UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN TO GUIDE THE ESTABLISHMENT OF A NATIONAL BOTANIC GARDEN PROJECT

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FINAL GRADUATION PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
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DEDICATION

I dedicate this research project to my sons, Seth and Connor, who make my life brighter and more meaningful. Thank you, daddy for always showing how proud you are of me. Mommy, I can no longer touch you, but your love will always be felt. Mi querida hermana. Te amo para siempre!

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ABBREVIATIONS AND ACRONYMS

BBS	National Herbarium of Suriname (Bureau Bosbeheer Suriname)
BGCI	Botanic Gardens Conservation International
e.g.	for example (*exempli gratia*)
FGP	Final Graduation Project
ha	hectare
N/A	not applicable
n.d.	no date
MPM	Master in Project Management
MSc.	Master of Science
PMB	Performance Measurement Baseline
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
RACI	Responsible/Accountable/Consult/Inform
RBS	Risk Breakdown Structure
UCI	University for International Cooperation (Universidad para la Cooperacion Internacional)
VoIP	Voice over Internet Protocol
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY (ABSTRACT)

The National Herbarium of Suriname (BBS) is the botanical research institute at the Anton de Kom University of Suriname. There is only one herbarium in Suriname and no botanic garden. Several gardens have been observed and none of them meet the requirements of a botanic garden. Some of the requirements are that the plants in the garden must have a scientific reference and they must be systematically sound. Also, scientific names must be displayed according to botanic taxonomy.

Despite the high diversity of plants in Suriname, a living collection to study plants and to conduct scientific educational botanic activities near the University does not exist. Not having a botanic garden will eventually be time consuming and expensive for students, researchers and educational institutions. As a result, plants that have been collected in areas that are difficult to reach cannot be kept alive. Not having a controlled environment to grow these plants hampers their survival as well as the opportunity to conduct research. Without a botanic garden, a refuge for confiscated plants does not exist. People will be missing a place that has the role of a sanctuary, where they would like to spend their time and that is beneficial for their well-being. As a result of public agriculture and forestry testing grounds being parcelled out, the conservation of the genetic resources that was intended by the testing grounds has been impaired.
Projects that have been executed by the Herbarium to date, were managed without proper guidelines and minor project management. Appropriate allocation of time and resources during the preliminary planning to guide the establishment of a botanic garden will maximize the chances of the project meeting its budgetary and scheduling needs in the implementation phase. This will also help attract further support and funding at a later stage.

The general objective was to develop a Project Management Plan to guide the establishment of a National Botanic Garden Project. The specific objectives were: to develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan; to create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully; to create a Schedule Management Plan to manage the timely completion of the project; to create a Cost Management Plan to complete the project within the approved budget; to develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements; to create a Resource Management Plan to complete the project successfully; to develop a Communications Management Plan to ensure timely and appropriate management of project information; to create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project; to develop a Procurement Management Plant to purchase or acquire products, services, or results needed from

outside the project team; to develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution.

The methodology for this research was the analytical research method. Interviews and document analysis were conducted to produce the specific objectives to guide the establishment of the National Botanic Garden project.

The main results of the project management plans were that the Suriname National Botanic Garden Project will comprise a 2.5 ha botanic garden that will be carried out in four stages and was scheduled to last 33 months. The four stages are Envisioning the Botanic Garden, Site Selection and Feasibility Study, Design and Pre-Operations, and Launch and Operations. The total project budget was estimated for the amount of $460,059.00. Among the main conclusions was one regarding the Quality Management Plan, which includes the stakeholders and requirements prioritization analysis. This plan shows that the Suriname National Botanic Garden Steering Group is the principle stakeholder and the principle requirement is expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management. Another main conclusion was that the four high priority risks in the Risk Management Plan that were identified are: Required labor exceed budgeted costs for the project; availability of adequate skilled staff delays landscaping, botanical, horticultural, educational activities; lack of regulations to protect botanic gardens; inadequate revenues generated from services provided by the botanic garden. Also, among the main conclusions was the Power-Interest Matrix showing that the stakeholders to be managed closely are the Project Sponsor and the Steering Group. The stakeholders with the highest impact and influence are the Steering Group and the University Board. Their views and opinions must be given the highest level of consideration because their opposition can make or break the project.

Among the recommendations were that the Suriname National Botanic Garden should manage all their projects led by a project management team, equipped with the right tools and techniques for adequate project planning and appropriate project documents. Quantitative risk analyses should be applied for all projects in order to identify appropriate risk responses and the project management team should have a storage system in place for project knowledge and lessons-learned for future use and review. The Suriname National Botanic Garden management team should incorporate environmental sustainability and social responsibility in all the project management processes.

1 INTRODUCTION

1.1. Background

The National Herbarium of Suriname (BBS) is the botanical research institute at the Anton de Kom University of Suriname that manages, maintains, and expands the plant collections while disseminating scientific botanical knowledge. The collections consist of Angiosperms, Bryophytes, Pteridophytes, wood, and a historical collection. The core activities include scientific research, education, and services to facilitate the academic community and to determine the natural, economic, and cultural value of the plant collections. The institution has executed several projects in the past, but the use of proper project management guidelines has been limited.

Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education (BGCI, 2012, p. 9). A herbarium is a collection of preserved plants stored, catalogued, and arranged systematically for study by professionals and amateurs from many walks of life (Kew Royal Botanic Gardens, n.d.). There is only one herbarium in Suriname and no botanic garden. Several gardens have been observed in Suriname and none of them meet the requirements of a botanic garden. Some of the requirements are that the plants in the garden must have a scientific reference and they must be systematically sound. Also, scientific names must be displayed according to botanic taxonomy. Given the importance to the Herbarium and the size of the project, the Project Management Plan that will be developed to guide the establishment of the National Botanic Garden is considered necessary for the proper implementation, monitoring and controlling, and closing of the project.

1.2. Statement of the problem

Despite the high diversity of plants in Suriname, a living collection to study plants and to conduct scientific educational botanic activities near the University does not exist. Most costs for facilitating students within practical botanical and nature conservation courses are associated with transportation, and for remote areas also

with costs for accommodation. The lack of a Botanic Garden will eventually be time consuming and expensive for students, researchers and educational institutions. As a result, plants that have been collected in areas that are difficult to reach cannot be kept alive. Not having a controlled environment to grow these plants hampers their survival as well as the opportunity to conduct research. Without a botanic garden a refuge for confiscated plants does not exist. These gardens are often valued for their role as a sanctuary, and not having one means that people are missing a place where they would like to spend their time and that is beneficial for their well-being. A phenomenon that has been taking place in recent years is that many public agriculture and forestry testing grounds have been parceled out. As a result, the conservation of the genetic resources that was intended by the testing grounds has been impaired.

Projects that have been executed by the Herbarium to date, were managed without proper guidelines and minor project management elements, tools and techniques to meet its deliverables. The development of a botanic garden is a long-term endeavour with considerable ongoing maintenance requirements. Institutions that plan to establish a botanic garden often underestimate the time and resources. Appropriate allocation of time and resources during the preliminary planning will maximise the.chances of the project meeting its budgetary and scheduling needs in the implementation phase. This will also help attract further support and.funding at a later stage. The project management approach to efficiently deliver the results for a project of this size can only be accomplished when this Project Management Plan will be developed.

1.3. Purpose

The scientific purpose of a botanic garden is to present the systematic classification of plants. Furthermore these plants cannot be collected but can only be used to study, so a living plant collection conserves these specimen and their genetic resources. It is expected that establishing a botanic garden will facilitate scientific research, contribute to conservation of plant species, save students and

lecturers from different educational institutions time and money, and display the country's plant diversity. With the establishment of a the botanic garden a controlled environment will be created to grow plants and the opportunity to conduct research will arise. Confiscated plants can become useful in the botanic garden. Also, the general public will have a place where they like to spend their time while being beneficial for their well-being.

In order to increase the successful establishment of the National Botanic Garden, the Project Management Plan will be developed. Each subsidiary document will elaborate on integration, scope, time, cost, quality, resources, communication, risk, procurement, and stakeholder management and will be strategically developed to be used as a guide during project execution.

1.4. General objective

To develop a Project Management Plan to guide the establishment of a National Botanic Garden Project.

1.5. Specific objectives

1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan;
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully;
3. To create a Schedule Management Plan to manage the timely completion of the project;
4. To create a Cost Management Plan to complete the project within the approved budget;
5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements;
6. To create a Resource Management Plan to complete the project successfully;

7. To develop a Communications Management Plan to ensure timely and appropriate management of project information;
8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response impelentation, and monitoring risk on a project;
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team;
10. To develop a Stakeholder Management Plan for effective engagement of stakeholders in project decisions and execution.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

The National Herbarium of Suriname is an institute of the Anton de Kom University of Suriname and operates separately from the faculties. The Head of the Herbarium reports directly to the Board of the University. The Herbarium has completed several projects successfully. However, these projects were executed without a project management plan. The establishment of a botanic garden has been a big idea for a long time and the project will be the largest to be executed by the institution regarding time, cost, and resources. Therefore, in order to successfully guide the establishment of the botanic garden, a comprehensive project management plan must be developed.

2.1.2 Mission and vision statements

The National Herbarium of Suriname (BBS) manages, maintains, and expands the plant collections while disseminating scientific botanical knowledge through scientific research, education, and services to facilitate the academic community and to determine the natural, economic, and cultural value of the plant collections.

The vision of the Herbarium is to be the main contributor to the correct management of our plants and applies its knowledge and prestige to influence national and international policies regarding biodiversity issues.

Guided by the project management plan proper project management inputs, tools and techniques will be used by the project manager and the project team to establish the botanic garden.

2.1.3 Organizational structure

The National Herbarium of Suriname is currently staffed with nine full time employees of which five members have an academic degree and four members have a technical educational background. With the establishment of the botanic garden the team can increase with at least four operational and project team members.

Below in figure 1 the institute's organizational structure is depicted. The Head of the Herbarium is Ms. Dorothy Traag, MSc. – Environmental Education specialist. The departments within the Herbarium that support management activities and decision-making are the Secretariat and Research Planning and Development. The secretariat is important for the institution's daily operations, since it directs and structures all the operational processes. This department also manages the administrative and logistical activities within projects, research, the collections, and education and outreach. The department for Research Planning and Development is responsible for the initiation, planning and execution of projects to acquire funding from outside the University for the development of the Herbarium and its collections.

The Department for Documentation is responsible for managing the monographs and to make them accessible to the general public. This department cooperates closely with the Central Library of the Anton de Kom University. Other documentation, namely articles, magazines, photographs, illustrations, and maps are being processed and made accessible by the Herbarium itself.

The quality and the management of the collections are influenced by spatial planning and the choice of techniques. The technical staff of the Herbarium manages and maintains

the collections and storage facilities, for example restoration and adequate storage and packing of plant specimens. Equally important is the technical processing of plant collections that enter the Herbarium.

The scientific management of the collections consists of the storage, identification and collection of species for management and expansion of the collections, while safeguarding its scientific value. The Herbarium strives to represent the Surinamese flora and validates the correct taxonomic nomenclature. The physical accessibility will be improved by arranging the collection according to geographical locations (countries) and botanical classification.

The department for Education and Outreach is being managed by scientists and assistant-researchers working at the Herbarium or the faculties. They can also assist from outside the University or from abroad. This department strives to disseminate knowledge and information on the Surinamese Flora and research that has a common ground with botany. The target groups are namely researchers and students from the University and all other educational levels.

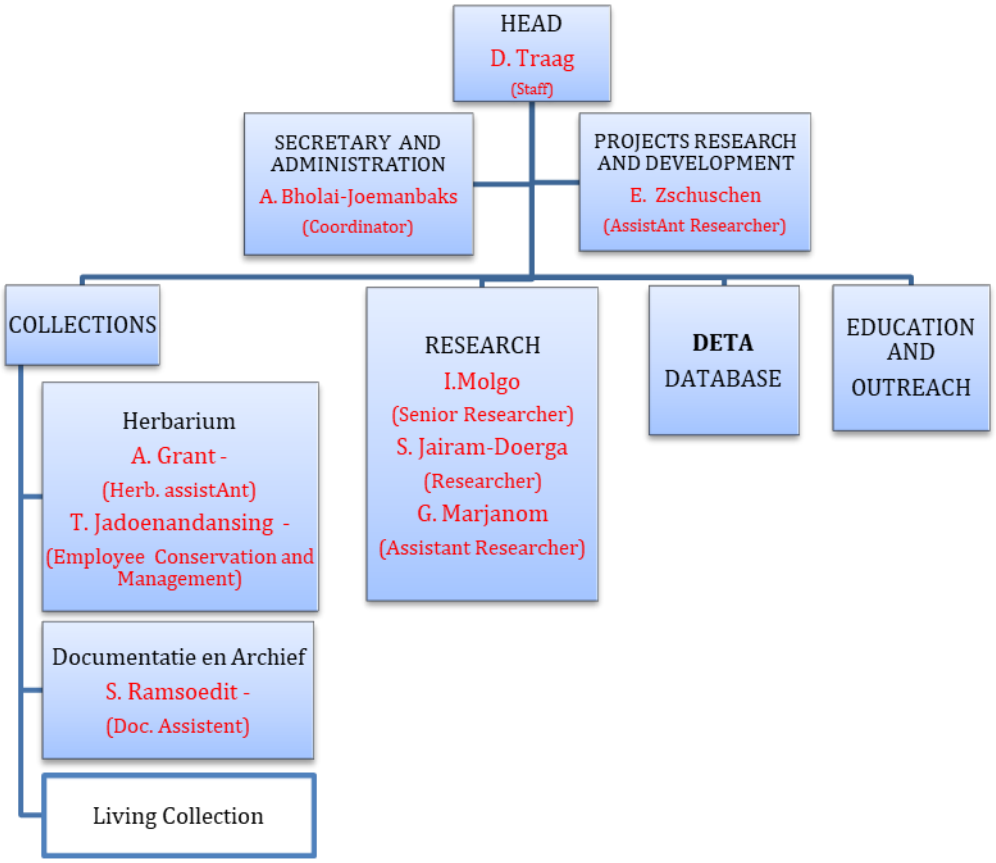

Figure 1 Organizational structure (Source: Dorothy Traag, Personal Communication, 30 September 2019)

2.1.4 Products offered

The National Herbarium of Suriname offers the following services:

- Plant identification
- Vegetation assessments (e.g. Invasive Alien Species, Non-Timber Forest Products, Ethnobotany, Medicinal plants, Supplementary research)
- Plant inventories
- Training in plant collecting
- Library
- Guided Tours

2.2 Project Management concepts

2.2.1 Project

Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education (BGCI, 2012, p. 9). The global mission of botanic gardens worldwide in conservation is to stem the loss of plant species and their genetic diversity and prevent further degradation of the world's natural environment (BGCI, 2012, p. 10).

According to the Project Management Institute a project can be defined as "a temporary endeavor undertaken to create a unique product, service, or result" (Project Management Institute, 2017, p. 4). The establishment of botanic gardens are long term endeavors with considerable ongoing operational requirements. Time and resources are often underestimated (BGCI, 2016, p. 11). Given this fact, it may require several projects to accomplish the desired products or results, guided by this Project Management Plan.

2.2.2 Project management

Project Management is the application of knowledge, skills, tools, and techniques to meet the project requirements (Project Management Institute, 2017, p. 10). The project life cycle is managed by executing a series of project management activities known as project management processes. Every project management process produces one or more outputs by using appropriate project management tools and techniques. The output can be a deliverable or an outcome. Outcomes are an end result of a process (Project Management Institute, 2017, p. 22). Project management processes fall into five groups:

1. Initiating
2. Planning
3. Executing
4. Monitoring and Controlling
5. Closing

In figure 4 in subsection 2.2.4. the project management processes are depicted.

According to the Botanic Garden Conservation International Manual on Planning, Development and Managing Botanic Gardens, thorough project management expertise is required throughout the entire development process from inception throughout the opening day of the botanic garden (BGCI, 2016, p. 14). This may be provided by the Botanic Garden Director, the Design Team or by an external, professional project management consultant. A Steering Group that represents the core group of stakeholders of the botanic garden development venture, consisting of a highly multi-disciplinary group, will have oversight of the development process. Frequent consultation with the Steering Group is essential to ensure that the project is delivered on time and budget. Key roles of the Project Manager include:

- Establishing and monitoring the budget;
- Establishing and monitoring project schedules and timelines;
- Procurement of the appropriate consultants and/or contractors
- Monitoring risks and quality;
- Overseeing and managing the project scope, keeping a close watch on ‘scope creep’;
- Ensuring effort and expenditure are appropriate to expectations;
- Resolving differences and disagreements during the project development process.

The development of the Final Graduation Project (FGP) will consist of the creation of the Project Charter and the Project Management Plan to guide the establishment of a national botanic garden project. These documents are part of the initiation phase. The establishment of the botanic garden itself will be managed as another project, or several projects if needed, within the following six phases:

1. *Phase 1*: Initiation
2. *Phase 2*: Site Selection and Feasibility Study
3. *Phase 3*: Design
4. *Phase 4*: Construction
5. *Phase 5*: Pre-Operations
6. *Phase 6*: Project Closure

2.2.3 Project life cycle

A project life cycle is the series of phases that a project passes through from its start to its completion (Project Management Institute, 2017, p. 19). The generic project life cycle is depicted in figure 2. Within a project life cycle, there can be one or more phases that are associated with the development of the product, service, or result. These are called a development life cycle. Development life cycles can be predictive, iterative, incremental, adaptive, or a hybrid model (Project Management Institute, 2017, p. 19).

In practice, the five process groups will overlap. Work will often start on the next phase prior to the current phase being completely finished. Phases may also start sooner, finish later, and plateau for some time (Boyde, 2014, p.38). Figure 3 shows the overlap of project phases. Similar to the process groups shown in figure 3, each of the six phases of the establishment of the botanic garden project will follow this progression. Hence each project phase will have its own initiating, planning, executing, monitoring and controlling, and closing phase.

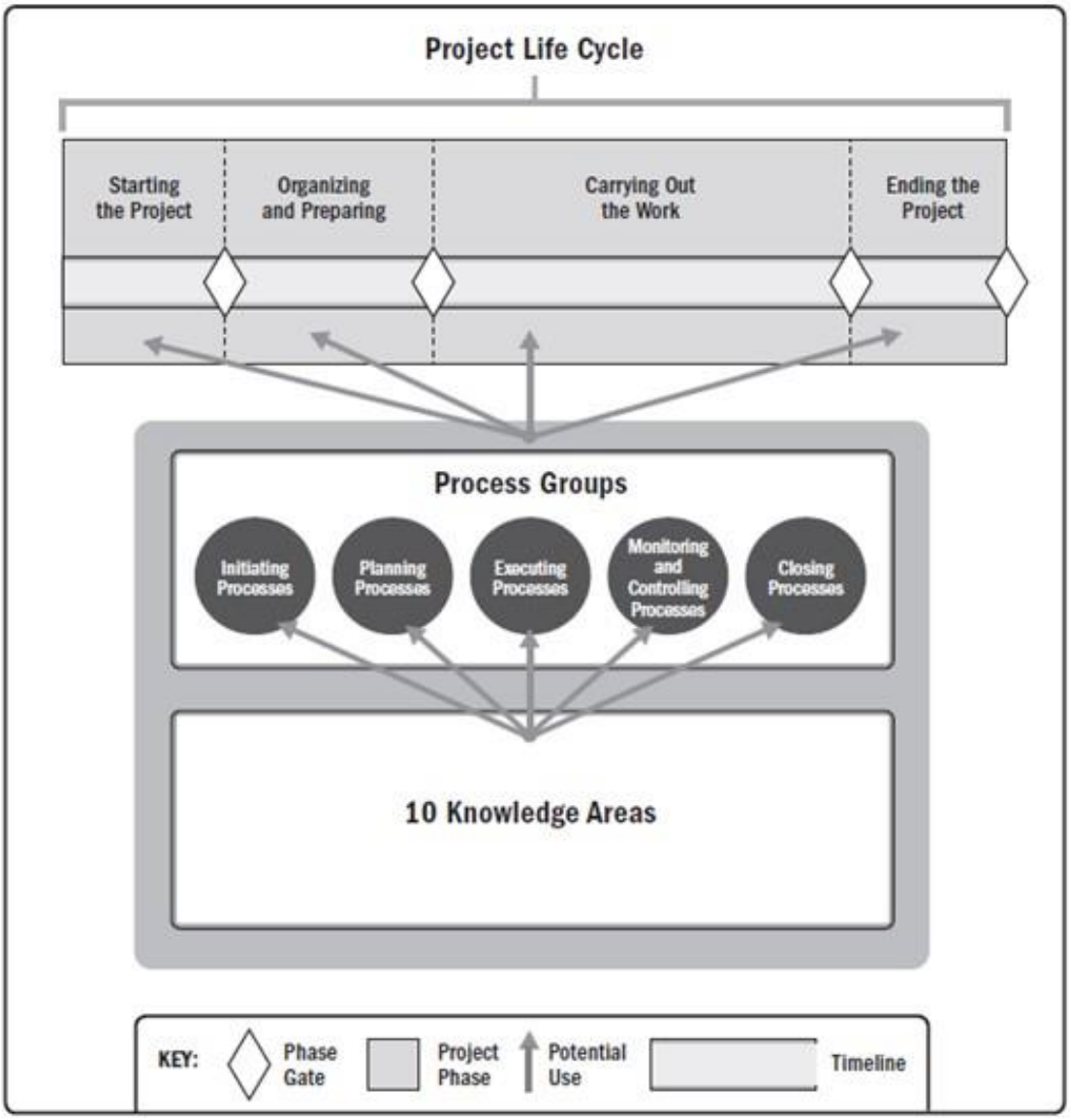

Figure 2 Generic Project Life Cycle. Reprinted from *A Guide to the Project Management Body of Knowledge* (p. 18), Project Management Institute. Copyright 2017 by Project Management Institute, Inc.

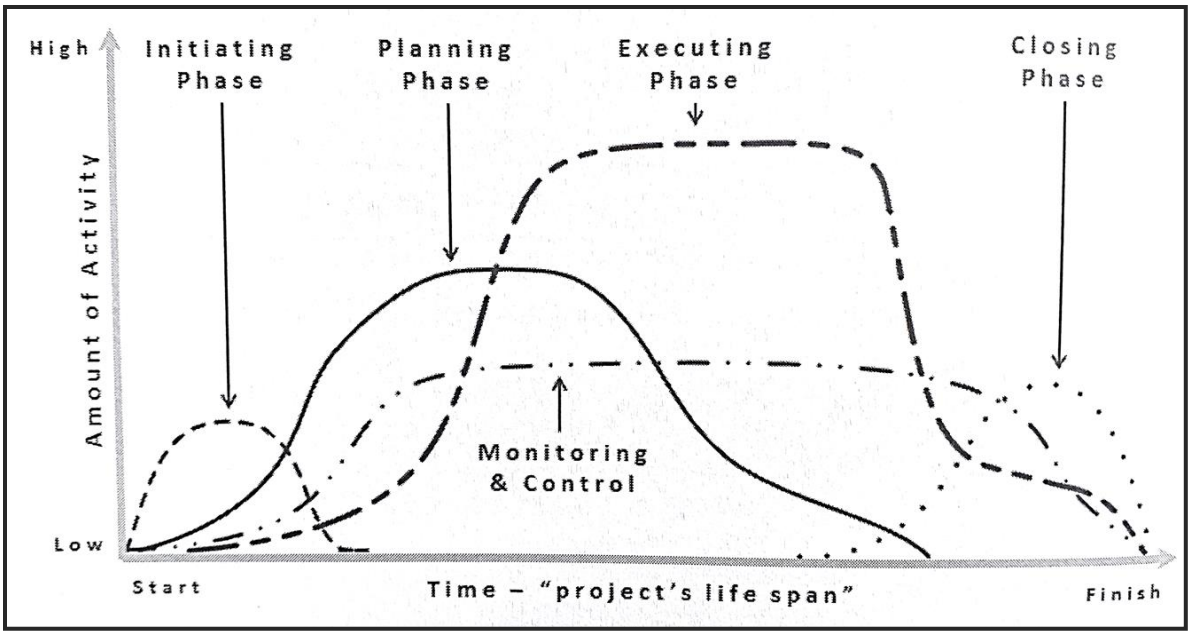

Figure 3 Overlap of project life cycle phases. Reprinted from *A Down-To-Earth Guide to SDLC Project Management, 2nd Edition* (p. 38) by Joshua Boyde, 2014. Copyright J. Boyde.

2.2.4 Project management processes

To develop the Project Management Plan to guide the establishment of a National Botanic Garden project only the processes involved in initiating and planning a project will be used. The Project Management Plan will be a compilation of subsidiary documents created as a result of each initiating and planning process activity. A subsidiary document is a document created to support the main document. Figure 4 depicts the project management processes of which the selected processes will be applied during this project.

Figure 4 Project Management Process Groups. PMI's PMBOK® 5th Edition Project Management Process Groups & Processes by Babou, 2013. Retrieved from https://pmleadershipchamps.com/2013/07/13/project-management-process-groups-processes-pmbok-5th-edition/. Copyright 2013 by Project Management & Leadership Champions, pmleadershipchamps.com.

2.2.5 Project management knowledge areas

The ten knowledge areas of project management are as follows:

1. Integration management
2. Scope management
3. Schedule management
4. Cost management

5. Quality management
6. Human Resources management
7. Communication management
8. Risk management
9. Procurement management
10. Stakeholders management

The Project Management Plan to be developed to guide the establishment of a National Botanic Garden project will include these ten knowledge areas for the initiating and planning process groups. As shown in figure 5 the documents that will be developed within this project include or are related to the following processes:

1. *The Project Charter*

   A document issued by the project sponsor that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities.

2. *The Project Management Plan*

   Defines, prepares, and coordinates all plan components and consolidates them into an integrated project management plan.

3.1. *Plan Scope Management*

The process of creating a scope management plan that documents how the project and product scope will be defined, validated, and controlled.

3.2. *Collect Requirements*

The process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives.

3.3. *Define Scope*

The process of developing a detailed description of the project and product.

3.4. *Create WBS*

The process of subdividing project deliverables and project work into smaller, more manageable components.

4.1. *Plan Schedule Management*

The process of establishing the policies, procedures, and documents for planning, developing, managing, executing, and controlling the project schedule.

