4.2.13 Scope validation

As this project progresses, the Project Manager will verify interim project deliverables against the original scope as defined in the scope statement, WBS and WBS Dictionary. Scope Validation is used to officially recognize the finished results of the project. Its primary benefit is that by validating the deliverables, it gives the acceptance process objectivity and enhances the completed item, service, or outcome. used to officially recognize the finished results of the project. The process to validate the scope helps identify changes or issues during project so they can be addressed in a timely fashion.

4.3. PROJECT SCHEDULE MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAINFED AGRICULTURE SYSTEMS

The project time management planning processes were conducted after Project Scope and Cost Management. The first process in project time management involved developing the Schedule Management Plan that would be used to guide the lifecycle of the project's schedule. The Project Charter and the Scope Management Plan were used as inputs to this process to gather information regarding the Scope Baseline and the summary milestone schedule. The tools and techniques used were expert judgement, analytical techniques, and meetings to create the Schedule Management Plan. Since there were no OPA's, a Schedule Management Plan template was derived from another source and modified for this purpose (Project Management Institute, 2013, p. 143).

SCHEDULE MANAGEMENT PLAN
THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

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4.3.1. Introduction

The project schedule is the guide for how the project will be completed and finished. The schedule is a critical because it provides the project team and stakeholders with a visual picture of the project's standing at any given time. The schedule management plan is used to define the technique the project team will use in creating the project schedule. This plan also comprises how the team will review the project schedule and manages changes after the standard schedule has been approved. This includes identifying, analyzing, documenting, prioritizing, approving, or rejecting, and publishing all schedule- related changes.

4.3.2 Schedule Management Approach

Project schedules will be made using Microsoft Project 2019. Activity definition will identify the specific work packages which must be performed to complete each deliverable. Activity sequencing will be used to determine the order of work packages and assign relationships between project activities. Activity duration estimating will be used to calculate the number of work periods required to complete work packages. Resource estimating will be used to assign resources to work packages to complete schedule development.

Once an initial schedule has been developed, the project manager and assistant project manager will assess it cautiously to review assigned project tasks. The project team and resources must agree to the proposed work package assignments, durations, and schedule. Once this is achieved the project sponsor will review and approve the schedule and it will then be baselined.

4.3.2 Roles and responsibilities for schedule development are as follows

The project manager will be responsible for facilitating the breakdown of work packages into activities that provide a basis for sequencing and estimating duration and resources with the project team. The project manager will also create the project schedule using MS Project 2019 and validate the schedule with the project team, and stakeholders. The project manager will obtain schedule approval from the stakeholders and baseline the schedule.

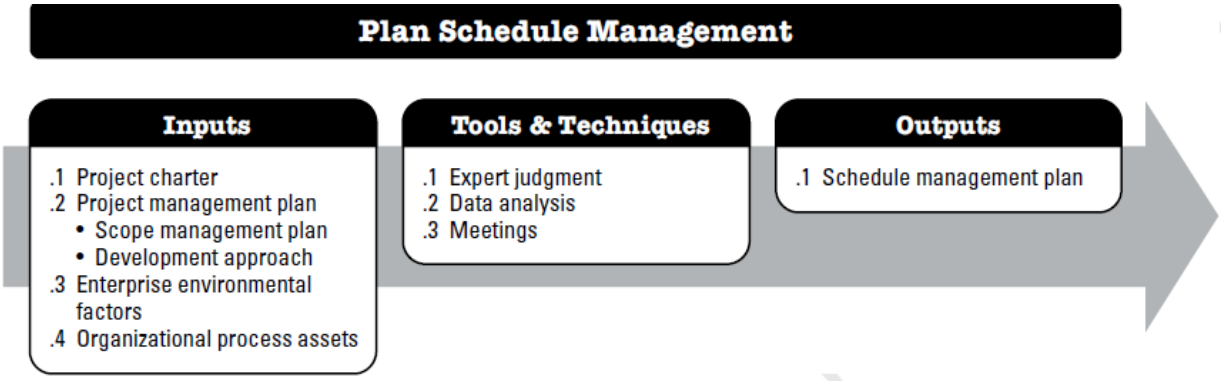
The project team is responsible for participating in training, and duration and resource estimating. The project team will also review and validate the proposed schedule and perform assigned activities once the schedule is approved.

The project stakeholders will participate in reviews of the proposed schedule, assist in its validation, and approve the final schedule before it is baselined.

4.3.3 Tools and technique for project schedule plan

According to PMBOK, the Plan Schedule Management process has as its aim to create the Schedule Management Plan, the portion of the overall project management plan that covers processes that have to do with creating, managing, and then controlling the schedule for the project. Essentially, then, the Schedule Management plan developed in this Process 6.1 Plan Schedule Management gives guidelines on how to do all the other schedule management processes, all the way from 6.2 Define Activities through 6.6 Control Schedule. These basically cover who will need to be consulted to create the plan (Expert Judgment), how the data from the inputs will be analyzed to create the plan (Data Analysis), and then where the schedule management plan will be developed (Meetings).

Figure19. *PMBOK® Guide Plan Schedule Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.3.4 Schedule control

The project schedule will be reviewed and updated as necessary when new or old information is added or deleted. It will include the actual start, finish, and percentages of the completion.

The project manager is responsible for holding schedule updates or review meetings and determining of schedule modifications. Submitting schedule change requests and reporting schedule status in accordance with the project's communications plan will be left to the project manager.

The project team is responsible for participating in schedule updates or review meeting sessions. The team must communicate any changes of the actual start/finish dates to the project manager. Finally, the team will participate in schedule variance resolution activities as needed.

The use of *Earned Value Analysis (or EVA)* in verifying whether the project is within budget and schedule will be executed at every stage of the project. Earned Value Analysis works in such a way that you enter a couple of project metrics into formulae, and it spills out a couple of key figures (or metrics) that indicates different interesting aspects about the project's status.

EVA (or EVM) gives two important key figures:

- The expected cost difference at the end of the project: How much more or less the project is going to cost at the end (also called V*ariance at Completion* or *VAC*)

- The estimated schedule variance: how far ahead or behind the project is on the timeline

As the project manager, *Earned Value Analysis* has the following advantages:

- Earned Value Analysis gives you a realistic picture of the project status
- Earned Value Analysis helps you predict any budget gaps and schedule issues

To understand EVA, there is the need to understand the concept of planned versus actual numbers with respect to cost and schedule. At all times start with a planned budget, which is presented in the approved project documents. The planned budget isn't just estimated as one

large figure, but it's calculated by estimating the effort and cost for every deliverable and activity in the project, and then summing up the values.

You also have a planned schedule: That's your agreed project schedule. It states the sequence of activities and contains deadlines for every task and deliverable.

The actual cost is the sum of funds incurred at every stage of the project. Which is determined by two factors: First, how much have been paid for an activity / deliverable. Second, the actual cost is dependent on the schedule and progress. Changing the sequence of tasks, will influence on the actual cost.

The actual schedule — in practice — may vary from the planned schedule. Some tasks may get delayed. Or the project manager might deliberately postpone an activity, swap, or skip activities or might start working on some tasks before its originally scheduled start date. All this will be considered in the EVA.

The project stakeholder(s) will maintain awareness of the project schedule status and review/approve any schedule change requests submitted by the project manager.

4.3.5 Schedule changes and thresholds

If any member of the project team determines that a modification to the schedule is essential, the project manager and team will meet to assess and evaluate the change. The project manager and project team must conclude which tasks will be impacted, identify any variance resulting from the potential change, and identify any alternatives or variance resolution activities they may employ to see how they would affect the scope, schedule, and resources. If, after this evaluation is complete, the project manager determines that any change will surpass the established schedule constraints, then a schedule change request must be submitted.

Submittal of a schedule change request to the project stakeholder(s) for approval is required if either of the two following conditions is true:

- The proposed change is estimated to reduce the duration of an individual work package by 2% or more or increase the duration of an individual work package by 10% or more.

- The change is estimated to reduce the duration of the overall baseline schedule by 10% or more or increase the duration of the overall baseline schedule by 2% or more.

Any change requests that would result in changes that are within or less than the percentages indicated in the above thresholds must be submitted to the project manager for approval.

Once the change request has been reviewed and approved the project manager is responsible for adjusting the schedule and communicating all changes and impacts to the project team and stakeholders. The project manager must also ensure that all change requests are stored for safety.

4.3.6 Schedule change

Scope change is inevitable. Scope change is natural. It is important to understand that our mission is not to stop scope change, but to successfully manage that change. The question: What do all projects have in common? Can be answered with the aid of A Guide to the Project Management Body of Knowledge (PMBOK® Guide) ---Third edition to find the textbook definition of a project (Project Management Institute [PMI], 2004), but most will agree that all projects share some basic characteristics. First, there is a definable objective. More formally, projects are a temporary endeavor undertaken to provide some unique product or service (PMI, 2004). Second, projects have boundaries and constraints as related to costs, schedules, and resources. There is an additional commonality that is not a part of the formal definition of a project, but heavily influences project-related decision making. This unspoken common factor is based on Albrecht's Theory of Service Relativity. The Theory of Service Relativity states that your customer's perception of value is equal to the delivered reality, less expectations (Albrecht, 1998). Like it or not, our stakeholders will develop a value perception of the project deliverable(s), the project management processes, and the project manager. The ability to manage scope, and their expectations as related to scope, will directly influence this perception. Poorly managed change control has a negative influence on our customer's expectations and their opinions about our effectiveness as project managers. Of course, this is just scratching the surface of the cascading impacts of a lack of change control.

SPONSOR ACCEPTANCE

Approved by: _____ Date: _____ Representative of IAEA

The next process in planning project schedule management, following the development of the Schedule Management Plan, was Activity Definition. The Schedule and Scope Management Plans containing the Scope Baseline comprised of the WBS, project deliverables, constraints and assumptions were inputs used specifically for activity definition. Of the techniques identified in the PMBOK® Guide, decomposition and expert judgement were the ones used during this process. The tool used to capture the information for this, and the remaining processes required to develop the schedule was Microsoft Office Project 2019, identified as a scheduling software in the PMBOK® Guide. The Activity List is an output developed from this process and was compiled from the information in the schedule.

According to PMI, an activity list is a comprehensive list with an activity identifier and scope of work description of the schedule activities required to complete each work package (PMI, 2013, p. 152). Also, while defining activities, milestones were added and modified. Subsequently, after defining the activities, the milestone list found in the Project Charter and Schedule Management Plan were updated.

An Activity Attributes list was not developed as an output to this process, as indicated in the PMBOK® Guide, because the information detailed in the Activity Attributes, such as the activity ID, activity description, WBS number, activity responsibility, predecessor scheduling and dependency, activity predecessors and dependencies, and successor scheduling and dependencies were already captured in other plans or matrices included in the FGP (Project Management Institute, 2013, p. 149).

Chart 10. *Activity list of the N15 Isotope Project. (Source: J. Joseph, (November 2021))*

Activity ID Number	Activity Name	Description of Work	Responsibility
1.1	Initiation Phase	Request for proposal	IAEA, MoAFSE
1.1.1	Collect Country's requirements	Meetings held to compile available data	MoAFSE, SIRDI, Project Manager, IAEA Experts

1.1.2	Briefing with the Ministry of Agriculture	Meeting with the government officials	IAEA Experts, Project Manager
1.1.3	Research Materials and Methods	Developing of research protocols	IAEA Experts, Project Manager, SIRDI, CARDI
1.1.4	Determine Initial Budget and perform Cost analysis	Calculating the present rate of inflation to accommodate for the procurement process	IAEA, MoAFSE
1.2	Planning Phase	Collaborative Effort of Consultations	IAEA, MoAFSE, SIRDI, CARDI
1.2.1	Experimental Design	Meeting with MoAFSE and SIRDI	IAEA Expert, MoAFSE, SIRDI, Project Manager
1.2.2	Selection of Personnel for training	Selection of experience and dedicated personnel	MoAFSE, SIRDI, CARDI, UB
1.2.3	Site selection Corozal and Orange Walk	Meeting with Sugarcane Producers Stakeholders	MoAFSE, SIRDI
1.2.4	Site preparation for training	Executing all the necessary procedure for project initiation	IAEA, MoAFSE, SIRDI, CARDI
1.3	Execution Phase	Phase where project execution occurs	IAEA, MoAFSE, SIRDI, CARDI, Project Manager
1.3.1	Procurement of material and equipment	Cost evaluation from prospected vendors	IAEA, Project Manager
1.3.2	Introduction to NIT	Theoretical introduction to NIT	IAEA Expert
1.3.3	Capacity building /training of officers	Field execution of project testing	IAEA Expert
1.3.4	Recording and reporting on project	Data collection and report writing	IAEA Expert, Project Manager
1.4	Control Phase	The management of the planning, execution, monitoring & controlling	IAEA Expert, Project Manager, MoAFSE
1.4.1	Monitoring and evaluation of Project	Data collection and report writing	IAEA Expert, Project Manager
1.4.2	Quality assurance exercise	Data collection from participants interviewed	IAEA Expert, Project Manager
1.4.3	Evaluation of participants	Interview of participants	Project Manager
1.4.4	Evaluation of training process	Interview of participant and trainers	Project Manager, IAEA Expert
1.5	Close Phase	Phase that signifies completion of project	IAEA Expert, Project Manager
1.5.1	Project evaluation	Report writing	Project Manager
1.5.2	Evaluation of participants	Interview and report writing	Project Manager

1.5.3	Evaluation of procurement procedure	Cost analysis	Project Manager, IAEA Expert
1.5.4	Final report	Data collection and interview	Project Manager

Once the activities were identified and defined, the third planning process of Project Schedule Management, they were sequenced “identifying and documenting relationships between project activities” (Project Management Institute, 2013, p. 153). The Schedule Management Plan, Activity list, Milestone list and Project Scope Statement found in Scope Management Plan were used as inputs to this process. The scheduling tool which utilizes the precedence diagramming method, dependency determination and leads and lags were used (Project Management Institute, 2013, p. 153).

Once the activities were identified and sequenced, Activity Resources, the fourth planning process of Project Schedule Management were assigned. Since most of the work is only the capacity building (Training) of human resources the activities are schedule as such. As more information becomes available, all resources detailed in the PMBOK® Guide will be identified for each activity and compiled in a Resource Breakdown Structure.

The inputs used to assign Activity Resources were the Schedule Management Plan, Activity List, Resource Calendar, Risk Register, and the Activity Cost Estimates detailed in the WBS Dictionary found in the Scope Management Plan. The tools and techniques used were the expert judgement of the project manager, and Microsoft Project 2019 scheduling tool, which was used to help plan, manage, and assign resources. The human resources assigned to each activity are outlined in the table below (Project Management Institute, 2013, p. 161).

Chart 11. *Resource assignment and activity duration. (Source: J. Joseph, (2021))*

Task Name	Duration	Resource Names
1.0 The use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer	2 Years	
1.1 Initiation Phase	30 days	IAEA Experts, MoAFSE, SIRDI, CARDI
1.1.1 Collect Country's requirements	20 days	Project Manager, IAEA expert, MoAFSE, SIRDI
1.1.2 Briefing with the Ministry of Agriculture	1 day	IAEA, MoAFSE
1.1.3 Research Materials and Methods	7 days	IAEA, MoAFSE, SIRDI
1.1.4 Determine Initial Budget and perform Cost analysis	7 days	IAEA, MoAFSE, SIRDI
1.2 Planning Phase	20 days	IAEA, MoAFSE, SIRDI
1.2.1 Experimental Design	14 days	IAEA, MoAFSE, SIRDI
1.2.2 Selection of Personnel for training	3 days	MoAFSE, SIRDI, CARDI, UB
1.2.3 Site selection Corozal and Orange Walk	7 days	MoAFSE, SIRDI, IAEA
1.2.4 Site preparation for training	20 days	MoAFSE, SIRDI, IAEA
1.3 Execution Phase	20 days	MoAFSE, SIRDI, IAEA
1.3.1 Procurement of material and equipment	60 days	IAEA, MoAFSE, SIRDI
1.3.2 Introduction to NIT	3 days	IAEA
1.3.3 Capacity building /training of officers	16 months	IAEA
1.3.4 Recording and reporting on project	16 months	Project Manager
1.4 Control Phase	20 days	Project Manager
1.4.1 Monitoring and evaluation of Project	12 months	Project Manager, IAEA
1.4.2 Quality assurance exercise	20 weeks	Project Manager, IAEA
1.4.3 Evaluation of participants	16 months	Project Manager, IAEA
1.4.4 Evaluation of training process	12 months	Project Manager, IAEA
1.5 Close Phase	20 days	Project Manager, IAEA
1.5.1 Project evaluation	4 months	Project Manager, IAEA
1.5.2 Evaluation of participants	4 months	Project Manager, IAEA
1.5.3 Evaluation of procurement procedure	4 months	Project Manager
1.5.4 Final report	3 months	Project Manager

The fifth planning process conducted for Project Schedule Management involved estimating Activity Durations as detailed in the PMBOK® Guide. The Schedule Management Plan, Activity List, Activity Resource Requirements, Resource Calendar, and the Project Scope Statement were used as inputs. The tools and techniques used were the expertise of the Project Manager, and the scheduling tool. The output from this process is detailed above.

Finally, the sixth planning process conducted for Project Time Management, also detailed in the PMBOK® Guide, was the development of the Schedule. The schedule was created concurrently with the preceding time management processes. The inputs to this process were the Schedule Management Plan, Activity List, Project Schedule Network Diagram, Activity Resource Requirements, Resource calendar, Activity Durations, Project Scope Statement, Risk Register, and Resource Requirements. The tools and techniques used to develop the project schedule seen in figure 20, were Schedule Network Analysis, Leads and Lags, and the Microsoft Excel 2016 scheduling tool mentioned previously.