4.2. *Define Activities*

The process of identifying and documenting the specific actions to be performed to produce the project deliverables.

4.3. *Sequence Activities*

The process of identifying and documenting relationships among the project activities.

4.4*. Estimate Activity Durations*

The process of estimating the number of work periods needed to complete individual activities with the estimated resources.

4.5. *Develop Schedule*

The process of analyzing activity sequences, durations, resources, requirements, and schedule constraints to create the project schedule model for project execution and monitoring and controlling.

5.1. *Plan Cost Management*

The process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled.

5.2. *Estimate Costs*

The process of developing an approximation of the monetary resources needed to complete project work.

5.3 *Determine Budget*

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

6. *Plan Quality Management*

The process of identifying quality requirements and/or standards for the project and the deliverables, and documenting how the project will demonstrate compliance with quality requirements and/or standards.

7.1 *Plan Resource Management*

The process of defining how to estimate, acquire, manage, and utilize physical and team resources.

7.2. *Estimate Activity Resources*

The process of estimating team resources and the type and quantities of material, equipment, and supplies necessary to perform project work.

8. *Plan Communications Management*

The process of developing an appropriate approach and plan the project communication activities based on the information needs of each stakeholder or group, available organizational assets, and the needs of the project.

9.1 *Plan Risk Management*

The process of defining how to conduct risk management activities for a project.

9.2 *Identify Risks*

The process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics.

9.3 *Perform Qualitative Risk Analysis*

The process of prioritizing individual project risk for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics.

9.4. *Perform Quantitative Risk Analysis*

The process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives.

9.5 *Plan Risk Responses*

The process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks.

10. *Plan Procurement Management*

The process of documenting project procurement decisions, specifying the approach, and identifying potential sellers.

11. *Identify Stakeholders*

The process of identifying project stakeholders regularly and analyzing and documenting relevant information regarding their interest, involvement, interdependencies, influence, and potential impact on the project.

12. *Plan Stakeholder Engagement*

The process of developing approaches to involve project stakeholders based on their needs, expectations, interests, and potential impact on the project.

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

Figure 5 Project Management Process Groups and Knowledge Area Mapping. Reprinted from *A Guide to the Project Management Body of Knowledge* (p. 25), Project Management Institute. Copyright 2017 by Project Management Institute, Inc.

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

The documents that can be used for the development of the Project Management Plan to guide the establishment of the National Botanic Garden include Botanic Gardens Conservation International's *Manual on Planning, Developing and Managing Botanic Gardens* and Botanic Gardens Conservation International's *International Agenda for Botanic Gardens in Conservation (2nd edition).* Both publications give some insight in the inputs, tools, and techniques required to effectively guide the establishment and the pre-operational management of botanical gardens.

3 METHODOLOGICAL FRAMEWORK

3.1 Information sources

Information is organized or structured data, processed for specific purpose to make it meaningful, valuable, and useful in specific contexts (Project Management Institute, 2017, p. 708). In the Oxford Dictionaries, a source is defined as a place, person, or thing from which something originates or can be obtained (Lexico.com, 2019). Therefore, for the development of the Final Graduation Project information sources can be defined as persons or things that provide organized or structured data, processed for a specific purpose to make it useful in specific contexts.

3.1.1 Primary sources

A primary source is a document, first-hand account, or other source that constitutes direct evidence of an object of study (Oxford University Press, 2019). In other words, the information is not taken from other books, etc.

The primary sources that will be used for the development of the Final Graduation Project include interviews. The primary sources are further listed in Chart 1 below.

3.1.2 Secondary sources

A secondary source is a book, article, or other source that provides information about an object of study but does not constitute direct, first-hand evidence (Oxford University Press, 2019). In other words, the writer has taken the information from some other source and has not collected it himself or herself.

For the development of the Final Graduation Project the secondary sources that will be used are the documents further listed in Chart 1 below.

Chart 1 Information sources (Source: Compiled by the author)

Objectives	Information sources	
	Primary	**Secondary**
1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan	Meeting minutes, personal interview with Head of the National Herbarium of Suriname	PMBOK® Guide and PMI database
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully	Meeting minutes, personal interview with Head of the National Herbarium of Suriname	PMBOK® Guide and PMI database, Botanic Gardens Conservation International database
3. To create a Schedule Management Plan to manage the timely completion of the project	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail	PMBOK® Guide and PMI database, Botanic Gardens Conservation International database

	with persons from Botanical Gardens Utrecht	
4. To create a Cost Management Plan to complete the project within the approved budget	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database, Botanic Gardens Conservation International database
5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database, Botanic Gardens Conservation International database
6. To create a Resource Management Plan to complete the project successfully	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database
7. To develop a Communications Management Plan to ensure timely and appropriate management of project information	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database

8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database, Botanic Gardens Conservation International database
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database
10. To develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution	Meeting minutes, personal interview with Head of the National Herbarium of Suriname, communications via e-mail with persons from Botanical Gardens Utrecht	PMBOK® Guide and PMI database

3.2 Research methods

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create better understanding of a topic (The University of Newcastle, Australia, 2019).

A distinction is made between several basic types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, and

some other types of research (Kothari, 2014, p. 3-4). For the development of the Final Graduation Project the Analytical Research Method will be used.

3.2.1 Analytical vs. Descriptive Research Method

In order to get a better understanding of the Analytical Research Method, this is compared with the Descriptive Research Method. The major purpose of descriptive research is description of the state of affairs as it exists at present (Kothari, 2014, p. 2). The main characteristic of this method is that the researcher has no control over the variables; he or she can only report what has happened or what is happening. The methods of research utilized in descriptive research are survey methods of all kinds, including comparative and correlational methods. In analytical research, on the other hand, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material (Kothari, 2014, p. 3). The Analytical Research Methods that will be used to develop the deliverables stated in Chart 2 include interviews and document analysis.

Chart 2 Research methods (Source: Compiled by the author)

Objectives	**Research methods**
	Interviews and document analysis
1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the	The Project Charter will be created from the sources identified in Chart 1 objective 1 above

project and to produce the project management plan	
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully	The documents which comprise the Scope Management Plan will be developed from the sources identified in Chart 1 objective 2 through interviews and document analysis
3. To create a Schedule Management Plan to manage the timely completion of the project	The documents which comprise the Schedule Management Plan will be developed from the sources identified in Chart 1 objective 3 through interviews and document analysis
4. To create a Cost Management Plan to complete the project within the approved budget	The documents which comprise the Cost Management Plan will be developed from the sources identified in Chart 1 objective 4 through interviews and document analysis
5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements	The documents which comprise the Quality Management Plan will be developed from the sources identified in Chart 1 objective 5 through interviews and document analysis
6. To create a Resource Management Plan to complete the project successfully	The documents which comprise the Resource Management Plan will be developed from the sources identified in Chart 1 objective 6 through interviews and document analysis
7. To develop a Communications Management Plan to ensure timely and appropriate management of project information	The documents which comprise the Communications Management Plan will be developed from the sources identified in

	Chart 1 objective 7 through interviews and document analysis
8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project	The documents which comprise the Risk Management Plan will be developed from the sources identified in Chart 1 objective 8 through interviews and document analysis
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team	The documents which comprise the Procurement Management Plan will be developed from the sources identified in Chart 1 objective 9 through interviews and document analysis
10. To develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution	The documents which comprise the Stakeholders Management Plan will be developed from the sources identified in Chart 1 objective 10 through interviews and document analysis

3.3 Tools

A tool is something tangible, such as a template or software program, used in performing an activity to produce a product or result (Project Management Institute, 2019, p. 723). The tools that will be used to produce the specific objectives of the Final Graduation Project are plotted in Chart 3 below. The three most common tools in the chart are:

- Interviews which will be performed with persons from whom information will be obtained and recorded;
- Templates that are written documents that serve as a pattern;
- Matrices that are a rectangular arrangement of elements into rows and columns, which will be used to compare or plot several elements or variables.

Chart 3 Tools (Source: Compiled by the author)

Objectives	Tools
1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan	Expert judgement Interviews Project Charter Template
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully	Expert judgement Interviews Alternatives Analysis Requirements Traceability Matrix Template Requirements Documentation Template Scope Management Plan Template
3. To create a Schedule Management Plan to manage the timely completion of the project	Expert judgement Schedule Management Plan Template Activity list template Work breakdown structure template Microsoft Project 2013
4. To create a Cost Management Plan to complete the project within the approved budget	Cost Management Plan template Cost baseline template Microsoft Excel 2016

5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements	Quality Management Plan template
6. To create a Resource Management Plan to complete the project successfully	Resource Management Plan template Resource breakdown structure template Responsibility assignment matrix
7. To develop a Communications Management Plan to ensure timely and appropriate management of project information	Communications Management Plan template Stakeholder engagement assessment matrix
8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project	Risk Management Plan template Risk breakdown structure template
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team	Procurement Management Plan template
10. To develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution	Stakeholders Management Plan template Assumption and constraint analysis Stakeholders engagement assessment matrix

3.4 Assumptions and constraints

An assumption is a factor in the planning process that is considered to be true, real, or certain, without proof or demonstration (Project Management Institute, 2017, p. 699). A constraint is a limiting factor that affects the execution of a project, program, portfolio, or process (Project Management Institute, 2017, p. 701). The assumptions and constraints

considered in the Final Graduation Project for each specific objective are plotted in Chart 4.

Chart 4 Assumptions and constraints (Source: Compiled by the author)

Objectives	Assumptions	Constraints
1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan	The charter will be created before all other subsidiary documents	There is only one week allocated to create the project charter
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully	All the information required to determine the scope is provided	The project scope may change as the project progresses
3. To create a Schedule Management Plan to manage the timely completion of the project	The time allocated for the development of the Project Management Plan is sufficient	Not enough expert judgment available to provide expert guidance
4. To create a Cost Management Plan to complete the project within the approved budget	A detail budget will be developed	Not enough time and resources available to complete a detailed budget

Objectives	Assumptions	Constraints
5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements	All stakeholder requirements will be collected and analyzed	Stakeholders' requirements and their level of interest may change and the requirements for project resources may not be adequately stated
6. To create a Resource Management Plan to complete the project successfully	The organization has sufficient resources to complete the project	Some resources may not be available while only the resources planned for will be included in the budget
7. To develop a Communications Management Plan to ensure timely and appropriate management of project information	The organization has the resources and technology required to communicate with all stakeholders	Timing and technology restrictions regarding communications within the organization may be limiting to the appropriate management of the project
8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project	The information required to adequately identify the project risks is sufficient	All of the project risks need to be identified within the planning phase
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team	All relevant suppliers have been identified	The list of suppliers includes international suppliers, which may cause schedule delays

Objectives	Assumptions	Constraints
10. To develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution	All stakeholders are identified	Stakeholders' requirements and level of interest may change during the project

3.5 Deliverables

A deliverable is any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project (Project Management Institute, 2017, p. 704). The deliverables of the Final Graduation Project for each specific objective are plotted in Chart 5.

Chart 5 Deliverables (Source: Compiled by the author)

Objectives	Deliverables
1. To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan	Project Charter
2. To create a Scope Management Plan to ensure that the project includes all the work required, and only the work required, to complete the project successfully	Requirements Traceability Matrix Requirements Documentation Work breakdown structure Scope Management Plan
3. To create a Schedule Management Plan to manage the timely completion of the project	Schedule Management Plan Activity list
4. To create a Cost Management Plan to complete the project within the approved budget	Cost Management Plan Cost baseline
5. To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements	Quality Management Plan
6. To create a Resource Management Plan to complete the project successfully	Resource Management Plan Resource breakdown structure

	Responsibility assignment matrix
7. To develop a Communications Management Plan to ensure timely and appropriate management of project information	Communications Management Plan Stakeholder engagement assessment matrix
8. To create a Risk Management Plan to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project	Risk Management Plan Risk breakdown structure
9. To develop a Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team	Procurement Management Plan
10. To develop a Stakeholders Management Plan for effective engagement of stakeholders in project decisions and execution	Stakeholders Management Plan Stakeholders engagement assessment matrix

4 RESULTS

4.1. Project Integration Management

Specific objective 1 for the establishment of a National Botanic Garden Project was to develop a Project Integration Management Plan. The processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups are referred to as Project Integration Management. (PMI, 2017, p.69) The Project Charter is the first process in the Project Integration Management knowledge area and is an integral part of the Project Integration Management Plan. The Project Charter is the deliverable for specific objective 1 of the Final Graduation project. It formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities. The approved business case is the business document most commonly used to create the charter. To guide the development of the establishment of the Suriname National Botanic Garden Project the business case is integrated in the Project Charter below. The charter includes an introduction to the project, the purpose and scope of the project and the business case. The business case was developed by conducting interviews with the business case analysis team, which consists of the project sponsor, the scientific staff of the National Herbarium of Suriname and an agronomist from outside the Herbarium for expert advice.

Suriname National Botanic Garden Project

Project Charter

1 Introduction

The National Herbarium of Suriname (BBS) is the botanical research institute at the Anton de Kom University of Suriname that manages, maintains, and expands the plant collections while disseminating scientific botanical knowledge. The collections consist of Angiosperms, Bryophytes, Pteridophytes, wood, and a historical collection. The core activities include scientific research, education, and services to facilitate the academic community in particular and to determine the natural, economic, and cultural value of the plant collections.

There is only one herbarium in Suriname and no botanic garden. Several gardens have been observed in Suriname and none of them meet the requirements of a botanic garden. Some requirements include that plants in the garden must have a scientific reference and they must be systematically sound. Also, scientific names must be displayed according to botanic taxonomy. Despite the high diversity of plants in Suriname, a living collection to study plants and to conduct scientific educational botanic activities near the University does not exist. Botanical research covers taxonomy, evolution, and phenology. Most costs for facilitating students within practical botanical and nature conservation courses are associated with transportation, and for remote areas also with costs for accommodation. The lack a botanic garden will eventually be time consuming and expensive for students, researchers and educational institutions. A phenomenon that has been taking place in recent years in Suriname is that many public agriculture and forestry testing grounds have been parcelled out. As a result, the conservation of the genetic resources that was intended by the testing grounds has been impaired.

1.1 Purpose

The establishment of the Suriname National Botanic Garden will bring to life the first living collection to study plants near to the University. Its scientific purpose is to present the systematic classification of plants, while conserving their genetic resource, facilitating scientific research, contributing to the conservation of plant species, saving students and lectures from different educational institutions time and money, and displaying the country's plant diversity.

1.2 Scope

Botanic gardens may vary in size. Examples of botanic gardens in countries like Haiti (Jardin Botanique des Cayes, 8 ha), the United States of America (Fairchild Tropical Botanic Garden, 9 ha), and the Netherlands (Botanische Tuinen Utrecht, 9 ha), reveal that a botanic garden with an area of approximately 10 ha can be easily managed. The Suriname National Botanic Garden will comprise 10 ha land that will be established gradually over a period of five years. The Project will be developed for an area of 2.5 ha and will comprise four stages, namely Envisioning the Botanic Garden, Site Selection and Feasibility Study, Design and Pre-Operations, and Launch and Operations. The remaining 7.5 ha falls outside the project scope and will be part of another project.

Chart 6 Summary Milestone Schedule (Source: Compiled by the author)

National Botanic Garden Project	Finish date
Envisioning the Botanic Garden	15 April 2020
Site Selection and Feasibility Study	23 July 2020
Project Plan Review and Completion	24 December 2020
Project Kickoff	2 April 2021
Construction Complete	14 October 2021
Pre-operations Complete	1 September 2022
Design and Pre-Operations	21 October 2022

National Botanic Garden Project	Finish date
Closeout/Project Completion	20 October 2022

1.3 Intended Audience

The intended audience of this project charter is the project sponsor, Ms. Dorothy Traag, and Head of the National Herbarium of Suriname.

2.1 Overview

2.1.1 Project Title and Description

The land that will be available for the Botanic Garden covers an area of 10 ha that will be developed gradually over a period of five years. The National Botanic Garden Project consists of the establishment of a garden for the first 2.5 ha and will be developed in four stages.

- Stage 1: Envisioning the Botanic Garden in which the Steering Group will be established and the Project Management Structure will be developed.
- Stage 2: Site Selection and Feasibility Study in which the Botanic Garden Site will be selected, the Feasibility Study will be conducted, and the Business Case will be projected.
- Stage 3: Design and Pre-Operations in which the garden will be designed, the garden and facilities will be constructed, and pre-operations will be managed.
- Stage 4: Launch and Operations in which the garden will be officially opened and will be run daily.

The remaining 7.5 ha will be developed within other projects.

2.1.2 Business Case

Business Case Analysis Team

The following individuals comprise the business case analysis team. They are responsible for the analysis and creation of the Suriname National Botanic Garden Project business case.

Chart 7 Business Case Analysis Team (Source: Compiled by the author)

Role	Description	Name/Title
Executive Sponsor	Provide executive support for the project	Dorothy Traag, Head of BBS
Scientific and Botanical Support	Provides all scientific, taxonomic, and botanical support for the project	Iwan Molgo, Senior Researcher

Role	Description	Name/Title
Plant Conservation Support	Provides all plant conservation support for the project	Sabitrie Jairam-Doerga, Researcher
Agronomic and Horticultural Support	Provides all horticultural support for the project	Anwar Helstone, Agro-Forestry Researcher
Project Manager	Manages the business case and project team	Eliza Zschuschen, Project Manager
Field Support	Provides all field support for the project	Gunovaino Marjanom, Assistant Researcher

Problem Definition

Problem Statement

Despite the high diversity of plants in Suriname, a living collection to study plants and to conduct scientific educational botanic activities does not exist. Some areas in the country have not yet been botanically inventoried because they are remote. These areas are inaccessible due to the lack of infrastructure e.g. air strips or roads. But when there is a possibility to collect plants in remote areas then the plants may not be in the desired phenological stage. With the lack of a botanic garden this results in the limitation of the possibility to collect these plants and to grow them in the nursery of a botanic garden. Not having a controlled environment to grow these plants hampers their survival as well as the opportunity to conduct research. Also, the lack of a living collection to facilitate students within practical botanical and nature conservation courses is associated with high transportation and accommodation costs, especially in remote areas. The absence of a botanic garden near our University will eventually be time consuming and expensive for students, researchers and educational institutions. At the same time the loss of plant diversity at national and global level will be maintained. Botanic gardens are often valued for their role as a sanctuary, and not having one is means that people are missing a place where they would like to spend their time and for their well-being. A phenomenon that has been taking place in recent years is that many public agriculture and forestry testing grounds have been parcelled out. As a result, the conservation of the genetic resources that was intended by the testing grounds has been impaired. Furthermore, if there is no botanic garden there will be no refuge for confiscated plants. These plants can be highly valuable because of their rareness, vulnerability, and endemic or protected state.

The development of a botanic garden is a long-term endeavor with considerable ongoing maintenance requirements. Institutions that plan to establish a botanic garden often underestimate the time and resources. Appropriate allocation of time and resources during the preliminary planning will maximize the chances of the project meeting its budgetary and scheduling needs in the implementation phase. This will also help attract further support and funding at a later stage.

Organizational Impact

Managing a botanic garden requires different skills, tools and techniques compared to managing herbarium collections. New roles will be created to meet the requirements of persons with specific skills, e.g. horticulturists, agronomists, collections and landscape managers. Persons who meet these requirements will need to be hired. Facilities will have to be established to guarantee supply of planting material and garden maintenance. These conditions will be needed to support the pre-operational phase. Other facilities, human and other resources will be part of the expansion of the Botanic Garden in the future.

Project Overview

The National Botanic Garden Project overview provides in detail how this project will address the problem of the National Herbarium of Suriname. The overview consists of a project description, goals and objectives for the National Botanic Garden Project, project performance criteria, project assumptions, constraints, and major milestones. As the project is approved and moves forward, each of these components will be expanded to include a greater level of detail in working toward the project plan.

Project Description

The scientific purpose of a botanic garden is that it is a living and tangible example of the systematic classification of plants. Furthermore, these plants cannot be collected, they can only be studied in their dried form, from a herbarium sheet. A living plant collection conserves these specimens and their genetic resources. Income from tourism will contribute to the savings beyond the Project. Tourists visit botanic gardens to see the beauty of plants and to enjoy their aromas, colors, etc. Tourism is important to the survival of the botanic garden as well as the country's economy. It is expected that establishing a botanic garden will facilitate scientific research, contribute to the conservation of plant species, save students and lecturers from different educational institutions time and money, and display the country's plant diversity.

Goals and Objectives

The National Botanic Garden Project directly supports several of the goals and objectives established by the National Herbarium of Suriname. The following table lists the goals and objectives that the Suriname National Botanic Garden Project supports and how it supports them:

Chart 8 Project goals and objectives (Source: Compiled by the author)

Business Goal/Objective	Description
Manage, maintain, and expand the plant collections	Establish the botanic garden to contribute to conservation of plant species
Determine the natural, economic, and cultural value of the plant collections to facilitate policy and decision-making	Display the country's plant diversity through different themes in the botanic garden e.g. medicinal plant collection, aquatic fresh water plant collection, including species that are considered vulnerable e.g. endemic, alien invasive, protected and endangered plant species.
Disseminate scientific botanical knowledge through scientific research, education, and services to facilitate the general community	Facilitate Scientific Research; Facilitate education to save students and lecturers from different educational institutions time and money e.g. through workshops, seminars, botanical events, facilitated lectures, and guided tours

Project Performance

The following table lists the key resources, processes, or services and their anticipated outcomes in measuring the performance of the project. These performance measures will be quantified and further defined in the detailed project plan.

Chart 9 Project performance measures (Source: Compiled by the author)

Key Resource/Process/ Service	Performance Measure
Collections management	The living plant collections consist of carefully selected species, are structured and well documented, and contribute to species conservation and conservation of the country's plant genetic resources
Education and outreach	Students, children from schools, researchers, and others interested will have easier access to study plants and learn about their benefits while the costs to visit the living collections will be less when compared to visiting natural, more remote sites. Educational material and an educational curriculum within the garden will be developed.

Project Assumptions

The following assumptions apply to the National Botanic Garden Project. As project planning begins and more assumptions are identified, they will be added accordingly.

1. Proper guidelines for establishing the scientific aspects of a botanic garden are available
2. Secondary level agricultural knowledge is sufficient to monitor and control technical aspects of maintaining the garden
3. Expert knowledge and capacity for authorized staff, technical and scientific management, acquired either internally or externally, are available and can be used
4. Key stakeholders are fully engaged
5. Accurate estimates of cost, time and resources have been made
6. Project is in line with the organizational strategy of the Herbarium (client)
7. Project is in line with both national legislation and regulations, and international agreements
8. Science and education are the core purpose of the project and are equally important for the project scope and services to be delivered
9. Support of and collaboration with the Botanic Gardens Utrecht has been formalized based on the historical relationship

Project Constraints

The following constraints apply to the National Botanic Garden Project. As project planning begins and more constraints are identified, they will be added accordingly.

1. Land required to establish the garden may not be readily available.
2. Supply of good quality seeds and planting material from trusted sources to set up the botanic garden may not be guaranteed, including support and supply from the Botanic Gardens Utrecht
3. Project budget for implementation of the project may not be timely and entirely allocated by donor organization or another financier
4. Stakeholder expectations may not be fully aligned with project scope and objectives

Major Project Milestones

The following are the major project milestones identified at this time. As the project planning moves forward and the schedule is developed, the milestones and their target completion dates will be modified, adjusted, and finalized as necessary to establish the baseline schedule.

Chart 10 Project milestones (Source: Compiled by the author)

Milestone/Deliverable	**Target date**
Envisioning the Botanic Garden	15 April 2020
Site Selection and Feasibility Study	23 July 2020
Project Plan Review and Completion	24 December 2020
Project Kickoff	2 April 2021
Construction Complete	14 October 2021

Pre-operations Complete	1 September 2022
Design and Pre-Operations	21 October 2022
Closeout/Project Completion	20 October 2022

Strategic Alignment

The National Botanic Garden Project is in direct support of several of the National Herbarium of Suriname's Strategic Plans. By directly supporting these strategic plans, this project will improve the organization's academic position and help move the organization forward to the next level of maturity.

Chart 11 Project alignment with organizational strategy (Source: Compiled by the author)

Plan	Goals/Objectives	Relationship to Project
2020 Institutional Policy regarding Plant Collections	Manage, maintain, and expand the plant collections	This project will add value to the herbarium and the University of Suriname and will contribute to the population's well-being
2020 Institutional Policy regarding Environmental Sustainability	Determine the natural, economic, and cultural value of the plant collections to facilitate policy and decision-making	The living collections will allow its users to determine the different values of plants and their role in the environment in addition to the non-living plant collections that are available in the Herbarium
2020 Institutional Policy regarding Research and Education	Dissemination of knowledge and education	This project will make living collections easily accessible for different users and will allow them to learn about plants and to increase people's knowledge of plant diversity

Cost Benefit Analysis

The following table captures the cost and savings actions associated with the National Botanic Garden Project, descriptions of these actions, and the costs or savings associated with them through the first year. Since the savings will not be obtained earlier than after completion of the project, at the bottom of chart 12 are the net savings for the first year after completion of phase 4 of the project. Inputs for the cost benefit analysis are the cost baseline in the cost management plan and the activity durations in the schedule management plan. The tools used to estimate the cost baseline are interviews with experts in the field of engineering, nature conservation, and plant inventory, and analogous and parametric estimating.

The costs for activity 1 in chart 12 are estimated to be similar to the costs for Pre-operations in the cost management plan. Activity 2 is estimated on the basis of the expected annual operational costs. Full-time staff will be employed by the Anton de Kom University by that time. The savings for activity 3 is associated with income from services such as tours, organization of events in the garden, venue rental, and sale of booklets. The savings for activity 4 is estimated to be somewhat equal to the costs that will be saved for fieldwork during Pre-operations activities. The amount of savings is dependant of the location where fieldwork will be carried out. Savings for activity 5 are associated with the amount of finances needed to manage protected areas annually.

Chart 12 Cost Benefit Analysis (Source: Compiled by the author)

#	Action	Action Type	Description	First year costs (- indicates anticipated savings)
1	Establish the Suriname National Botanic Garden	Cost	Investment of the Suriname National Botanic Garden Project	$137,578.00
2	Manage the living plant collections	Cost	Operations of the Suriname National Botanic Garden project	$51,672.00
3	Provide education and services	Savings	Provide tours for kids, regular tours, scientific tours, organization of events in the garden, rent venue for events, sale of booklets	-$3,195.00
4	Offer schools and researchers an alternative to study and improve their knowledge about plants	Savings	Students, children from schools, researchers, and others interested will have easier access to study plants and learn about their benefits	-$50,000.00
5	Allow decision makers nationally to valuate the costs of *in situ* (protected areas) versus *ex situ* (botanic garden) conservation of plants	Savings	The living plant collections contribute to species conservation and conservation of the country's plant genetic resources (e.g. plants in trade, protected species, endemic species, invasive alien species)	-$132,000.00
	Net First Year Savings			**-$4,055.00**

A limitation when calculating the costs and savings of the project is the difficulty to assign numerical values to e.g. ecosystem services or the value of the garden to human well-being and the conservation of species. Botanic gardens are unique for the

Guianas (Guyana, Suriname, and French Guyana). Located in the center of the Guianas, the Suriname National Botanic Garden will cover plants that represent the uniqueness of the Guyana Shield, a unique biome in the world.

Based on the cost benefit analysis above we see that by authorizing the National Botanic Garden Project the amount of savings is higher than the costs. In the first year of the Project an investment of $137,580.00 is needed, while it will cost $51,700.00 to keep the garden running after the Project has been completed. The annual income is estimated to be about $3,200.00, while students and researcher will save about $50,000.00 on fieldtrips and botanical or related research activities, which cover taxonomy, evolution, and phenology. The combination of in situ and ex situ collections supports this completely. It costs the authorities about $132,000.00 to implement conservation management activities annually in protected areas alone. These numbers indicate the relevance of the Suriname National Botanic Garden and proves to add value to the operations of the Anton de Kom University of Suriname, the National Herbarium of Suriname, and will be beneficial towards the authorities as well.

Alternatives Analysis

The following alternative options have been considered to address the problem. These alternatives were not selected for a number of reasons which are also explained below.

Chart 13 Alternatives Analysis (Source: Compiled by the author)

No Project (Status Quo)	**Reasons For Not Selecting Alternative**
No living collection to support research and education	• Vulnerable or endangered plant species remain unprotected • Absence of seed banks • Education on the systematics and importance of plants remain limited and will not be disseminated
Alternative Option	**Reasons For Not Selecting Alternative**
Facilitate excursions and field trips to different, more remote natural sites	• Significantly higher cost • Time consuming • (Highly) Dispersed habitats
Alternative Option	**Reasons For Not Selecting Alternative**
Assess plant species and monitor their conservation status in established protected areas	• Relative percentage of protected areas is not representative for the country's plant diversity • Monitoring plans are not yet developed, including schedule and cost analysis • Monitoring strongly dependent on available funding

Approvals

The signature of the person below indicates an understanding of the purpose and content of this document by her signing it. By signing this document, you indicate that you approve of the proposed project outlined in this business case and that the next steps may be taken to create a formal project in accordance with the details outlined herein.

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.2. Project Scope Management

Specific objective 2 for the establishment of a National Botanic Garden Project was to create a Scope Management Plan. Managing the project scope is primarily concerned with defining and controlling what is and is not included in the project to complete the project successfully. The Scope Management Plan below was created by conducting interviews with the project sponsor and persons experienced in construction and infrastructural works, and includes the processes Plan Scope Management, Collect Requirements, Define Scope, Create WBS, Validate Scope, and Control Scope.

Suriname National Botanic Garden Project

Scope Management Plan

1. **Plan Scope Management**

   The planning phase involves how the project and product scope will be defined, developed, validated, monitored and controlled. For the Suriname National Botanic Garden Project input from the project stakeholders was gathered by conducting interviews with the project sponsor and the business case analysis team. Together was decided and documented how the project's scope was to be defined, managed, validated, and controlled. In section 2 of the scope management plan is included how the deliverables will be accepted through the Collect Requirements process. In section 3 the scope statement and scope exclusion are defined. Another key element is the work breakdown structure (WBS) that is included in section 4. Information on how unforeseen circumstances will be handled throughout the project is included in the Validate and Control Scope processes in sections 5 and 6 of the Scope Management Plan.

2. **Collect Requirements**

   This process includes determining, documenting, and managing stakeholders needs and requirements to meet project objectives. Stakeholders roles and

responsibilities are included in chart 14 below. Chart 15 shows the requirements for the different project deliverables.

Chart 14 Stakeholders Roles and Responsibilities (Source: Compiled by the author)

Stakeholder/Role	Responsibility
Head of the Herbarium; Project Sponsor	Authorizing the Project
Suriname National Botanic Garden Steering Group: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager	Planning and designing
Chair of the University Board	Program management and authorizing
Minister of Physical Planning, Land and Forest Management	Authorizing land acquisition
Minister of Education	Authorizing educational activities at different levels
Botanic Gardens Conservation International	Providing guidelines, training and access to resources regarding botanic gardens globally
Engineer	On-site safety and managing of earth-works
Other Botanic Gardens: Utrecht Botanic Gardens, Missouri Botanical Garden, Atlanta Botanical Garden	Exchanging plant material and expert knowledge
Regulating Agencies	Managing compliance with national and international regulations and exchanging knowledge on plant conservation

The Collect Requirements process gives a clear idea of what the stakeholders want and how their expectations are going to be managed. The requirements traceability matrix below shows what is wanted out of the project's final deliverables. The matrix below links product requirements from their origin to the deliverables that satisfy them.

Chart 15 Requirements Traceability Matrix (Source: Compiled by the author)

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
001	1.0	Experts in Landscape Architecture, Architecture, Botany, Horticulture, Education, Project Management	Manage, maintain, and expand the plant collections	Establish the botanic garden to contribute to conservation of plant species	Establishment of Steering Group			
	1.1	Work Breakdown Structure complete			Project Management Structure			
	1.2	Organization's Strategic Planning document			Defining the NBGS Purpose - Vision and Mission Statements			
	1.3	N/A			BGCI Membership			
002	2.0	Preparation Statement or Notary Decision of land (10 ha)	Manage, maintain, and expand the plant collections	Establish the botanic garden to contribute to conservation of plant species	Selecting the Botanic Garden Project Site			
	2.1	Project Charter and sufficient financial, market, managerial, and technical information			Conducting a Feasibility Study			
	2.2	Project Charter			Projecting and Valuing the Investment - the Business Case			
003	3.0	Experts in Landscape Architecture, Architecture, Botany, Horticulture, Education and resources for pre-operations	Manage, maintain, and expand the plant collections	Establish the botanic garden to contribute to conservation of plant species	Design Team Composition and Design process options			
	3.1	Project Charter			Request for Proposals/Scope of Work			
	3.2	General instructions; Background information, including maps and photographs; Scope of Work; Deliverables; Schedule;			Design Brief			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
		Financial and administrative terms; Submission requirements						
	3.3	Background research; Relevant examples of precedent projects – photos and illustrations; Spacing of components and activities; Site analyses – biophysical, operational, contextual; Diagram and sketches to illustrate the conceptual options; Potential garden operations; Design options and relationship diagrams; Analysis of design options – strengths, weaknesses, opportunities, challenges; To-scale plan drawings, illustrations, sketches; Cost estimates			Master Plan			
	3.4	Design workshops as part of the collaborative design development; The Project Owner should be familiar with the content of the drawings and review them in detail in close association with the Design Team; Regulating agencies may also be involved to ensure that the drawings and specifications comply with any applicable legal requirements			Detailed Design			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
	3.5	Specified state of the materials, equipment, systems, standards and workmanship that are required for the construction; Tender Documents are prepared by the Design Team, with detailed input, review and approval by the Project Owner; Regulating agencies may also be involved to review and approve the plans			Tender Documents			
	3.6	Detailed design completed			Project Plan Review and Completion			
	3.7	Relevant experience; Availability; Track record; Attitude; Professionalism; Commitment to environmentally sustainable construction practices; Fair pricing			Procurement			
	3.8	Communication between Project Owner, the Design Team and the Contractor			Contract Administration			
	3.9	N/A			Project kick-off			
	3.9.0	Accessibility of the site			Site clearing and preparation			
	3.9.1	Detailed design completed			Existing landscape and vegetation protection			
	3.9.2	Depth of stripping predetermined; Stockpile location away from drainage ways and			Topsoil stripping and stockpiling			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
		traffic routes, topsoil stockpiled in small piles located near areas where they will be used						
	3.9.3	Drainage and irrigation designs complete			Grading and earthworks			
	3.9.4	Drainage and irrigation system and infrastructure in place			Drainage and storm water management			
	3.9.5	Spacing requirements; grouped plantings; species selection			Bed and tree pit preparation			
	3.9.6	Volumes calculated			Unit paving			
	3.9.7	Design documents complete			Concrete works			
	3.9.8	Design documents complete			Stone masonry			
	3.9.9	Plant species requirements			Soil preparation			
	3.9.10	Canal system and required depth			Irrigation facilities			
	3.9.11	Water supply; accessibility; pest controlled			Nursery facilities			
	3.9.12	Pest controlled			Plant material – installation, staking, mulching			
	3.9.13	Genebank procedures in accordance with national and international standards for acquisition and the preparation of samples for conservation, maximum longevity and minimum frequency of regeneration, regeneration with adequate viability and genetic integrity, characterizing accessions using standardized formats and recognized descriptors, distribution in accordance with international			Establishment of a seed bank, field genebanks, cryopreservation facility, etc.			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
		legislation and meet requirements for international phytosanitary certification, keep records of distribution from the use of accessions						
	3.9.13.0	Educational curriculum			Education Department			
	3.9.13.1	Organizational and marketing strategy			Public Relation Department			
	3.9.13.2	Greenhouse facility to create a controlled environment to conduct experiments			Research Department			
	3.9.13.3	Comprehensive species records; cooling units/refrigerators for seed storage			Horticulture Department			
	3.10	Detailed design and tender documents			Construction Supervision and Inspection			
	3.11	N/A			Construction complete			
	3.12	Fairness in the treatment of all stakeholders, accountability to give an explanation or reason for the organization's actions and conduct, transparency as to willingness by the organization to provide clear information to stakeholders			Governance and Organizational Structure			
	3.12.0	Good communication between management and board, employee performance rewarding mechanism, SWOT analysis			Develop Strategic Plan for 3-5 years			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
	3.12.1	Current, sufficient and accurate financial and technical information			Develop Business Plan			
	3.12.2	Current, sufficient and accurate operational information			Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training; Environmental Sustainability; Health and Safety			
	3.12.3	Job descriptions and specified requirements, WBS, WBS Dictionary			Staff Recruitment and Training			
	3.12.3.0	Collecting, storage, and treatment standard; Geographical location distributions; Seasonal and phenological information			Field work to collect the required plant material			
	3.12.3.1	Propagation standards	Determine the natural, economic, and cultural value of the plant collections to facilitate policy and decision-making	Display the country's plant diversity through different themes in the botanic garden, including species that are considered vulnerable	Propagation or acquisition of plants			
	3.12.3.2	Tree spotters and botanists			Species identification and verification			
	3.12.3.3	Collections management guidelines			Labelling and accessioning			
	3.12.3.4	International guidelines			Horticultural and plant maintenance protocols			
	3.12.3.5	Herbarium handbook and mounting material			Processing of herbarium vouchers			

Requirements Traceability Matrix								
Project Name:		Suriname National Botanic Garden Project						
Cost Center:								
Project Description:		Development of a 2.5 ha botanic garden within 33 months in four stages: Envisioning the Botanic Garden; Site Selection and Feasibility Study; Design and Pre-Operations; Launch and Operations						
ID	Associate ID	Requirements Description	Business Needs, Opportunities, Goals, Objectives	Project Objectives	WBS Deliverables	Product Design	Product Development	Test Cases
	3.12.4	Botanist and horticulturist			Botanical and Horticultural Activities			
	3.12.5	Greenhouse facilities to create a controlled environment and educational curriculum			Initiating Research Activities			
	3.12.6	Education and communication specialist; Educational curriculum and communications plan			Developing Education, Interpretation and Communication Activities			
	3.12.7	Situation analysis; Target market profile; Clear marketing objectives; Financial plan			Preparing a Marketing Strategy			
	3.12.8	N/A			Pre-operations complete			
004	4.0	Entertainment, agenda, promotions	Disseminate scientific botanical knowledge through scientific research, education, and services to facilitate the general community	Facilitate Scientific Research; Facilitate education to save students and lecturers from different educational institutions time and money	Opening Ceremony			
	4.1	Performance measures			Day-to-Day Running and Periodical Review			
	4.2	Contract close-out, Settle payments, Identify and document lessons learned, Finalize reports, Index/archive project documentation, Release project resources			Close-out/Project Completion			

3. Define Scope

The organizational strategy involves the development of a living plant collection within five years. Botanic gardens may vary in size and the collections are created gradually over a certain period of time. Examples of botanic gardens in countries like Haiti (The Botanical Garden of Les Cayes, 8 ha), the United States of America (Fairchild Tropical Botanic Garden, 9 ha), and the Netherlands (Utrecht Botanic Gardens, 9 ha), reveal that a botanic garden with an area of approximately 10 ha can be managed within a reasonable amount of time and budget. Furthermore, an area of 10 ha will be sufficient to represent a significant part of the country's plant diversity. The Suriname National Botanic Garden will comprise 10 ha land that will be established gradually over a period of five years.

Scope statement

The Project, for which this FGP was developed, will comprise of an area of 2.5 ha and will be carried out in four stages:

1. Envisioning the Botanic Garden
2. Site Selection and Feasibility Study
3. Design and Pre-Operations
4. Launch and Operations

The Project duration will be 33 months for these four stages.

Scope exclusion

The remaining 7.5 ha falls outside the project scope and will be part of another project as part of the organizational five-year strategy.

4. Create WBS

This process subdivides the project deliverables and project work into smaller, more manageable components. It organizes and defines the total scope of the project and represents the work specified in the current approved project scope

statement. The Work Breakdown Structure for the establishment of the Suriname National Botanic Garden Project is depicted in figure 6 below.

The WBS Dictionary is a document that supports the WBS and provides detailed deliverable, activity, and scheduling information about each component in the WBS in chart 16 below.

Chart 16 WBS Dictionary (Source: Compiled by the author)

WBS Dictionary	
Project Name: Suriname National Botanic Garden Project	**Suriname National Botanic Garden**
Control Account ID: n/a	
Work Package Name: Pre-Operations	
Responsible Organization: National Herbarium of Suriname (BBS)	
Work Package Deliverable Description: Pre-operations include eight stages. Governance and Organizational Structure followed by Strategic Framework, Institutional Policies, Business Plan; Staff Recruitment and Training; Developing Plant Collections; Botanical and Horticultural Activities; Initiating Research Activities; Developing Education, Interpretation and Communication Activities; and Preparing a Marketing Strategy. Pre-operations last 330 days and start on 16 July 2021 and end on 20 October 2022.	Other Comments:
Assumptions and Constraints: *Constraints* – Unfavorable weather conditions, project finance, inclement weather, expensive to build, expensive to maintain, availability of resources, regulatory and land title issues, policy issues that may interfere with the project. *Assumptions* - stakeholders agree on the specification of the designs, equipment and machinery available locally to complete construction and pre-operations, permission from government given to commence landscaping and construction, skilled and unskilled labor available, adequate financing provided for completion of pre-operations.	Other Comments:
Quality Metrics: Scientific, sustainability, safety/protection, lifetime value/life expectancy, net profit, gross profit margin, client satisfaction, ecosystem service.	Other Comments:

Resources Assigned: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; skilled & unskilled laborers; Project Manager & Project team; Administrative staff; Earthmoving equipment & operator; raw materials including topsoil, gravel; finance.	Other Comments:
Schedule Milestones: Project Plan Review and Completion, Project Kick-Off, Establishment of a Seed Bank, Field Genebanks, Cryopreservation Facility, etc., Construction Complete, Pre-Operations Complete.	Other Comments:
Approved by: Dorothy Traag, MSc. Date: 2019	

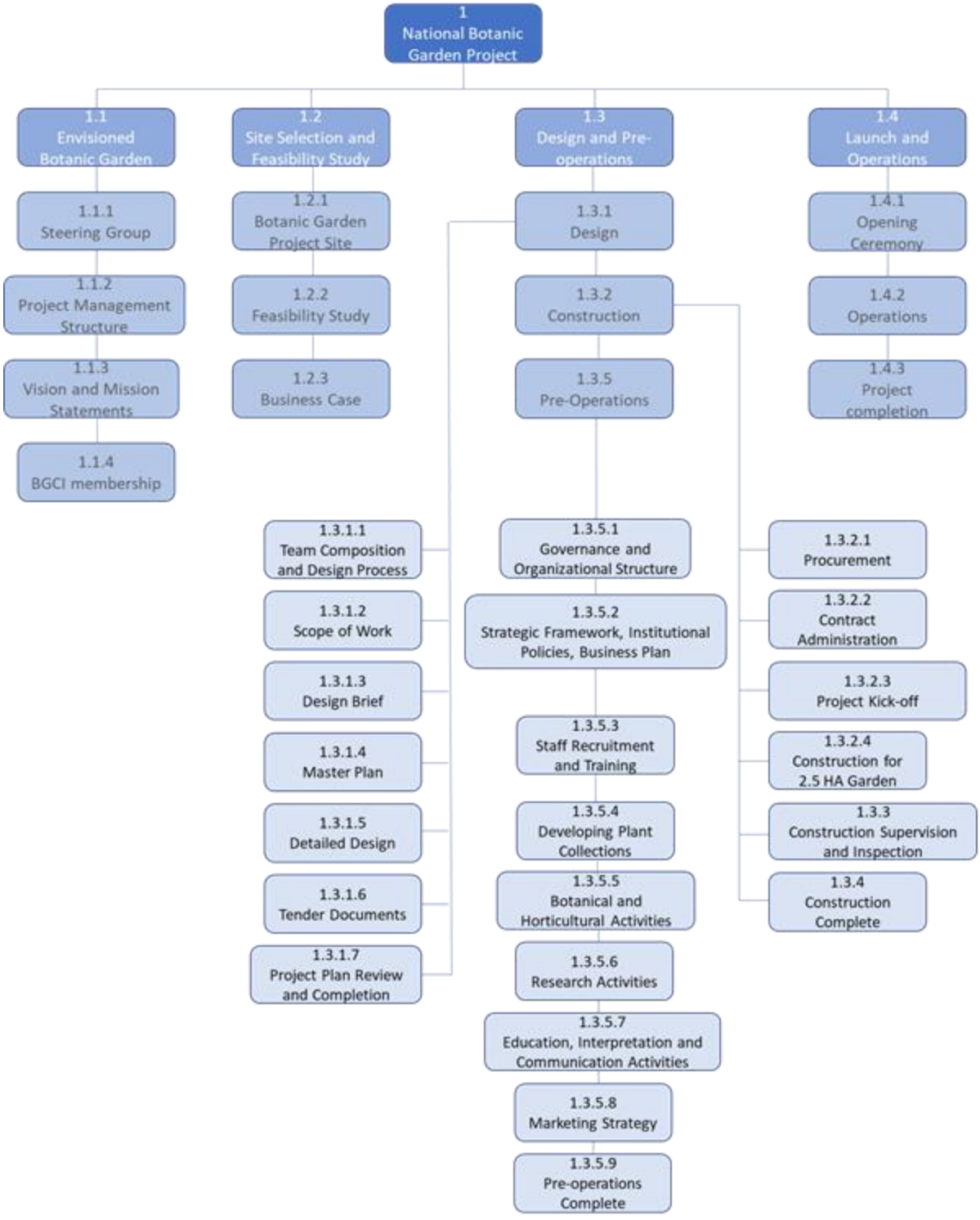

Figure 6 WBS for the Suriname National Botanic Garden Project (Source: Compiled by the author)

5. Validate Scope

The project deliverables will be reviewed by the stakeholders that need to approve them. It is important to have a plan in place for exactly how project deliverables will be accepted as complete. At the end of this process, deliverables, change requests, or project document updates will be accepted. For the Suriname National Botanic Garden Project planning documents and designs will be accepted by the Project Sponsor and the Steering Group that consists of several experts. Designs, for example, will be accepted by the engineer, while the deliverables from landscaping activities will be accepted by the Landscape Architect, the Horticulturist, and the Engineer. Deliverables resulting from the establishment of the plant collections will be accepted by the Horticulturist and the Botanist, while the Education Expert will accept the educational curriculum.

6. Control Scope

This is the process of monitoring the status of the project and product scope and managing changes to the scope baseline. The project's status should be monitored from start to finish to ensure that it is being executed according to the project scope management plan. It is possible that the scope may need to change or a customer may add new requirements. In order to control the scope, the performance reports need to be compared with the project requirements. Other outputs of the Control Scope process are Change Requests, Project Management Plan updates and Project Document updates. Changes in the project scope will be recorded by a formal change request. An example of the Change Request template is depicted in figure 7 below.

CHANGE REQUEST TEMPLATE

Date:		Submitted by:	
Project Name:			
Change Proposal Number:		Contract Number:	
Change Proposal Title:			
Scope of Change Proposal:			
Implementation of Change Proposal (Timing):			
Items Affected by Change			

Impact of Change			
	Effort (Man Hours)		
Analysis/ Investigagtion		Total Effort	Days
Design		Total Cost	
Manuals		Schedule Impact	Days
		Cost Impact	

Comment Box

Figure 7 Change Request Template (Source: Compiled by the author)

7. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.3. Project Schedule Management

Specific objective 3 for the establishment of a National Botanic Garden Project was to create a Schedule Management Plan. The processes required to manage the timely completion of the project are Plan Schedule Management, Define Activities, Sequence Activities, Estimate Activity Durations, Develop Schedule, and Control Schedule. The method used for scheduling was the critical path and was realized by meetings with the project sponsor and interviews with other project managers.

Suriname National Botanic Garden Project

Schedule Management Plan

1. Plan Schedule Management

This is the process of establishing the policies, procedures, and documentation for planning, developing, executing, and controlling the project schedule. BGCI's Manual on Planning, Developing and Managing Botanic Gardens was used as a guide to develop the schedule for the Suriname National Botanic Garden Project. This manual provides an outline of the steps and strategic thinking recommended for the planning, design and construction of a botanic garden project of any scale or complexity. When there is an approved change request, or when there is a variance, the existing schedule will need to be updated. The project schedule was developed with Microsoft Project 2013 and will be used to measure the schedule performance monthly. After the activities had been identified and described in section 2 of the Schedule Management Plan, the activity durations had been estimated in section 3. In doing so, the project resources were also taken into consideration. The schedule developed in section 4 contains activity descriptions, durations start dates, finish dates and predecessors for each activity. The critical path depicted in this section shows the sequence of activities that represents the longest path throughout the project, which determines the shortest possible duration. The Control Schedule process is described in section 5 of the Schedule Management plan.

2. Define Activities

This is the process of identifying and documenting the specific actions to be performed to produce the project deliverables.

Activity list

Scheduled activities are tabulated in chart 17 below, showing the activity description, activity identifier, and a sufficiently detailed scope of work description so project team members understand what work is to be performed to establish the botanic garden.

Chart 17 Activity List for the National Botanic Garden Project (Source: Compiled by the author)

Activity identifier	Activity description	Scope of work
1.1	**Envisioning the Botanic Garden**	
1.1.1	Establishment of Steering Group	Executive oversight of the development process, and formulates clear objectives and terms of reference for the project
1.1.2	Project Management Structure	Implement project management activities
1.1.3	Defining the NBGS Purpose - Vision and Mission Statements	Constitute an important part of the botanic garden's Strategic Framework documents, setting out the broad framework within which the botanic garden will operate and define key roles and responsibilities of the stakeholders involved
1.1.4	BGCI Membership	Involve a broad network of expertise and resources
1.2	**Site Selection and Feasibility Study**	
1.2.1	Selecting the Botanic Garden Project Site	Evaluate and score criteria for the assessment and selection of the project site
1.2.2	Conducting a Feasibility Study	Determine if the project is realistic and achievable
1.2.3	Projecting and Valuing the Investment - the Business Case	Provide a compelling argument for the added value of the project and justify the resources needed for the investment
1.3	**Design and Pre-Operations**	

Activity identifier	Activity description	Scope of work
1.3.1	**Design**	
1.3.1.1	Design Team Composition and Design process options	Work with a designer or a team of designers to translate the project goals into reality
1.3.1.2	Request for Proposals/Scope of Work	Select a highly qualified and experienced Design Team that is informed and excited about the project
1.3.1.3	Design Brief	Develop detailed project information to guide the design process, focused on outcomes and results of the design
1.3.1.4	Master Plan	Provide a comprehensive document that presents a possible solution to the intended project outcome and guides all subsequent design phases leading to project realization
1.3.1.5	Detailed Design	Advance the Master Plan into achievable, specific design solutions
1.3.1.6	Tender Documents	Submit a price to construct the project, and include the highest level of detail for all drawings and technical specifications by the Contractor
1.3.1.7	Project Plan Review and Completion	Prepare and review all documents required for construction and pre-operations
1.3.2	**Construction**	
1.3.2.1	Procurement	Evaluate bids submitted by Contractors based both on cost and the technical merit
1.3.2.2	Contract Administration	Examine bids and bidders
1.3.2.3	Project kick-off	Formalize the start of the construction activities
1.3.2.4	**Construction for 2.5 ha Garden**	
1.3.2.4.1	Site clearing and preparation	Manage site clearing and preparation of the project site
1.3.2.4.2	Existing landscape and vegetation protection	Manage landscaping activities and conservation of existing vegetation
1.3.2.4.3	Topsoil stripping and stockpiling	Coordinate topsoil removal, relocation and stockpiling activities
1.3.2.4.4	Grading and earthworks	Coordinate grading and earthworks activities
1.3.2.4.5	Drainage and storm water management	Manage drainage, storm water, and natural irrigation activities

Activity identifier	Activity description	Scope of work
1.3.2.4.6	Bed and tree pit preparation	Coordinate bed and tree pit preparation
1.3.2.4.7	Unit paving	Coordinate construction of trails, roads
1.3.2.4.8	Concrete works	Coordinate concrete Works
1.3.2.4.9	Stone masonry	Coordinate Stone masonry
1.3.2.4.10	Soil preparation	Manage soil preparation
1.3.2.4.11	Irrigation facilities	Coordinate construction of man-made irrigation facilities
1.3.2.4.12	Nursery facilities	Coordinate construction of nursery facilities
1.3.2.4.13	Plant material – installation, staking, mulching	Coordinate planting activities
1.3.2.4.14	Establishment of a seed bank, field genebanks, cryopreservation facility, etc.	Manage the plant collections
1.3.2.4.15	**Construction of facility to house 4 departments**	
1.3.2.4.15.1	Education Department	Coordinate the construction of the Education Department
1.3.2.4.15.2	Public Relation Department	Coordinate the construction of the Public Relations Department
1.3.2.4.15.3	Research Department	Coordinate the construction of the Research Department
1.3.2.4.15.4	Horticulture Department	Coordinate the construction of the Horticulture Department
1.3.3	Construction Supervision and Inspection	Conduct supervision and inspection of the construction activities
1.3.4	Construction complete	Close out the construction phase
1.3.5	**Pre-Operations**	
1.3.5.1	Governance and Organizational Structure	Establish staff structures for all departments to guide the staff recruitment process to inform the business plan development
1.3.5.2	**Strategic Framework, Institutional Policies, Business Plan**	
1.3.5.2.1	Develop Strategic Plan for 3-5 years	Plan and develop actions to accomplish objectives
1.3.5.2.2	Develop Business Plan	Describe how and where the botanic garden expects to make and spend money
1.3.5.2.3	Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training;	Develop and update policies and procedures as part of the day to day workings of the organization

Activity identifier	Activity description	Scope of work
	Environmental Sustainability; Health and Safety	
1.3.5.3	Staff Recruitment and Training	Streamline the organizational structure and develop staff to an expected level of expertise and performance
1.3.5.4	**Developing Plant Collections**	
1.3.5.4.1	Field work to collect the required plant material	Coordinate field work to collect the required plant material
1.3.5.4.2	Propagation or acquisition of plants	Coordinate propagation and acquisition of plants
1.3.5.4.3	Species identification and verification	Manage species identification and verification
1.3.5.4.4	Labelling and accessioning	Manage labelling and accessioning of the collections
1.3.5.4.5	Horticultural and plant maintenance protocols	Develop horticultural and plant maintenance protocols
1.3.5.4.6	Processing of herbarium vouchers	Coordinate processing of herbarium vouchers
1.3.5.5	Botanical and Horticultural Activities	Coordinate botanical and horticultural activities
1.3.5.6	Initiating Research Activities	Coordinate research activities
1.3.5.7	Developing Education, Interpretation and Communication Activities	Develop Education, Interpretation and Communication Activities
1.3.5.8	Preparing a Marketing Strategy	Prepare a marketing strategy
1.3.5.9	Pre-operations complete	Close out pre-operations
1.4	**Launch and Operations**	
1.4.1	Opening Ceremony	Coordinate the official opening of the botanic garden
1.4.2	Day-to-Day Running and Periodical Review	Manage daily operations
1.4.3	Close-out/Project Completion	Close out the project

3. Estimate Activity Durations

This is the process of estimating the number of work periods needed to complete individual activities with the estimated resources. In chart 18 below the activity durations are estimated for the establishment of the botanic garden.