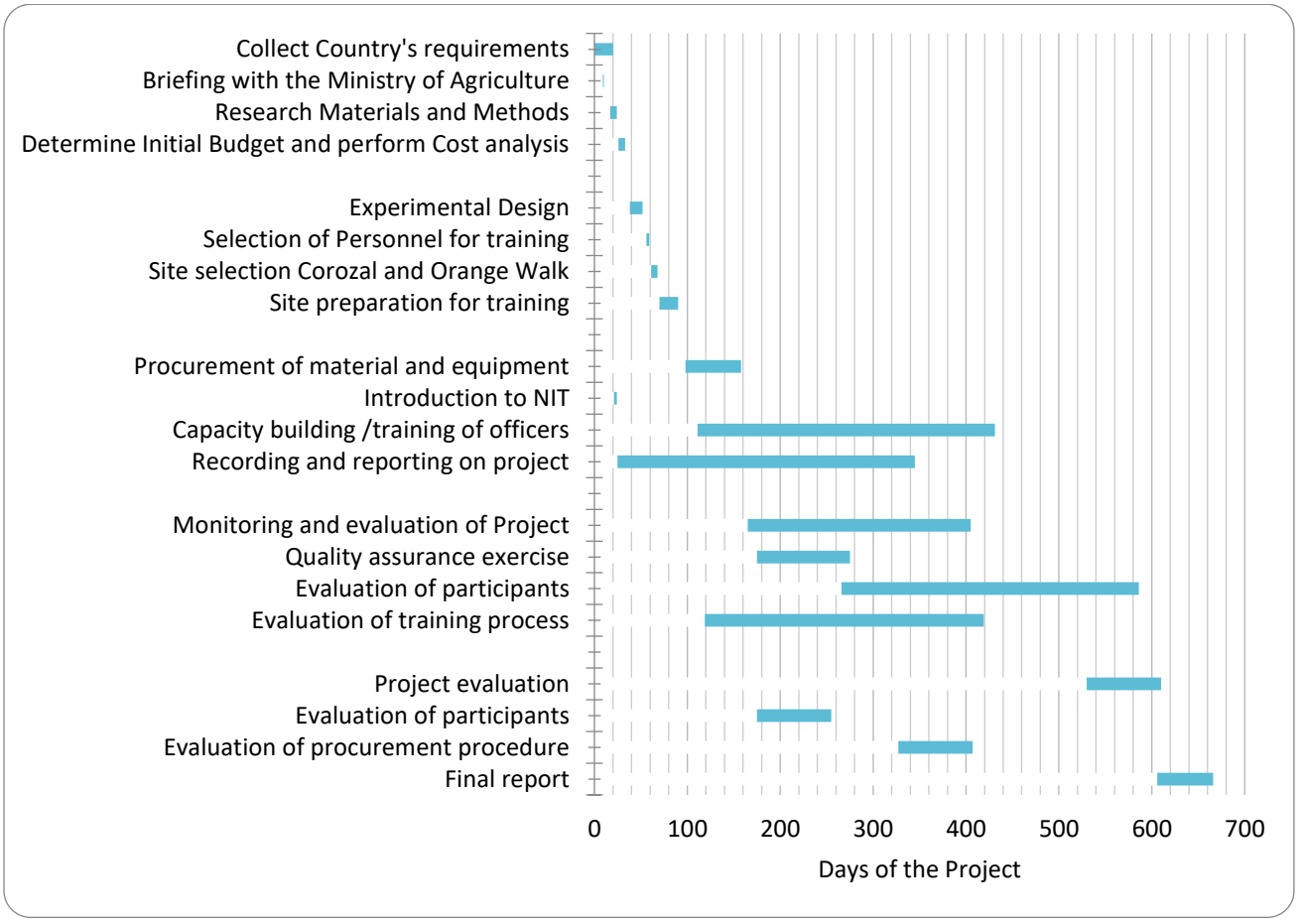
Chart 12. *Schedule management plan and duration. (Source: J. Joseph, (2021))*

	TASK NAME	START DATE	END DATE	START ON DAY*	DURATION* (WORKDAYS)	TEAM MEMBER	PERCENT COMPLETE
Initiation Phase							
	Collect Country's requirements	01/01/2022	31/01/2022	-38	20	IAEA Expert	
	Briefing with the Ministry of Agriculture	10/01/2022	10/01/2022	-29	1	IAEA Expert	
	Research Materials and Methods	18/01/2022	26/01/2022	-21	7	IAEA Expert	
	Determine Initial Budget and perform Cost analysis	27/01/2022	04/02/2022	-12	7	IAEA Expert	
Planning Phase							
	Experimental Design	08/02/2022	25/02/2022	0	14	IAEA Expert	

	Selection of Personnel for training	26/02/2022	02/03/2022	18	3	MoAFSE, SIRDI, CARDI	
	Site selection Corozal and Orange Walk	03/03/2022	11/03/2022	23	7	IAEA Expert, MoAFSE, SIRDI	
	Site preparation for training	12/03/2022	08/04/2022	32	20	IAEA Expert	
Execution Phase							
	Procurement of material and equipment	09/04/2022	02/07/2022	60	60	IAEA Expert, MoAFSE, SIRDI	
	Introduction to NIT	22/01/2022	23/01/2022	-17	3	IAEA Expert	
	Capacity building /training of officers	22/04/2022	26/12/2023	73	320	IAEA Expert	
	Recording and reporting on project	26/01/2022	29/01/2023	-13	320	Project Manager	
Control Phase							
	Monitoring and evaluation of Project	15/06/2022	24/10/2023	127	240	Project Manager	
	Quality assurance exercise	25/06/2022	30/01/2023	137	100	Project Manager, IAEA Expert	
	Evaluation of participants	24/09/2022	30/10/2023	228	320	Project Manager, IAEA Expert	
	Evaluation of training process	30/04/2022	31/08/2023	81	300	Project Manager, IAEA Expert	
Close Phase							

	Project evaluation	15/06/2023	24/10/2023	492	80	Project Manager, IAEA Expert	
	Evaluation of participants	25/06/2022	30/10/2023	137	80	Project Manager, IAEA Expert	
	Evaluation of procurement procedure	24/11/2022	24/04/2023	289	80	Project Manager	
	Final report	30/08/2023	31/12/2023	568	60	Project Manager	

Figure 20. *Gantt Chart for the N15 Isotope project. (Created in Microsoft excel 2016, November 2021)*



4.4. PROJECT COST MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

The first process of Project Cost Management, Plan Cost Management, was completed after the first process of Schedule Management, because the scope baseline, along with the Schedule Management Plan was used to develop the CostManagement Plan (Project Management Institute, 2013, p.195)**.**

The tools and techniques used to develop the Cost Management Plan were expert judgement, analytical techniques, and meetings. Following this process, documents such as the Project Charter, Scope Management Plan, and Schedule Management Plan were updated in accordance with the *PMBOK® Guide.*

4.4.1 Introduction

The Project Manager will be responsible for managing and reporting on the project's cost throughout the duration of the project. The Project Manager will send out a weekly financial report by E-mail to the Project Sponsor. During the bi-monthly project progress meeting, the Project Manager and Assistant Project Manager will meet with Project Sponsors to present and review the project's cost performance for the preceding month.
Performance will be measured using earned value management or metrics. The Assistant Project Manager is responsible for preparing the Cost Management Plan and the Cost Baseline. The Project Manager is responsible for accounting for cost deviations and presenting the Project Sponsor with options for getting the project back on budget. The Project Sponsor has the authority to make changes to the project to bring it back within budget.

4.4.2 Roles and Responsibilities

The Project Manager, and Sponsor (IAEA) will all play key roles in managing the Cost of this project. As such, the project sponsor and manager, must be aware of their responsibilities to ensure that training performed on the project is within the established

budget throughout the duration of the project. The table below defines the roles and responsibilities for the Cost management of this project.

Chart 13. *Project manager roles and responsibilities. (Source: J. Joseph, (2021))*

Name	Role	Responsibilities
IAEA	Project Sponsor	a. Approve or deny procurement change requests
		b. Procurement of goods
		c. Accept project deliverables within the budget allotted
Jeffery Joseph	Project Manager	a. Measure and verify procurement procedure
		b. Facilitate cost requests by vendors
		c. Facilitate impact of cost increases on budget
		d. Organize and facilitate scheduled budget meetings
		e. Communicate outcomes of cost increases
		f. Update project budget on the prices quoted by vendors.

4.4.3 Tools and techniques for Cost Management

Since this is the first planning process for the knowledge area, with an aim towards creating the Cost Management Plan, the tools and techniques used in this process are the “generic” ones that apply to any knowledge area planning process, namely expert judgment, data analysis, and meetings.

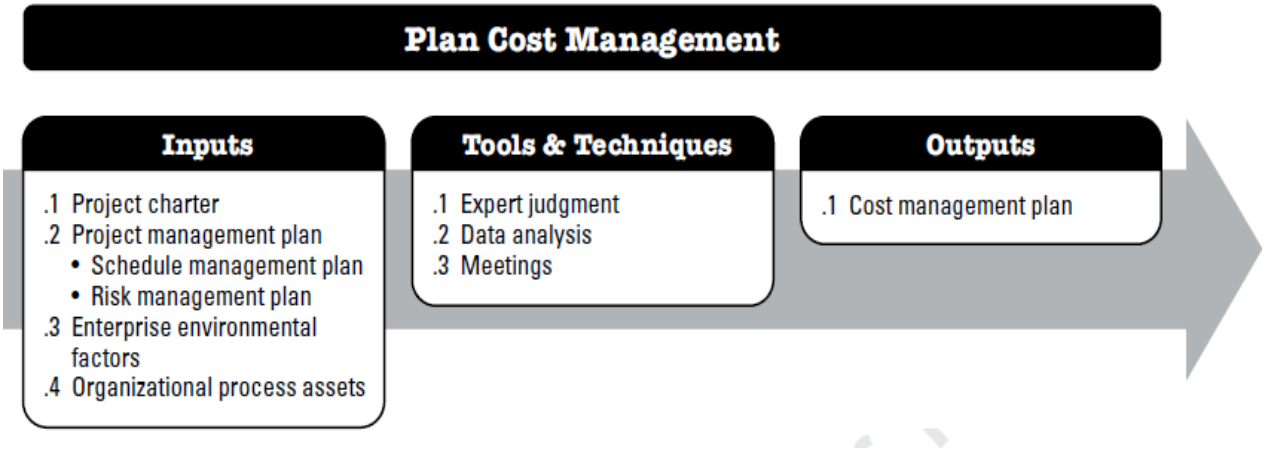
Expert Judgment

Who is going to assist your project team in creating the cost management plan? Experts with specialized knowledge of:

- Creating the budget on previous similar projects
- Cost estimating and budgeting techniques that are used in the application area in general
- Earned value management

The cost management planning effort occurs early in project planning and sets the framework for each of the cost management processes so that performance of the processes will be efficient and coordinated. The cost management processes, and their associated tools and techniques are documented in the cost management plan. The cost management plan is a component of the project management plan.

Figure 21. *PMBOK® Guide Plan Cost Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.4.4 Cost Management Approach

Costs for this project will be managed at the second level of the Work Breakdown Structure (WBS). Control Accounts (CA) will be created at this level to track costs. Earned Value calculations for the CAs will measure and manage the financial performance of the project. Credit for work will be assigned at the work package level. The percentage (%) of credit granted to each work package will be calculated based on the amount of work completed at a point in time compared to the total costs required to complete the work package. Costs may be rounded to the nearest dollar and work hours rounded to the nearest whole hour.

Cost variances of +/- 0.1 in the cost and schedule performance indexes will change the status of the cost to cautionary; as such, those values will be changed to yellow in the project status reports. Cost variances of +/- 0.2 in the cost and schedule performance indexes will change the status of the cost to an alert stage; as such, those values will be highlighted in red in the project status reports. This will require corrective action from the Project Manager to bring the cost and/or schedule performance indexes below the alert level. Corrective actions will require a project change order and must be approved by the Project Sponsor before it can be included within the scope of the project.

4.4.5 Reporting Format

Reporting for cost management will be included in the bi-monthly project progress report. The Monthly Project Progress Report will include a section labelled, “Cost Management”. This section will contain the Earned Value Metrics identified in the previous section. All cost variances outside of the thresholds identified in this Cost Management Plan will be reported on including any corrective actions which are planned. Change orders which are triggered based upon project cost overruns will be identified and tracked in this report.

4.4.6 Cost Variance Response Process

The Control Threshold for this project is a CPI or SPI of less than 0.95 or greater than 1.15. If the project reaches one of these Control Thresholds, a Cost Variance Corrective Action Plan is required. The Project Manager will present the Project Sponsor with options for corrective actions within five business days from when the cost variance is first reported.

Within three business days from when the Project Sponsor selects a corrective action option, the Project Manager will present the Project Sponsor with a formal Cost Variance Corrective Action Plan. The Cost Variance Corrective Action Plan will detail the actions necessary to bring the project back within budget and how the effectiveness of the actions in the plan will be measured. Upon acceptance of the Cost Variance Corrective Action Plan, it will become a part of the project plan and the project will be updated to reflect the corrective actions.

4.4.7 Cost Change Control Process

Change control is a methodology used to manage any change requests that impact the baseline of your project. It's a way to capture that change from the point where it's been identified through every step of the project cycle. That includes evaluating the request and then approving, rejected, or deferring it. The purpose of this process is to make sure that you're not changing things in the project that don't need to be changed. The last thing you want to do is disrupt the project for no good reason, wasting valuable time and resources. Any changed that is approved is then documented. The change control process is part of the larger change management plan.

A change request is usually the trigger that starts the process of change control. The change request can originate from stakeholders asking for new features, the need to repair something that proves faulty during the execution phase, upgrades, or any number of other causes. Whatever or wherever the change comes from, change control determines its value and how to feasible implement it.

The cost change control process will follow the established project change order process. Approvals for project budget/cost changes must be approved by IAEA.

4.4.8 Project Budget

After developing the schedule, the costs were estimated for the project. The Cost Management Plan was used as an input to this process. The tools and techniques used were

expert judgement, bottom-up, analogous, and parametric estimating, reserve analysis, and a project management software. Meetings were conducted with Project Manager and the expert, to determine the most effective means of estimating the budget for the project. The Assistant Project Manager was advised to estimate the costs for each component of work (bottom- up estimating) in a modified Microsoft Excel 2016 project budget spreadsheet (Project Management Institute, 2013, p. 200).

To determine the cost of each work package, costs were estimated for each related task required to complete the components of work identified during Activity Definition. The software used to calculate the estimated project costs was Microsoft Excel 2016, whereas Microsoft Word 2016 was used to capture the information. The Activity Cost Estimates can be seen in WBS Definition.

Using the information from the Activity Costs Estimates, Scope Baseline, Cost Management Plan, Project Schedule, Risk Register and Agreements, the budget was determined by aggregating the costs of each work package. During this process, expert judgement was used along with funding limit reconciliation to ensure that the planned expenditure did not exceed the funds committed to the project by the Project Sponsor. The Cost Baseline seen cannot be constructed since the funding agency have procured some of the item prior to the project initiation phase and this information have not been shared.

4.5. PROJECT QUALITY MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

The Quality Management Plan was created after the Procurement Management Plan, to adequately plan and ensure that quality was built into the project's processes and the product. Plan Quality Management is the only Quality Management process used during project planning.

The inputs for this process identified in the *PMBOK® Guide* were used to develop the Quality Management Plan. These inputs included theStakeholder register, Risk register, and the

Requirements documentation previously developed by the Assistant Project Manager. In addition, the Requirements Management Plan was used as an input, because it identified the requirements of good quality previously outlined by the project team. The tools and techniques that will be used are check sheets and meetings (Project Management Institute, 2013, p. 232).

As this project was unique, in that IAEA was responsible for designing and execution of the NIT project, the agency “increased [its] responsibility for the project beyond simply financing, but its execution” (Barlow, 2009, p. 7). Consequently, the Quality Management Plan was used as a guide to ensure that the design, training processes used, materials and equipment met or in most cases exceeded industry standards to elevate the quality of the capacity building venture.

4.5.1 Introduction

The Quality Management Plan for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems will establish the activities, processes, and procedures for ensuring a quality product upon the conclusion of the project. The purpose of this plan is to:

- Ensure quality is planned
- Define how quality will be managed
- Define quality assurance activities
- Define quality control activities
- Define acceptable quality standards

4.5.2 Roles and Responsibilities

The Project Manager, MoAFSE, SIRDI, and Sponsor (IAEA) will all play key roles in managing the Quality Management Plan of this project. As such, the project sponsor and manager, must be aware of their responsibilities to ensure that the quality of training and the materials that are procured performed to ensure the project’s deliverables are met throughout the duration of the project.

4.5.3 Tools and Technique for Quality Management Plan

According to PMBOK, Plan Quality Management is the process of identifying quality requirements and/or standards for the project and its deliverables and documenting how the project will demonstrate compliance with quality requirements and/or standards.

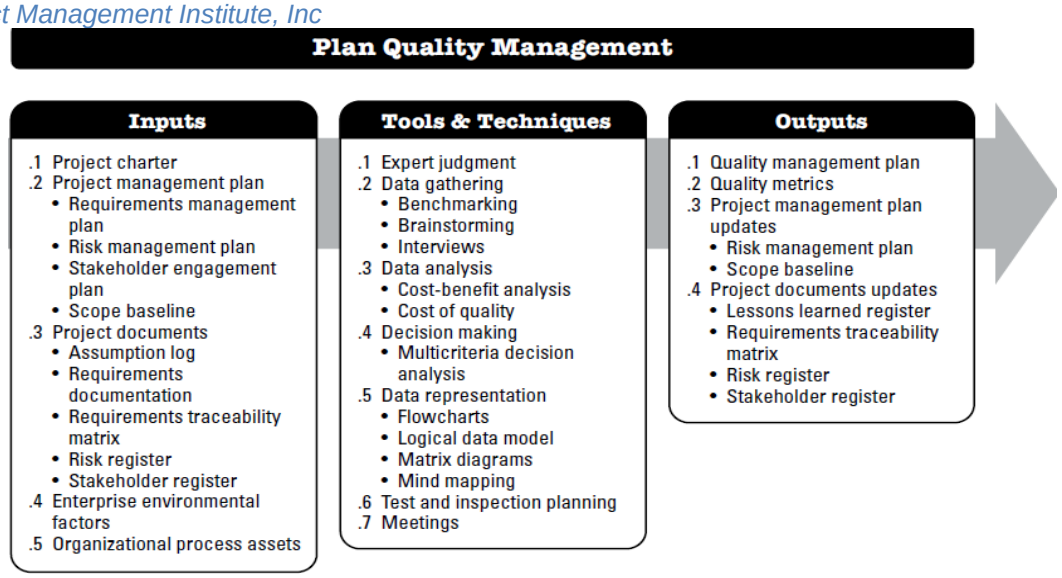
The key benefit of this process is that it provides guidance and direction on how quality will be managed and verified throughout the project. This process is performed once or at predefined points in the project. There are certain “generic” tools and techniques that are used in any process in the PMBOK® Guide that creates a management plan: expert judgment, decision making, and meetings. There are other tools and techniques that are specific to this quality management knowledge area.