Chart 18 Activity durations for the Suriname National Botanic Garden Project (Source: Compiled by the author)

Activity identifier	Activity description	Duration
1	**National Botanic Garden Project**	**776 days**
1.1	**Envisioning the Botanic Garden**	**120 days**
1.1.1	Establishment of Steering Group	31 days
1.1.2	Project Management Structure	11 days
1.1.3	Defining the NBGS Purpose - Vision and Mission Statements	11 days
1.1.4	BGCI Membership	0 days
1.2	**Site Selection and Feasibility Study**	**71 days**
1.2.1	Selecting the Botanic Garden Project Site	31 days
1.2.2	Conducting a Feasibility Study	20 days
1.2.3	Projecting and Valuing the Investment - the Business Case	20 days
1.3	**Design and Pre-Operations**	**585 days**
1.3.1	**Design**	**109 days**
1.3.1.1	Design Team Composition and Design process options	20 days
1.3.1.2	Request for Proposals/Scope of Work	40 days
1.3.1.3	Design Brief	5 days
1.3.1.4	Master Plan	30 days
1.3.1.5	Detailed Design	35 days
1.3.1.6	Tender Documents	19 days
1.3.1.7	Project Plan Review and Completion	0 days
1.3.2	**Construction**	**211 days**
1.3.2.1	Procurement	60 days
1.3.2.2	Contract Administration	11 days
1.3.2.3	Project kick-off	0 days
1.3.2.4	**Construction for 2.5 HA Garden**	**211 days**
1.3.2.4.1	Site clearing and preparation	20 days
1.3.2.4.2	Existing landscape and vegetation protection	10 days
1.3.2.4.3	Topsoil stripping and stockpiling	5 days
1.3.2.4.4	Grading and earthworks	15 days
1.3.2.4.5	Drainage and storm water management;	10 days
1.3.2.4.6	Bed and tree pit preparation	15 days
1.3.2.4.7	Unit paving	15 days
1.3.2.4.8	Concrete works	20 days
1.3.2.4.9	Stone masonry	15 days
1.3.2.4.10	Soil preparation	10 days
1.3.2.4.11	Irrigation facilities	15 days
1.3.2.4.12	Nursery facilities	40 days
1.3.2.4.13	Plant material – installation, staking, mulching	30 days

Activity identifier	Activity description	Duration
1.3.2.4.14	Establishment of a seed bank, field genebanks, cryopreservation facility, etc.	0 days
1.3.2.4.15	**Construction of facility to house 4 departments**	**120 days**
1.3.2.4.15.1	Education Department	120 days
1.3.2.4.15.2	Public Relation Department	25 days
1.3.2.4.15.3	Research Department	25 days
1.3.2.4.15.4	Horticulture Department	30 days
1.3.3	Construction Supervision and Inspection	232 days
1.3.4	Construction complete	0 days
1.3.5	**Pre-Operations**	**330 days**
1.3.5.1	Governance and Organizational Structure	75 days
1.3.5.2	**Strategic Framework, Institutional Policies, Business Plan**	**130 days**
1.3.5.2.1	Develop Strategic Plan for 3-5 years	65 days
1.3.5.2.2	Develop Business Plan	25 days
1.3.5.2.3	Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training; Environmental Sustainability; Health and Safety	40 days
1.3.5.3	Staff Recruitment and Training	60 days
1.3.5.4	**Developing Plant Collections**	**265 days**
1.3.5.4.1	Field work to collect the required plant material	230 days
1.3.5.4.2	Propagation or acquisition of plants	130 days
1.3.5.4.3	Species identification and verification	140 days
1.3.5.4.4	Labelling and accessioning	140 days
1.3.5.4.5	Horticultural and plant maintenance protocols	30 days
1.3.5.4.6	Processing of herbarium vouchers	60 days
1.3.5.5	Botanical and Horticultural Activities	35 days
1.3.5.6	Initiating Research Activities	35 days
1.3.5.7	Developing Education, Interpretation and Communication Activities	35 days
1.3.5.8	Preparing a Marketing Strategy	30 days
1.3.5.9	Pre-operations complete	0 days
1.4	**Launch and Operations**	**35 days**
1.4.1	Opening Ceremony	5 days
1.4.2	Day-to-Day Running and Periodical Review	30 days
1.4.3	Close-out/Project Completion	0 days

4. Develop Schedule

This is the process of analyzing activities sequences, durations, resource requirements, and individual schedule constraints to create the project schedule model for project execution and monitoring and controlling. The critical path is depicted in Figure 7 and the schedule for the establishment of the Suriname Botanic Garden Project is presented in Chart 19 below.

Chart 19 Schedule for the establishment of the Suriname National Botanic Garden Project (Source: Compiled by the author)

Activity description	Duration	Start date	Finish date	Predecessors
National Botanic Garden Project	**776 days**	**Thu 10/31/19**	**Thu 10/20/22**	
Envisioning the Botanic Garden	**120 days**	**Thu 10/31/19**	**Wed 4/15/20**	
Establishment of Steering Group	31 days	Mon 2/3/20	Mon 3/16/20	
Project Management Structure	11 days	Tue 3/17/20	Tue 3/31/20	3
Defining the NBGS Purpose - Vision and Mission Statements	11 days	Wed 4/1/20	Wed 4/15/20	3,4
BGCI Membership	0 days	Thu 10/31/19	Thu 10/31/19	
Site Selection and Feasibility Study	**71 days**	**Thu 4/16/20**	**Thu 7/23/20**	
Selecting the Botanic Garden Project Site	31 days	Thu 4/16/20	Thu 5/28/20	2
Conducting a Feasibility Study	20 days	Fri 5/29/20	Thu 6/25/20	8
Projecting and Valuing the Investment - the Business Case	20 days	Fri 6/26/20	Thu 7/23/20	9
Design and Pre-Operations	**585 days**	**Fri 7/24/20**	**Thu 10/20/22**	
Design	**109 days**	**Fri 7/24/20**	**Wed 12/23/20**	
Design Team Composition and Design process options	20 days	Fri 7/24/20	Thu 8/20/20	10
Request for Proposals/Scope of Work	40 days	Fri 8/21/20	Thu 10/15/20	13
Design Brief	5 days	Fri 8/21/20	Thu 8/27/20	13
Master Plan	30 days	Fri 8/28/20	Thu 10/8/20	15
Detailed Design	35 days	Fri 10/9/20	Thu 11/26/20	16
Tender Documents	19 days	Fri 11/27/20	Wed 12/23/20	17,16
Project Plan Review and Completion	0 days	Wed 12/23/20	Wed 12/23/20	18
Construction	**211 days**	**Thu 12/24/20**	**Thu 10/14/21**	**18**
Procurement	60 days	Thu 12/24/20	Wed 3/17/21	16,17
Contract Administration	11 days	Thu 3/18/21	Thu 4/1/21	21
Project kick-off	0 days	Thu 4/1/21	Thu 4/1/21	22
Construction for 2.5 ha Garden	**211 days**	**Thu 12/24/20**	**Thu 10/14/21**	
Site clearing and preparation	20 days	Fri 4/2/21	Thu 4/29/21	23
Existing landscape and vegetation protection	10 days	Fri 4/30/21	Thu 5/13/21	25

Activity description	Duration	Start date	Finish date	Predecessors
Topsoil stripping and stockpiling	5 days	Fri 5/14/21	Thu 5/20/21	26,25
Grading and earthworks	15 days	Fri 5/21/21	Thu 6/10/21	27
Drainage and storm water management;	10 days	Fri 6/11/21	Thu 6/24/21	28
Bed and tree pit preparation	15 days	Fri 6/25/21	Thu 7/15/21	29
Unit paving	15 days	Fri 4/30/21	Thu 5/20/21	25
Concrete works	20 days	Fri 5/21/21	Thu 6/17/21	31
Stone masonry	15 days	Fri 6/18/21	Thu 7/8/21	32
Soil preparation	10 days	Thu 12/24/20	Wed 1/6/21	
Irrigation facilities	15 days	Thu 12/24/20	Wed 1/13/21	
Nursery facilities	40 days	Thu 12/24/20	Wed 2/17/21	
Plant material – installation, staking, mulching	30 days	Fri 7/16/21	Thu 8/26/21	30
Establishment of a seed bank, field genebanks, cryopreservation facility, etc.	0 days	Thu 8/26/21	Thu 8/26/21	37
Construction of facility to house 4 departments	**120 days**	**Fri 4/30/21**	**Thu 10/14/21**	
Education Department	120 days	Fri 4/30/21	Thu 10/14/21	25
Public Relation Department	25 days	Fri 4/30/21	Thu 6/3/21	25
Research Department	25 days	Fri 4/30/21	Thu 6/3/21	25
Horticulture Department	30 days	Fri 4/30/21	Thu 6/10/21	25
Construction Supervision and Inspection	232 days	Fri 10/15/21	Mon 9/5/22	24,39
Construction complete	0 days	Thu 10/14/21	Thu 10/14/21	39
Pre-Operations	**330 days**	**Fri 7/16/21**	**Thu 10/20/22**	
Governance and Organizational Structure	75 days	Fri 10/15/21	Thu 1/27/22	45
Strategic Framework, Institutional Policies, Business Plan	**130 days**	**Fri 1/28/22**	**Thu 7/28/22**	
Develop Strategic Plan for 3-5 years	65 days	Fri 1/28/22	Thu 4/28/22	47
Develop Business Plan	25 days	Fri 4/29/22	Thu 6/2/22	47,49
Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training; Environmental Sustainability; Health and Safety	40 days	Fri 6/3/22	Thu 7/28/22	50,47,49
Staff Recruitment and Training	60 days	Fri 7/16/21	Thu 10/7/21	30
Developing Plant Collections	**265 days**	**Fri 8/27/21**	**Thu 9/1/22**	
Field work to collect the required plant material	230 days	Fri 10/15/21	Thu 9/1/22	36,45
Propagation or acquisition of plants	130 days	Fri 10/15/21	Thu 4/14/22	36,45
Species identification and verification	140 days	Fri 10/15/21	Thu 4/28/22	36,45
Labelling and accessioning	140 days	Fri 10/15/21	Thu 4/28/22	36,45

Activity description	Duration	Start date	Finish date	Predecessors
Horticultural and plant maintenance protocols	30 days	Fri 8/27/21	Thu 10/7/21	37
Processing of herbarium vouchers	60 days	Fri 10/8/21	Thu 12/30/21	58
Botanical and Horticultural Activities	35 days	Fri 9/2/22	Thu 10/20/22	54
Initiating Research Activities	35 days	Fri 9/2/22	Thu 10/20/22	54
Developing Education, Interpretation and Communication Activities	35 days	Fri 9/2/22	Thu 10/20/22	54
Preparing a Marketing Strategy	30 days	Fri 6/3/22	Thu 7/14/22	50
Pre-operations complete	0 days	Thu 9/1/22	Thu 9/1/22	48,53
Launch and Operations	**35 days**	**Fri 9/2/22**	**Thu 10/20/22**	
Opening Ceremony	5 days	Fri 9/2/22	Thu 9/8/22	64
Day-to-Day Running and Periodical Review	30 days	Fri 9/9/22	Thu 10/20/22	66
Close-out/Project Completion	0 days	Thu 10/20/22	Thu 10/20/22	66,67

Critical Path

The critical path depicted in figure 7 below for the Suriname National Botanic Garden Project shows the sequence of activities that represents the longest path throughout the project, which determines the shortest possible duration. The red lines depict the critical path. It is normally characterized by zero total float on the critical path (PMI, 2017, p. 210).

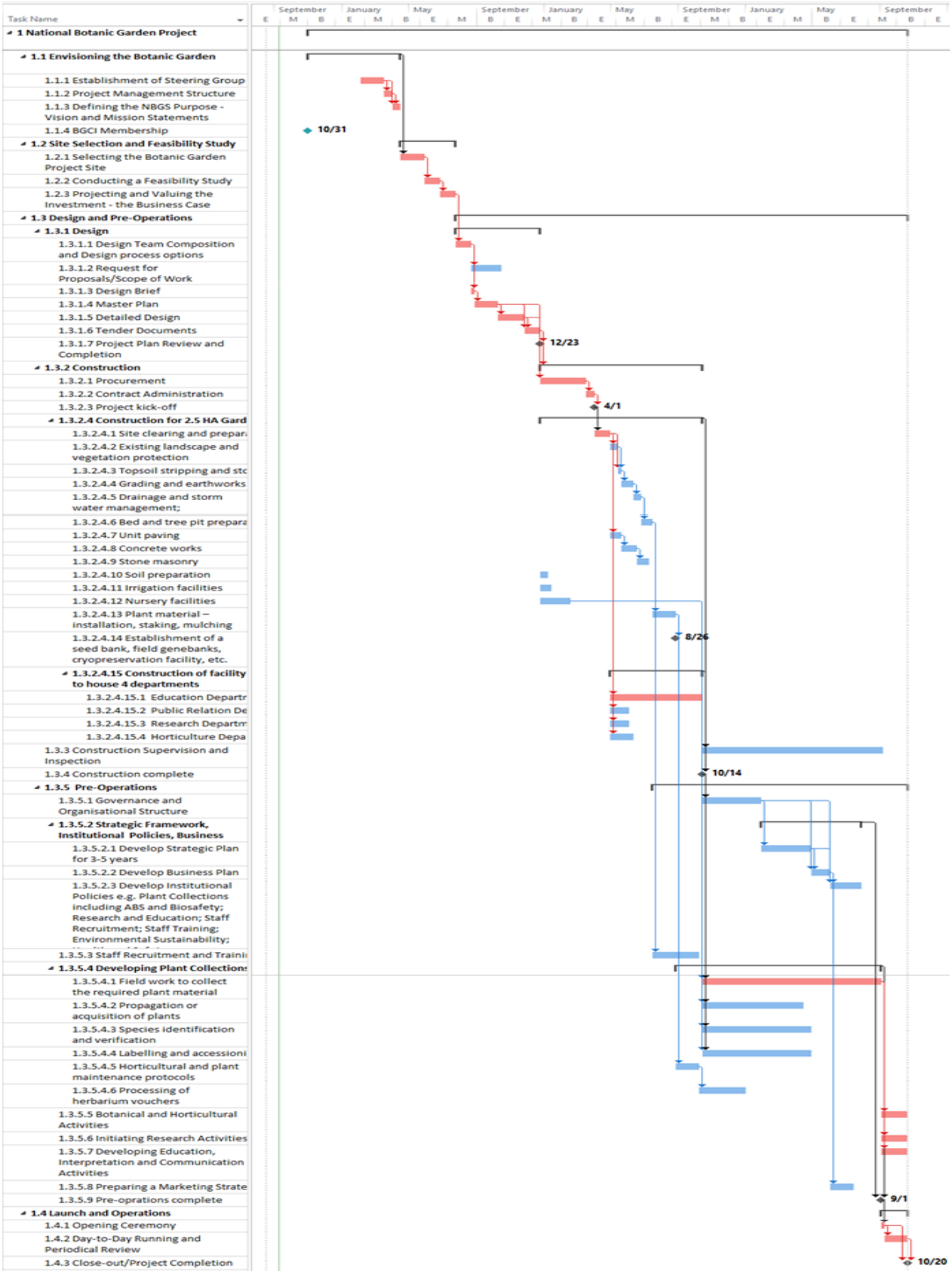

Figure 8 Critical Path for the Suriname National Botanic Garden Project (Source: Compiled by the author)

5. Control Schedule

Regardless of the project planning accuracy, project actual values will differ from the planned ones. And once there is a deviation in the project schedule, necessary corrective and preventive actions must be taken to get back on track. Plan Schedule Management process provides this guidance when necessary. The schedule for the Suriname National Botanic Garden Project will be controlled by using MS Project software.

6. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.4. Project Cost Management

Specific objective 4 for the establishment of a National Botanic Garden Project was to create a Cost Management Plan. The processes involve planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget including Plan Cost Management, Estimate Cost, Determine Budget, and Control Cost.

Suriname National Botanic Garden Project

Cost Management Plan

1. Plan Cost Management

This is the process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled. The costs for the establishment of the Suriname National Botanic Garden Project are estimated using analogues and parametric estimating techniques. Costs for construction activities are calculated by parametric estimation, while analogous estimating was used to estimate other costs. The budget is determined by adding management and contingency reserves to the cost baseline. Data analyses, contingency reserves, and cost changes will be managed in the Control Cost process.

2. Estimate Cost

This is the process of developing an approximation of the monetary resources needed to complete project work.

Cost baseline

The cost baseline is the approved version of the time-phased project budget, excluding any management reserves, which can only be changed through formal change control procedures. It is used as a basis for comparison to actual results.

The cost baseline is developed as a summation of the approved budgets for the different scheduled activities. The following equation shows that the Project Budget (E) is derived from the Cost Baseline (D_1) plus the Management Reserve (D_2).

(1) Equation: $E = D_1 + D_2$

E: Project Budget

D_1: Cost Baseline

D_2: Management Reserve

Several components make up the Cost Baseline as shown in the following equations.

(2) Equation: $D_1 = \sum C = B_1 + B_2$

$D_1 = \sum C$: Cost Baseline is a summation of Control Accounts

B_1: Work Package Cost Estimates

B_2: Contingency Reserve

(3) Equation: $B_1 = A_1 + A_2$

A_1: Activity Cost Estimate

A_2: Activity Contingency Reserve

The cost baseline for the Suriname Botanic Garden Project is estimated in chart 20 below. Costs for construction activities are calculated by parametric estimation, while analogous estimating was used to estimate other costs. Calculations were made with Microsoft Excel 2016. Interviews with experts in the field of engineering, nature conservation, and plant inventory were also conducted for realistic estimating of relevant activities.

Chart 20 Cost baseline for the Suriname National Botanic Garden Project (Source: Compiled by the author)

No.	Activity	Duration	Activity Cost Estimate	Backup Information
1	**National Botanic Garden Project**	**776 days**		
1.1	**Envisioning the Botanic Garden**	**120 days**		

No.	Activity	Duration	Activity Cost Estimate	Backup Information
1.1.1	Establishment of Steering Group	31 days	$16500	Monthly fee for 5 steering group members for 33 months
1.1.2	Project Management Structure	11 days	$1025	11 Quarterly Reports, Office supplies: 12 flip-over charts, 1 flip-over chart stand, 24 white board markers, 10 notebooks, 15 pencils
1.1.3	Defining the NBGS Purpose - Vision and Mission Statements	11 days	$0	Responsibility of Steering Group
1.1.4	BGCI Membership	0 days	$450	Annual membership fee for 3 years
1.2	**Site Selection and Feasibility Study**	**71 days**		
1.2.1	Selecting the Botanic Garden Project Site	31 days	$1540	Fee for surveyor, Maps (figurative and chart map). Land application form, Demarcation posts by surveyor, Notarial deed, Transportation
1.2.2	Conducting a Feasibility Study	20 days	$2000	Consultancy fee
1.2.3	Projecting and Valuing the Investment - the Business Case	20 days	$0	Responsibility of Steering Group
1.3	**Design and Pre-Operations**	**585 days**		
1.3.1	**Design**	**109 days**		
1.3.1.1	Design Team Composition and Design process options	20 days	$0	Responsibility of Steering Group
1.3.1.2	Request for Proposals/Scope of Work	40 days	$270	Print of requirements Documentation, Transportation, Office overhead (telephone costs)
1.3.1.3	Design Brief	5 days	$0	Responsibility of Steering Group
1.3.1.4	Master Plan	30 days	$1950	Drawings 2D, Presentation for key stakeholders, Venue for presentation, Consumption for presentation
1.3.1.5	Detailed Design	35 days	$5215	Drawings 3D, Transportation, Office overhead (telephone costs)

No.	Activity	Duration	Activity Cost Estimate	Backup Information
1.3.1.6	Tender Documents	19 days	$396	Print of requirements documentation, Transportation, Office overhead (telephone costs)
1.3.1.7	Project Plan Review and Completion	0 days	$0	Responsibility of Steering Group
1.3.2	**Construction**	**211 days**		
1.3.2.1	Procurement	60 days	$240	Office overhead (telephone costs)
1.3.2.2	Contract Administration	11 days	$75	Print of agreements and requirements documentation
1.3.2.3	Project kick-off	0 days	$250	Consumption for project team
1.3.2.4	**Construction for 2.5 ha Garden**	**211 days**		
1.3.2.4.1	Site clearing and preparation	20 days	$300	Labor costs
1.3.2.4.2	Existing landscape and vegetation protection	10 days	$150	Labor costs
1.3.2.4.3	Topsoil stripping and stockpiling	5 days	$14625	Machinery rental (excavator), Transportation of machinery, Trucks for removal of wastes
1.3.2.4.4	Grading and earthworks	15 days	$4875	Machinery rental (tractor), Transportation of machinery
1.3.2.4.5	Drainage and storm water management;	10 days	$9375	Water discharge, Driveway construction material (sewer pipe), Driveway construction machinery, Water discharge reservoir, Transportation of machinery
1.3.2.4.6	Bed and tree pit preparation	15 days	$225	Labor costs
1.3.2.4.7	Unit paving	15 days	$5750	625 m walking roads and 125 m driving roads, transportation of gravel, Machinery for paving
1.3.2.4.8	Concrete works	20 days	$300	Labor costs
1.3.2.4.9	Stone masonry	15 days	$225	Labor costs
1.3.2.4.10	Soil preparation	10 days	$150	Labor costs
1.3.2.4.11	Irrigation facilities	15 days	$6225	Water pump, Irrigation hose 100m (1"),

No.	Activity	Duration	Activity Cost Estimate	Backup Information
				Irrigation hose 100m (1.5"), PVC hose (1"), accessories and shut-off valve, Generator, Fuel, Water reservoir, elevation construction, welding wire, labor costs
1.3.2.4.12	Nursery facilities	40 days	$12300	1.5" 6m galvanized tubes, accessories, humus, shadow mesh 50%, Cement, sand, Stone, labor costs
1.3.2.4.13	Plant material – installation, staking, mulching	30 days	$6952	NPK (12-12-17-2) (50kg), Urea (40kg), chicken manure, planting bags, Chlorine, buckets (20 liter), Biopesticides (serenade, biopel, bio power, neemal, cure), Packing material, labels, labor costs
1.3.2.4.14	Establishment of a seed bank, field genebanks, cryopreservation facility, etc.	0 days	$0	Milestone
1.3.2.4.15	**Construction of facility to house 4 departments**	**120 days**		
1.3.2.4.15.1	Education Department	120 days	$71528	Education Department, Public Relations Department, Horticulture Department, Research Department including Doors and Windows, Roof construction, Bridge and stairs, Floor of exposition area, Walls of exposition area, Entrance exposition area, Finish office units, sewage, sanitary rooms exposition area, toilet for office units, kitchenettes, paint work, electrical installation, air conditioning, construction facilities
1.3.2.4.15.2	Public Relation Department	25 days	$34850	
1.3.2.4.15.3	Research Department	25 days	$36678	
1.3.2.4.15.4	Horticulture Department	30 days	$35764	
1.3.3	Construction Supervision and Inspection	232 days	$3000	Labor costs

No.	Activity	Duration	Activity Cost Estimate	Backup Information
1.3.4	Construction complete	0 days	$0	Milestone
1.3.5	**Pre-Operations**	**330 days**		
1.3.5.1	Governance and Organizational Structure	75 days	$0	Responsibility of Steering Group
1.3.5.2	**Strategic Framework, Institutional Policies, Business Plan**	**130 days**		
1.3.5.2.1	Develop Strategic Plan for 3-5 years	65 days	$0	Responsibility of Steering Group
1.3.5.2.2	Develop Business Plan	25 days	$0	Responsibility of Steering Group
1.3.5.2.3	Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training; Environmental Sustainability; Health and Safety	40 days	$0	Responsibility of Steering Group
1.3.5.3	Staff Recruitment and Training	60 days	$89900	Staff 4 departments with 1 coordinator each, 1 assistant for the research department and 2 assistants for the horticulture department, BGCI online training for 3 modules for 1 person, Train 4 coordinators, Train 3 assistants
1.3.5.4	**Developing Plant Collections**	**265 days**		
1.3.5.4.1	Field work to collect the required plant material	230 days	$31660	4 locations Bakhuys, Keti swamp, Kanawapan, Tibiti savanne, flights, car rental, Fuel, Boat, Boat fuel, Nautulus, Canoe, Tree spotter, Tree climber, Local guide, Researcher, Assistant, Boat driver, Equipment, Consumption, insurance, Village fee, krutu (village meeting)
1.3.5.4.2	Propagation or acquisition of plants	130 days	$0	Included in staff salary
1.3.5.4.3	Species identification and verification	140 days	$0	Included in staff salary
1.3.5.4.4	Labelling and accessioning	140 days	$840	Included in staff salary

No.	Activity	Duration	Activity Cost Estimate	Backup Information
1.3.5.4.5	Horticultural and plant maintenance protocols	30 days	$0	Included in staff salary
1.3.5.4.6	Processing of herbarium vouchers	60 days	$2400	Processing of herbarium vouchers, material for processing of herbarium vouchers
1.3.5.5	Botanical and Horticultural Activities	35 days	$6420	Spades, hoes, machetes, back sprayer, Wheel barrel, water hose,1 3/4" (100 m), water hose 1 " (100 m), Brush cutter. Fuel (mengsel), cutting line, refrigerator
1.3.5.6	Initiating Research Activities	35 days	$1050	Labor costs
1.3.5.7	Developing Education, Interpretation and Communication Activities	35 days	$1050	Labor costs
1.3.5.8	Preparing a Marketing Strategy	30 days	$1050	Labor costs
1.3.5.9	Pre-operations complete	0 days	$0	Milestone
1.4	**Launch and Operations**	35 days		
1.4.1	Opening Ceremony	5 days	$2975	Catering for 75 persons, Transportation for 50 persons, decorations, posters, booklets, banner, party tent rental with portable WC and 75 chairs
1.4.2	Day-to-Day Running and Periodical Review	30 days	$18750	Staff of 4 coordinators and 3 assistants
1.4.3	Close-out/Project Completion	0 days	$0	
		Total Costs	***$429278***	

3. Determine Budget

With the equations presented in section 2 of the Cost Management Plan, the budget for the Suriname National Botanic Garden Project was determined.