Expert Judgment

Subject matter experts are always sought after when creating a management plan; in the case of this knowledge area, experts are sought with expertise in anything having to do with quality:

- Quality assurance (making sure that the quality processes are done correctly),
- Quality control (making sure that the quality outcomes fulfill the project criteria),
- Quality improvements (making sure that there is a process in place to improve quality such as Six Sigma),
- Quality systems (making sure that the benefits of pursuing the desired quality levels outweigh the costs of implementing those systems).

Figure 22. *PMBOK® Guide Plan Quality Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.5.4 Quality Management Approach

The quality management approach for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems will ensure quality is planned for both the product and process. To be successful, this project will meet its quality objectives by utilizing an integrated quality approach to define quality standards, measure quality, and continuously improve quality.

Product quality for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems will be defined by the IAEA current standards and criteria based on industry standards. The focus is on the project's deliverable and the standards and criteria being used will ensure the product meets established quality standards and country's satisfaction.

Process quality for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems will focus on the processes by which the project deliverable will be designed and transferred. Establishing process quality standards will ensure that all activities conform to organizational and regulatory standards which results in the successful delivery of the product.

The Project Manager will define and document all organizational and project specific quality standards for both product and processes. All quality documentation will become part of the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems. The Project Management Plan and will be transitioned into an operational management document upon the successful completion of the project.

Metrics will be established and used to measure quality throughout the project life cycle for the product and processes. The Project Manager will be responsible for working with the project team to define these metrics, conduct measurements, and analyze results. These product and process measurements will be used as one criterion in determining the success of the project and must be reviewed by the project sponsor/client. Metrics will include:

- Plot experimental design
- Schedule
- Resources
- Cost
- Participant's performance
- Product performance
- Participants Satisfaction

Quality improvements will be identified by any member of the project team. Each recommendation will be reviewed to determine the cost versus benefit of implementing the improvement and how the improvement will affect the product or processes. If an improvement is implemented, the Project Manager will update all project documentation to include the improvement.

4.5.5 Quality Requirements / Standards

Quality standards are defined as documents that provide requirements, specifications, guidelines, or characteristics that can be used consistently to ensure that materials, products, processes, and services are fit for their purpose. Standards provide organizations with the shared vision, understanding, and procedures.

4.5.5.1 Product Quality

The product quality standards and requirements will be determined by the Project Manager. These standards will primarily be based on the IAEA's documented standards. There may be product-specific quality standards identified that are not currently part of the documented organizational standards. In this case, the project Manager will review these newly identified standards and will incorporate them into organizational documentation if approved. The project team will also document any newly identified quality standards into for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems Management plan and ensure communication with all stakeholders.

4.5.5.2 Process Quality

The process quality standards and requirements will be determined by the Project Manager. Many of these standards will be based on existing IAEA process standards. The use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems team will work with the Project Manager to establish acceptable standards and document these standards for incorporation into both organizational process documents as well as the Project Management plan. These standards will be communicated to all project stakeholders.

4.5.5.3 Quality Assurance

The quality assurance of for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems focuses on the processes used in the transferring of technologies. To ensure quality, an iterative quality process will be used throughout the project life cycle. This iterative process includes measuring process metrics, analyzing process data, and continuously improving the processes.

The Project Manager and the project team will perform assessments at planned intervals throughout the project to ensure all processes are being correctly implemented and executed.

Chart 14. *Quality Assurance assessment plan. (Source: J. Joseph, (November 2021))*

Process Action	Acceptable Process Standards	Process Phase	Assessment Interval
Evaluation of Trainees	Comprehension of subject matter	Interview	Bimonthly
Soil and tissue sample analysis	Presence/ traces of N15 Isotopes	Laboratory analysis	Quarterly
Evaluation of Trainers	Ability of getting information across	Interview	Monthly

The Project Manager and the project team will provide day-to-day quality management and conduct process audits on a weekly basis, monitor process performance metrics, and assure all processes comply with project training standards. If discrepancies are found, the Project Manager will meet with the IAEA Expert and review the identified discrepancies.

The Project Manager will schedule regularly occurring project, management, and document reviews. In these reviews, an agenda item will include a review of project processes, any discrepancies and/or audit findings, and a discussion on process improvement initiatives.

Process improvement is another aspect of quality assurance. Quality assurance reviews, findings, and assessments should always result in some form of process improvement and, as a result, product improvement. All process improvement efforts must be documented, implemented, and communicated to all stakeholders as changes are made.

4.5.5.4 Quality Control

The quality control of the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems focuses primarily on the capacity building of Belize's Field Agricultural Officers and Laboratory technicians. The quality performance standards for the Project are in accordance with the organizational standards. Additionally, all technology transfer measurements will be conducted to ensure compliance with established quality standards. The project team will perform all physical measurements on site when needed and will ensure all physical and performance standards are met.
The Project Manager will schedule regularly occurring project, management, and document reviews. In these reviews, an agenda item will include a review of trainings, any

discrepancies and/or audit findings from the Project staff, and a discussion on product improvement initiatives. It is imperative to the success of the project that all the established physical and performance standards are met.

4.5.5.5 Quality Control Measurements

All the Project deliverables and processes must be measured and fall within the established standards and tolerances. The below logs will be used by the project team in conducting these measurements and will be maintained for use as supporting documentation for the project's acceptance. This section should contain a sample or useable table/log to be used in taking quality measurements and comparing them against standards/requirements. These forms may be found in many different styles or formats. The most important aspect of this log is to provide documentation of the findings. If actual measurements do not meet the standards or requirements, then some action must be taken. This may be done in regularly scheduled project status meetings or as necessary throughout the project lifecycle.

Chart 15. *Key performance indicators. (Source: J. Joseph, (November 2021))*

Key Performance Indicator	**Formula**	**Frequency of Measure**	**Acceptance Criteria**	**Responsible**
Effectiveness of trainer		Bimonthly	Officers responding well to testing	Project Manager
Ability of trainees grasping		Bimonthly	Field officers responding well to quizzes	Project Manager, IAEA Expert
Equipment availability		Monthly	Items are readily available when needed	Project Manager, IAEA Expert
Internal Quality Assessments		Monthly	Project Budget is on track	Project Manager
Procurement process		Monthly	Item Specifications desired are met	Project Manager, IAEA Expert

4.5.6 Quality Baseline

The Quality Baseline in its current form may be a new concept but already plays a very important role in our N15 Isotope projects. It gives every stakeholder a voice on quality and invokes collaboration from the beginning to the end of the project.

The Quality Baseline document communicates what we will deliver as part of the product and which metrics are used to determine success criteria between the IAEA Expert team and the Field Officers and Laboratory Technicians of Belize involve in the project. It is also a communication tool between the IAEA expert and the Project Manager, outlining what the IAEA Expert can and need to deliver in terms of overall product quality.

4.6. PROJECT RESOURCE MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

After creating the Communications Plan, the Resource Management Plan was produced as seen below. The activity resource requirements derived from the work packages seen in *Work Breakdown Structure* of the Scope Management Plan and the *Stakeholder Analysis Register* of the Stakeholder Management Plan were used as inputs to this process. In addition, expert judgement, and meetings, in the form of a personal interview, were the tools and techniques utilized to identify the resources required, the roles and responsibilities of each, and how they will be managed throughout the project lifecycle (Project Management Institute, 2013, p. 258).

Plan Resource Management is the only process from the ResourceManagement knowledge area that will be used during the planning process. The other three processes outlined will be conducted during project execution.

4.6.1 Introduction

Resources management is an important part of the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems. The human resources management plan is a tool which will aid in the management of this project's

human resource activities throughout the project until closure. The human resources management plan includes:

- Roles and responsibilities of team members throughout the project
- Project organization charts
- **Staffing management plan to include:**

a. How resources will be acquired
b. Timeline for resources/skill sets
c. Training required to develop skills
d. How performance reviews will be conducted
e. Recognition and rewards system

The purpose of the human resources management plan is to achieve project success by ensuring that the appropriate human resources are designated with the necessary skills, resources skills, team building strategies are clearly defined, and team activities are effectively managed.

4.6.2 Roles and Responsibilities

The roles and responsibilities for the project team of the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems are essential to project success. All team members must clearly understand their roles and responsibilities to successfully perform their portion of the project. For the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems the following project team roles and responsibilities have been established.

4.6.3 Resource Management Approach

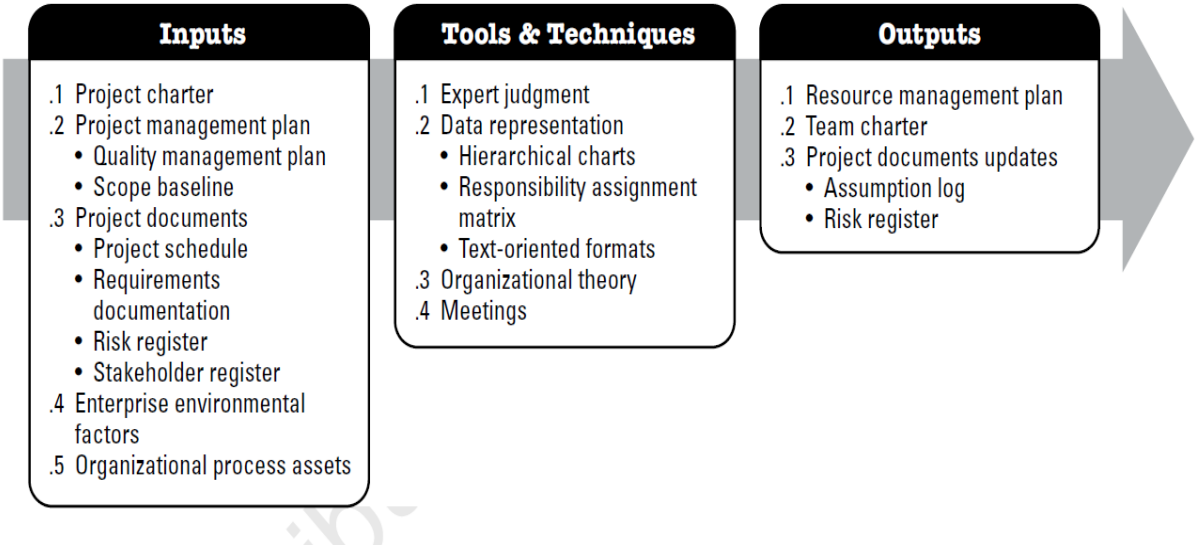
the human resource force is one of the most vital assets within this project. In this regard, it is vital for organizations to ensure that they formulate and implement human resource management policies that will optimize the field officers and laboratory technicians' contributions to maintain a positive moral in their different participation in their capacity building. The human relations approach is the general pathway on which this project will be

based. The premise that monetary rewards is not the only way in which employees can be motivated is key, the participants will be motivated through other social factors like being praised, promoted, or making developing in them a sense of belonging to the period of change for the agricultural sector of Belize and the protection of our environment.

4.6.4 Tools and Techniques

According to PMBOK, Plan Resource Management is the process of defining how to estimate, acquire, manage, and use team and physical resources. The key benefit of this process is that it establishes the approach and level of management effort needed for managing project resources based on the type and complexity of the project. Before any project can proceed, the project resource requirements need to be defined. The main part of this initial planning step involves identifying the type and quantity of resources that are required, including people. Some resources have a grade or skill level associated with them, such as experience level of people, or size of crane. Job descriptions are created for the project team members.

Figure 23. *PMBOK® Guide Plan Resource Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.6.5 Field Officers Selection

For the Project, the project staff will consist of solely internal resources. This project is to enhance the national capacity of Field officers within the agricultural sector of Belize. The procurement of instruments, tools, and equipment to study the capacity of our soils and their ability to hold nutrients will be a huge game changer for the sector that once was the breadbasket for the economy of the country. The need for officers that understand the importance of this project is vital to successful execution of this project. There will be a contract that will be developed which would be signed by all the participants, for attendance and participation in the training.

The managerial staff and office workers will work at the office of SIRDI for the Sugarcane portion of the project and be required to visit the site weekly.

4.6.6 Project Organizational Charts

The following RACI chart shows the relationship between project tasks and team members. Any proposed changes to project responsibilities must be reviewed and approved by the project manager. Changes will be proposed in accordance with the project's change control process. As changes are made all project documents will be updated and redistributed accordingly.

Chart 16. *Project Organizational Charts. (Source: J. Joseph, (November 2021))*

	Project Manager	IAEA Expert	MoAFSE	SIRDI	Field Officers
Requirements Gathering	A	A	A	A	I
Experimental Design	A	A	A	A	
Change Requests	A	I	I	I	I
Feasibility Study	A				
Site Management	A		I	I	I
Project Scope	A	I	I	I	I
Project Communications	A		I	I	I
Project Quality	A		I	I	I
Stakeholder Management	A			I	I
Accounting	A	A	C		
Status Reports	A		I	I	I
Manage Site	A	A		A	I
Procurements	A	A	I	I	

Key:

A – Accountable for ensuring task completion/sign off

I – Informed of when an action/decision has been made

C – Consulted before any decisions are made

4.6.7 Staffing Management

The staffing management plan or process is ultimately the document that explains the various human resources requirements that will be met for both staff management and the trainers. The plan is essentially a portion of the project management plan in which allows the N 15 Isotope project to be successful by properly managing all the entities involved. The primary consideration of the staffing plan for project management is to determine the specific skill sets required for completing project deliverables. The staffing plan entails drawing up a time schedule for specific skill requirements based on the project schedule and task plan. Staffing Management Plan is a part of Human Resource plan and includes Plan for staff acquisition, Resource calendars, Staff release plan, Staff training needs, Rewards and recognition, and Compliance.

4.6.7.1 Staff Acquisition

Staff acquisition is key to a successful project. A plan for staff acquisition is part of the staffing management plan, which in turn is part of the human resource management plan. The staff acquisition section explains how the staff will be obtained. Common sources for staff are from internal organizations or from external contracting.

Staff acquisition focuses on working within the policies and procedures of the performing organization to obtain the needed resources to complete the project work. Negotiation, communication, and political savvy are key to getting the desired resources on the project team.

The method entails development and use of delegation and re-assignment models to make efficient staff assignments considering the benefits and visibility of competing projects. The team acquisition methods can be used separately or taken together to acquire project team. Project gets staffed when all team members have appropriate assignments. Finding the right staff. Staff acquisition is key to a successful project. A plan for staff acquisition is part of the staffing management plan, which in turn is part of the human resource management plan.

For the N15 Isotope project, the project staff will consist of only internal resources. No work will be subcontracted to external resources. There will be no outsourcing/contracting performed within the scope of this project. The Project Manager will negotiate with various companies to identify and assign resources for the project. The managerial staff will work at the offices of SIRDI and MoAFSE and be required to visit the sites weekly.

4.6.7.2 Resource Calendars

The resource calendar refers to the specific calendar that lists all the working days as well as all the nonworking days that the project management team and or the project management team leader need to utilize to determine the specific dates on which a specific resource of element is being utilized or engaged, versus the dates on which they may in fact be inactive. When Project schedules the project, it uses the resource calendar to schedule the tasks that do not have a fixed duration and that have resources assigned. For example, if a resource has two weeks of vacation specified on his or her resource calendar, Project will not schedule the task for those weeks.

The project will last for a total of two years. Not all resources are required before the project can begin. The resource histograms cannot be completed because all the information is not readily available.

4.6.7.3 Training

Training is the basis of this project. The building of local field officers' capacities in the use of N15 Isotopes to tract the movement of nitrogen within the soil, plant tissue and the water is vital to protecting our fragile ecosystem and ensuring the efficient use of inorganic fertilizer within our agricultural sector.

4.6.7.4 Performance Reviews

The project manager will review the overall performance of the project during the project lifecycle. At the onset of the project, the Project Manager will communicate with the IAEA experts and MoAFSE to inform them of all expectations of the training to be performed. The Project Manager it is his responsibility to manage and evaluate each team member's performance and judge how effectively they are completing their assigned work. Prior to

releasing project attendees' reports, in accordance with the training schedule, the Project Manager will meet with the Research coordinators and provide feedback on employee project performance.

4.6.7.5 Recognition and Rewards

Although the scope of this project does not allow for ample time to provide cross-training or potential for monetary rewards, there are several planned recognition and reward items for project team members.

- The laboratory officer that performs the best will be incentivized by being selected for the distance learning that is a part of this project.

4.6.8 Control Resource

This process ensures the availability of planned physical resources, monitoring them against the plan, and taking corrective actions when required. By doing this, the right resources are available to the project at the right time and place and released when no longer required.

4.7. PROJECT RISK MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

4.7.1. Introduction

The Risk Management Plan briefly describes the purpose, terminology, and process of risk management for this project. Use this document in conjunction with the Risk Log template. This document is intended for use by the Project Manager and Assistant Project Manager. Risks are positive or negative events or conditions that may or may not occur during the project lifecycle and can impact project objectives. Impact is defined as the ability to increase or decrease the probability of an event or condition. Trigger is defined as an event that marks the occurrence of a risk. A contingency plan is a plan designed to take account of a possible future event or circumstance. Risks are controlled by watching for triggering events of risks and executing the corresponding response plan.

Although Project Risks were identified during the development of the Project Charter and taken into consideration while planning Project Time and Cost Management, Project Risk Management was the final knowledge area addressed during the planning for the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems.

As indicated, to adequately identify and plan for the project risks, risk management was planned, then the project risks were identified, qualitatively analyzed and finally responses planned for each identified risk. Risks were not quantitatively analyzed due to a lack of tools, for example simulation software, that would be required during the process.

Although, risk management was completed as the final planning activity in the development of the Project Management Plan, during the development of the plan, Project Manager was actively identifying the risks that could arose during project management planning.

To plan risk management, in accordance with Project Risk Management described in the PMBOK® Guide, the previously developed subsidiary plans, including the Project Charter and Stakeholder register were used as inputs to the process. The tools and techniques used were analytical techniques, expert judgement, and meetings. The output developed was the

Risk Management Plan seen below. The plan speaks to how risks will be identified, analyzed, planned for, and monitored and controlled throughout the project lifecycle.

4.7.2. Risk management approach

The risk management approach determines the processes, techniques, tools, and team roles and responsibilities for a specific project. The risk management plan describes how risk management will be structured and performed on the project. There are hybrid approaches to risk management as well. Under these approaches, the project faces the consequences of risk up to a certain threshold level. Once the threshold level is breached, the risk gets transferred to an external party (MoAFSE and SIRDI). The idea here is to make risk management cost-effective. The project may be able to bear the smaller losses. However, it will get help in the event of catastrophic losses. Since catastrophic losses are less likely, the premium to be paid for transferring these risks is less. Risk-sharing will be used as an effective strategy to obtain wider coverage at a lower cost.