Contingency Reserve

This is the time or money allocated in the schedule or cost baseline for known risks with active response strategies (also known as the 'known-unknowns').
Fort the establishment of the Suriname National Botanic Garden Project 8 percent contingency was calculated because the botanic garden is a new endeavor for the country.

Management Reserve

This is an amount of the project budget or project schedule held outside of the performance measurement baseline (PMB) for management control purposes, that is reserved for unforeseen work that is within scope of the project (also known as the 'unknown-unknowns').
All projects have a 5% management reserve in case that an event unexpected or a natural disaster may happen, for example loss of seeds and planting material due to natural conditions or pest invasions, heavy rainfall or extended dry seasons.
The contingency and management reserves for the Suriname National Botanic Garden Project are calculated in chart 21 below.

Chart 21 Contingency reserve for the Suriname National Botanic Garden Project (Source: Compiled by the author)

No.	Activity	Activity Cost Estimate	% Contingency	Contingency Reserve
1	**National Botanic Garden Project**			
1.1	**Envisioning the Botanic Garden**			
1.1.1	Establishment of Steering Group	$16500	5%	$17,325
1.1.2	Project Management Structure	$1025	5%	$1,076
1.1.3	Defining the NBGS Purpose - Vision and Mission Statements	$0	0%	$0
1.1.4	BGCI Membership	$450	0%	$450
1.2	**Site Selection and Feasibility Study**			$0

No.	Activity	Activity Cost Estimate	% Contingency	Contingency Reserve
1.2.1	Selecting the Botanic Garden Project Site	$1540	5%	$1,617
1.2.2	Conducting a Feasibility Study	$2000	5%	$2,100
1.2.3	Projecting and Valuing the Investment - the Business Case	$0	0%	$0
1.3	**Design and Pre-Operations**			$0
1.3.1	**Design**			$0
1.3.1.1	Design Team Composition and Design process options	$0	0%	$0
1.3.1.2	Request for Proposals/Scope of Work	$270	8%	$292
1.3.1.3	Design Brief	$0	0%	$0
1.3.1.4	Master Plan	$1950	8%	$2,106
1.3.1.5	Detailed Design	$5215	8%	$5,632
1.3.1.6	Tender Documents	$396	8%	$428
1.3.1.7	Project Plan Review and Completion	$0	0%	$0
1.3.2	**Construction**			$0
1.3.2.1	Procurement	$240	8%	$259
1.3.2.2	Contract Administration	$75	5%	$79
1.3.2.3	Project kick-off	$250	5%	$263
1.3.2.4	**Construction for 2.5 ha Garden**			$0
1.3.2.4.1	Site clearing and preparation	$300	8%	$324
1.3.2.4.2	Existing landscape and vegetation protection	$150	8%	$162
1.3.2.4.3	Topsoil stripping and stockpiling	$14625	8%	$15,795
1.3.2.4.4	Grading and earthworks	$4875	8%	$5,265
1.3.2.4.5	Drainage and storm water management;	$9375	8%	$10,125
1.3.2.4.6	Bed and tree pit preparation	$225	8%	$243
1.3.2.4.7	Unit paving	$5750	8%	$6,210
1.3.2.4.8	Concrete works	$300	8%	$324
1.3.2.4.9	Stone masonry	$225	8%	$243
1.3.2.4.10	Soil preparation	$150	8%	$162
1.3.2.4.11	Irrigation facilities	$6225	8%	$6,723
1.3.2.4.12	Nursery facilities	$12300	8%	$13,284

No.	Activity	Activity Cost Estimate	% Contingency	Contingency Reserve
1.3.2.4.13	Plant material – installation, staking, mulching	$6952	8%	$7,508
1.3.2.4.14	Establishment of a seed bank, field genebanks, cryopreservation facility, etc.	$0	0%	$0
1.3.2.4.15	**Construction of facility to house 4 departments**			$0
1.3.2.4.15.1	Education Department	$71528	8%	$77,250
1.3.2.4.15.2	Public Relation Department	$34850	8%	$37,638
1.3.2.4.15.3	Research Department	$36678	8%	$39,612
1.3.2.4.15.4	Horticulture Department	$35764	8%	$38,625
1.3.3	Construction Supervision and Inspection	$3000	8%	$3,240
1.3.4	Construction complete	$0	0%	$0
1.3.5	**Pre-Operations**			$0
1.3.5.1	Governance and Organizational Structure	$0	0%	$0
1.3.5.2	**Strategic Framework, Institutional Policies, Business Plan**			$0
1.3.5.2.1	Develop Strategic Plan for 3-5 years	$0	0%	$0
1.3.5.2.2	Develop Business Plan	$0	0%	$0
1.3.5.2.3	Develop Institutional Policies e.g. Plant Collections including ABS and Biosafety; Research and Education; Staff Recruitment; Staff Training; Environmental Sustainability; Health and Safety	$0	0%	$0
1.3.5.3	Staff Recruitment and Training	$89900	5%	$94,395
1.3.5.4	**Developing Plant Collections**			$0
1.3.5.4.1	Field work to collect the required plant material	$31660	8%	$34,193
1.3.5.4.2	Propagation or acquisition of plants	$0	8%	$0
1.3.5.4.3	Species identification and verification	$0	5%	$0
1.3.5.4.4	Labelling and accessioning	$840	5%	$882
1.3.5.4.5	Horticultural and plant maintenance protocols	$0	5%	$0
1.3.5.4.6	Processing of herbarium vouchers	$2400	5%	$2,520
1.3.5.5	Botanical and Horticultural Activities	$6420	8%	$6,934
1.3.5.6	Initiating Research Activities	$1050	8%	$1,134

No.	Activity	Activity Cost Estimate	% Contingency	Contingency Reserve
1.3.5.7	Developing Education, Interpretation and Communication Activities	$1050	8%	$1,134
1.3.5.8	Preparing a Marketing Strategy	$1050	8%	$1,134
1.3.5.9	Pre-operations complete	$0	0%	$0
1.4	**Launch and Operations**			$0
1.4.1	Opening Ceremony	$2975	5%	$3,124
1.4.2	Day-to-Day Running and Periodical Review	$18750	8%	$20,250
1.4.3	Close-out/Project Completion	$0	0%	$0
	Total Budget	***$429278***		***$460059***

The S-curve

The S-curve is a display of cumulative costs (Total Cost + Contingency Reserve) against time. Figure 8 depicts the S-curve for the National Botanic Garden Project.

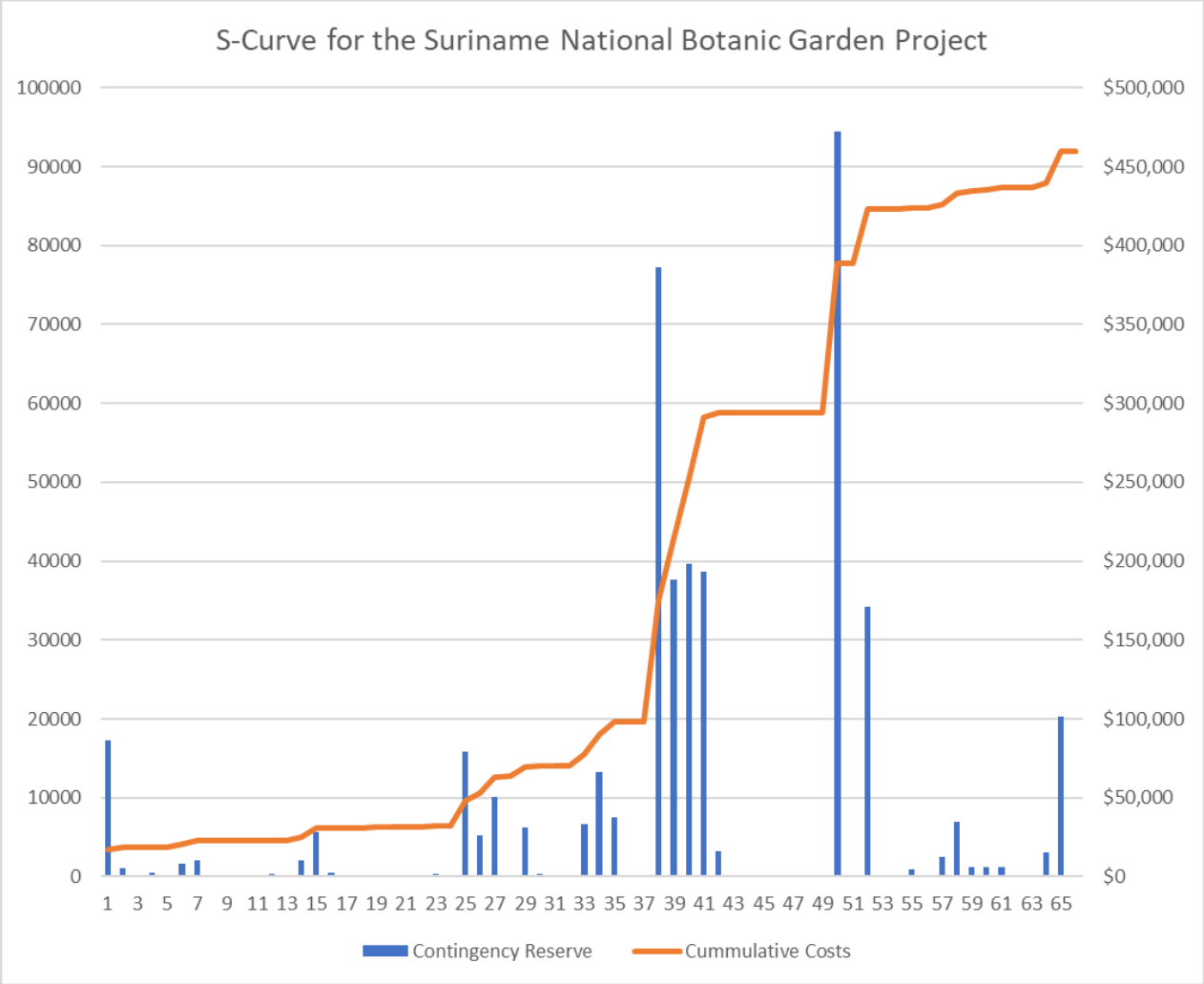

Figure 9 S-curve for the National Botanic Garden Project (Source: Compiled by the author)

4. Control Cost

This is the process of monitoring the status of the project to update the project costs and manage changes to the cost baseline. Responsibility for implementing cost control measures or procedure for the Suriname National Botanic Garden Project, will be shared among the project manager, supervisors and project administrators. The cost management planning will be done early in the project planning phase and will set the framework for each of the cost management processes in order to ensure efficiency and coordination.

A number of tools and techniques will be used to ensure success. Firstly, meetings comprising the project manager, sponsor, selected project team members, selected stakeholders and other relevant persons will be held weekly to develop the cost management plan. Also, data analyses will be used in order to determine ways to acquire project resources such as purchasing, renting and leasing. Finally, expertise will be considered form the project manager, sponsors, project team and supervisors who may have training or specialized knowledge in establishing botanic gardens, financial management and in cost estimating and budgeting.

The Suriname National Botanic Garden Project will also adopt the following controlled measures; ensure that there are contingencies in place to deal with unforeseen expenses, effective communication among the project manager, sponsor and other stakeholders to ensure that all persons adhere to the budget.

Cost Changes will be received and documented bi-weekly or when necessary at earlier times. Cost baseline changes will be posted in the project status comments. Changes must be approved by the sponsor or project manager and the appropriate updates to the project costs must be made and a new project baseline established.

5. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.5. Project Quality Management

Specific objective 5 for the establishment of a National Botanic Garden Project was to develop a Quality Management Plan. On behalf of the performing organization continuous process improvement activities are undertaken continuously by incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements. The processes involved in Project Quality Management include Plan Quality Management, Manage Quality, and Control Quality.

Suriname National Botanic Garden Project

Quality Management Plan

1. Plan Quality Management

This is the process of identifying 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 first step in managing the project was identifying the stakeholders and prioritizing them using the L Shape Matrix. The purpose of prioritizing stakeholders is to gain an understanding of the relative importance of the many stakeholders. Essentially, it helps the team to identify stakeholders that can individually cause the project to stop. The project team collected all the requirements that were then prioritized using the L Shape Matrix. The results of these analyses are part of the Quality Management Plan of the project. The stakeholder matrix presented in chart 22 shows the impact, interest, power, and influence of the stakeholders of the Suriname National Botanic Garden Project.

Chart 22 Stakeholder Matrix (Source: Compiled by the author)

Stakeholder	Impact (low, medium, high)	Interest (low, medium, high)	Power (low, medium, high)	Influence (low, medium, high)
Head of the Herbarium; Project Sponsor	Medium	High	High	Medium
Suriname National Botanic Garden Steering Group: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager	High	High	Medium	High
Chair of the University Board	High	Medium	Medium	High
Minister of Physical Planning, Land and Forest Management	Medium	Medium	Low	Low
Minister of Education	Medium	Medium	Low	Low
Botanic Gardens Conservation International	Medium	High	Low	Medium
Engineer	High	Medium	Low	Medium
Other Botanic Gardens: Utrecht Botanic Gardens, Missouri Botanical Garden, Atlanta Botanical Garden	Medium	High	Low	Low
Regulating Agencies	High	Low	Medium	Medium

2. Manage Quality

This is the process of translating the quality management plan into executable quality activities that incorporate the organization's quality policies into the project.

Stakeholder L-Shape Matrices

The following matrices prioritize the stakeholders and the requirements for the Suriname National Botanic Garden Project from much more important (10) to much less important (1/10). For each stakeholder the requirements are prioritized, using the same scoring values. At the end of the analysis it will become visible which stakeholder and which requirement is most important for the project.

Key: 10 = Much more important; 5 = More important; 1 = Equally important; 1/5 = Less important; 1/10 = Much less important

Stakeholder Prioritization SURINAME NATIONAL BOTANIC GARDEN PROJECT	Project Sponsor	Steering Group	University Board	Minister of Physical Planning, Land and Forest Management	Minister of Education	Botanic Gardens Conservation International	Engineer	Other Botanic Gardens	Regulating Agencies	**Row Total**	**Relative Dec. Value**
Project Sponsor		1	5	10	10	5	1	5	5	42	0.23
Steering Group	1		5	10	10	5	5	5	5	46	0.25
University Board	1/5	1/5		5	1	1	1/5	1	1	10.6	0.06
Minister of Physical Planning, Land and Forest Management	1/10	1/10	1/5		1/5	1/5	1/10	1/10	1/5	1.2	0.01
Minister of Education	1/10	1/10	1	5		1	1/5	1	1/5	8.6	0.05
Botanic Gardens Conservation International	1/5	1/5	1	5	1		1/5	1	1/5	8.8	0.05
Engineer	1	1/5	5	10	5	5		5	5	36.2	0.20
Other Botanic Gardens	1/5	1/5	1	10	1	1	1/5		1	14.6	0.08
Regulating Agencies	1/5	1/5	1	5	5	5	1/5	1		17.6	0.09
									Grand Total	185.6	

Stakeholder Prioritization Ranking

SURINAME NATIONAL BOTANIC GARDEN PROJECT		
Stakeholder	**Total**	**Rank**
Steering Group	0.25	1
Project Sponsor	0.23	2
Engineer	0.20	3
Regulating Agencies	0.09	4
Other Botanic Gardens	0.08	5
University Board	0.06	6
Botanic Gardens Conservation International	0.05	7
Minister of Education	0.05	8
Minister of Physical Planning, Land and Forest Management	0.01	9

Requirements Prioritization and L-Shape Matrices

SURINAME NATIONAL BOTANIC GARDEN PROJECT
Requirements
1. Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs
2. 10 ha Land accessible and assured with Preparation Statement or Notary Decision
3. Plans, designs, and construction documents reviewed and approved by regulating agencies
4. Environmental sustainability included in plans, designs, and construction
5. Processes and procedures developed in accordance with national and international standards and formats
6. Educational curriculum developed
7. Marketing strategy developed
8. 2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations

Requirements Prioritization PROJECT SPONSOR	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		1	5	1	5	5	5	5	27	0.24
10 ha Land accessible and assured	1		1	5	5	10	5	1	28	0.25
Plans, designs, and construction documents reviewed and approved	1/5	1		1	1	5	5	1	14.2	0.13
Environmental sustainability included in plans, designs, and construction	1	1/5	1		1	5	1	1	10.2	0.09
Processes and procedures developed	1/5	1/5	1	1		5	1	1	9.4	0.08
Educational curriculum developed	1/5	1/10	1/5	1/5	1/5		1/5	1/5	1.3	0.01
Marketing strategy developed	1/5	1/5	1/5	1	1	5		1/5	7.8	0.07
2.5 ha garden created with plant collections and 4 departments	1/5	1	1	1	1	5	5		14.2	0.13
								Grand Total	112.1	

Requirements Prioritization Ranking

PROJECT SPONSOR		
Requirement	**Total**	**Rank**
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.25	1
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.24	2
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.13	3
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.13	4
Environmental sustainability included in plans, designs, and construction	0.09	5
Processes and procedures developed in accordance with national and international standards and formats	0.08	6
Marketing strategy developed	0.07	7
Educational curriculum developed	0.01	8

Requirements Prioritization STEERING GROUP	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		10	5	5	5	5	5	5	40	0.23
10 ha Land accessible and assured	1/10		1/10	1/5	1/10	1/10	1/5	1/10	0.9	0.01
Plans, designs, and construction documents reviewed and approved	1/5	10		5	5	10	10	5	45.2	0.26
Environmental sustainability included in plans, designs, and construction	1/5	5	1/5		5	10	5	5	30.2	0.17
Processes and procedures developed	1/5	1/10	10	1/5		1	1	5	17.5	0.1
Educational curriculum developed	1/5	1/10	10	1/10	1		1	5	17.4	0.1
Marketing strategy developed	1/5	1/5	5	1/5	1	1		5	12.6	0.07
2.5 ha garden created with plant collections and 4 departments	1/5	1/10	10	1/5	1/5	1/5	1/5		11.2	0.06
								Grand Total	175	

STEERING GROUP		
Requirement	**Total**	**Rank**
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.26	1
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.23	2
Environmental sustainability included in plans, designs, and construction	0.17	3
Processes and procedures developed in accordance with national and international standards and formats	0.1	4
Educational curriculum developed	0.1	5
Marketing strategy developed	0.07	6
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.06	7
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.01	8

Requirements Prioritization ENGINEER	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		10	5	5	10	10	10	5	55	0.31
10 ha Land accessible and assured	1/10		1/5	1/5	1	5	5	5	16.5	0.09
Plans, designs, and construction documents reviewed and approved	1/5	5		1/5	5	10	10	1	31.4	0.18
Environmental sustainability included in plans, designs, and construction	1/5	5	5		5	10	10	1	36.2	0.2
Processes and procedures developed	1/10	1	1/5	1/5		5	5	1	12.5	0.07
Educational curriculum developed	1/10	1/5	1/10	1/10	1/5		1/5	1/10	1	0.01
Marketing strategy developed	1/10	1/5	1/10	1/10	1/5	5		1/5	5.9	0.03
2.5 ha garden created with plant collections and 4 departments	1/5	1/5	1	1	1	10	5		18.4	0.1
								Grand Total	176.9	

ENGINEER		
Requirement	**Total**	**Rank**
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.31	1
Environmental sustainability included in plans, designs, and construction	0.2	2
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.18	3
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.1	4
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.09	5
Processes and procedures developed in accordance with national and international standards and formats	0.07	6
Marketing strategy developed	0.03	7
Educational curriculum developed	0.01	8

Requirements Prioritization REGULATING AGENCIES	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		1	1	1	5	10	10	10	38	0.25
10 ha Land accessible and assured	1		1	1	1	5	5	5	19	0.12
Plans, designs, and construction documents reviewed and approved	1	1		1	1	10	10	5	29	0.19
Environmental sustainability included in plans, designs, and construction	1	1	1		1	10	10	5	29	0.19
Processes and procedures developed	1/5	1	1	1		5	10	5	23.2	0.15
Educational curriculum developed	1/10	1/5	1/10	1/10	1/5		5	1	6.7	0.04
Marketing strategy developed	1/10	1/5	1/10	1/10	1/10	1/5		1/5	1	0.01
2.5 ha garden created with plant collections and 4 departments	1/10	1/5	1/5	1/5	1/5	1	5		6.9	0.05
								Grand Total	152.8	

REGULATING AGENCIES		
Requirement	**Total**	**Rank**
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.25	1
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.19	2
Environmental sustainability included in plans, designs, and construction	0.19	3
Processes and procedures developed in accordance with national and international standards and formats	0.15	4
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.12	5
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.05	6
Educational curriculum developed	0.04	7
Marketing strategy developed	0.01	8

Requirements Prioritization OTHER BOTANIC GARDENS	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		5	5	1	1	5	5	1	23	0.15
10 ha Land accessible and assured	1/5		1	1/10	1/10	1/5	1	1/10	2.7	0.02
Plans, designs, and construction documents reviewed and approved	1/5	1		1/10	1/5	1/5	1	1/10	2.8	0.02
Environmental sustainability included in plans, designs, and construction	1	10	10		1	5	10	1	38	0.24
Processes and procedures developed	1	10	5	1		5	10	1	33	0.21
Educational curriculum developed	1/5	5	5	1/5	1/5		5	1/5	15.8	0.1
Marketing strategy developed	1/5	1	1	1/10	1/10	1/5		1/10	2.7	0.02
2.5 ha garden created with plant collections and 4 departments	1	10	10	1	1	5	10		38	0.24
								Grand Total	156	

OTHER BOTANIC GARDENS		
Requirement	**Total**	**Rank**
Environmental sustainability included in plans, designs, and construction	0.24	1
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.24	2
Processes and procedures developed in accordance with national and international standards and formats	0.21	3
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.15	4
Educational curriculum developed	0.1	5
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.02	6
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.02	7
Marketing strategy developed	0.02	8

Requirements Prioritization UNIVERSITY BOARD	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		1	1	5	1	1	1	1	11	0.13
10 ha Land accessible and assured	1		1	5	1	1	1	1	11	0.13
Plans, designs, and construction documents reviewed and approved	1	1		5	1	1	1	1	11	0.13
Environmental sustainability included in plans, designs, and construction	1/5	1/5	1/5		1/5	1/10	1/5	1/5	1.3	0.02
Processes and procedures developed	1	1	1	5		1	1	1	11	0.13
Educational curriculum developed	1	1	1	10	1		5	1	20	0.23
Marketing strategy developed	1	1	1	5	1	1/5		1	10.2	0.12
2.5 ha garden created with plant collections and 4 departments	1	1	1	5	1	1	1		11	0.13
								Grand Total	86.5	

UNIVERSITY BOARD		
Requirement	**Total**	**Rank**
Educational curriculum developed	0.23	1
Processes and procedures developed in accordance with national and international standards and formats	0.13	2
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.13	3
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.13	4
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.13	5
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.13	6
Marketing strategy developed	0.12	7
Environmental sustainability included in plans, designs, and construction	0.02	8

Requirements Prioritization BOTANIC GARDENS CONSERVATION INTERNATIONAL	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		5	5	1/5	1	5	5	1/5	21.4	0.14
10 ha Land accessible and assured	1/5		1/5	1/10	1/10	1/5	1	1/10	1.9	0.01
Plans, designs, and construction documents reviewed and approved	1/5	5		1/10	1/5	1	1	1/10	7.6	0.05
Environmental sustainability included in plans, designs, and construction	5	10	10		1	5	5	1	37	0.24
Processes and procedures developed	1	10	5	1		5	5	1	28	0.18
Educational curriculum developed	1/5	5	1	1/5	1/5		1	1/10	7.7	0.05
Marketing strategy developed	1/5	1	1	1/5	1/5	1		1/10	3.7	0.02
2.5 ha garden created with plant collections and 4 departments	5	10	10	1	1	10	10		47	0.3
								Grand Total	154.3	