4.7.3. Roles and Responsibilities

The roles and responsibilities for the project team of the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems are essential to project success. All team members must clearly understand their roles and responsibilities to successfully perform their portion of the project. For the use of nuclear and isotopic techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems the following project team roles and responsibilities have been established.

The project manager will be responsible for facilitating risk identification and the plan response activities that provide a basis for informing the project staff on the presence of risk. The project manager will also create and avenue where all the project members can report on potential risks.

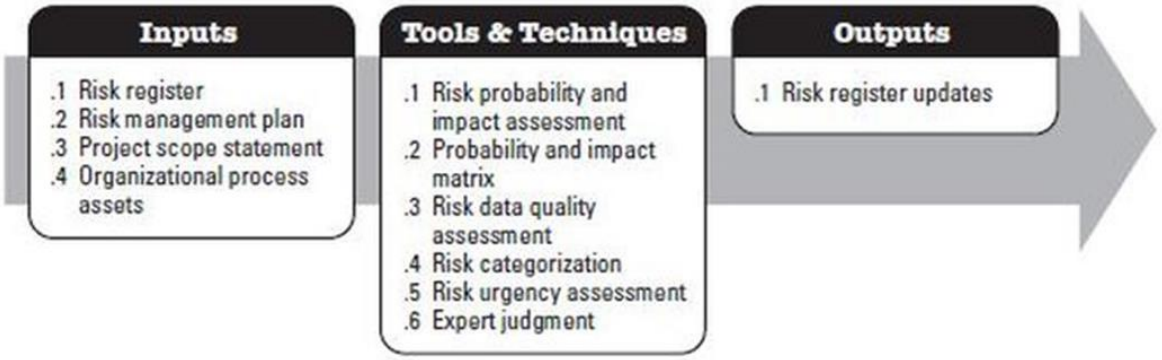
Chart 17. *Risk Management roles and responsibility. (Source: J. Joseph, (November 2021))*

Name	Role	Responsibilities
IAEA	Project Sponsor	a. Approve or deny Risk management plan
		b. identification of risks
		c. Analysis of risk
Jeffery Joseph	Project Manager	a. Development of Risk management plan
		b. Facilitate scope change requests
		c. Facilitate the identification of risk
		d. Analysis of risks
		e. monitoring and control of risk
		f. Reporting of risk to the project
Assistant Project and Project Team	Coordinators of Institutions	a. Participate in risk management plan
		b. Participate in the planning, response planning and the reporting of risks.
Stakeholders	Field Officers, Laboratory technicians	a. Consulted on the risks and lessons learned
		b. informed on the risks

4.7.4. Tools and Techniques

Plan Risk Management is the process of defining how to conduct risk management activities for a project. The key benefit of this process is that it ensures that the degree, type, and visibility of risk management are proportionate to both risks and the importance of the project to the organization and other stakeholders. This process is performed once or at predefined points in the project. Risk management tools and techniques are the things and ideas which are used to help to control risk in a company. They can help an organization to identify, evaluate, reduce, or remove risk, so that these risks will not have as much of a potential impact onto that organization. Tools and techniques may be formal or informal. Risk Management Tools & Techniques for Project Management. Brainstorming. Root Cause Analysis. SWOT Analysis. Risk Assessment Template for IT. Probability and Impact Matrix. Risk Data Quality Assessment. Variance and Trend Analysis. Reserve Analysis.

Figure 24. *PMBOK® Guide Plan Risk Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.7.5. Identifying Risks

The risk in project management refers to a range of probabilities that cause an adverse event and therefore the results prior to the event. Risks in project management can be identified, estimated, assessed, and controlled risk management activities of the project. Management of project risk management can be described as a complex process of planning, identification, analysis, evaluation, and control of project risks. [1 A Guide to the Project Management Body of Knowledge (PMBOK), Fifth edition, Project Management Institute, Pennsylvania, USA, 2013, p. 488-489].

Identifying risks in a project is a basic step in the management of project risk management. Through special tools to identify risks, all data collected and analyzed with the aim to identify risks is an essential basis for risk analysis projects, risk assessment and, moreover, for an accurate survey of the future potential risks.

Risk identification is the process of determining which risks may affect the project and documenting their characteristics. The key benefit of this process is documentation of existing risks and the knowledge and skills offered by the project team anticipate risk events. Participants in activities to identify risks include project manager, project team members, customers (farmers), and experts from outside the project team, end users, other project managers, stakeholders, and risk management experts.

Risk identification is a complex process because new risks may evolve or become known project that arose. Format risk situations should be consistent, to ensure that every risk is understood clearly and unequivocally to support effective analysis and develop the right answer.

Initially, risks will be identified while developing the project charter. However, during creation of the subsidiary plans, a comprehensive risk register will be compiled. Finally, during risk identification, the risk register will be reviewed to include or remove any risks that may or may no longer be applicable to the project. The risk register will be created and maintained by the Assistant Project Manager, under the responsibility of the Project Manager. The categories of risks relevant to this project are financial, planning, stakeholder, and scheduling.

Chart 18. *Risk identification and cause. (Source: J. Joseph, (November 2021))*

Risk Identification	Probable Cause of Risk
Price increase on materials over time	Inflation
Damage to materials on site	Improper storage, handling, weather conditions or human error
Accidents on site	Weather conditions or human error
Underestimating of Project Cost	Human error
Regulatory demands not consistent with approved methodologies	Human error
MoAFSE unauthorized or misplaced involvement in the project	Ineffective stakeholder management
Natural disasters (mother nature)	Act of Nature
Shipping delay	Human error
Equipment/Material delay	Human error in estimating fabrication timeline or payment delay from sponsor
Experimental design delay	Experts underestimated time required to complete activity
Non-compliant Trainers	Unable to secure proper Expert to perform the task

4.7.6. Analyzing Risks

Risk Analysis in project management is a sequence of processes to identify the factors that may affect a project's success.

The impact and probability of risks will be evaluated using a probability impact matrix during qualitative risk analysis. There will be a response plan developed for all risks identified as having any impact on the project, positive or negative. Risk analysis is the process that figures out how likely that a risk will arise in a project. It analyzes the uncertainty of potential risks and how they would impact the project in terms of schedule, quality, and costs if in fact they were to show up. Two ways to analyze risk are quantitative and qualitative. But it's important to know that risk analysis is not an exact science, so it's important to track risks throughout the project life cycle. It's a project planning technique that helps you to mitigate risk. There are also tools that can assist. You should at the very least, have a risk tracking software tool to identify and list those risks. Project Manager, for instance, lets you build project plans on Gantt charts, task lists, Kanban boards and more. Then, you can use our real-time tracking tools to ensure your risks stay in check and don't turn into major issues.

4.7.7. Planning Risk Responses

The project management team, including consultants, vendors, and trainees, will identify and assist with planning risk responses. However, the Project Manager will oversee planning risk responses with the IAEA Representatives managing data collection and storage. The Plan Risk Response is a process in project management that is used to develop options and encourage action to promote opportunities as well as reduce the threats of the project. The benefit of this project management process is that it helps address the risk according to their priority. The Plan Risk Response is a process in project management that is used to develop options and encourage action to promote opportunities as well as reduce the threats of the project. The corresponding response plan might include various cost saving measures aimed at keeping the well economic. The risk management plan needs to scale to the project. For small projects it might not be a necessity to have any response plans drawn up during project planning. For medium sized projects several risk response plans might be developed.

Chart 19. *Risk Management planning. (Source: J. Joseph, (November 2021))*

Risk Identification	Prevention Strategy	Trigger Event	Contingency Plan
Price increase on materials over time	Procurement contracts must be Firm Fixed Price (FFP)	Increase in purchase price of items being procured	Contact sellers and meet regarding contract terms and agreements
Damage to materials on site	Ensure proper storage trailers, adequate site management and on- site supervision.	The occurrence of physical injuries, material waste or repurchasing materials	All risk equipment insurance
Accidents on site	Ensure proper site management and supervision	Human injury and material damage	Injury or waste to be at the expense of the subcontractors or contractors all risk builder's insurance
Underestimating of Project Cost	Project Manager will check budget more than 3 times to ensure accuracy	Data shows that there are cost deviations	Contingency added to budget
Regulatory demands not consistent with approved methodologies	Meet with representatives from the regulatory bodies more than once to review requirement	Denied permits and/or inspections even though specifications were adhered to	Contingency added to budget for rework or to complete works
MoAFSE unauthorized or misplaced involvement in the project	Discuss and include client expected involvement in project agreement	Communicating with project personnel or making decisions that they are not authorized to do	Review contract with Sponsors, and if damages or delays result from their actions, contract conditions will be reinforced
Natural disasters (mother nature)	Secure the equipment in structures that can withstand storms and floods	Weather reports on the news	Accept that acts of nature occur and in this case the funds allocated for the budget will not allow for the desired prevention strategy
Shipping delay	Include consequences of delay in contract with fabricators and allocate two-week scheduling contingency	Shipping date of materials delayed	Having all items scheduled to be shipped no less than 5 weeks before use and communicating with all vendors daily to check the status of procured goods.
Equipment/Material delay	Select a fabricator that has the experience, technical expertise, and work force to deliver the deliverable. Communicate daily to ensure production specifications are understood.	Missed training deadlines	Having all items scheduled to be delivered no less than 3 weeks before use and communicating with all vendors daily to check the status of procured goods.
Experimental design delay	Ensure that the Expert is experienced and available to complete the work	Missed design deadline	Avoid having a design delay by ensuring that there is enough planned time in the schedule

Non-compliant Trainers	Ensure the selected Expert has the experience and technical resources to perform the task before selecting him or her.	Doesn't have the resources to complete the project	Use qualified selected Expert to

4.7.8. Qualitative Risk Analysis

Qualitative risk analysis is the process of assessing the likelihood of a risk occurring and the impact it would have on a project if it happened. Qualitative analysis of risk serves 3 functions: Prioritize risks according to probability & impact; Identify the main areas of risk exposure; and improve understanding of project risks.

The primary goals for qualitative risk analysis are to prioritize risks based on their probability and impact. The project manager of the N15 Isotope project can focus on devising treatments for the most significant risks.

Using this method also gives the project manager a better idea of the main areas of risk exposure. This can be achieved by categorizing risks by their source. This is important when it comes to prioritizing risk areas and treatment schedules.

Qualitative risk analysis improves the project manager's understanding of risks. This helps in devising more effective risk treatments and contingency budgeting. Project manager can discover much more than risk probability and consequences. The ability to discover trigger conditions, assumptions and affected project elements. All of this helps build up a better picture for the project.

Chart 20. *Qualitative Risk Analysis. (Source: J. Joseph, (November 2021))*

Risk Identification	Prevention Strategy	Risk Level (H, M, L)			Trigger Event	Contingency Plan
Price increase on materials over time	Procurement contracts must be Firm Fixed Price (FFP)				Increase in purchase price of items being procured	Contact sellers and meet regarding contract terms and agreements

Damage to materials on site	Ensure proper storage trailers, adequate site management and on-site supervision.				The occurrence of physical injuries, material waste or repurchasing materials	All risk equipment insurance
Accidents on site	Ensure proper site management and supervision				Human injury and material damage	Injury or waste to be at the expense of the subcontractors or contractors all risk builder's insurance
Underestimating of Project Cost	Project Manager will check budget more than 3 times to ensure accuracy				Data shows that there are cost deviations	Contingency added to budget
Regulatory demands not consistent with approved methodologies	Meet with representatives from the regulatory bodies more than once to review requirement				Denied permits and/or inspections even though specifications were adhered to	Contingency added to budget for rework or to complete works
MoAFSE unauthorized or misplaced involvement in the project	Discuss and include client expected involvement in project agreement				Communicating with project personnel or making decisions that they are not authorized to do	Review contract with Sponsors, and if damages or delays result from their actions, contract conditions will be reinforced
Natural disasters (mother nature)	Secure the equipment in structures that can withstand storms and floods				Weather reports on the news	Accept that acts of nature occur and in this case the funds allocated for the budget will not allow for the desired prevention strategy
Shipping delay	Include consequences of delay in contract with fabricators and allocate two-week scheduling contingency				Shipping date of materials delayed	Having all items scheduled to be shipped no less than 5 weeks before use and communicating with all vendors daily to check the status of procured goods.

Equipment/Material delay	Select a fabricator that has the experience, technical expertise and work force to deliver the deliverable. Communicate daily to ensure production specifications are understood.				Missed training deadlines	Having all items scheduled to be delivered no less than 3 weeks before use and communicating with all vendors daily to check the status of procured goods.
Experimental design delay	Ensure that the Expert is experienced and available to complete the work				Missed design deadline	Avoid having a design delay by ensuring that there is enough planned time in the schedule
Non-compliant Trainers	Ensure the selected Expert has the experience and technical resources to perform the task before selecting him or her.				Doesn't have the resources to complete the project	Use qualified selected Expert to

4.7.9. Plan Risk Responses

This is used to develop options and encourage action to promote opportunities as well as reduce the threats of the project. The benefit of this project management process is that it helps address the risk according to their priority.

The risk response planning involves determining ways to reduce or eliminate any threats to the project, and the opportunities to increase their impact. The project manager works to eliminate the threats before they occur. Similarly, the project manager works to ensure that opportunities occur. Likewise, the project manager is responsible to decrease the probability and impact of threats and increase the probability and impact of opportunities.

For the threats that cannot be mitigated, the project manager has a robust contingency plan and a response plan if contingencies do not work.

It is not required to eliminate all the risks of the project due to resource and time constraints. The project manager should review risk throughout the project. Planning for risks is iterative. Qualitative risk, quantitative risk, and risk response planning do not end once the work on the project start.

4.7.10. Monitoring and Controlling Risks

The Project Manager will monitor the status of risks by comparing the data collected during project execution with the risk register and risk analysis summary. The risk register will be updated weekly and communicated to the Sponsors and project management team during project status meetings. The Project Manager is responsible for deciding when to execute a risk response.

To identify the project risks, the Risk Management Plan, Cost Management Plan, Schedule Management Plan, Quality Management Plan, Human Resource Management Plan, Scope baseline, Activity Cost and Duration Estimates, Stakeholder Register and Procurement documents were used as inputs to the process. The tools and techniques employed were documentation reviews, and expert judgement. The risk register below is the output from this process. However, there are a few elements that have been added to the chart below as it will be used during project execution to control risks. The risk register was compiled in Microsoft Excel 2019.

The Control Risks process discharges risk responses as outlined in the risk register within the Project Management Plan. It involves, tracking existing risk, identifying new risks, monitoring the effects of previous risk control activities, and evaluating how effective the current risk management processes are. Part of the Control Risks process is to actively push the evolution of the risk processes through each iteration of the risk register to the project's conclusion. The Inputs, Tools & Techniques and Outputs for the Control Risk process are listed in the figure.

Figure 25. *PMBOK® Guide Risk Management Plan. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*

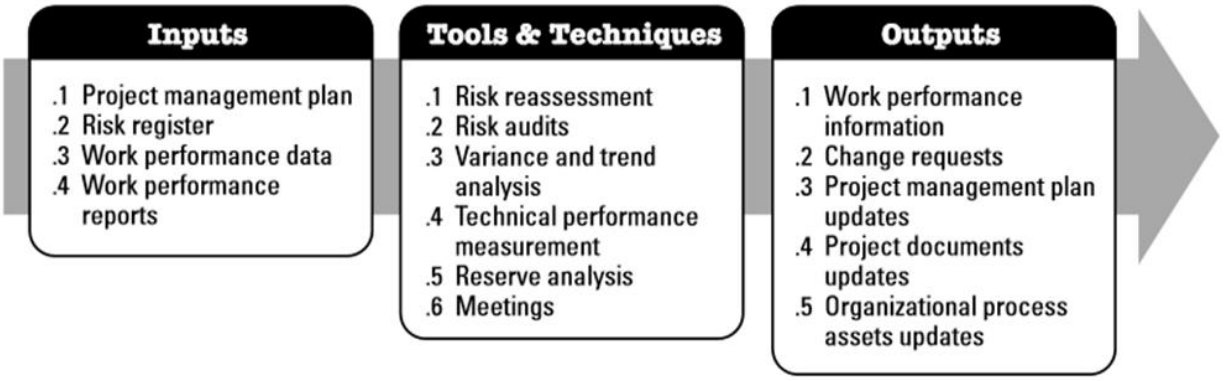


Chart 21. *Risk Register for N15 Isotope Project. (Source: J. Joseph, (October 2021))*

Risk ID	Risk Description	Category	Date	Status	Responsible Individual	Probable Cause of Risk	Prevention Strategy	Trigger Event	Contingency Plan	Contingency Plan Activation Date	Planned Resolution Date	Risk Close Date	Comments
1	Price increase on materials over time	Financial	21-Oct-21	Open	Project Manager/ IAEA	Inflation	Procurement contracts must be Firm Fixed Price (FFP)	Increase in purchase price of items being procured	Contact sellers and meet regarding contract terms and agreements				
2	Damage to materials on site	Financial	21-Oct-21	Open	Project Manager/ IAEA	Improper storage, handling, weather conditions or human error	Ensure proper storage trailers, adequate site management and on-site supervision.	The occurrence of physical injuries, material waste or repurchasing materials	All risk equipment insurance				
3	Accidents on site	Financial	21-Oct-21	Open	Project Manager/ IAEA	Weather conditions or human error	Ensure proper site management and supervision	Human injury and material damage	Injury or waste to be at the expense of the subcontractors or contractors all risk builder's insurance				
4	Underestimating of Project Cost	Financial	21-Oct-21	Open	Project Manager/ IAEA	Human error	Project Manager will check budget more than 3 times to ensure accuracy	Data shows that there are cost deviations	Contingency added to budget				
5	Regulatory demands not consistent	Planning	21-Oct-21	Open	Project Manager and IAEA	Human error	Meet with representatives from the regulatory	Denied permits and/or inspection	Contingency added to budget for rework				

	with approved methodologies						bodies more than once to review requirements	s even though specifications were adhered to	or to complete works				
6	MoAFSE unauthorized or misplaced involvement in the project	Stakeholder	21-Oct-16	Open	Project Manager	Ineffective stakeholder management	Discuss and include client expected involvement in project agreement	communicating with project personnel or making decisions that they are not authorized to do	review contract with Sponsors, and if damages or delays result from their actions, contract conditions will be reinforced				
7	Natural disasters (mother nature)	Scheduling	21-Oct-21	Open	Project Manager	Act of Nature	Secure the equipment in structures that can withstand storms and floods	Weather reports on the news	accept that acts of nature occur and in this case the funds allocated for the budget will not allow for the desired prevention strategy				
8	Shipping delay	Scheduling	21-Oct-21	Open	Project Manager	Human error	Include consequences of delay in contract with fabricators and allocate two-week scheduling contingency	Shipping date of materials delayed	having all items scheduled to be shipped no less than 5 weeks before use and communicating with all vendors daily to check the status of				

									procured goods.				
9	Equipment /Material delay	Scheduling	21-Oct-21	Open	Project Manager/ IAEA	Human error in estimating fabrication timeline or payment delay from sponsor	Select a fabricator that has the experience, technical expertise, and work force to deliver the deliverable. Communicate daily to ensure production specifications are understood.	Missed training deadlines	having all items scheduled to be delivered no less than 3 weeks before use and communicating with all vendors daily to check the status of procured goods.				
10	Experimental design delay	Scheduling	21-Oct-21	Open	Project Manager/ IAEA	Experts underestimated time required to complete activity	Ensure that the Expert is experienced and available to complete the work	Missed design deadline	avoid having a design delay by ensuring that there is enough planned time in the schedule				
11	Non-compliant Trainers	Scheduling	20-Oct-21	Open	Project Manager/ IAEA	unable to secure proper Expert to perform the task	Ensure the selected Expert has the experience and technical resources to perform the task before selecting him or her.	Doesn't have the resources to complete the project	Use qualified selected Expert to complete the task or project.				

In addition, to detailing a list of identified risks and risk responses, the risk register will be used to capture information regarding how each risk is prioritized by combing its probability of occurrence and impact, which are both aspects of Qualitative Risk Analysis. To perform Qualitative Risk Analysis, the Risk Management Plan, Risk Register and Scope Baseline were used. Microsoft Excel 2016 was used as a tool to capture the information detailed in Chart 21.

4.8. PROJECT PROCUREMENT MANAGEMENT PLAN THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

Project Procurement Management was conducted after Project Cost, Time, and Human Resource Management. To develop a Procurement Management Plan, a template was used. As documented in the *PMBOK Guide,* the Requirements Documentation, Risk Register, Stakeholder Register and Project Charter were the inputs used in the process. The tools and techniques were expert judgement and meetings, in the form of a personal interview with the lead Project Manager (Project Management Institute, 2013, p. 358).

As Procurement Management is integral to the success of the project, and subject to financial and scheduling constraints, it was imperative that all items being purchased by the project team were done efficiently and effectively, thus providing enough time for delivery, within budget and of an acceptable standard of quality. Since most of the materials for the project, including the Isotopic Nitrogen fertilizer, were to be purchased from international suppliers, it was important that the Procurement Management Plan identified the items that would be outsourced and the date they were required as seen in the procurement definition, a subset of the plan.

4.8.1. Introduction

For this project, a procurement statement of work was not developed, and the Source Selection Criteria was included in the Procurement Management Plan labelled as the Decision criteria. In addition, the Procurement Management Plan identified elements that the

Procurement Documents and a sample Check sheet since the IAEA will be procuring all the materials needed for the execution of the project.

This Procurement Management Plan sets the procurement framework for this project. It will serve as a guide for managing procurement throughout the life of the project and will be updated as acquisition needs change. A make or buy analysis will not be used for this project as some of this information already exists in the capacity and institute building capacity specifications and requirements defined during project initiation, found in the project charter. In addition, due to the vast experience and technical expertise of the IAEA team, the items to be purchased, are already known. This plan identifies and defines the items to be procured, the types of contracts to be used in support of this project, the contract approval process, and decision criteria. The importance of coordinating procurement activities, establishing firm contract deliverables, and utilizing metrics in measuring procurement activities is included. Other items included in the procurement management plan are procurement risks and procurement risk management considerations; how costs will be determined; how standard procurement documentation will be used; and procurement constraints.

4.8.2. Roles and Responsibilities

The Project Manager, and Sponsor (IAEA) will all play key roles in procuring the goods for this project. As such, the project sponsor and manager, must be aware of their responsibilities to ensure that items necessary for the successful execution of the project are procured on time and are of the quality specified within the project document. Using the cost management plan is critical to the execution of the procurement management plan, and much be use as reference during the procurement process.

4.8.3. Tools and Techniques

According to PMBOK, Plan Procurement Management is the process of documenting project procurement decisions, specifying the approach and identifying potential sellers. The key benefit of this process is that it determines whether to acquire goods and services from outside the project and, if so, what to acquire as well as how and when to acquire it. Goods and services may be procured from other parts of the performing organization or from

external sources. This process is performed once or at predefined points in the project. Plan Procurement Management contains some tools and techniques which are generic, that is, common to other similar planning processes for other knowledge areas, and those specific to this process. The generic tools and techniques are Expert Judgment and Meetings.

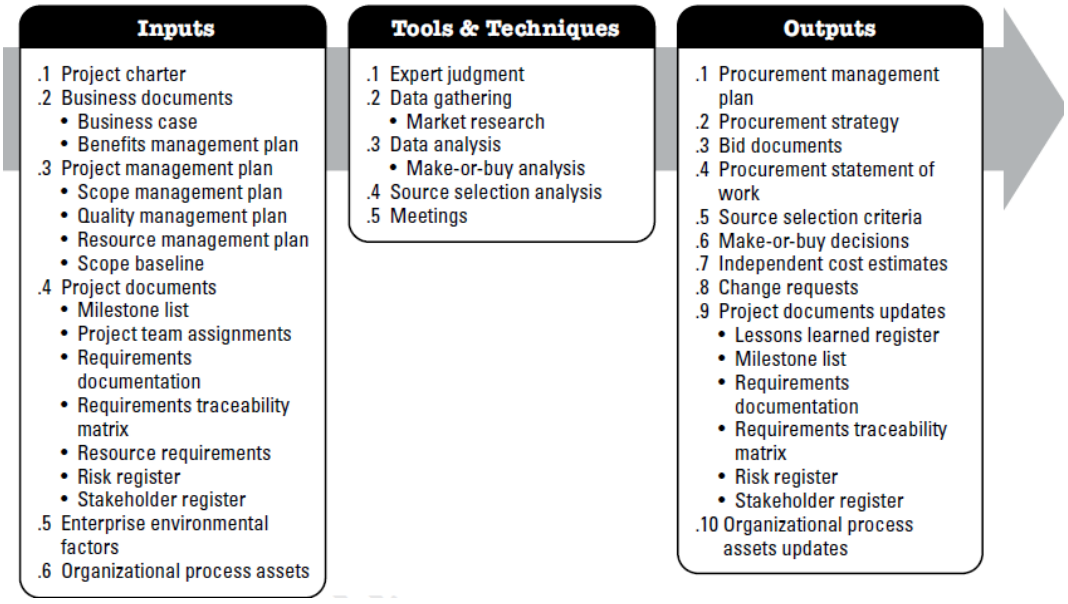
Expert Judgment

As a project manager, obtaining help from experts who have expertise in the following areas to draft your Procurement Management Plan. Which includes Procurement and purchasing, Contract types and contract documents, and Regulations and compliance issues

Data Analysis

Make-or-buy analysis is used to determine whether the deliverables of a project (which are found in the project scope statement) can best be accomplished by the project team or should be purchased from outside sources. The factors to be considered are the organization's current resource allocation, as well as their skills and abilities, the need for specialized expertise, the desire not to expand permanent employment obligations, the need for independent expertise, and the risks involved with the make-or-buy decision.

Figure 26. *PMBOK® Guide Procurement Management Plan. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.8.4. Procurement Management Approach

Procurement is a purchasing process that controls quantity, quality, sourcing, and timing to ensure the best possible total cost of ownership. How It Works. Procurement may be a simple purchasing arrangement with a supplier.

The project manager will provide oversight and management for all procurement activities under this project. The project manager will work with the IAEA experts to identify all items to be procured for the successful completion of the project. The project manager will then review the procurement list prior to purchasing which will be done by the IAEA experts. The project manager will review the procurement items, and begin the vendor selection, purchasing and the contracting process.

4.8.5. Procurement Risks

All procurement activities carry some potential for risk which must be managed to ensure project success. While all risks will be managed in accordance with the project's risk management plan, there are specific risks which pertain specifically to procurement which must be considered:

- Unrealistic schedule and cost expectations for vendors
- Manufacturing capacity capabilities of vendors
- Conflicts with current contracts and vendor relationships
- Configuration management for upgrades and improvements of purchased technology
- Potential delays in shipping and impacts on cost and schedule
- Questionable past performance for vendors
- Potential that final product does not meet required specifications

These risks are not all-inclusive and the standard risk management process of identifying, documenting, analyzing, mitigating, and managing risks will be used.

4.8.6. Procurement Risk Management

As previously stated, project risks will be managed in accordance with the project's risk management plan. However, for risks related specifically to procurement, there must be additional consideration and involvement. Project procurement efforts involve external organizations and potentially affect current and future business relationships as well as internal supply chain and vendor management operations. Because of the sensitivity of these relationships and operations, the project team will include the project sponsor/client and the project team in all project meetings and status reviews.

Additionally, any decisions regarding procurement actions must be approved by the project IAEA and project manager before implementation. Any issues concerning procurement actions, or any newly identified risks will immediately be communicated to the project management team as well as the project sponsor.

4.8.7. Cost Determination

For this project we will procurement procedures of the IAEA. The project Manager will have to become familiar with the procurement procedures of the IAEA. Cost determination is a crucial step in creating a procurement management plan as it directly affects the budget of the project. Mostly, it includes issuing a request for a proposal (RFP), which asks vendors to offer bids for their products or services. These RFPs generally involve critical schedule dates and provide details on vendors' work arrangements, and previous experience.

4.8.8. Procurement Constraints

There are several constraints that must be considered as part of the project's procurement management plan. These constraints will be included in the RFQ and communicated to all vendors to determine their ability to operate within these constraints. These constraints apply to several areas which include schedule, cost, scope, resources, and technology:

- **Schedule:**

  • Project schedule is not flexible and the procurement activities, contract administration, and contract fulfilment must be completed within the established project schedule.

- **Cost:**

  • Project budget has a contingency reserve built in; however, the reserve may not be applied to procurement activities. Reserves are only to be used in the event of an approved change in project scope.

- **Scope:**

  • All procurement activities and contract awards must support the approved project scope statement. Any procurement activities or contract awards which specify work which is not in direct support of the project's scope statement will be considered out of scope and disapproved.

- **Resources:**

  • All procurement activities must be performed and managed with current personnel. No additional personnel will be hired or re-allocated to support the procurement activities on this project.

- **Technology:**

  • Parts specifications have already been determined and will be included in the statement of work as part of the RFQ. While proposals may include suggested alternative material or manufacturing processes, parts specifications must match those provided in the statement of work exactly.

4.8.9. Decision Criteria

The criteria for the selection and award of procurement contracts under this project will be based on the following decision criteria:

- Ability of the vendor to provide all items by the required delivery date
- Quality
- Cost
- Expected delivery date

- Comparison of outsourced cost versus in-sourcing
- Past performance

These criteria will be measured by the Project Manager using the procurement procedures of IAEA. The ultimate decision will be made based on these criteria as well as available resources. The project is based on capacity building and the procuring of state-of-the-art laboratory equipment to enhance the development of agriculture in Belize. The use of the make-or-buy analysis cannot be applied to this project based on the fact that the project sponsor have the human resource of expertise for the delivering of the training, and the materials required for the execution of the project cannot be manufacture within the country.

4.8.10. Contracts

A written or spoken agreement, especially one concerning employment, sales, or tenancy, that is intended to be enforceable by law.

Procurement contracts are the agreements to use certain products and services on a project. The types of procurement contracts and are typically either fixed-price, cost-reimbursable, or time and materials. Some agreements can include more than one of these payment structures on a single procurement contract.

The management of contracts will be under the control of the Project Manager and will be responsible for the process of managing contract creation, execution, and analysis to maximize operational and financial performance, to assist in reducing financial risk. Contract management proves to be a very time-consuming element of projects, which facilitates the need for an effective and automated contract management system. The basis for contract management relies on the implementation of successful post-award and upstream activities. During the pre-award stage, vendors should focus on the reason for establishing the contract and if the supplier can fulfil the terms of the agreement. Additional consideration is needed to understand how the contract will work once awarded. Avoiding unwanted surprises requires careful research and clarity of purpose in the actual contract.

The project manager requires a level of flexibility for both parties involved and a willingness to adapt contract terms to reflect any changing circumstances. Problems are inevitable,

which means the project management team must be prepared for the unexpected and be able to adjust contract terms when needed. While there are many components of contract management, we can summarize the process by breaking it into five clear stages: creation, collaboration, signing, tracking and renewal, if needed.

4.8.11. Cost determination

Cost determination is a crucial step in creating a procurement management plan as it directly affects the budget of the project. Mostly, it includes issuing a request for a proposal (RFP), which asks vendors to offer bids for their products or services.

4.8.12. Documentation

Procurement documents are the contractual relationship between the customer and the supplier of goods or services. Some examples of what constitutes procurement documents include the buyer's commencement to bid and the summons by the financially responsible party for concessions. Procurement documents are the documents prepared by the buyer or seller to complete the procurement management process. Solicitations are all invitations or requests from the buyer to seller. For example, invitation for bid, request for information, request for quotation or proposal, etc. are solicitations.

Procurement Statement of Work (SOW)

Buyer usually prepares the SOW towards the seller. SOW contains the actual work the seller needs to do as part of the procurement.

Request for Information (RFI)

Buyer asks all the selected suppliers to provide information related to them. For example, information on supplier pertaining to organization capabilities, capacity, skill sets, references, etc.

Invitation for Bid (IFB)

Invitation for bid is a formal way of buyer asking suppliers to provide the bid. IFB is primarily used when buyer has a good understanding on what work is involved and solution is also more or less the same from all sellers and the prime differentiator is only the price.

Request for proposal (RFP)

On the other hand, request for proposal (RFP) is like IFB and will be issued by the buyer to suppliers. However, this involves buyer asking for sellers' proposal to solve an issue or complete a project. This usually includes a solution to propose along with commercials, level of compliances, and other terms and conditions.

Invitation for Quote (IFQ)

Invitation for quote is a type of procurement solicitation in which buyer asks the suppliers or sellers for a fixed price quotation to bid for a project. Sometimes buyers ask the sellers for IFQ or RFQ to understand the cost of the project in very high level before issuing an RFP.

Purchase Order (PO)

Purchase order (PO) is type of fixed price agreement or contract from buyer to seller asking the seller to supply the products and services that are agreed by both the parties.

4.8.13. Contract Approval Process

The contract approval process is vital but sometimes complicated, but it is incredibly important to have a solid, easy-to-understand process. This ensures that everyone has access to the same information and is on the same proverbial page. Not only does this help keep employees on track, but it also improves the efficiency of the entire process. Most often, contract approvals are still done manually. Any process that is done manually will be less efficient than those that can be automated using the software. When you manage your contract approvals manually, other involved parties may not have access to any information about the approval process. What this does is leave important parties out of the loop and unsure of where in the process of approval a given contract is. Some contracts and processes are more important than others. When they are done manually, vital time can be lost.

The contract approval process is the second stage of the contract management lifecycle. It happens after contract creation and contract negotiation and before contract execution. The project manager and the key stakeholders (project administration unit) will be tasked to review the contracts. The project execution unit will also verify whether all parties have reviewed them, and which service or good provider still need to approve them.

4.8.14. Vendor management

Vendor management is a structured program to manage suppliers and improve their impact on the buyer's business. It includes managing vendor deliverables, working collaboratively to co-develop new processes, managing compliance as well as payment of invoices. This is usually managed by the procurement officer, but within this project the project manager will be responsible for the vendor management.

4.8.15. Performance metrics

Procurement performance metrics helps an organization determine accurately how its procurement sector is performing. These metrics help in measuring and benchmarking the effectiveness and efficiency of supply management. Performance Metrics for Procurement Activities.

Chart 22. *Performance metrics. (Source: J. Joseph, (May 2021))*

Key Performance Indicator	Formula	Frequency of Measure	Acceptance Criteria	Responsible
Purchase lead time		Date	Days for delivery	Project Manager
Number of suppliers		Quantity	More than two	Project Manager
Supplier rating		Monthly	Pass / Fail	Project Manager
Lead time		Date	Delivery time	Project Manager
Purchase cost KPI's		Price quotation	Market value	Project Manager
Inventory KPI's		Quantity	Delivery time	Project Manager

The following metrics are established for vendor performance for this project’s procurement activities. Each metric is rated on a 1-3 scale as indicated below:

Metric	Product Quality	On Time Delivery	Documentation Quality	Development Costs	Development Time	Cost per Unit	Transactional Efficiency
Vendor#1							
Vendor#2							

1 – Unsatisfactory
2 – Acceptable
3 - Exceptional

In addition to rating each vendor, actual values will be noted to build a past- performance data base for selecting vendors for future procurement activities.

4.9. PROJECT COMMUNICATION MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

To ensure that information communicated about the project during the project lifecycle will be disseminated to the appropriate parties at the correct time, the Communications Management Plan, was developed using the *PMBOK® Guide*. The plan details how each stakeholder would receive information from members of the project team, the frequency of communication, the information that would be communicated to them and the person responsible for ensuring that the correct information was received by the communication sent (Project Management Institute, 2013, p. 289).

4.9.1. Introduction

The Communications Plan will serve as a guide to assist in communication between the stakeholders of the N15 Isotope Project. The Project Manager and IAEA Expert will take the primary role in ensuring effective communications on this project. The communications matrix is a major section of this plan. It documents the communications requirements, the information being communicated, the audience for each communication, the frequency of communication, and the individual responsible for the communication or dissemination of the information to the appropriate audience.

4.9.2. Communication Approach

The Communication Management Approach is one of the four approach (guideline) documents created at the start of the project by the project manager and is then used by the project manager as a guideline on how to communicate with stakeholders (both internal and external to the project) during the project. So, this document contains such information as: the different types of stakeholders in the project, whether they support or oppose the project, the type (format) of information to communicate, when and how often to communicate, etc. In other words, the Communication Management Approach facilitates engagement with stakeholders through the establishment of a controlled and bi-directional flow of information.

4.9.3. Roles and responsibilities

The Project Manager, and Sponsor (IAEA) will all play key roles in communication for this project. As such, the project sponsor and manager, must be aware of their responsibilities to ensure that the transfer of information and communication in general is executed on a level that will reduce the risks and the delivery of the deliverable for the project. The documentation of findings and status of the project is the primary responsibility of the Project Manager, using the tools and medium allotted for communication to ensure that all the stakeholders are up to date on the activities of the project.