BOTANIC GARDENS CONSERVATION INTERNATIONAL		
Requirement	**Total**	**Rank**
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.3	1
Environmental sustainability included in plans, designs, and construction	0.24	2
Processes and procedures developed in accordance with national and international standards and formats	0.18	3
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.14	4
Educational curriculum developed	0.05	5
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.05	6
Marketing strategy developed	0.02	7
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.01	8

Requirements Prioritization MINISTER OF EDUCATION	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		10	1	5	1	1/5	5	1	23.2	0.22
10 ha Land accessible and assured	1/10		1	1	1/5	1/10	1	1/5	3.6	0.03
Plans, designs, and construction documents reviewed and approved	1	1		5	1	1/10	1	1	10.1	0.1
Environmental sustainability included in plans, designs, and construction	1/5	1	1/5		1/5	1/5	1	1	3.8	0.04
Processes and procedures developed	1	5	1	5		1	5	5	23	0.22
Educational curriculum developed	5	10	10	5	1		10	1	42	0.41
Marketing strategy developed	1/5	1	1	1	1/5	1/10		1/5	3.7	0.04
2.5 ha garden created with plant collections and 4 departments	1	5	1	1	1/5	1	5		14.2	0.14
								Grand Total	103.6	

MINISTER OF EDUCATION		
Requirement	**Total**	**Rank**
Educational curriculum developed	0.41	1
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.22	2
Processes and procedures developed in accordance with national and international standards and formats	0.22	3
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.14	4
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.1	5
Environmental sustainability included in plans, designs, and construction	0.04	6
Marketing strategy developed	0.04	7
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.03	8

Requirements Prioritization MINISTER OF PHYSICAL PLANNING, LAND AND FOREST MANAGEMENT	Expertise available to review and approve plans and designs	10 ha Land accessible and assured	Plans, designs, and construction documents reviewed and approved	Environmental sustainability included in plans, designs, and construction	Processes and procedures developed	Educational curriculum developed	Marketing strategy developed	2.5 ha garden created with plant collections and 4 departments	**Row Total**	**Relative Dec. Value**
Expertise available to review and approve plans and designs		1/10	1/5	1	1	5	5	1/5	12.5	0.08
10 ha Land accessible and assured	10		10	5	5	10	10	1	51	0.33
Plans, designs, and construction documents reviewed and approved	5	1/10		1	1	5	5	1/5	17.3	0.11
Environmental sustainability included in plans, designs, and construction	1	1/5	1		5	5	5	1	18.2	0.12
Processes and procedures developed	1	1/5	1	1/5		5	5	1/5	12.6	0.08
Educational curriculum developed	1/5	1/10	1/5	1/5	1/5		1	1	2.9	0.02
Marketing strategy developed	1/5	1/10	1/5	1/5	1/5	1		1/10	2	0.01
2.5 ha garden created with plant collections and 4 departments	5	1	5	1	5	1	10		28	0.18
								Grand Total	154.5	

MINISTER OF PHYSICAL PLANNING, LAND AND FOREST MANAGEMENT		
Requirement	**Total**	**Rank**
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.33	1
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.18	2
Environmental sustainability included in plans, designs, and construction	0.12	3
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.11	4
Processes and procedures developed in accordance with national and international standards and formats	0.08	5
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.08	6
Educational curriculum developed	0.01	7
Marketing strategy developed	0.02	8

Stakeholders-Weighted Required Prioritization

Stakeholders-Weighted Required Prioritization	Steering Group (0.25)	Project Sponsor (0.23)	Engineer (0.20)	Regulating Agencies (0.09)	Other Botanic Gardens (0.08)	University Board (0.06)	Botanic Gardens Conservation	Minister of Education (0.05)	Minister of Physical Planning, Land and Forest Management	Row Total	Relative Decimal Value
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.01	0.25	0.09	0.12	0.02	0.13	0.01	0.03	0.33	**0.99**	**0.106**
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.23	0.24	0.31	0.25	0.15	0.13	0.14	0.22	0.08	**1.75**	**0.188**
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.26	0.13	0.18	0.19	0.02	0.13	0.05	0.1	0.11	**1.17**	**0.126**
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.06	0.13	0.1	0.05	0.24	0.13	0.3	0.14	0.18	**1.33**	**0.143**
Environmental sustainability included in plans, designs, and construction	0.17	0.09	0.2	0.19	0.24	0.02	0.24	0.04	0.12	**1.31**	**0.141**
Processes and procedures developed in accordance with national and international standards and formats	0.1	0.08	0.07	0.15	0.21	0.13	0.18	0.22	0.08	**1.22**	**0.131**
Marketing strategy developed	0.07	0.07	0.03	0.01	0.02	0.12	0.02	0.04		**0.58**	**0.062**
Educational curriculum developed	0.1	0.01	0.01	0.04	0.1	0.23	0.05	0.41	0.01	**0.96**	**0.103**
									Grand Total	**9.31**	

Stakeholders-Weighted Required Prioritization Stack Ranking

STAKEHOLDERS-WEIGHTED REQUIRED PRIORITIZATION STACKRANKING		
PRIORITIZATION	DECIMAL VALUE TOTAL	STACK RANKING
Expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs	0.188	1
Environmental sustainability included in plans, designs, and construction	0.144	2
2.5 ha garden created with plant collections and 4 departments – Horticulture, Education, Research, Public Relations	0.143	3
Processes and procedures developed in accordance with national and international standards and formats	0.131	4
Plans, designs, and construction documents reviewed and approved by regulating agencies	0.126	5
10 ha Land accessible and assured with Preparation Statement or Notary Decision	0.106	6
Educational curriculum developed	0.103	7
Marketing strategy developed	0.062	8

According to the stakeholders and requirements prioritization matrices above the Steering Group is the principle stakeholder and the principle requirement is expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management to review and approve plans and designs. The Steering Group should therefor preferably consist of an interdisciplinary team with expertise in at least the required fields of Architecture, Landscaping, Botany, Horticulture, Education, and Project Management.

3. Control Quality

This is the process of monitoring and recording results of executing the quality management activities in order to assess performance and ensure the project outputs are complete, correct, and meet customer expectations. The tools and techniques that the Suriname National Botanic Garden Project will use to control quality such are Checklists, Check sheets, Questionnaires and Surveys, and Inspections (audits). Each process will be evaluated in order to validate that the requirements for the botanic garden are met.

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4. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.6. Project Resource Management

Specific objective 6 for the establishment of a National Botanic Garden Project was to create a Resource Management Plan. The processes help ensure that the right resources will be available to the project management team at the right time and place, and include Plan Resource Management, Estimate Activity Resources, Acquire Resources, Develop Team, Manage Team, and Control Resources.

Suriname National Botanic Garden Project

Resource Management Plan

1. **Plan Resource Management**

   This is the process of defining how to estimate, acquire, manage, and utilize physical and team resources. Figure 9 below depicts the organizational chart for the Suriname National Botanic Garden Project.

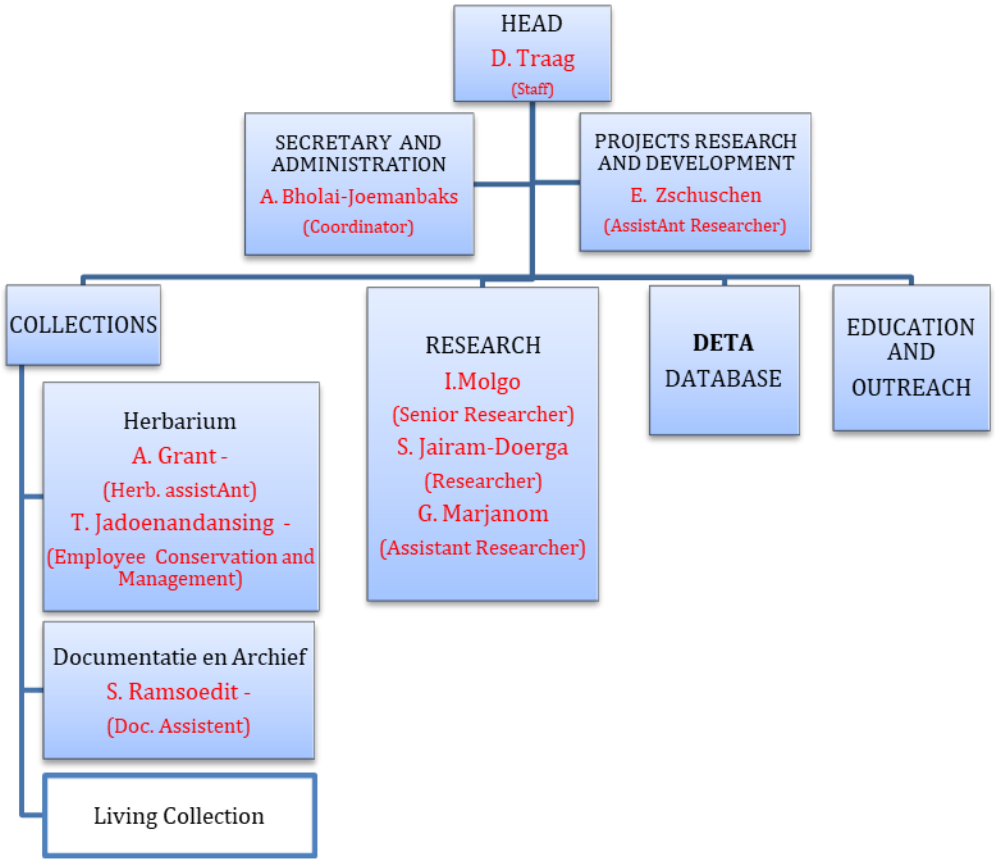


Figure 10 Organizational structure (Source: Dorothy Traag, Personal Communication, 30 September 2019)

Responsibility assignment matrix

This is a grid that shows the project resources assigned to each work package. Responsibilities of team members within the project management process groups are represented in the RACI Matrix below.

Chart 23 RACI matrix (Source: Compiled by the author)

RACI Chart	**Person**						
Activity	Engineer	Horticulturist	Landscapist	Education Specialist	Project Manager	Marketing Specialist	Project Sponsor
Team composition and design process	R	R	R	C	A	C	C
Scope of work	C	C	C	I	R	I	A
Design brief	R	R	R	I	A	I	C
Master plan	R	R	R	I	A	I	C

RACI Chart	Person						
Activity	Engineer	Horticulturist	Landscapist	Education Specialist	Project Manager	Marketing Specialist	Project Sponsor
Detailed design	R	R	R	I	A	I	C
Tender documents	A	I	I	I	R	I	I
Project plan review and composition	A	I	I	I	R	I	I
Governance and organizational structure	I	I	I	I	R	I	A
Strategic framework, institutional policies, business plan	C	C	C	C	R	C	A
Staff recruitment and training	I	C	C	C	R	I	A
Developing plant collections	C	R	R	C	A	I	C
Botanical and horticultural activities	I	R	C	C	A	I	C
Research activities	I	C	C	A	R	I	C
Education, interpretation and communication activities	I	C	C	A	R	C	C
Marketing strategy	I	C	C	C	R	A	C
Procurement	R	I	I	I	A	I	I
Contract administration	R	I	I	I	A	I	C
Project kick-off	I	I	I	I	A	C	R
Construction for 2.5 ha garden	C	R	R	I	A	I	C
	R=Responsible; A=Accountable; C=Consult; I=Inform						

2. Estimate Activity Resources

The total number of resources per activity per month for the Suriname National Botanic Garden Project are presented in Chart 24 below. To estimate the resources the number of laborers needed to complete the work within the

scheduled time was considered. The schedule management plan and the cost management plan were used as inputs for estimating these resources. Interviews with the business case analysis team were also conducted to estimate the minimum amount of resources required to perform the work.

Chart 24 Resource Calendar with number of resources per month (Source: Compiled by the author)

	Months in 2020					
Activity	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Team composition and design process	7	7				
Scope of work		7	7	7		
Design brief		7				
Master plan		7	7	7		
Detailed design				7	7	
Tender documents					10	10
Project plan review and composition						7
Governance and organizational structure						
Strategic framework, institutional policies, business plan						
Staff recruitment and training						
Developing plant collections						
Botanical and horticultural activities						
Research activities						
Education, interpretation and communication activities						
Marketing strategy						

Procurement						2
Contract administration						
Project kick-off						
Construction for 2.5 ha garden						15

	Months in 2021											
Activity	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Team composition and design process												
Scope of work												
Design brief												
Master plan												
Detailed design												
Tender documents												
Project plan review and composition												
Governance and organizational structure										3	3	3
Strategic framework, institutional policies, business plan												
Staff recruitment and training							3	3	3	3		
Developing plant collections								9	9	18	18	18
Botanical and horticultural activities												
Research activities												
Education, interpretation and communication activities												
Marketing strategy												
Procurement	2	2	2									
Contract administration			2	2								
Project kick-off				16								

Construction for 2.5 ha garden	15	9	9	19	19	21	21	15	12	12		

	Months in 2022									
Activity	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Team composition and design process										
Scope of work										
Design brief										
Master plan										
Detailed design										
Tender documents										
Project plan review and composition										
Governance and organizational structure	3									
Strategic framework, institutional policies, business plan	7	7	7	7	7	7	7			
Staff recruitment and training										
Developing plant collections	18	18	18	18	12	12	12	12	12	12
Botanical and horticultural activities									9	9
Research activities									9	9
Education, interpretation and communication activities									9	9
Marketing strategy						7	7			
Procurement										
Contract administration										
Project kick-off										

Construction for 2.5 ha garden										

3. Acquire Resources

This is the process of obtaining team members, facilities, equipment, materials, supplies, and other resources necessary to complete project work. The resource calendar is a tool used in the Resource Plan to schedule the days, dates and time a particular resource will work or be used. Planned vacation days can even be incorporated so that the project team will know when a particular resource is unavailable and can plan accordingly. The resource calendar can be updated on a continuous basis if new team members are acquired or changes in scheduling occur. Microsoft Project software will be used to develop the resource calendar for the Suriname National botanic Garden Project.

Multi-criteria Decision Analysis

This technique utilizes a decision matrix to provide a systematic analytical approach such as risk levels, uncertainty, and valuation, to evaluate and rank many ideas. Within the Suriname National Botanic Garden Project decisions need to be made when it comes to acquiring material, equipment, and supplies. The project team will list the alternatives for the particular items. Each item must comply with several criteria that have different weights. Criteria can vary, depending on the type of material, equipment, or supply, for example durability, cost, warranty, environmental sustainability, etc. When plotting the alternatives against the different criteria by means of numerical scores, the alternative and criterion with the highest score will be selected. Figure 10 depicts an example of the Multi-criteria Decision Analysis for acquiring material, equipment, and supplies for the project. In this example Criterion 2 is the most important criterion, while the best alternative is Alternative 15.

Alternative	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	
1	0.4	2.7	1.2	0.75	0.6	5.65
2	0.8	2.7	1.6	1.05	0.6	6.75
3	0.8	3.15	1.6	1.35	0.7	7.6
4	0.4	1.35	1	0.75	0.6	4.1
5	0.6	*2.25*	1	0.75	0.6	5.2
6	0.2	1.8	1.2	0.75	0.6	4.55
7	0.6	3.6	1.2	0.9	0.6	6.9
8	0.8	2.7	1.4	0.9	0.6	6.4
9	0.4	2.25	0.8	0.45	0.5	4.4
10	0.5	2.7	1	1.05	0.5	5.75
11	0.7	2.7	1.6	1.2	0.7	6.9
12	0.2	1.35	1	0.6	0.3	3.45
13	0.5	2.7	1.2	1.05	0.5	5.95
14	0.2	1.35	0.4	0.6	0.4	2.95
15	0.8	4.05	1.6	1.5	0.9	8.85
16	0.7	2.7	1	0.9	0.6	5.9
17	0.6	2.7	1	0.9	0.5	5.7
18	0.7	3.6	1.2	1.2	0.7	7.4
Totals	9.9	46.35	21	16.65	10.5	

Figure 11 Example of the Multi-criteria Decision Analysis for acquiring material, equipment, and supplies for the project (Source: Compiled by the author)

When it comes to acquiring human resources the project team may have to choose between several candidates for a specific job. The criteria to decide which candidate to select may vary for the Suriname National Botanic Garden Project availability, cost, experience ability, knowledge, attitude and fit in the team will be considered in the multi-criteria decision analysis. Figure 11 depicts an example of the multi-criteria decision analysis for acquiring team members for the project. In this example Person C best fits the criteria, while experience is considered the most important criterion.

Criteria	Weight (importance)	Person A	Person B	Person C	Person D	Person E
Availability	10%	4	6	6	5	6
Cost	10%	8	6	8	7	6
Experience	20%	8	7	8	9	7
Ability	15%	4	3	5	5	6
Knowledge	10%	6	5	5	5	6
Attitude	20%	2	4	6	5	6
Fit in team	15%	7	6	8	8	7

Criteria	Person A	Person B	Person C	Person D	Person E	
Availability	0.4	0.6	0.6	0.5	0.6	2.7
Cost	0.8	0.6	0.8	0.7	0.6	3.5
Experience	1.6	1.4	1.6	1.8	1.4	7.8
Ability	0.6	0.45	0.75	0.75	0.9	3.45
Knowledge	0.6	0.5	0.5	0.5	0.6	2.7
Attitude	0.4	0.8	1.2	1	1.2	4.6
Fit in team	1.05	0.9	1.2	1.2	1.05	5.4
Totals	5.45	5.25	6.65	6.45	6.35	

Figure 12 Example of the multi-criteria decision analysis for acquiring team members for the Project (Source: Compiled by the author)

4. Develop Team

This is the process of improving competencies, team member interaction, and the overall team environment to enhance project performance. The Suriname National Botanic Garden Project involves a wide range of different team members, with particular disciplines and backgrounds, and diversity of skills. It will be the role of the project manager to get the individual team members to view the project from the big picture perspective and direct them towards the same clear goals. Team building will be a key process of getting a group of diverse individuals to work together effectively as a team. For teams to be effective, the people in the team must be able to work together to contribute collectively to team outcomes. The project team will go through definitive stages during development. Bruce Tuckman's five-stage development process describes that most teams go through certain stages to become high performing (Project Smart, 2010). He called the stages: forming, storming, norming, performing, and adjourning. Most high-

performing teams go through five stages of team development

Forming stage: The forming stage involves a period of orientation and getting acquainted. Uncertainty is high during this stage, and people are looking for leadership and authority. A member who asserts authority or is knowledgeable may be looked for to take control. Team members are asking such questions as What does the team offer me? What is expected of me? Will I fit in? Most interactions are social as members get to know each other.

Storming stage: The storming stage is the most difficult and critical stage to pass through. It is a period marked by conflict and competition as individual personalities emerge. Team performance may actually decrease in this stage because energy is put into unproductive activities. Members may disagree on team goals, and subgroups and cliques may form around strong personalities or areas of agreement. To get through this stage, members must work to overcome obstacles, to accept individual differences, and to work through conflicting ideas on team tasks and goals. Teams can get bogged down in this stage. Failure to address conflicts may result in long-term problems.

Norming stage: If teams get through the storming stage, conflict is resolved and some degree of unity emerges. In the norming stage, consensus develops around who the leader or leaders are, and individual member's roles. Interpersonal differences begin to be resolved, and a sense of cohesion and unity emerges. Team performance increases during this stage as members learn to cooperate and begin to focus on team goals. However, the harmony is precarious, and if disagreements re-emerge the team can slide back into storming.

Performing stage: In the performing stage, consensus and cooperation have been well-established and the team is mature, organized, and well-functioning. There is a clear and stable structure, and members are committed to the team's mission. Problems and conflicts still emerge, but they are dealt with constructively. The

team is focused on problem solving and meeting team goals.

Adjourning stage: In the adjourning stage, most of the team's goals have been accomplished. The emphasis is on wrapping up final tasks and documenting the effort and results. As the workload is diminished, individual members may be reassigned to other teams, and the team disbands. There may be regret as the team ends, so a ceremonial acknowledgement of the work and success of the team can be helpful.

Once the team has been established, the next step will be getting the individuals to work together as a team. The project manager of the Suriname National Botanic Garden Project will consider the competencies of the team and will develop and improve upon those skills to enhance overall project performance. The Project manager must identify the skills required, build the project team by motivating the team members, and provide leadership and inspiration to achieve high performance in order to achieve the project's objectives.

5. Manage Team

This is the process of tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project performance. Teamwork and strong open communication are critical for project success and the project manager must create a suitable environment for this to develop. Conflicts need to be managed in a constructive manner which will encourage collaboration, enhance problem solving and ensure that good decisions are taken in a timely manner. One crucial step to the team building process is the kick-off, or start up meeting. This start-up meeting is a chance for the team members to get to know each other, establish relationships and lines of communication, identify problems, set goals and objectives and obtain commitments.

Within the Suriname National Botanic Garden Project monthly core team meetings and accountability sessions will be held where members will have the opportunity

to review project performance but also provide constructive feedback on each other's performance and ventilate interpersonal issues towards a goal of resolving them.

6. Control Resources

This is the process of ensuring that the physical resources assigned and allocated to the project are available as planned, as well as monitoring the planned versus the actual use of resources, and performing corrective actions as necessary. Controlling Resources will commence with using the Project Plan to determine what resources are needed, then assigning them to the various tasks on the project at the correct time. This process will continue throughout the project lifecycle to ensure the planned resources are ready and available as required to avoid delays in delivery.

The project manager for the Suriname National Botanic Garden Project will assess any changes in the actual performance and use of the physical resources, for example material, equipment, and supplies, against the project plan. The availability of resources required must be guaranteed when needed, and the project manager must ensure that there is no shortage of resources. Resources will be released when they are no longer needed and the project manager will make sure that maximum utilization of resources to optimize the cost will be managed. Any changes in the planned resource requirements will be proactively managed.

7. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.7. Project Communications Management

Specific objective 7 for the establishment of a National Botanic Garden Project was to develop a Communications Management Plan. The processes necessary to ensure that the information needs of the project and the stakeholders are met are part of Project Communications Management which consists of two parts. First a strategy needs to be developed to ensure communication is effective and second activities necessary to implement the communication strategy need to be carried out. The processes involved to create the Communications Management Plan are Plan Communications, Manage Communications, and Monitor Communications.

Suriname National Botanic Garden Project

Communications Management Plan

1. **Plan Communications Management**

   This is the process of developing an appropriate approach and plan for project communication activities based on the information needs of each stakeholder or group, available organizational assets, and the needs of the project. As described in the Suriname National Botanic Garden Project Resources Plan the Organizational Chart and RACI Matrix describe the different responsibilities of the team members, as presented in the charts below. Also presented below is the total number of resources for the project. The primary position and interest and the source of power of main stakeholders of the project are presented in chart 25 below.