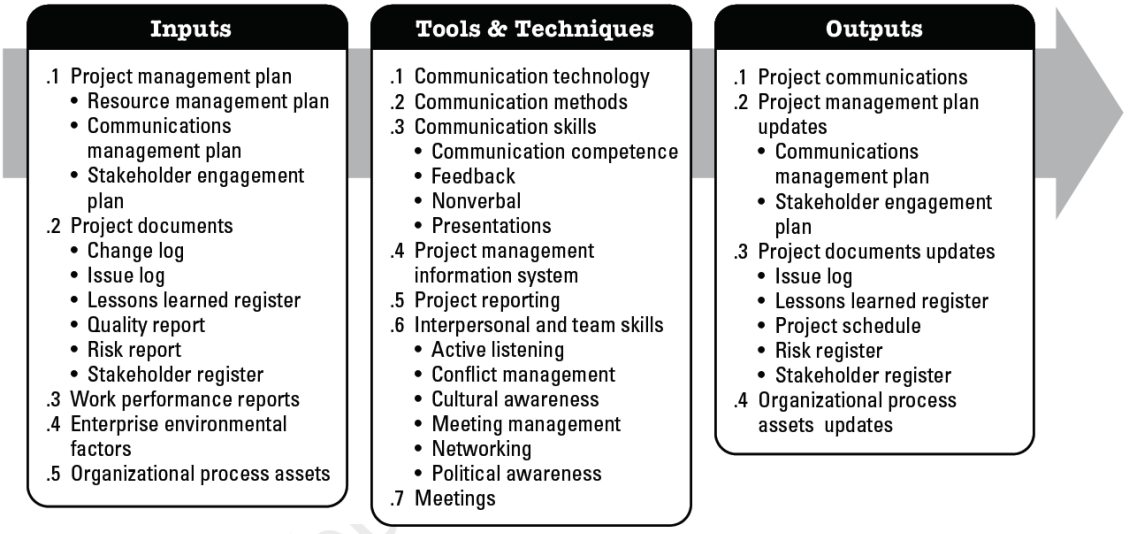
Chart 23. *Communication plan roles and responsibilities. (Source: J. Joseph, (May 2021))*

Name	Role	Responsibilities
IAEA	Project Sponsor	a. Approve the means of communications set forth by the Project manager.
		b. Evaluate need for change in communication strategy
		c. Accept communication method being used
Jeffery Joseph	Project Manager	a. Measure and verify the method of communication to be used
		b. Facilitate input from stakeholder in method of communication to be used.
		c. Facilitate assessments of communication method/s being used.
		d. Organize and facilitate meetings
		e. Communicate outcomes meetings to stakeholders
		f. Update project documents and issue reports on such documents.
Assistant Project and Project Team	Coordinators of Institutions	a. Participate in defining communication strategies.
		b. Evaluate the need for proper and meaningful communication.
Stakeholders	Field Officers, Laboratory technicians	a. Can propose communication changes
		b. Will execute meetings and reports requested by Project Manager

4.9.4. Tools and Techniques

Plan Communications Management is the process of developing an appropriate approach and plan for project communications activities based on the information needs of each stakeholder or group, available organizational assets, and the needs of the project. The key benefit of this process is a documented approach to engage stakeholders effectively and efficiently by presenting relevant information in a timely manner. This process is performed periodically throughout the project as needed. It is sometimes said that 90% of what a project manager does on a project has to do with communications of one form or another. The process of creating of a communications plan, therefore, is a very important process, and should be taken as seriously as the creation of a schedule or budget of a project. Communications management tools and techniques is all about describing the tools required to plan and manage communications in the project. In a very simple terminology what is communication all about? Eventually communication is nothing but information exchange between two or more entities. Communications management is all about planning, managing, and controlling communications on your project. As part of communications management planning, you would also calculate the number of communication channels require in the project, so that every relevant stakeholder gets the information he needs.

Figure 27. *PMBOK® Guide Plan Communication Management. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.9.5. Stakeholders

Chart 24. *The major Stakeholders for this project. (Source: J. Joseph, (May 2021))*

STAKEHOLDERS		
Institutions	Acronym	Description
International Atomic Energy Agency (Project Sponsor)	IAEA	The International Atomic Energy Agency is the world's central intergovernmental forum for scientific and technical co-operation in the nuclear field. It works for the safe, secure, and peaceful uses of nuclear science and technology, contributing to international peace and security and the United Nations' Sustainable Development Goals.
Ministry of Agriculture, Food Security and Enterprise (Project Sponsor)	MoAFSE	Under the leadership of Hon. Jose Abelardo Mai, Minister of Agriculture, Food Security and Enterprise, have the role ensuring and promoting that agriculture plays a critical element in the Belizean economy. Increasing local production and reducing the food import bill.
Sugar Industry Research and Development Institute	SIRDI	The Sugar Industry Research and Development Institute (SIRDI) is an organization established by the Sugar Industry ACT of 2001. The mandate of the SIRDI is well defined in the objectives of the institute under the Sugar Act (2001) and includes the following: research, develop and adopt technological innovations and production options for the benefit of the industry.
Caribbean Agricultural Research and Development Institute	CARDI	The Caribbean Agricultural Research and Development Institute (CARDI) is an autonomous organization serving the states of the Caribbean Community (CARICOM), to provide an appropriate agricultural research and development service for the agricultural sector of all member states.

University of Belize	UB	University of Belize is dedicated to fostering Belize's development by producing graduates who are socially and ecologically responsible, analytical, self-confident, disciplined, ethical, entrepreneurial, and skilled communicators and who are committed to using these skills and values for Belize's enrichment.

4.9.6. Communication Delivery Methods and Technologies

The primary communication vehicles are e-mail, phone, face-to-face (personal communication), meetings, reports, presentations, and announcements.

- E-mail, handwritten correspondence in personal and business interactions are gradually paving the way for email messages. In the business sphere, email messages are utilized to communicate ideas with clients and employees. Email messages are also used by learning institutions to communicate to parents and students on issues of interest to the parties. Email messages have captured the interests of many users, especially due to the ability to get prompt and immediate feedback among communicating parties. Notably, using other written correspondence take time for the message to reach the intended recipient and the response from the latter takes the time to reach the other party. Email messages are also cost friendly to the users as most providers offer free accounts. The project manager will use this medium to communicate arising matters to the staff, funding agency and stakeholders that were deemed important for receiving the information being transferred. The information that is being transmitted via this medium is to inform and to ask for personal opinions on the subject at hand.

- Phone, the use of this communication device will be use when communicating is urgent and the actors that should be involves are not in proximity. The message being transferred will be done person to person and confirmation of receiving the information can be confirmed with one question, 'Do you understand the task being ask'. Technological advancement has resulted in the improvement of cellphones that support video calls. Possibly, cell phones are the most widespread way of communication owing to the ease of accessibility and availability of phones to

many people. Almost everyone in the world owns a phone, which is basically used for communication.

- Face to face, this will be the forum use for most of the stakeholders' meetings. Where the exchange of ideas and the prospective of all involved in the project can register their opinion of the day-to-day activity of the project, they can mention the possibility of risk, methods on improving the project and its deliverable, etc.
- Meetings will be used for stakeholder activities and for updating the project sponsors on the status of the project. As well as all the queries that are deemed important by al the stakeholders. Meetings due to the presence of the Covid pandemic, will have to be at times virtual.

4.9.7. Communication Standards

There are currently no organizational communication standards.

The main five communication types in project management are verbal, non-verbal, writing, visual, and listening. These types transform into five efficient project communication methods: emails, instant messages, meetings, voice calls, and request tickets.

I will be suggesting that our primary means in communicating will be via email and face to face where the minutes of the meeting will be recorded. These two methods in our present situation with the global pandemic will be adequate to get the project going and keeping the communications within all the stakeholder a very productive one.

4.9.8. Communications Matrix

See the Communications Matrix attached. Communication Matrix is a portion of the communication Plan deliverable. It is simply a table that lays out the list of stakeholders and details the type of project communications that will be used and the frequency they will be delivered. it also lays out the format of the delivery.

A communication management plan for the N15 Isotope project is presented in a communication matrix. The communication matrix consists of the type, the deliverables, the

description, the methods, the frequency, the personnel responsible to initiate communication, and the audience (stakeholders).

Project Team Communication Matrix						
	Deliverable	**Description**	**Delivery Method**	**Frequency**	**Responsible**	**Stakeholders**
Personal Communication	Project updates	Regular communication	E-mail Virtual	Needs basis	IAEA	MoAFSE, SIRDI, CARDI
	Project updates	Regular communication	E-mail Virtual	Needs basis	MoAFSE, SIRDI	IAEA
	Project updates	Regular communication	Telephone Calls E-mail Face to Face Meetings	As needed	MoAFSE, SIRDI	Stakeholders
	Training	Technology transfer / training	Telephone Calls E-mail face to face	Daily	IAEA	MoAFSE, SIRDI, CARDI
Reports	Project status report (Project Process)	Regular update on critical project issues	E-mail	Weekly	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	Quality audit report	Regular updates on project quality performance	E-mail	Bi- monthly	Project Manager and IAEA	MoAFSE, SIRDI
	Financial report	Regular updates on project finances	E-mail	Weekly - Friday	Project Manager and IAEA	MoAFSE, SIRDI
	Task report	Regular updates on critical project issues pertaining to the team	E-mail	Weekly - Every Monday morning after Team meeting	Project Manager	IAEA MoAFSE, SIRDI
Presentations	Project review	Project status updates	Meeting	Monthly	Project Manager	IAEA MoAFSE, SIRDI
	Final account	A complete audit of project finances from the project, done at the end of the project. In addition to operational costs' projections.	Meeting	Once	Project Manager and IAEA	IAEA MoAFSE, SIRDI, CARDI
Project Announcements	Task reminders	Task schedule reminders	E-mail	Daily	Project Manager	IAEA

	Change Request/Orders	Request to add or remove scope from the project.	Written (Standard Form)	Needs basis	Project Manager and IAEA	IAEA MoAFSE, SIRDI, CARDI
	Project updates	Project updates for Stakeholders	Written	Needs basis	Project Manager and IAEA	IAEA MoAFSE, SIRDI, CARDI
Reviews and Meetings	Team meeting	Meeting to review project status	Planning Meeting	Weekly First thing Monday morning	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	Financial report	Regular updates on project finances	Progress Meeting	Monthly	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	Project status meeting (project Process	Regular updates on critical project issues	Progress meeting	Bimonthly	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	Planning	Regular updates and project planning	Progress and Planning meeting	Daily	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	Consultant meetings	Technical planning session to collaborate on work schedules and delays, etc.	Planning meeting	By request	Project Manager and/ or IAEA	IAEA MoAFSE, SIRDI, CARDI
	Site Meeting	Regular updates and project planning	Progress/Planning Meeting	Monthly	Project Manager	IAEA MoAFSE, SIRDI, CARDI
	External Regulatory meeting	Meeting at the request of government Regulatory Agencies	Meeting	By request	Project Manager and/or IAEA	IAEA MoAFSE, SIRDI
Team Morale	Team event	Regularly schedule team moral events	Event	Quarterly	Project Manager and/or IAEA	IAEA MoAFSE, SIRDI, CARDI

4.9.9. Monitoring Communication

Monitor Communications process makes sure that every stakeholder gets the information they are supposed to get at the time they are expecting it and using the method they are supposed to get it by (as defined in the communication plan and stakeholder management plan). Monitoring is the process of establishing checkpoints to make sure that you are on the right track. This means that you must establish a system for recording, on a regular basis, useful information for keeping track of the activities and progress being made towards the set objectives. Whenever something is going wrong, monitoring should provide basis for taking the best course of action to correct the situation. Monitoring is complementary to the organization of the work plan since it is supposed to identify indicators for measuring the success of the activities and determining the checkpoints to assess the project progress. This project management activity may discover shortcomings in communications. Monitoring should begin as soon as the project is being originated and it should occur in all the phases of the communication process. During the research phase monitoring ensures that the identified community NOPS will be analyzed and prioritized appropriately. During the planning phase monitoring provides indicators to closely check the feasibility and the way the project is supposed to progress. During the implementation phase monitoring measures, the effectiveness and the relevance of the activities being carried out. It is important that the indicators for monitoring the process be established and agreed upon with the community. This ensures the participatory nature of the program and avoids differences and misunderstandings in the expected outputs.

How does monitoring occur? First and foremost, you need to identify indicators that will serve as checkpoints throughout the whole process. As usual indicators can be easily defined for activities resulting in physical outputs, but they are not so easy to define when dealing with other aspects not physically quantifiable. If in the work plan one of the outputs is to conduct a series of training workshops for at least, 80% of the farmers in the district an indicator is going to be the percentage of people trained. By getting statistical data on the farmers' population and counting the number of participants attending your workshops, you can easily monitor if you are achieving the intended result.

4.9.10. Project Reporting

Reporting in project management simply refers to providing a high-level overview that offers the critical data the project generates in a simple, easy-to-use format. Project reporting is essential to project management success since it provides a window into what's happening and what to do about it for the entire team. As the Project Management Institute's manual, A Guide to the Project Management Body of Knowledge (PMBOK Guide) explains, effective project communication requires planning, ongoing management, and monitoring and control processes carried out during the entire project. The creation of regular project reports on the progress of the project in terms of content, schedule and costs is a core task of project reporting. The aim is to prepare current information in condensed form as a basis for decision-making for a defined target group. Project reporting is the formalized recording of project progress and (interim) project results. Based on a target/actual comparison of the individual controlling aspects, project status reports are created and presented to a defined target group. This usually consists of the project manager, the project client and (if available) the steering committee.

The project reports are to be prepared regularly at intervals to be defined. Even if there is supposedly nothing to report, this must be "reported" accordingly. These intervals should be the same for all projects, a gradation according to the size of the project should rather be based on the content (degree of detail). Deviating reporting intervals of a project should only occur in exceptional situations. To ensure structured and sustainable project reporting, a uniform PM process (at least all reporting activities) will be defined and introduced.

4.10. PROJECT STAKEHOLDER MANAGEMENT PLAN

THE USE OF NUCLEAR AND ISOTOPIC TECHNIQUES FOR OPTIMIZING THE USE OF NITROGEN FERTILIZER IN RAIN FED AGRICULTURE SYSTEMS.

4.10.1. Introduction

Stakeholder Management includes the processes required to identify the people, groups and organizations that could affect or be affected by the project, to analyze

stakeholder expectations and their impact on the project, and to develop appropriate strategies and tactics for effectively engaging stakeholders in a manner appropriate to the stakeholders' interest and involvement in the project. The Stakeholder Management Plan helps ensure that stakeholders are effectively involved in project decisions and execution (PMBOK 6th Edition) throughout the lifecycle of the project, to gain support for the project and anticipate resistance, conflict, or competing objectives among the project's stakeholders.

Project Stakeholder Management was the last process to be conducted of the initiation process group. To conduct Project Stakeholder Management, the stakeholders involved with the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems project were identified using the inputs, and tools and techniques in figure taken from the PMBOK® Guide. As such, the agreement between the Ministry of Agriculture Food Security and Enterprise, SIRDI and CARDI, the agreement with IAEA and the initial list of stakeholders outlined in the project charter were reviewed by the SIRDI and the MoAFSE and the IAEA expert, to develop a more complete stakeholder register (Project Management Institute, 2013, p. 393).

4.10.2. Stakeholder management approach

The Stakeholder Management Plan includes several sections:

- Identify Stakeholders – identify by name and title of the people, groups, and organizations that have significant influence on project direction and its success or who are significantly impacted by the project.
- Plan Stakeholder Management – identify the strategies and mechanisms that will be used to achieve the greatest support of stakeholders and minimize resistance.
- Manage Stakeholder Engagement – outlines the processes and steps that will be undertaken to carry out the planned strategies.

- Control Stakeholder Engagement – describes the methods that will be used to monitor stakeholder engagement and alert the project team if problems are surfacing.

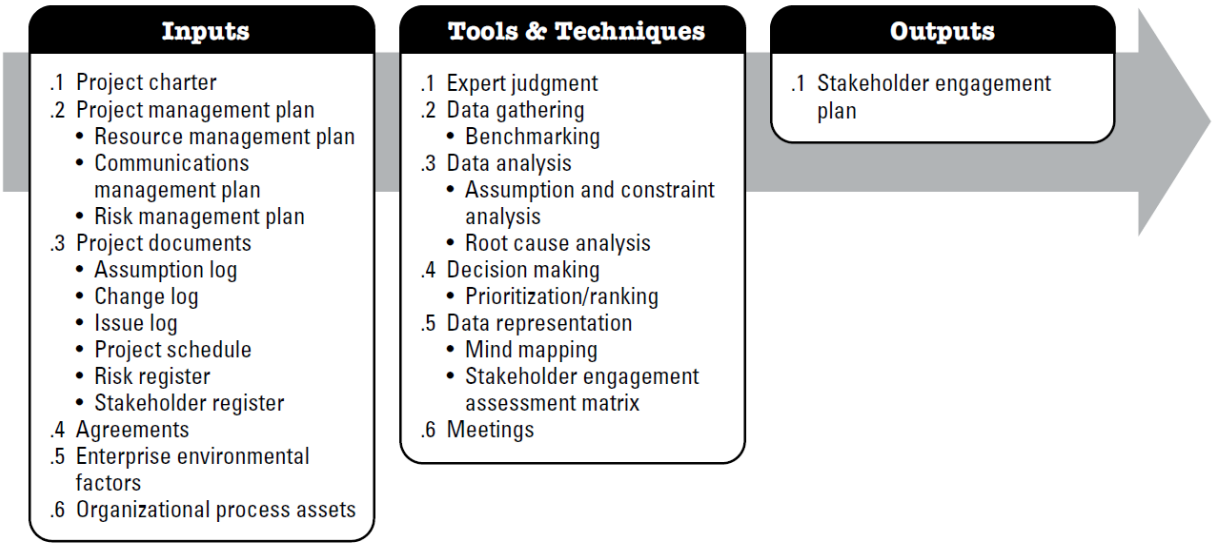
4.10.3. Roles and responsibilities

The Project Manager, MoAFSE, SIRDI, CARDI, and Sponsor (IAEA) will all play key roles in Stakeholder management plan for this project. As such, the project sponsor and manager and the entire project execution team, must be aware of their responsibilities to ensure that the transfer of information and communication to the stakeholders to ensure that they are engage in the process that will ultimately benefit them financially.

4.10.4. Tools and Techniques

According to PMBOK, Plan Stakeholder Engagement is the process of developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project. The key benefit is that it provides an actionable plan to interact effectively with stakeholders. This process is performed periodically throughout the project as needed. As with other planning processes, there are “generic” tools and techniques that are used in practically all knowledge areas, such as expert judgment, decision making, and meetings. You talk to the people who know about your knowledge area, you get together with your project team in meetings, and you make decisions about what goes in the management plan. Now there are some techniques which are specific to this knowledge area, the most important of which is the stakeholder engagement assessment matrix, which together with the stakeholder register will be the workhorse of not just this process, but all other processes in this area.

Figure 28. *PMBOK® Guide Plan Stakeholder Engagement. Reprinted from A Guide to the Project Management Body of Knowledge, Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc*



4.10.5. Identify Stakeholders

To develop an effective plan for managing stakeholders, they first need to be clearly identified and assessed. Stakeholders will be identified by performing a stakeholder analysis in which potential stakeholders and relevant information (interests, involvement, interdependencies, influence, and potential impact on project success) are gathered, documented, and analyzed. (PMBOK 6th Edition). To assist with stakeholder identification and analysis, the team has created and is completing a Stakeholder Analysis Register categorized by Stakeholder Group.

The Stakeholder Analysis Register captures the following information

- Group Name
- Number of Stakeholders in the Group
- Description of the Group
- Level of Impact on the Project
- Level the Group is Impacted by Project
- Current Change Readiness State

- Desired Change Readiness State
- Issues, Opportunities and Risks associated with each group
- Strategies and Actions to address issues, risks, and opportunities
- A snapshot from the Stakeholder Analysis Register is provided.

Take note: Impact is measured by High (H), Medium (M) or Low (L). State of change readiness is assessed using the measures from PMBOK as follows:

S – Supportive – aware of the project and the potential changes and impacts and is supportive

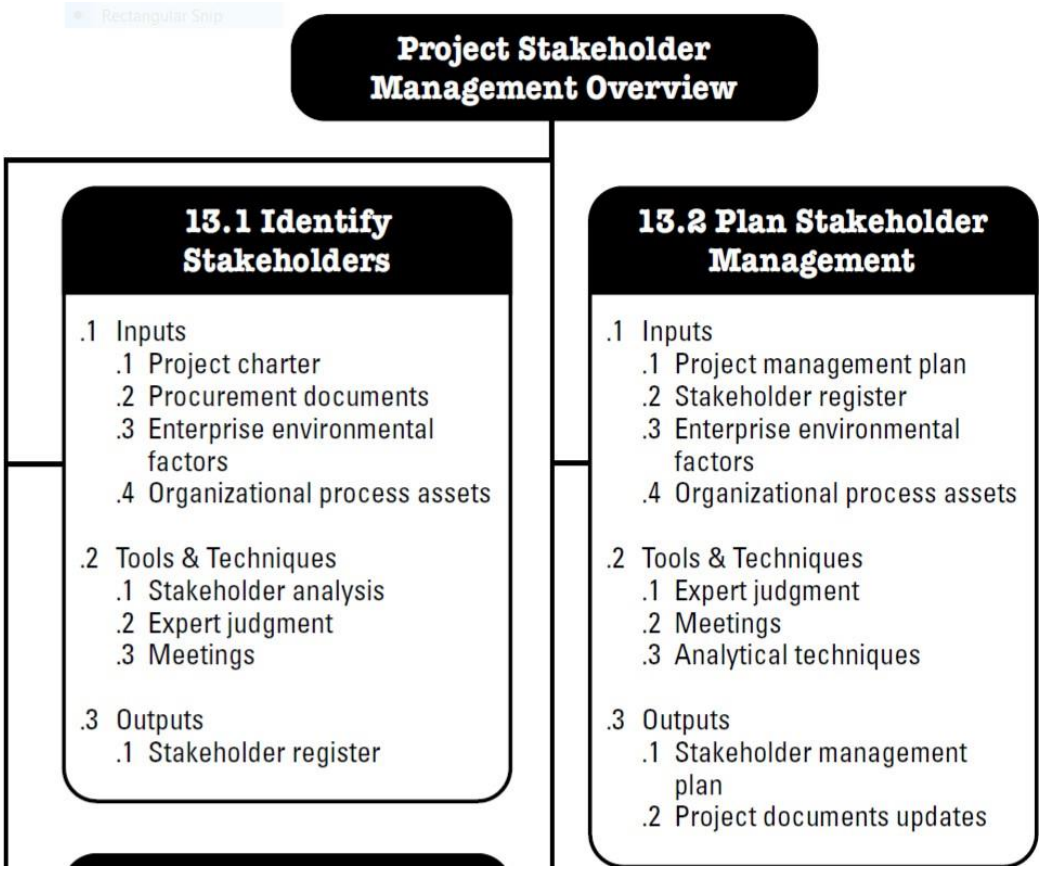
L – Leading – aware of the project and actively engaged to ensure the project's success

Chart 25. *Stakeholder analysis registry. (Source: J. Joseph, (May 2021))*

Group Name	# In group	Description & Key attributes	Impact on Project	Impacted by Project	Current State	Desired State	Issues, Opportunities and Risks	Mitigation Strategies and Actions
IAEA	3	Technical capacity	H	H	L	L	Issue: the covid pandemic and the government of Belize's funding	Mitigate through signed contracts of and funds payment
MoAFSE	7	Decision makers and Field Officers (trainees)	H	H	L	L	Opportunities: To create and develop a national soil and tissue laboratory for Belize Agricultural sectors	Incentivize (Human Resource Management)
SIRDI	7	Field Officers Laboratory technicians (trainees)	H	H	L	L	Risk: Trained personnel leaving institute after training.	Incentivize (Human Resource Management)
CARDI	3	Director and Field Officers	L	H	S	L	Opportunities: Develop to produce legumes and other crops	Incentivize (Human Resource Management)
University of Belize	N/A	Contracted professional	L	L	S	S	Opportunities: the development of student capacity in laboratory setting with	Training of multiple personnel and UB students in

							knowledge of NIT	laboratory techniques
Sugarcane Farmer Associations	N/A	Execute findings within fields	L	H	S	S	Opportunity: International products	
Grain Farmer Associations	N/A	Execute findings within fields	L	H	S	S	Opportunity: International products	

Figure 29. *PMBOK® Guide: Stakeholder Management Planning Processes Overview. Reprinted from A Guide to the Project Management Body of Knowledge (p. 392), Project Management Institute, 2013, Project Management Institute. Copyright 2013 by Project Management Institute, Inc.*



Following the steps described in the *PMBOK Guide*® - outlined in figure 29, after identifying the potential stakeholders, the relevant information regarding “roles, departments, interests, expectations, and influence levels” (Project Management Institute, 2013, p. 396) were detailed as seen in the chart 25.

Chart 26. *Stakeholder Registry. (Source: J. Joseph, (November 2021))*

Project Name: The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems **Prepared by: J. Joseph October 21, 2021**											
ID	Name	Organization	Role	Title	Contact Information	Communication Types	Communication Vehicles	Stake In Project	Influence	Perspective Regarding Project	Comments
0	N/A	IAEA	Financier & key decision maker	Consultant/ Trainer	N/A	Meetings Personal Communication Reports Presentation Announcements	E-Mail virtual meeting	Has high interest in the project and is responsible for the funding of the project. Is most critical throughout enter project	High	Positive	Suggested the project with Belize
1	Jose Abelardo Mai	MoAFSE	Key Decision Maker	Minister of Agriculture, Food Security and Enterprise	N/A	Meetings Personal Communication Reports Presentation Announcements	E-Mail Telephone Face to Face	Has high interest in the project and is highly involved in decision making. Is most critical throughout the project lifecycle.	High	Positive	
2	Dr. Victoriano Pasqual	MoAFSE	Project leader	Director Water Management and Climate Change	dir.wmcc@agriculture.gov.bz	Personal Communication	E-Mail	Has high interest in the project and is highly involved in decision making.	Med	Positive	
3	Ina Iris Sanchez	MoAFSE	Research & Innovation Program	Coordinator	ina.sanchez@agriculture.gov.bz	Meetings Personal Communication	E-Mail Face to Face Virtual	Has high interest in the project and is responsible for designs. Is critical throughout the project	High	Positive	

4	Dr. Luciano Chi	SIRDI	Research and development for sugarcane production	Coordinator	luciano.chi@sirdi.bz	Meetings Personal Communication	E-Mail Face to Face Virtual	Has high interest in the project and has responsibility of managing fertilizer application research.	High	Positive	
5	Jeffery Joseph	SIRDI	Agricultural Engineer	Coordinator	jeffery.joseph@sirdi.bz	Meetings Personal Communication	E-Mail Face to Face Virtual	Has high interest in the project and has	High	Positive	
6	Omaira Avila	CARDI Belize	Research and Innovation	Country Representative	OAvila@cardi.org	Meetings Personal Communication Reports Presentation Announcements	E-Mail Face to Face Virtual	Has high interest in the project focusing on corn producers	High-Med	Positive	
7	N/A	University of Belize	Research	Research	N/A	Meetings Personal Communication	E-Mail Telephone Face to Face	Has high interest in producing students with the understanding of NIT	Mid - Low	Positive	
8	N/A	Sugarcane Associations	Project and Research division	Director	N/A	Meetings Personal Communication	E-Mail Telephone Face to Face	Has high interest in the project, has responsibility in informing the sugarcane farmers	High-Med	Positive	
9	N/A	Belize Grain Producer Association	Research and Innovation	Director	N/A	Meetings Personal Communication	E-Mail Telephone Face to Face	Has high interest in the project and has responsibility for following technical specifications and industry	High-Med	Positive	

Chart 27. *Stakeholder analysis and level of engagement. (Source: (J. Joseph October 2021))*

Project Name: The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems					
Stakeholder Name/Group:	**Key interests or stake in the change and degree of impact (H, M or L?)**	**Level of influence over the change (H, M or L?)**	**Present attitude to the change (in favor or opposed?)**	**Stakeholder management strategies**	**Key points for Stakeholder Engagement and Management Plan**
IAEA	Interest High Impact High	H	Favor	Consult, involve and keep informed	Two-way engagement essential
MoAFSE	Interest High Impact High	H	Favor	Consult, involve and keep informed	Two-way engagement essential
SIRDI	Interest High Impact High	H	Favor	Consult, involve and keep informed	Two-way engagement essential
CARDI	Interest High Impact Medium	M	Favor	Involve and keep informed	One-way communication and support essential
University of Belize	Interest High Impact High	M	Favor	Involve and keep informed	One-way communication and support essential
Sugarcane Associations	Interest High Impact High-Medium	M	Favor	Involve and keep informed	One-way communication and support essential
Grain Producers Association	Interest High Impact High	M	Favor	Involve and keep informed	One-way communication and support essential
Suppliers	Interest High Impact High	M	Favor	Consult, involve and keep informed	One-way communication and support essential

Stakeholder Analysis involved the review of the data compiled in Chart 8**,** the Stakeholder Register, to identify the relevant information required to select the appropriate management strategies and level of engagement for each stakeholder (some are grouped by type) identified in Chart 9**:** Stakeholder Analysis and Level of Engagement. Stakeholder analysis (stakeholder mapping) is a way of determining who among stakeholders can have the most positive or negative influence on an effort, who is likely to be most affected by the effort, and how you should work with stakeholders with different levels of interest and influence.

4.10.6 Purpose of Stakeholder management plan

An important outcome of the stakeholder identification and analysis work, includingthe Power/Interest Grid, is to identify the most influential and most impacted stakeholder groups so that a focused stakeholder management strategy and plan can be developed and executed. This project is primarily training and capacity building of field officers and laboratory technician to improve the use of fertilizer and thus protect the environment when needed.

5. CONCLUSIONS

1. The project is designed to produce sustainable avenues in the enhancement of the agricultural sector of Belize. Although the focus is primarily to produce sugarcane and corn, the information as well as the methodologies executed can be used to transform other crops within the agriculture sector. Project managers or project management methodologies can ensure that a project future concludes with positive results that were the objectives of the project when consulted in the early phase on project development.

2. The Project Charter was the first subsidiary element of the Project Management Plan, created as the deliverable for specific objective number one. Using a template as a guide, to capture and organize the country's needs and objectives, project description, preliminary scope statement, initial project risks, project deliverables, summary milestones, and project budget, the Project Charter also included identification of the project manager and the sponsor's authorization for the project to commence. Developing the project charter illustrated the need for project managers to be present from the inception of project development. Selecting and developing the deliverable that would be essential to the overall outputs of the project. A project manager that understands the project from the onset of the creation of the project document is quite beneficial for the execution of the project.

3. To define and specify the scope of the project, the Scope Management Plan, the deliverable created for specific objective number two, along with the WBS, WBS dictionary, Requirements Management Plan, Requirements Document, and Requirements Traceability Matrix, were developed from a table or template, capturing the information gathered from the project document created by the IAEA and the project stakeholders. This section was where project requirements were defined. It is also where sustainable objectives can be infused into the general objective of the NIT project objectives. The study or researching in the uptake of nutrient by plants and the method in analyzing that process will provide great benefits in reducing the cost of production and the effects agro-chemicals have on the environment.

4. The Schedule Management Plan, the output from specific objective number three, was created along with the Activity List, Schedule Network Diagram, and Resource Assignments table, to adequately identify each project activity to ensure the project's completion within the time constraints. Schedule management correlates to the coordination of the project and the effectiveness of the project execution and to ensure that planned activities are in sequence and done on time with minimum wastage. This scheduling for this project needs a more detailed insight to reach a satisfactory baseline.

5. To create the Cost Management Plan, the output from specific objective number four, a template in Microsoft Excel was used to adequately develop the project budget, and a template was used to capture the Cost Management Plan which will guide the development of cost management performance measures and documents such as the Cost Baseline and the Project Funding Requirements. This project requires a more detailed analytical insight to its budget. Not much detailing of the items that will be purchased within this project was properly arranged in the budget.

6. To develop the Quality Management Plan, the output from specific objective number five, a template was used to identify the project's quality management approach, quality requirements/standards, quality assurance, quality control, and the quality control measure that will be used throughoutthe project, to ensure that quality was built into the project's training processes and product. The life cycle of the project has indicated that the objectives are consistent with the improving of the agricultural sector, the role of the IAEA within the project automatically proves that the project is noteworthy, and the execution of the project should produce the increase capacity of the field officers and lab technicians that will participate in the capacity building project.

7. The human resource management plan demonstrates what the project will require from the human component of the project. The project will be a training of field officers and lad technicians that are present employed under the government of Belize Agricultural

extension unit, the Sugar Industry Control Board and the Caribbean Agriculture Research and Development Institute. The role of the IAEA personnel is to facilitate the training and overall capacity development of Belize's technical officers to the use of NIT.

8. To fulfil specific objective number seven, the Project Communications Plan,a template was used along with a list of all stakeholders and their roles and responsibilities. In addition, a Communications Matrix was developed, detailing all project stakeholders (names/titles, information, format) throughout the project lifecycle, and ensuring that the information disseminated during the project is done so at the right time, in the right format, to the right people and by the right person. With the onset of the covid pandemic, the mode of communicating has changed considerably, and the use of electronic, virtual meeting software will be relied upon more heavily within this project.

9. The deliverable for specific objective number eight, the Risk Management Plan, was created using a template. Additionally, to capture and classify project risks, so that effective risk responses could be planned, a Risk Register was developed along with a qualitative risk analysis. Quantitative Risk Analysis was not performed during this process as the tools were not available for use. Note that all risks have a degree of probability of occurrence and are likely to have an impact on one or more project objectives. The seriousness of the impact will decide the type of risk strategies to b use and the level of contingencies to add to the project budget.

10. The Procurement Management Plan deliverable, created for specific objective nine, was developed using a template to identify the project's procurement management approach, it was not fully developed since the procurement procedure that most of the project material will be procured by the IAEA. The procurement requires more information for it to be effective for the project execution. The lack of information from the project sponsor in sharing their procurement protocols have somewhat hamstringed the outlook on the completion of the overall procurement plan.

11. The Stakeholder Management Plan, developed for specific objective ten, was also developed using a template. In addition to the plan, which details how stakeholders will be identified, classified, managed, and engaged throughout the project, the Stakeholder Register and Stakeholder Analysis and Level of Engagement were also developed to provide more information for effective stakeholder engagement. The importance of stakeholder for the successful execution of any project is paramount, and this project will be communicating with all key stakeholders to ensure the sustainability of the project. The fitting of a soil analysis laboratory will require the buy-in from all the agricultural sectors of Belize.

6. RECOMMENDATIONS

1. IAEA and the MoAFSE should employ a project manager or Project Management team to increase the likelihood of project success in the completion of NIT projects.

2. IAEA and the MoAFSE should develop standard project management initiation and planning documents prior to the execution of building projects.

3. All projects managed by the government should be headed by a project management team, using developed standard project planning documents tailored for the project.

4. The MoAFSE and IAEA should invest in the tools required to complete quantitative risk analyses for all projects.

5. The MoAFSE and IAEA should use a Project Management Guide or Framework to direct the development of all project management tools.

6. The MoAFSE and IAEA project management team should exercise care and caution during the development of each subsidiary plan of the Project Management Plan to ensure that all planning subsets for each knowledge area or respective application area are thorough and accurate.

7. The MoAFSE and IAEA project management team should utilize a document management and storage system, to organize and store all documents created for future use and review.

8. The MoAFSE and IAEA should ensure that the project team be selected and in place prior to the execution of any project and ensure that this team conduct all project planning related activities to enhance the proper management of the project during its lifecycle.

9. The project management team of IAEA should consider the use of the planning process and templates created during the development of the Project Management Plan for training in the use NIT, as a basis for implementing a methodology to be used by the Government of Belize for future projects of similar relevance.

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APPENDICES

Appendix 1: FGP Charter

PROJECT CHARTER	
Date:	**Project Name:**
January 1, 2022	The use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rain fed agriculture systems.
Knowledge Areas / PM Processes:	**Application Area (Sector / Activity):**
Knowledge areas: Integration, Scope, Time, Cost, Quality, Resource, Communication, Risk, Procurement and Stakeholder. **Process groups:** Initiation, Planning, Execution, Monitoring & controlling, Closing	Agricultural water and soil management
Project Start Date:	**Project Finish date:**
January 1, 2022	December 29, 2023
Project Objectives (General and Specific):	
General Objective: To develop a Project Management Plan for efficient cropping systems through the adoption of novel isotope techniques that helps to improve productivity and reduce the impact of agro-contaminants in the environment Project. **Specific Objectives:** 1. To create the Project Charter to define the key input elements to develop the Project Management Plan. 2. To develop the Scope Management Plan to ensure that the project includes all the work required to complete the project successfully.	
3. To develop the Time Management Plan to ensure which tasks can be adjusted and how the resources will be allocated and managed throughout the project.	
4. To develop the Cost Management Plan to be able to continuously evaluate costs and ensure the project is completed within the budget.	