Organizational Chart

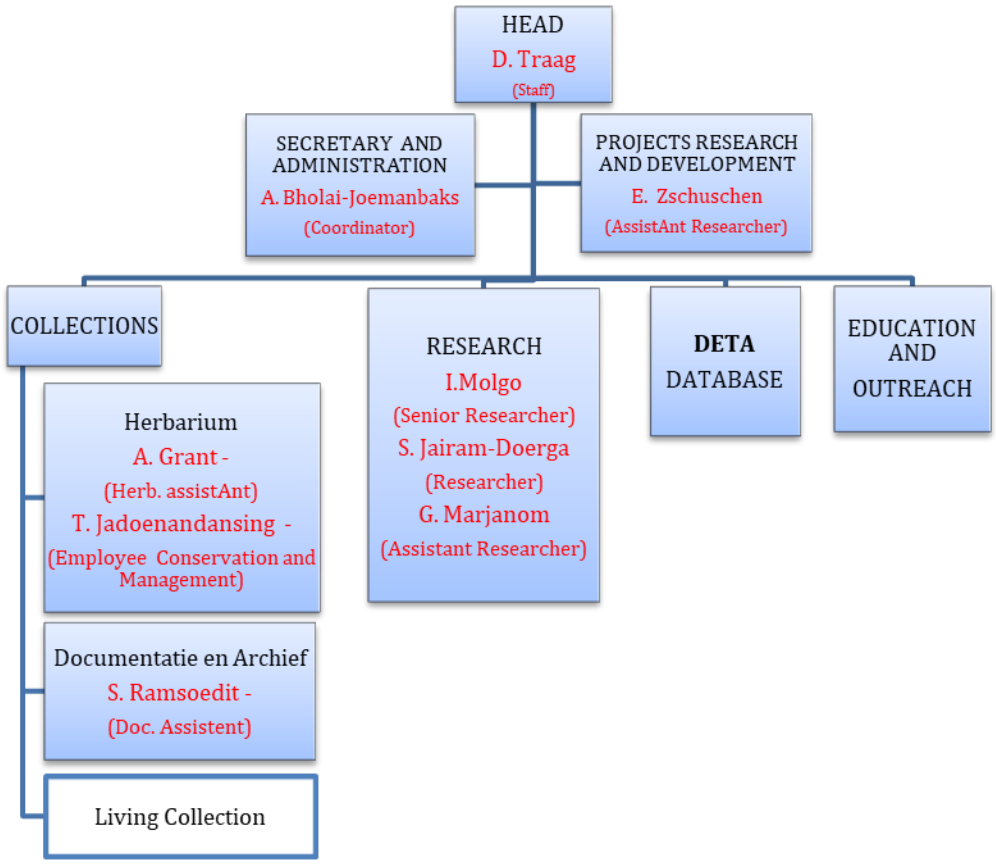


Figure 13 Organizational structure (Source: Dorothy Traag, Personal Communication, 30 September 2019)

Chart 25 RACI Matrix (Source: Compiled by the author)

RACI Chart	**Person**						
Activity	Engineer	Horticulturist	Landscapist	Education Specialist	Project Manager	Marketing Specialist	Project Sponsor
Team composition and design process	R	R	R	C	A	C	C
Scope of work	C	C	C	I	R	I	A
Design brief	R	R	R	I	A	I	C
Master plan	R	R	R	I	A	I	C
Detailed design	R	R	R	I	A	I	C
Tender documents	A	I	I	I	R	I	I
Project plan review and composition	A	I	I	I	R	I	I

RACI Chart	Person						
Activity	Engineer	Horticulturist	Landscapist	Education Specialist	Project Manager	Marketing Specialist	Project Sponsor
Governance and organizational structure	I	I	I	I	R	I	A
Strategic framework, institutional policies, business plan	C	C	C	C	R	C	A
Staff recruitment and training	I	C	C	C	R	I	A
Developing plant collections	C	R	R	C	A	I	C
Botanical and horticultural activities	I	R	C	C	A	I	C
Research activities	I	C	C	A	R	I	C
Education, interpretation and communication activities	I	C	C	A	R	C	C
Marketing strategy	I	C	C	C	R	A	C
Procurement	R	I	I	I	A	I	I
Contract administration	R	I	I	I	A	I	C
Project kick-off	I	I	I	I	A	C	R
Construction for 2.5 ha garden	C	R	R	I	A	I	C
	R=Responsible; A=Accountable; C=Consult; I=Inform						

Chart 26 Total Number of Resources (Source: Compiled by the author)

Activity	Total number of resources
Team composition and design process	7
Scope of work	7
Design brief	7
Master plan	7
Detailed design	7
Tender documents	10
Project plan review and composition	7
Governance and organizational structure	3
Strategic framework, institutional policies, business plan	7
Staff recruitment and training	3
Developing plant collections	18
Botanical and horticultural activities	9

Activity	Total number of resources
Research activities	9
Education, interpretation and communication activities	9
Marketing strategy	7
Procurement	2
Contract administration	2
Project kick-off	16
Construction for 2.5 ha garden	21

Chart 27 Stakeholder's primary position, interest, and power (Source: Compiled by the author)

Stakeholder	Primary position	Primary interest	Source of power
Head of the Herbarium; Project Sponsor	The project is in line with the organizational strategy, mission and vision and will add value to the organization's operations	To ensure that the project is completed successfully	Strategist/Champion
Suriname National Botanic Garden Steering Group: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager	The project needs to move forward provided that the technical requirements are established by the relevant experts	To provide expertise and to make sure that the project is executed according to its requirements	Expertise/Expert knowledge
Chair of the University Board	The project needs to move forward and adds value to the University's core activities and it must be cost-effective on the long term	To ensure that the processes, procedures and project outcomes do not conflict with the University's strategy	Authority/Ownership
Minister of Physical Planning, Land and Forest Management	If the University does not have enough land and public land application is required to establish the botanic garden, the project must be in line with the national biodiversity action plans and support policy-making on national and international related biodiversity issues in order to move forward	To ensure that the project contributes to halt the loss of plant diversity	Formal/Authority

Stakeholder	Primary position	Primary interest	Source of power
Minister of Education	The project needs to move forward since its objectives are highly focused on research and will facilitate different educational levels	To ensure that plant related research can be facilitated to support education, human well-being, and policy-making	Formal/Authority
Botanic Gardens Conservation International	The project will contribute to assist in the halt of loss of plant diversity and needs to move forward	To support the establishment, conservation, and management of botanic gardens	Collaboration
Engineer	The project needs an interdisciplinary approach and the requirements for construction and establishment of the garden must be well-defined in order for the project to move forward	To contribute to successful project completion	Expertise
Other Botanic Gardens: Utrecht Botanic Gardens, Missouri Botanical Garden, Atlanta Botanical Garden	Mutual benefits regarding training, exchange of knowledge and plant material are empowered by the historical relationship and good accessibility which are in favor of the project	To ensure exchange of knowledge and plant material	Collaboration
Regulating Agencies	Import and export of plant material needs to be compliant with national and international regulations, namely phytosanitary certificates and international conventions, land required must be legal in order for the project to move forward	To avoid schedule delays and ensure that the legal procedures are followed	Formal/Authority

Chart 28 Stakeholder engagement assessment matrix (Source: Compiled by the author)

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Head of the Herbarium; Project Sponsor					C/D
Suriname National Botanic Garden Steering Group: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager				C	D
Chair of the University Board			C	D	
Minister of Physical Planning, Land and Forest Management	C			D	
Minister of Education	C			D	
Botanic Gardens Conservation International	C			D	
Engineer	C			D	
Other Botanic Gardens: Utrecht Botanic Gardens, Missouri Botanical Garden, Atlanta Botanical Garden			C	D	
Regulating Agencies	C		D		

C=Current engagement level; D=Desired engagement level

As shown in the matrixes and the organizational chart above, throughout the Suriname National Botanic Garden Project communication will take place within distributed teams. Some groups are located in other countries with different time zones, cultures, and languages. Communication may become challenging and when the project does not proceed as expected, communication is often given as the main reason. The project team will make use of technologies such as instant messaging, voice over IP (VoIP), e-mail, and video-conferencing. Alignment of activities is key and will be reached by quarterly strategic meetings and monthly team ownership meeting. Effective teams have a clear agenda and time box for their meetings. A strong facilitator, either the project manager or a skilled facilitator, helps create meaningful discussions and can ensure clear agendas. Including everyone affected by a certain discussion topic in a meeting helps spread the right knowledge and everyone should be included in all important communication. Transparency is needed to enable everybody to have an overview of the status of the project. Strategic plans and product backlogs should be shared among the

project team to help spread important information. Openness empowers the team to help each other solve problems and create a better understanding among team members.

2. Manage Communications

This is the process of ensuring timely and appropriate collection, creation, distribution, storage, retrieval, management, monitoring, and the ultimate disposition of project information. This process is important to ensure that there is efficient and effective communication between the project team and stakeholders. The communication technology that has been identified to facilitate the project are instant messaging, voice over IP (VoIP), video conferencing, and e-mailing to share information, report matters, schedule meetings etc. Techniques that will be used to effectively manage communication between the team and stakeholders are:

- *Sender-Receiver Models*: this is to incorporate feedback loops and provide for interaction/participation between the team and stakeholders and remove barriers to communication
- *Choice of Media*: establishing when to communicate in writing versus orally, using informal memos (this will be used among the project team) versus a formal report (when communicating with stakeholders), and when to use push/pull options
- *Writing Style*: appropriate use of active versus passive voice, sentence structure and word choice especially in written communication where tone is more open to interpretation
- *Meeting Management*: the expected structures of meetings are to be established when planning communication. The essentials are preparing an agenda, inviting participants, distributing necessary information for the meeting, and ensuring participants' attendance
- *Facilitation*: this technique involves building consensus and overcoming obstacles such as difficult group dynamics and maintaining interest and

enthusiasm among group members.

- *Active Listening*: for any verbal communication to be effective the team and stakeholders must use active listening which involves acknowledging, clarifying, confirming and understanding and removing barriers that adversely affect comprehension.

As part of effective communication management, communication requirements should be identified. This means that the Project Team identifies the meeting to be held, the medium to be used, frequency, audience, owner/facilitator, the meeting deliverables and format for distribution. Disputes, conflicts or discrepancies regarding communications should also be handled in a timely manner to ensure that the project remains on schedule and any future issues can be mitigated. Any changes made during this process to increase effectiveness and efficiency of communication is updated in the Communications Management Plan.

3. Monitor Communications

This is the process of ensuring that information needs of the project and the stakeholders are met. To ensure optimal information flow for effective stakeholder expectation management, the issue log will be used to document the issues and monitor its resolutions by the person responsible. The data analysis tool will include the stakeholder engagement assessment matrix to assess the current situation of communication effectiveness through the review of changes between the desired and current engagement and adjusting communications as necessary.

The project documents which will be used as inputs to monitor communications within the Suriname National Botanic Garden Project include:

- Issue Log – in particular, any issues related to stakeholder engagement will be relevant for this process;
- Lessons learned register – if lessons are learned with regard to stakeholder

communication, then these will be added to the register to improve effectiveness of communication in the remainder of the project and;

- Project communication – this provides information on the communication that has been distributed.

4. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.8. Project Risk Management

Specific objective 8 for the establishment of a National Botanic Garden Project was to create a Risk Management Plan. The objectives of project risk management are to increase the probability and/or impact of positive risks and to decrease the probability/impact of negative risks, in order to optimize the chances of project success. The processes involved are Plan Risk Management, Identify Risks, Perform Qualitative Risk Analysis, Perform Quantitative Risk Analysis, Plan Risk Responses, Implement Risk Responses, Monitor Risks.

Suriname National Botanic Garden Project

Risk Management Plan

1. Plan Risk Management

This 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 the risks and the importance of the project to the organization and other stakeholders. The inputs for the Risk Management Plan are the Suriname National Botanic Garden project charter, assumption analysis, and expert judgment being the source for the identification and evaluation of the risks. The risks were grouped in four areas in the Risk Breakdown Structure (RBS); Technical Risks, Management Risks, External Risk and Commercial Risks which were further subdivided into individual and overall project risks. The Probability and Impact analysis was performed to identify the magnitude of the risks. The Risk Register, Causes, Triggers, Owners, Risk Response strategies and Response costs are presented for all the identified risks.

The risk responses provide a framework for the effective management of the negative (threats) risks.

Below is a hierarchical representation of potential sources of risks.

Chart 29 Risk Breakdown Structure (RBS) (Source: Compiled by the author)

Suriname National Botanic Garden – Risk Breakdown Structure (RBS)			
RBS Level 0	**RBS Level 1**	**RBS Level 2**	**RBS Level 3**
0. All sources of project risk	1. Technical Risks	1.1 Requirement Definition	1.1.1 Scope definition exceeds available financing
			1.1.2 Inadequate storage, treatment and transportation of plant material
		1.2 Estimates and Assumptions	1.2.1 Possibility of a cost overrun during landscaping, construction and collecting of plant material
			1.2.2 Site conditions for preparation, unlocking the area and landscaping exceed budgeted costs
			1.2.3 Required works/labor exceed budgeted costs for the project
			1.2.4 Management reserves allow for additional works
		1.3 Technical Process	1.3.1 Changes in design and construction standards once the construction has started
			1.3.2 Delays in approval of designs and change requests may cause delays during the construction phase
		1.4 Technical Specifications	1.4.1 Earthworks and landscaping are below technical specifications
		1.5 Skilled Trained Personnel	1.5.1 Availability of adequate trainers may delay landscaping, botanical, horticultural, educational activities
			1.5.1 Availability of adequate skilled staff delays landscaping, botanical, horticultural, educational activities
		1.6 Equipment Failure	1.6.1 Work delays occur due to repairs that must be facilitated or substitute equipment that must be found
			1.6.2 Additional costs to source alternate equipment
		1.7 Contractor Performance	1.7.1 Contractor performs below standard due to contracting type
			1.7.2 Contractor adherence to terms and conditions of contracts
			1.7.3 Turnover in laborers results in in schedule delays
		1.8 Technical Capacity of Project Team	1.8.1 Lack of training can cause schedule delays
	2. Management Risks	2.1 Permits/Approvals	2.1.1 Delays in obtaining earthworks, construction and plant collecting approvals and permits
		2.2 Health and Safety	2.2.1 Environment and work conditions determined unsafe for workers
			2.2.2 Injuries sustained by contractor's personnel
		2.3 Communication	2.3.1 Communication across multiple government departments through hierarchical systems causes schedule delays
		2.4 Organization	2.4.1 Weak organizational structure may present issues with time allocation for project activities
	3. External Risks	3.1 Environmental/Weather	3.1.1 The garden site becomes unusable in the rainy season causing schedule delays
		3.2 Material deficiency in project area	3.2.1 Insufficient material within project site
		3.3 Stakeholder acceptance	3.3.1 Resistance/objection from community persons
			3.3.2 Resistance/objection from project workers to guidelines/new regulations
			3.3.3 Lack of project workers in training workshops
		3.4 Legislation	3.4 Lack of regulations to protect botanic gardens
		3.5 Availability of land	3.5.1 Preparation statement of assigned land withdrawn by the authorities

Suriname National Botanic Garden – Risk Breakdown Structure (RBS)			
RBS Level 0	**RBS Level 1**	**RBS Level 2**	**RBS Level 3**
	4. Commercial Risks	4.1 Pricing of services	4.1.1 Inadequate revenues generated from services provided by the botanic garden
		4.1 Exchange rates	4.1.2 Frequent fluctuations in exchange rates may cause budget overruns

2. Identify Risks

This is the process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics. One of the outputs of this project is the risk register presented below. The risks associated with the Suriname National Botanic Garden Project were identified using a series of approaches starting with the examination of the risks identified in the Project Charter as the preliminary risk lists and the assumptions and constraints in the Project Charter were evaluated.

Three other sources of risk identification were utilized:

- Expert Judgment: interviews with the project sponsor and the business case analysis team were conducted to identify and evaluate potential risks;
- Risk Assessment Meeting: meeting with the business case analysis team to identify and rank risks;
- Analog Data: information from historical data inclusive of rates and estimates from related sectors was incorporated and used to identify common risks as well any potential strategies to mitigate risks associated with project works.

The results of these processes were entered in the risk register and evaluated.

3. Perform Qualitative and Quantitative Risk Analysis

Qualitative Risk Analysis is the process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact

as well as other characteristics. On the other hand, Quantitative Risk Analysis is the process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives. Once risks are identified it is important to determine the probability and impact of each risk in order to prioritize the risk avoidance and mitigation strategy. Risks which are more likely to occur and have a significant impact on the project will be the highest priority risks while those which are more unlikely or have a low impact will be a much lower priority. This is usually done with a probability – impact matrix. The probability assessment involves estimating the likelihood of a risk to occur. The impact assessment estimates the effects of a risk event on a project objective. These impacts can be both positive and negative, for instance opportunities and threats.

For each identified risk, the impact and probability were assessed. Interviews and meetings with the project sponsor and the business case analysis team were the basis for the impact and probability scales. The scoring of the risks in the Risk Register is facilitated by using a Risk Scoring Matrix or 'Probability and Impact Matrix' which has as its basis the probability and impact scales. Risks were first analyzed and evaluated in terms of probability (likelihood) of occurrence and the impact (seriousness) if they should occur. The probability of the risk to occur was assessed and given a rating of Very Low (VL), Low (L), Moderate (M), High (H), or Very High (VH) likelihood. Separately the impact upon the project if the risk were to occur was given a rating of Very Low (VL), Low (L), Moderate (M), High (H), or Very High (VH) seriousness. Using these ratings in conjunction with the Risk Scoring Matrix, the risks could be graded to provide a measure of the project's risk exposure for each.

Probability

On the basis of the chances of the risks to occur, each risk can be classified under one of the following probabilities:

Suriname National Botanic Garden Project – Probability Scale Definition		
Likelihood		**Description**
Relative	**Numerical**	
Very low	0.1	Highly unlikely to occur
Low	0.3	Will most likely not occur
Moderate	0.5	Possible to occur
High	0.7	Likely to occur
Very high	0.9	Highly likely to occur

Impact

On the basis of the impact that a risk will have on the project, the risk can be classified under one of the five degree of impacts:

Suriname National Botanic Garden Project – Impact Scale Definition					
Objective	**Relative / Numerical Scale**				
	Very low / 0.05	**Low / 0.1**	**Moderate / 0.2**	**High / 0.4**	**Very high / 0.8**
Time	Insignificant change in schedule	Maximum of 1-week slip	1-2 weeks slip	2-3 weeks slip	More than 3 weeks slip
Cost	Insignificant change in cost	Maximum of 2% increase	2%-4% increase	4%-8% increase	More than 8% increase
Scope	Barely noticeable scope decrease	Minor areas affected	Major areas affected	Unacceptable scope reduction	Project end result effectively useless
Quality	Barely noticeable quality decrease	Minor reduction of quality	Quality reduction requires sponsor approval	Unacceptable quality reduction	Project end result effectively useless

Probability and Impact Scales (PxI)

Suriname National Botanic Garden Project – Probability and Impact Scales										
Probability				Impact			P x I			
Scale	Score	Range	Description	Scale	Score	Description	Score	Range	Description	Calssifiaction
1	0.1	Very low	Less than 10% chances of occurrence	1	0.05	Insignificant risks	0.18 to 0.72	18 to 25	High	
2	0.3	Low	10% to 30% chances of occurrence	2	0.1	Marginal risks	0.06 to 0.17	11 to 17	Moderate	
3	0.5	Moderate	30% to 50% chances of occurrence	3	0.2	Moderate risks	0.01 to 0.05	1 to 10	Low	
4	0.7	High	50% to 70% chances of occurrence	4	0.4	Critical risks				
5	0.9	Very high	70% to 100% chances of occurrence	5	0.8	Catastrophic risks				

Probability and Impact Matrix

This matrix is used to classify risks on the basis of the impact they will have on the project and the probability of their occurrence.

The scale used for classifying risks according to these two risk measurement metrics is given in the Probability and Impact scales table below.

Suriname National Botanic Garden Project – Probability and Impact Matrix													
		Threaths					Opportumities						
Probability	Very high 0.9	0.5	0.9	0.18	0.36	0.72	0.72	0.36	0.18	0.9	0.5	Very high 0.9	Probability
	High 0.7	0.4	0.7	0.14	0.28	0.56	0.56	0.28	0.14	0.7	0.4	High 0.7	
	Moderate 0.5	0.3	0.5	0.10	0.20	0.40	0.40	0.20	0.10	0.5	0.3	Moderate 0.5	
	Low 0.3	0.2	0.3	0.06	0.12	0.24	0.24	0.12	0.06	0.3	0.2	Low 0.3	
	Very low 0.1	0.1	0.1	0.02	0.04	0.08	0.08	0.04	0.02	0.1	0.1	Very low 0.1	
		Very low 0.1	Low 0.3	Moderate 0.5	High 0.7	Very high 0.9	Very high 0.9	High 0.7	Moderate 0.5	Low 0.3	Very low 0.1		

Key: High Moderate Low

Classifying and Prioritizing Risk

After each risk was placed in the matrix, all the risks were given an overall “risk ranking”. Risks that have severe negative consequences *and* are highly likely to occur receive the highest rank; risks with both low impact and low likelihood receive the lowest rank. Impact and likelihood ratings were combined to help identify which risks pose the greatest overall threats (and therefore are the top priority to address).

Based on how each risk scores on these two scales it can be placed in one of the intersecting cells. Once all the risks had been allocated a place on the risk management probability and impact matrix, the entries on the matrix were interpreted as follows:

Each of the cells on the 5×5 matrix has been given one of the three colors – red, yellow and green. The significance of these colors is:

Red (High Risk) – All risks that fall in the red cells are of utmost importance. Prevention and mitigation strategies for all these risks must be framed a long time in advance so as to prevent their occurrence or to fight them back as soon as they surface up.

Yellow (Moderate Risk) – These are the risks that again must be optimally addressed, however they do not enjoy top priority like the risks in the red cells. These are also significant risks and it is advisable to have them included in the risk management strategies.

Green (Low Risk) – These are risks that are the least likely to occur, have the lowest impact and can be left out during the formulation of risk management strategies, as these are low priority risks. Remediation on these risks should be done where the cost of remediation is low or negligible.

Interpretation

	Consequences				
Likelihood	**Insignificant**	**Marginal**	**Moderate**	**Critical**	**Catastrophic**
Very High	Low 9	Medium 14	High 18	High 22	High 25
High	Low 7	Medium 12	Medium 17	High 21	High 24
Medium	Low 5	Low 10	Medium 15	High 19	High 23
Low	Low 3	Low 6	Medium 11	Medium 16	High 20
Very Low	Low 1	Low 2	Low 4	Low 8	Medium 13

Recommended Corrective Action

Risk Level	Action Required
High Risk 18 - 25	- This rating level is not acceptable - Report immediately to Senior Management - Consider alternative activity unless appropriate controls are implemented - Develop specific Treatment/Action Plan for immediate implementation to address high risks - Allocate actions and budget for implementation within one month - Report to Senior Management on effectiveness of control
Medium Risk 11-17	- Develop and implement a specific Treatment/Action Plan for medium risks - Consider alternative activity unless appropriate controls are implemented - Allocate actions and budget to minimize risk; monitor implementation - Report to Senior Management on effectiveness of control
Low Risk 1 - 10	- Accept and Monitor low-priority risks - Manage via routine procedures where possible; Monitor via normal internal reporting mechanisms

Risk Register

The Risk Register captures details of identified individual project risks. The results of Perform Qualitative Risk Analysis, Plan Risk Responses, Implement Risk Responses, and Monitor Risk Responses are recorded in the risk register as those

processes are conducted throughout the project. Each risk is broken down into the cause, consequence, probability, impact, trigger, owner, strategy and cost. Each of the elements are described in the chart below:

RBS Code - The RBS code links each risk to the Risk Breakdown structure.

Cause - A cause is a definite event or a number of circumstances inherent in a project or its environment that may give rise to an uncertainty and can trigger risks.

Risk - A risk is an uncertainty that may affect the achievement of the project goals. Many times, risks are considered only negative, however, positive risks may occur. Negative risks are called threats while positive risks are called opportunities. Positive risks can present opportunities for improvement in the project as much as negative risks can cause faults and failures.

Consequence - A consequence is the result of an identified risk occurring. Consequences may range from slight delays in schedule or increased costs to project failure, including abandoning the project.

Probability - Probability is the numerical value assigned to each risk to measure the likelihood of the risk occurring. Probability measures from 0.1 - very unlikely to occur to 0.9 very likely will happen.

Impact - Impact is also a numerical value assigned to each risk which measures how much the associated risk would affect the outcome of the project. The grades range from <10% which is very low to >70% which is very high.

PxI - Probability times impact is the probability assigned multiplied by the impact assigned.

Trigger - Trigger is event or circumstance that activates the causes that results in the risk occurring.

Owner - Owner is the entity with whom the risk would be assigned.

Strategy - Strategy is the action that will be taken to mitigate the risk should it occur or to pass on the risk to another entity.

Cost - the estimated value of the impact should the risk occur.

Chart 30 Probability-Impact Matrix (Source: Compiled by the author)

RBS Code	Cause	Risk	Consequence	Probability	Impact	Pxl	Classification	Trigger	Owner	Strategy	Cost to Project	Cost (additional comments)
1.2.3	Poor estimates of human resources	Required works/labor exceed budgeted costs for the project	Acquiring less workers cause schedule delays or less paid workers deliver poor quality work	0.7	0.4	0.28		Progress against performance shows a schedule delay and increase in cost	Project Lead	Risk mitigation: set performance targets and monitor more frequently	$10,000	Approximately 2% budget overrun
1.5.1	Lack of commitment and agreements with staff	Availability of adequate skilled staff delays landscaping, botanical, horticultural, educational activities	Schedule delays	0.5	0.8	0.4		Staffing of departments with skilled personnel 3 weeks behind schedule	Project Lead	Risk mitigation: Assess alternative expertise and set appropriate requirements	$0	No cost to the project since the fee is linked to performance
3.4	Lack of action plans for botanic gardens on national level	Lack of regulations to protect botanic gardens	Delays in strategic planning	0.9	0.4	0.36		Failure to meet quality standards	Environmental Authority	Risk mitigation: follow international standards and prepare national strategy	$0	No cost to the project
4.1.1	Changes in market conditions and demands	Inadequate revenues generated from services provided by the botanic garden	Dependency on alternative funding	0.5	0.8	0.4		Operational costs exceed the amount of incomes	Steering Committee	Risk mitigation: perform feasibility study including market analysis and change strategy	$5,000	Equals the amount of annual income
1.1.1	Poor scope definition	Scope definition exceeds available financing	Project cannot meet the objectives	0.1	0.8	0.08		Poor requirements and insufficient change control	Project Lead	Risk mitigation: write additional document to seek funding from other financing agencies	150,000	Approximately 30% of total budget

1.2.1	Other sites chosen to establish the garden and to collect planting material	Possibility of a cost overrun during landscaping, construction and collecting of plant material	Inferior quality of facilities and insufficient planting material	0.3	0.2	0.06		Larger distance to different selected sites and less accessible	Steering committee	Risk mitigation: assess alternative sites and set criteria and requirements	$12,000	4 different locations selected with additional costs of $3000 per location
1.2.4	Overestimation of costs of overall activities	Management reserves allow for additional works	Schedule delays	0.3	0.4	0.12		Budget reviews at consecutive finish dates of activities have unaffected management reserve	Project Manager	Risk mitigation:	$4,500	Additional labor costs to carry out extra work for 150 labor days at the expense of $30 each
1.3.1	New construction regulations	Changes in design and construction standards once the construction has started	Schedule delays	0.1	0.8	0.08		Design changes totalling in access of 25% of the project cost and/or incurred delays affect the critical path	Steering committee	Risk mitigation: Hire third party independent consultant to review and design the garden layout	$1,500	Consultant fee of $1,500
1.6.1	Inspection of equipment not required	Work delays occur due to repairs that must be facilitated or substitute equipment that must be found	Schedule delays and budget overruns	0.5	0.2	0.1		Comparison of progress against project schedule; works behind schedule by greater than 25% or equipment repair/replacement exceeds 2 weeks	Contractor	Risk mitigation: Draft contract with strict performance criteria and guidelines, inclusive of penalty clauses for non-performance	$450	Contract drafting services $450
1.7.2	Contract in the event of notice of default by the contractor to his disadvantage	Contractor adherence to terms and conditions of contracts	Difficulties to implement changes	0.5	0.2	0.1		Contractor performance behind schedule or over budget beyond his power	Contractor	Risk mitigation: Mediate the drafting of addendum to the contract to set clear criteria and guidelines	$600	Contract drafting $450 and mediation services $150
1.7.3	Terms of reference not specified	Turnover in laborers results in schedule delays	Schedule delays	0.3	0.4	0.12		Turnover in laborers exceeds 25%	Contractor/Project manager	Risk mitigation: Draft contracts and terms of reference with strict criteria and guidelines	$450	Contract drafting services $450