5. To develop the Quality Management Plan to identify the requirements and ensure the successful completion of the project.

6. To develop the Resource Management Plan to manage the efficient and effective use of technical capacity building and training.

7. To develop the Risk Management Plan to identify, analyze, respond, and monitor risk on the project.

8. To develop the Procurement Management Plan to ensure that any entity that will deliver these tasks or services have a set well defined protocol in doing so.

9. To develop the Communication Management Plan to ensure the stakeholders who need to know what and when before the project starts are identified.

10. To develop the Stakeholder Management Plan to identify, analyze and manage stakeholder expectation and impact on the project.

Project purpose or justification (merit and expected results):

The aim of this Final Graduation Project (FGP) is to create a Project Management Plan that will eventually guide the project execution to maximize its success chances. Given that the Institute have had successful project experiences in the past with hiring of outside personnel to manage the project, the creation and use of the project management plan will develop in house personnel to better define project objectives, success criteria, resources allocation, and in general plan everything that is needed for the project success. In addition, this Project Management Plan will become the Institute's organizational asset that might be use as the basis for future project plans.

The project for the use of Nuclear and Isotopic Techniques for optimizing the use of nitrogen fertilizer in rainfed agriculture systems is critical for the country's agricultural development and the reduction of agricultural contaminants into the soil and waterways. This Project management plan must be professionally managed to fulfil the social, economic, environmental, and cultural needs of the country's agricultural stakeholders. A precise and well develop Project Management Plan for the Final Graduation Project can eventually be use for the actual project and its execution.

Description of Product or Service to be generated by the Project – Project final deliverables:

The Final Graduation Project (FGP) will provide a comprehensive project management plan with all its subsidiary management plans. The Project Management Plan will address all good practices recommended in appropriate bibliographical sources such as the Project Management Body of Knowledge (PMBOK 6th Edition). Specific Deliverable Associated with each specific objective include: 1. Project Charter, 2. Scope Management Plan, 3. Time Management Plan, 4. Cost Management Plan, 5. Quality Management Plan, 6. Resource Management Plan, 7. Risk Management Plan, 8. Procurement Management, 9. Communication Management Plan, 10. Stakeholder Management Plan. The complete development of these deliverables will ensure that the FGP criteria are met in the creation of a project charter. However, implementing this Management Plan into the project will drastically reduce crisis management and move the project into forward thinking and proactive decision-making. Refining and iterating them into the project will enhance the ability of managing the project and the people involved in them.

Assumptions:

1. It is assumed that all the required information to complete this FGP will be available when requested.
2. It is assumed that the Institute will provide all the project specific information on a timely manner and without any significant restriction to create the Project Management Plan.
3. It is assumed that the project is still deem as urgent (Priority) by the newly elected political party and there will be delay in the project execution.
4. It is assumed that the project meets the qualifications and requirements set for being a part of the FGP.
5. It is assumed that by 2022 travel band due to the global pandemic will be lessen and the project will start on the stated date for initiation.

Constraints:

1. Time: the pre-established timeframe stated by UCI for each one of the FGP development phases.
2. Quality: The material (project document) being used to create the FGP is incomplete and awaiting the final and complete project document.
3. Scope: the project is wide reaching and entails information both technical and scientific that may not become evident.
4. Project execution date is plan for January 2022, and the final project document have not been shared to all stakeholders.
5. The pandemic is restricting international travel and the expert for the training are in countries that are band from entering international traveling hubs.

Preliminary Risks:

1. If all the information needed to complete the FGP is not made available, it might cause the FGP to not be completed, influencing the final grade for the course.

2. If the institute do not provide the information on a timely manner, it might lead to not being able to develop an insightful Project Management Plan affecting the quality of work produce.

3. If the newly elected government do not see the benefit of the innovating project and remove its agricultural department from the project.

4. Project start date can be push to a later date due to the pandemic.

Budget:

The four-month timeframe in the development of the Project Management Pan for the FGP in relation to the project have a value of $5000.00 (five thousand US dollars).

Cost for developing each management plan $400.00 totaling to $4000.00.

Cost for writing and developing the project management Plan $1000.00 (literature review, communication, transportation, data collection and analysis).

Milestones and dates:

Milestone	**Start date**	**End date**
Final Graduation Project Start	May 10th, 2021	September 30th, 2012
Graduation Seminar	May 10th, 2021	June 6th, 2021
FGP Deliverables	May 10th, 2021	June 6th, 2021
Annexes	May 17th, 2021	June 6th, 2021
Tutoring Process	June 7th, 2021	August 8th, 2021
Reading by reviewers	August 9th, 2021	August 22nd, 2021
Reviewer’s work	August 23rd, 2021	September 5th, 2012
Adjustments	September 6th, 2021	September 25th, 2021
Presentation to Board of Exams	September 26th, 2021	September 30th, 2021

Relevant historical information:

The Sugar Industry Research and Development Institute (SIRDI) is an organization established by the Sugar Industry ACT of 2001. A “Board of Directors’’ composed of members appointed by the Minister administers the Institute. The mandate of the SIRDI is well defined in the objectives of the institute under the Sugar Act (2001) and includes the following: research, develop and adopt technological innovations and production options for the benefit of the industry. Establish norms and standards and provide technical services to the Sugarcane Production Committee (SCPC) for determining sugarcane quality. SIRDI and the SCPC both fall under the umbrella of the Sugar Industry Control Board (SICB).
Improving Productivity: Participatory methods as tools – Farmer Field Schools is one of the many projects SIRDI have work on with huge success. The Sugar Industry Research Institute of Belize (SIRDI) has developed the Farmer Field School (FFS) program (the “Program”) on the principles of learning through practical example and application. The flow of information in FFS is shared via theory (presentation or flip charts) and is reworked in practical exercises where there is fluid interchange of experience between farmers-farmers, farmers-Field Officers and Field Officers-farmers. These exchanges are the strength behind the FFS modules. With the use of the FFS as a method, SIRDI has evolved from a linear technology transfer model to a participatory implementation of sustainable sugarcane management, based on ecology and participation. The process must be participatory because each farmer not only has valuable knowledge to contribute, but also has critical knowledge gaps to fill. The group prioritizes thematic areas where they recognize weaknesses and use the exchanges as the avenue to solution identification. They test their new ideas in demonstration plots where they could learn new techniques and skills as a group.

Stakeholders:

Direct stakeholders:

International Atomic Energy Agency,

Ministry of Agriculture, Food Security & Enterprise,

Sugar Industry Research and Development Institute,

Caribbean Agricultural Research and Development Institute.

Indirect stakeholders:
University of Belize,

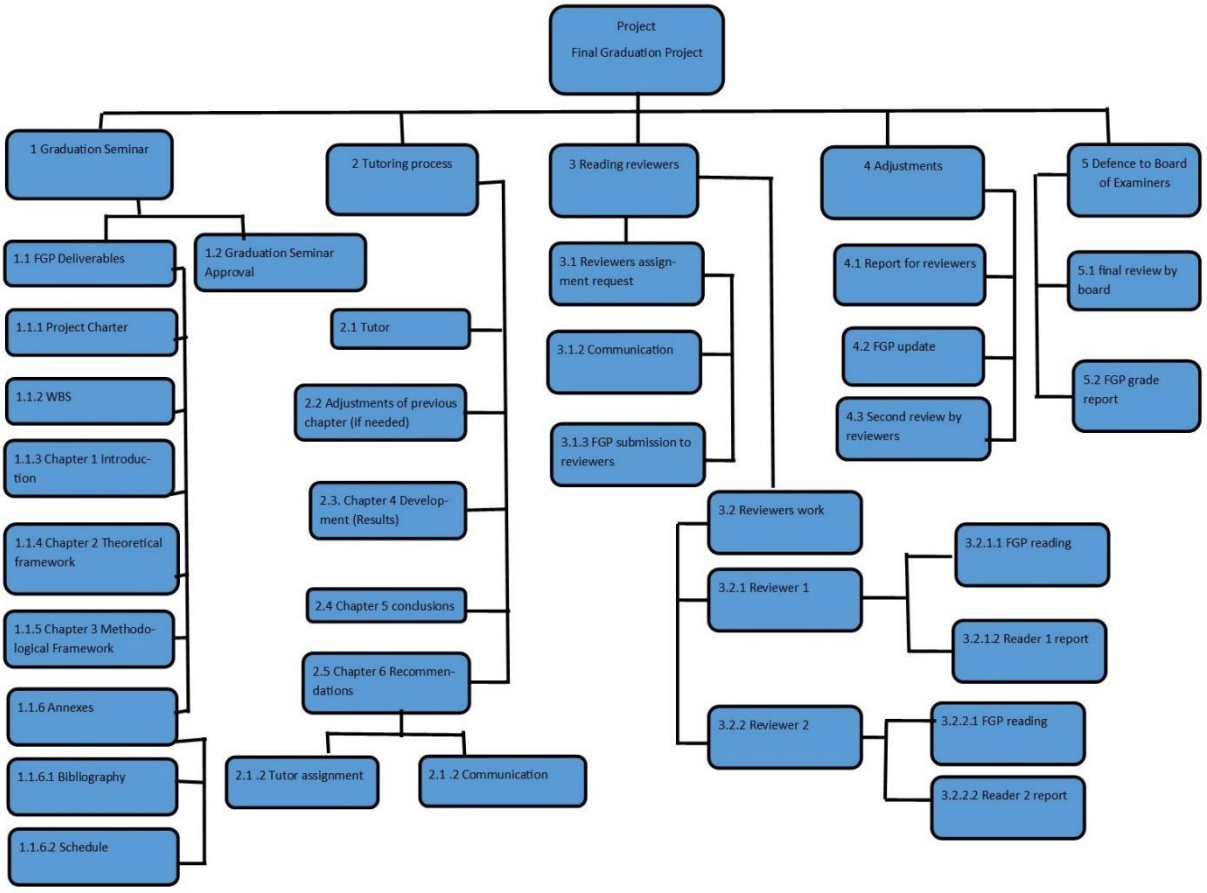
Sugarcane Associations of Belize,

Belize Grain Producers Association

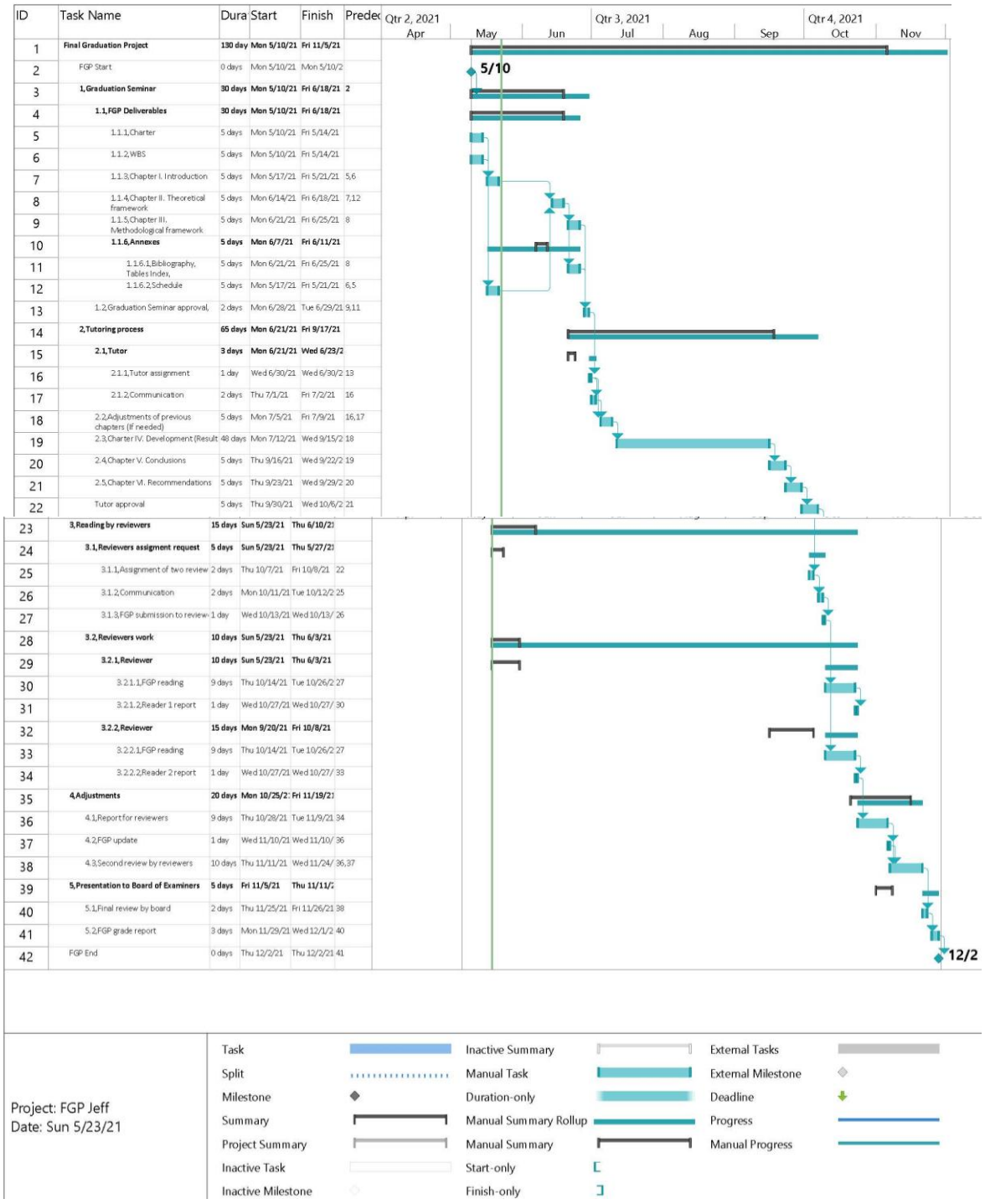
Approval:

Project Manager: Jeffery Joseph	Signature:
Authorized by:	Signature:

Appendix 2: FGP WBS



Appendix 3: FGP Schedule



ID	Task Name	Dura	Start	Finish	Predec
1	**Final Graduation Project**	**130 day**	**Mon 5/10/21**	**Fri 11/5/21**	
2	FGP Start	0 days	Mon 5/10/21	Mon 5/10/2	
3	**1,Graduation Seminar**	**30 days**	**Mon 5/10/21**	**Fri 6/18/21**	2
4	**1.1,FGP Deliverables**	**30 days**	**Mon 5/10/21**	**Fri 6/18/21**	
5	1.1.1,Charter	5 days	Mon 5/10/21	Fri 5/14/21	
6	1.1.2,WBS	5 days	Mon 5/10/21	Fri 5/14/21	
7	1.1.3,Chapter I. Introduction	5 days	Mon 5/17/21	Fri 5/21/21	5,6
8	1.1.4,Chapter II. Theoretical framework	5 days	Mon 6/14/21	Fri 6/18/21	7,12
9	1.1.5,Chapter III. Methodological framework	5 days	Mon 6/21/21	Fri 6/25/21	8
10	**1.1.6,Annexes**	**5 days**	**Mon 6/7/21**	**Fri 6/11/21**	
11	1.1.6.1,Bibliography, Tables Index,	5 days	Mon 6/21/21	Fri 6/25/21	8
12	1.1.6.2,Schedule	5 days	Mon 5/17/21	Fri 5/21/21	6,5
13	1.2,Graduation Seminar approval,	2 days	Mon 6/28/21	Tue 6/29/21	9,11
14	**2,Tutoring process**	**65 days**	**Mon 6/21/21**	**Fri 9/17/21**	
15	**2.1,Tutor**	**3 days**	**Mon 6/21/21**	**Wed 6/23/2**	
16	2.1.1,Tutor assignment	1 day	Wed 6/30/21	Wed 6/30/2	13
17	2.1.2,Communication	2 days	Thu 7/1/21	Fri 7/2/21	16
18	2.2,Adjustments of previous chapters (If needed)	5 days	Mon 7/5/21	Fri 7/9/21	16,17
19	2.3,Charter IV. Development (Result	48 days	Mon 7/12/21	Wed 9/15/2	18
20	2.4,Chapter V. Conclusions	5 days	Thu 9/16/21	Wed 9/22/2	19
21	2.5,Chapter VI. Recommendations	5 days	Thu 9/23/21	Wed 9/29/2	20
22	Tutor approval	5 days	Thu 9/30/21	Wed 10/6/2	21
23	**3,Reading by reviewers**	**15 days**	**Sun 5/23/21**	**Thu 6/10/21**	
24	**3.1,Reviewers assigment request**	**5 days**	**Sun 5/23/21**	**Thu 5/27/21**	
25	3.1.1,Assignment of two review	2 days	Thu 10/7/21	Fri 10/8/21	22
26	3.1.2,Communication	2 days	Mon 10/11/21	Tue 10/12/2	25
27	3.1.3,FGP submission to review	1 day	Wed 10/13/21	Wed 10/13/	26
28	**3.2,Reviewers work**	**10 days**	**Sun 5/23/21**	**Thu 6/3/21**	
29	**3.2.1,Reviewer**	**10 days**	**Sun 5/23/21**	**Thu 6/3/21**	
30	3.2.1.1,FGP reading	9 days	Thu 10/14/21	Tue 10/26/2	27
31	3.2.1.2,Reader 1 report	1 day	Wed 10/27/21	Wed 10/27/	30
32	**3.2.2,Reviewer**	**15 days**	**Mon 9/20/21**	**Fri 10/8/21**	
33	3.2.2.1,FGP reading	9 days	Thu 10/14/21	Tue 10/26/2	27
34	3.2.2.2,Reader 2 report	1 day	Wed 10/27/21	Wed 10/27/	33
35	**4,Adjustments**	**20 days**	**Mon 10/25/2**	**Fri 11/19/21**	
36	4.1,Report for reviewers	9 days	Thu 10/28/21	Tue 11/9/21	34
37	4.2,FGP update	1 day	Wed 11/10/21	Wed 11/10/	36
38	4.3,Second review by reviewers	10 days	Thu 11/11/21	Wed 11/24/	36,37
39	**5,Presentation to Board of Examiners**	**5 days**	**Fri 11/5/21**	**Thu 11/11/2**	
40	5.1,Final review by board	2 days	Thu 11/25/21	Fri 11/26/21	38
41	5.2,FGP grade report	3 days	Mon 11/29/21	Wed 12/1/2	40
42	FGP End	0 days	Thu 12/2/21	Thu 12/2/21	41