2.2.1	Lack of protective equipment and calamity response plan	Environment and work conditions determined unsafe for workers	Schedule delays	0.1	0.8	0.08		Health issues and site closure	Contractor/Project manager	Risk mitigation: Draft calamity plan; contractor must obtain third party insurance	$450	Consultancy fee to draft calamity plan $450
2.2.2	Safety requirements not complied with by personnel	Injuries sustained by contractor's personnel	Budget overruns and schedule delays	0.3	0.4	0.12		Site incidents and safety reports	Contractor	Risk mitigation: Contractor must obtain third party insurance to cover compensation for injuries	$0	Insurance costs to be covered by the contractor
2.3.1	Untimely and insufficient sequencing of activities	Communication across multiple government departments through hierarchical systems causes schedule delays	Schedule delays	0.7	0.1	0.07		Slippage in schedule activities of greater than one week	Relevant agency Heads	Risk mitigation: identify key persons in related agencies to facilitate necessary processes	$0	No costs since key persons are government staff
3.1.1	Large amounts of precipitations	The garden site becomes unusable in the rainy season causing schedule delays	Schedule delays	0.5	0.2	0.1		Heavy rainfalls and schedule delays of greater than 2 weeks	Project manager	Risk mitigation: include time buffers in schedule due to weather	$10,000	Cost of time buffer 2% of project budget
3.3.1	Conflicting community interests	Resistance/objection from community persons	Schedule delays	0.1	0.8	0.08		Claims from community persons	Community members	Risk mitigation: mediation to facilitate communication and distribute pamphlets to announce project outcomes and benefits	$200	Cost for mediation $150 and 50 pamphlets $50
3.3.3	Lack of interest of workers to attend training	Lack of project workers in training workshops	Decrease in quality of deliverables	0.1	0.8	0.08		Training workshop attendance sheets and performance reviews with schedule delays	Project manager	Risk mitigation: Include training in terms of reference and contracts	$0	Costs of training already incorporated in project budget

3.5.1	Conflicting interests of national authorities	Preparation statement of assigned land withdrawn by the authorities	Illegal status of the botanic garden	0.1	0.8	0.08		Political interference and/or change of management at governmental agencies	Ministry of Physical Planning, Land and Forest Management	Risk mitigation: Draft agreements and regulations to secure the status of the botanic garden	$0	No costs since expertise to be provided by Steering Committee
1.1.2	Lack of guidelines and instructions	Inadequate storage, treatment and transportation of plant material	Budget overruns and rework of acquiring new planting material	0.5	0.4	0.2		Loss of more than 5% of planting material	Staff and team of experts	Risk mitigation: train all staff and relevant workers according to specific guidelines	$0	Nos costs since BGCI already provides international guidelines
1.2.2	Unfavorable condition of the sites	Site conditions for preparation, unlocking the area and landscaping exceed budgeted costs	Initial activities will be completed at the expense of other activities	0.3	0.1	0.03		Budget overruns at early start of construction activities	Contractor	Risk mitigation: Ensure that cost management plant has adequate management reserve	$0	Management reserve already included in project budget
1.3.2	Cumbersome organizational structure with governmental approvals and permits required	Delays in approval of designs and change requests may cause delays during the construction phase	Schedule delays and budget overruns	0.5	0.4	0.2		Approval of designs exceed delays of over 2 weeks of normal processing time	Steering committee/Project manager	Risk mitigation: Include time buffers in schedule and build in automatic reminders for approval requests	$0	Steering group requires no additional fee
1.4.1	Human resources not adequately trained	Earthworks and landscaping are below technical specifications	Rework and schedule delays	0.1	0.4	0.04		Comparison of progress against project schedule; works behind schedule by greater than 25%	Project manager	Risk mitigation: Develop and implement strict selection criteria and requirements guidelines	$0	No additional costs to project

1.5.1	Insufficient skilled trainers	Availability of adequate trainers may delay landscaping, botanical, horticultural, educational activities	Schedule delays	0.5	0.4	0.2		Training and workshops behind schedule for over 2 weeks	project lead	Risk mitigation: Include provisions for use of non-national expertise for training if not available within the country	$5,000	Travel and accommodation for international expert and consultancy fee $5,000
1.6.2	Repairs of equipment not possible	Additional costs to source alternate equipment	Budget overruns	0.3	0.05	0.02		Comparison of progress against schedule; delay of over 2 weeks	Contractor/Supplier	Risk mitigation: Require contractor to work with qualified equipment or to perform inspection prior to start; warranty guaranteed by supplier	$0	No additional cost
1.7.1	Inadequate contracting type chosen	Contractor performs below standard due to contracting type	Change requests and rework	0.1	0.4	0.04		Comparison of progress against schedule; delay of over 2 weeks	Project manager	Risk mitigation: Make legal advice a requirement in drafting stage	$450	Contract drafting services $450
1.8.1	Training not included in terms of reference	Lack of training can cause schedule delays	Schedule delays	0.1	0.4	0.04				Risk mitigation:		
2.1.1	Cumbersome processes at governmental institutions	Delays in obtaining earthworks, construction and plant collecting approvals and permits	Schedule delays	0.3	0.1	0.03		Approval and permits exceed delays of over 2 weeks of normal processing time	Relevant governmental agencies	Risk mitigation: Include time buffers in schedule and identify key persons in related agencies to facilitate necessary processes	$0	No additional costs since key persons work at governmental agencies

3.2.1	Delays in supply of material	Insufficient material within project site	Schedule delays	0.1	0.2	0.02		Comparison of progress against performance; schedule delay of over 2 weeks	Project manager	Risk mitigation: Identify and earmark additional suppliers or sites for provisional storage	$1,500	Costs for provisional storage site and additional transportation
3.3.2	Introduction of new regulations	Resistance/objection from project workers to guidelines/new regulations	Schedule delays	0.1	0.4	0.04		Comparison of progress against performance; schedule delay of over 2 weeks	Regulating agencies	Risk mitigation: Provide for adequate management reserve	$0	Management reserve already included in project budget
4.1.2	Economic instability	Frequent fluctuations in exchange rates may cause budget overruns	Budget overruns	0.1	0.05	0.01		Cost performance assessments	Project manager	Risk mitigation: Provide for adequate management reserve	$0	Management reserve already included in project budget

4. Plan Risk Responses

This is the process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks. A risk strategy should be developed for each identified risk on the project. This is vital as it allows the team to assess the risks that have the greatest impact on the project to be correctly controlled.

5. Implement Risk Responses

This is the process of implementing agreed-upon risk response plans. Mitigation and avoidance strategies have been identified for the high priority risks (high, medium and low risks) as identified in the risk prioritization sections. The strategies include adjustments to the project plan and the inclusion of mechanisms for effective project management that limit or reduce the potential impacts.

6. Monitor Risks

This is the process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analysing new risks, and evaluating risk process effectiveness throughout the project. The Project Manager is responsible for monitoring and reporting of the project risks. Monthly reports inclusive of any new or emerging risks, risk responses and effectiveness of risk responses will be presented to the Suriname National Botanic Garden Project Steering Group.

The risks identified and ranked very high in the risk register will be added to the project schedule and monitored by either the Project manager and/or the Project Lead dependent on the area in which those risks fall. The monthly Steering Group meetings will be used to assess effectiveness of risk response strategies and the need to alter or add additional risk responses. The risk monitoring will be

continuous throughout the life of the project and also includes the identification and monitoring of the trigger conditions for each risk to help determine if a risk is likely to occur or is being approached.

7. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.9. Project Procurement Management

Specific objective 9 for the establishment of a National Botanic Garden Project was to develop a Procurement Management Plan. The objectives of project procurement management are to purchase or acquire products, services, or results needed from outside the project team. The processes involved are Plan Procurement Management, Conduct Procurement, Control Procurement.

Suriname National Botanic Garden Project

Procurement Management Plan

1. Plan Procurement Management

This is the process of documenting project procurement decisions, specifying the approach, and identifying potential sellers. In order to execute the Suriname National Botanic Garden Project, the following main procurement activities have to be conducted:

- Construction of a 2.5 ha botanic garden including site clearing and earthworks, and the construction of a plant nursery. These activities will be carried out by contractors;
- Construction of a building to house four departments and an event venue to be carried out by a contractor;
- Collection and purchase of plant material. Collecting locally will be conducted by a team of field experts, and certain seeds will be acquired from other botanic gardens and seed suppliers outside the country;
- Procurement of goods and services locally and internationally, e.g. gardening tools, fertilizers, and training to develop the plant collections.

The Suriname National Botanic Garden Project will make use of a preapproved sellers list. Only approved contractors will be selected according to the selection criteria, which indicates the method used for selecting the supplier. Selecting a supplier must be justified based on the method for the project. The work will only commence after signing a vetted contract. The requirements documentation should clearly define resource requirements, as well as staff training facilities if adequate. The stakeholder register is a helpful input to identify stakeholders in the tender process.

2. Conduct Procurements

This is the process of obtaining seller responses, selecting a seller, and awarding a contract. The method for evaluating and negotiating bids should be specified. A procurement specialist can be beneficial in the negotiating process as he/she would first be aware of the company's negotiating process and have experience in negotiating for procurement. The Procurement Management Plan should indicate what should be included in the contract, e.g. performance clauses, delivery date, work schedules and processes for change requests. Expert judgment can prevent wrong judgment of vendors. Contracts obligate the seller to meet specified requirements, including penalties for late delivery if adequate to motivate the supplier to ensure on time delivery. All agreements should be made formally in writing and signed by both parties.

The Suriname National Botanic Garden Project Steering Group should approve the signing of contracts above a certain threshold. Before sending out invitations to bid, the approved sellers list should be consulted.

3. Control Procurements

This is the process of managing procurement relationships, monitoring contract performance, making changes and corrections as appropriate, and

closing out contracts. Agreements should be signed between the seller and the buyer in order to formalize the duties of both parties and set the terms and conditions, the scope of work and the deliverables. In addition to setting the scope of work and terms and conditions, the contractor's agreement should include the process for change orders. This agreement can then be used as an input document to control the work that has been procured.

A Subject Matter Expert should be consulted to supervise the construction works and to accept the delivered material to help to assure quality.

A good Integrated Change Control Process will make sure that change requests are dealt with through this process and that the approvals required for additional procurement of materials, goods or services are obtained.

4. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

4.10. Project Stakeholder Management

Specific objective 10 for the establishment of a National Botanic Garden Project was to develop a Stakeholder Management Plan. The objectives of project stakeholder management are to identify the people, or organizations that could impact or be impacted by the project, to analyze stakeholders' expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution.

Suriname National Botanic Garden Project

Stakeholder Management Plan

1. **Identify Stakeholder**

   This includes the process of identifying project stakeholders regularly and analyzing and documenting relevant information regarding their interest, involvement, interdependencies, influence, and potential impact on project success. Stakeholders can be either directly or indirectly involved in the project (Boyde, 2014, p. 366). Direct stakeholders have an immediate input in the project, while indirect stakeholder input refers to an input into the project that was introduced via the feedback because of effects of the project's outputs and outcomes. Once the stakeholders have been identified, it would be beneficial to list them in the stakeholder register. This register provides the list of project stakeholders and any information needed to execute the stakeholder engagement plan.

Chart 31 Stakeholder Register (Source: Compiled by the author

Suriname National Botanic Garden Project							
ID	**Stakeholder**	**Functional Area**	**Roles - Responsibilities**	**Main Expectations**	**Major Requirements**	**Influence/Impact (Low-Medium-High)**	**Additional Comments**
1	Project Sponsor	Head of the Herbarium	To ensure that the project is completed successfully	The project is in line with the organizational strategy, mission and vision and will add value to the organization's operations	Champion of the project; strategic planning	Medium	
2	Suriname National Botanic Garden Steering Group	Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager	To provide expertise and to make sure that the project is executed according to its requirements	The project needs to move forward provided that the technical requirements are established by the relevant experts	Expertise/Expert knowledge	High	
3	Anton de Kom University	University Board	To ensure that the processes, procedures and project outcomes do not conflict with the University's strategy	The project needs to move forward and adds value to the University's core activities and it must be cost-effective in the long term	Power of authority/Ownership	Medium	
4	Ministry of Physical Planning, Land and Forest Management	Minister	To ensure that the project contributes to halt the loss of plant diversity	If the University does not have enough land and public land application is required to establish the botanic garden, the project must be in line with the national biodiversity action plans and support policy-making on national and international related biodiversity issues in order to move forward	Formal/Power of authority	Low	
5	Ministry of Education	Minister	To ensure that plant related research can be facilitated to support education, human well-being, and policy-making	The project needs to move forward since its objectives are highly focused on research and will facilitate different educational levels	Formal/power of authority	Low	

6	Botanic Gardens Conservation International	Trustees and directors	To support the establishment, conservation, and management of botanic gardens	The project will contribute to assist in the halt of loss of plant diversity and needs to move forward	Collaboration	Medium	
7	Technical Expert	Engineer	To contribute to successful project completion	The project needs an interdisciplinary approach and the requirements for construction and establishment of the garden must be well-defined in order for the project to move forward	Expertise	Medium	
8	Other Botanic Gardens	Directors of Botanische Tuinen Utrecht, Missouri Botanical Garden, Atlanta Botanical Garden	To ensure exchange of knowledge and plant material	Mutual benefits regarding training, exchange of knowledge and plant material are empowered by the historical relationship and good accessibility which are in favor of the project	Collaboration	Low	
9	Regulating Agencies	Heads of legal agencies and advisors	To avoid schedule delays and ensure that the legal procedures are followed	Import and export of plant material needs to be compliant with national and international regulations, namely phytosanitary certificates and international conventions, land required must be legal in order for the project to move forward	Formal/Power of authority	Medium	

2. Plan Stakeholder Engagement

This is the process of developing approaches to involve project stakeholders based on their needs, expectation, interest, and potential impact on the project.

Stakeholder engagement assessment matrix

This matrix supports comparison between the current engagement levels of stakeholders and the desired engagement levels required for successful project delivery.

Chart 32 Stakeholder engagement assessment matrix (Source: Compiled by the author)

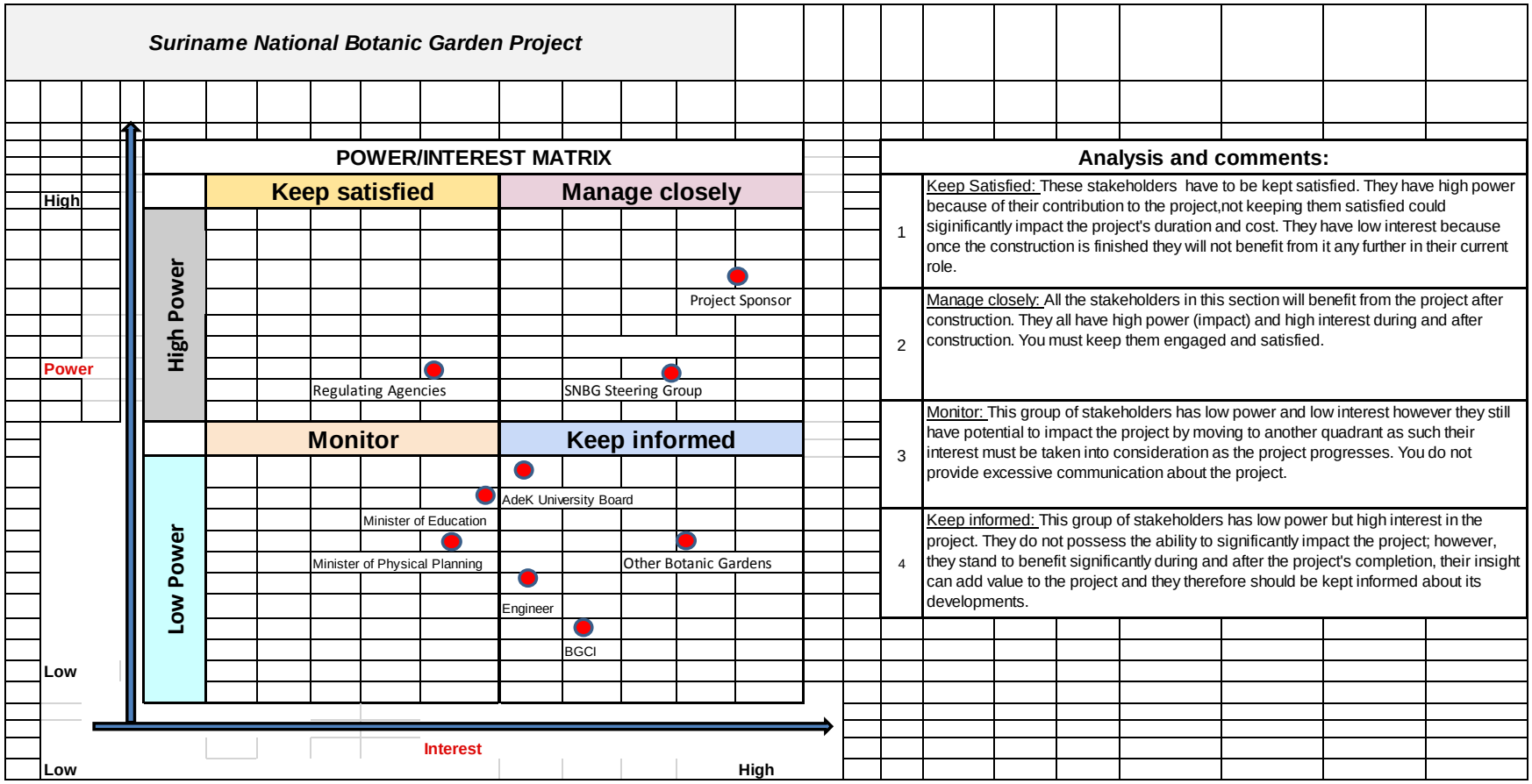
Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Head of the Herbarium; Project Sponsor					C/D
Suriname National Botanic Garden Steering Group: Landscape Architect; Architect; Senior Botanist; Horticulturist; Education expert; Project Manager				C	D
Chair of the University Board			C	D	
Minister of Physical Planning, Land and Forest Management	C			D	
Minister of Education	C			D	
Botanic Gardens Conservation International	C			D	
Engineer	C			D	
Other Botanic Gardens: Utrecht Botanic Gardens, Missouri Botanical Garden, Atlanta Botanical Garden			C	D	
Regulating Agencies	C		D		

C=Current engagement level; D=Desired engagement level

The main stakeholders of the Suriname National Botanic Garden Project were analyzed via Stakeholder Matrices. It must be remembered that an individual

stakeholder's location on each grid can dynamically change over the life of the project.

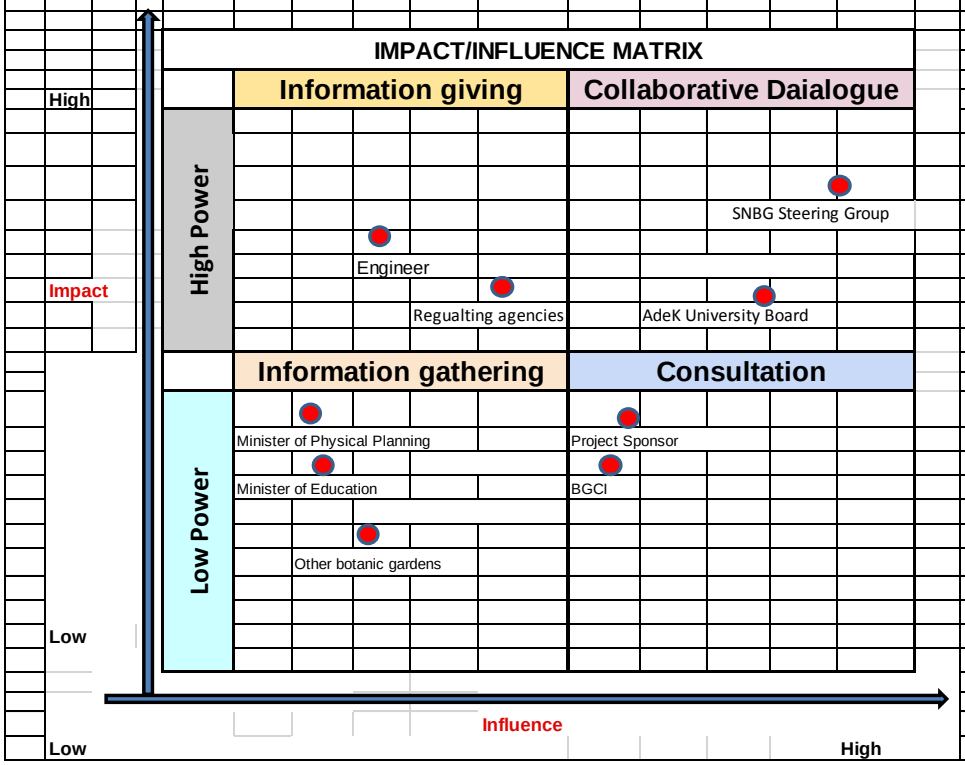
Stakeholder Power Interest Matrix



	Analysis and comments:
1	Keep Satisfied: These stakeholders have to be kept satisfied. They have high power because of their contribution to the project,not keeping them satisfied could siginificantly impact the project's duration and cost. They have low interest because once the construction is finished they will not benefit from it any further in their current role.
2	Manage closely: All the stakeholders in this section will benefit from the project after construction. They all have high power (impact) and high interest during and after construction. You must keep them engaged and satisfied.
3	Monitor: This group of stakeholders has low power and low interest however they still have potential to impact the project by moving to another quadrant as such their interest must be taken into consideration as the project progresses. You do not provide excessive communication about the project.
4	Keep informed: This group of stakeholders has low power but high interest in the project. They do not possess the ability to significantly impact the project; however, they stand to benefit significantly during and after the project's completion, their insight can add value to the project and they therefore should be kept informed about its developments.

Stakeholder Impact Influence Matrix

Suriname National Botanic Garden Project



	Analysis and comments:
1	Information gathering: These stakeholders are relatively unaffected by the project and its outcomes, though they have limited means of influencing the project's outcomes. They are a source of information on what probably will and will not affect them.
2	Consultation: This group is affected by the project and its outcome, but they have limited means of influencing the project's outcomes. They most probably understand the inner-workings of those issues that affect them, and hence they should be consulted before they become problematic or antagonistic.
3	Information giving: This group is relatively unaffected by the project and its outcome, but they do have the means to influence the project if they choose to do so. They are a source of information as to the possible objectives of the project.
4	Collaborative Dialog: They are affected by the project and its outcomes, and they do have the means to influence the project. Their views and opinions must be given the highest level of consideration because their opposition can make or break the project.

3. Manage Stakeholder Engagement

This is the process of communicating and working with stakeholders to meet their needs and expectations, address issues, and foster appropriate stakeholder engagement involvement. By actively managing the stakeholders of the Suriname National Botanic Garden Project, the project manager is better able to balance the providing of benefits to the stakeholders while still achieving the project's objectives, and hence prevent or mitigate those stakeholder related risks and issues confronting the project. The project manager should communicate openly and clearly about the project, listen to the stakeholders' concerns, and acknowledge that they have been heard. Communication should be tailored specifically for the targeted stakeholders so that it contains predominantly the information that is relevant to them, in a form that they can understand and utilize (Boyde, 2014, p.386).

4. Monitor Stakeholder Engagement

This is the process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through the modification of engagement strategies in plans. Stakeholders should be periodically monitored by making appropriate adjustments to the stakeholder strategies. New stakeholders should be identified when they appear. When their priority in the power-interest and impact-influence matrices changes, their position should be changed accordingly. To prevent the stakeholders' from evolving into risk and issues for the project, their expectations, perspectives, concerns, needs and wants should be managed correctly and in a timely fashion.

5. Approvals

Approver Name	Title	Signature	Date
Dorothy Traag	Head of the Herbarium		

5 CONCLUSIONS

- The Integration Management Plan to manage the integration within the project and to coordinate the various project management activities was developed, including the creation of a project charter. The Project Charter includes the purpose and scope of the project, and the business case. The business case analysis team defined the problem and the project goals and objectives. The botanic garden will contribute to conservation of plant species, display the country's plant diversity through different themes in the botanic garden, and facilitate scientific research and education. The business case also describes project performance, assumptions, constraints, milestones, strategic alignment, and captures the costs and savings associated with the project. The project was scheduled to be completed October 20, 2022 and the net first year savings in the operational phase of the botanic garden were estimated to be approximately $4,000.
- The Scope Management Plan was created to ensure that the project includes all the work required, and only the work required, to complete the project successfully. The plan includes the key stakeholders and their responsibilities, the project requirements, the scope statement and work breakdown structure (WBS), and how the scope will be monitored and controlled. The project will comprise a 2.5 ha botanic garden that will be carried out in four stages within 33 months. The four stages are Envisioning the Botanic Garden, Site Selection and Feasibility Study, Design and Pre-Operations, and Launch and Operations. From these four stages the WBS was created, which subdivides the project deliverables and project work into smaller, more manageable components. The performance reports and change request templates are the main documents that will be used in the Control Scope process.
- The Schedule Management Plan was created to manage the timely completion of the project. The Activity List was created to describe the project activities and the scope of work for each activity. The duration of the project

was estimated to be 33 months: 120 days for Envisioning the Botanic Garden; 71 days for Site Selection and Feasibility Study; 585 days for Design and Pre-operations; 35 days for Launch and Operations. The project start date will be October 31, 2019, and the finish date was estimated to be October 20, 2022. Microsoft Project was used to create the project schedule and will also be used in the Control Schedule process.

- The Cost Management Plan to complete the project within the approved budget was created. The cost baseline was calculated by parametric and analogous estimating, while taking the duration and backup information into account. The contingency reserve has a value of 8 percent and the management reserve has been set at 5 percent. The total project budget was estimated for the amount of $460,059.00. To control costs, effective communication among the project manager, sponsor and other stakeholders will be ensured, cost changes and cost baseline changes will be received and documented bi-weekly and will be posted in the project status comments.
- The Quality Management Plan was developed to meet stakeholders' expectations by accurately identifying their requirements. For each stakeholder their impact, interest, power, and influence were plotted in the Stakeholder Matrix. The stakeholder and requirements prioritization analysis show that the Suriname National Botanic Garden Steering Group is the principle stakeholder. The principle requirement is expertise available in Architecture, Landscaping, Botany, Horticulture, Education, and Project Management. Quality will be controlled by using checklists, check sheets, questionnaires and surveys, and by performing inspections (audits).
- The Resource Management Plan to complete the project successfully was created. The responsibilities of each team member within the project management process groups were assessed. For each project activity the total number of resources per month was estimated; the number varies from 2 to 21 human resources per month. Within the Suriname National Botanic Garden Project acquiring material, equipment, supplies, and team members will be established through Multi-criteria Decision Analysis. This method lists

the best alternative against several criteria. The project manager for the Suriname National Botanic Garden Project will assess any changes in the actual performance and use of the physical resources against the project plan.

- The Communications Management Plan was developed to ensure timely and appropriate management of project information. The Responsibility Assignment Matrix and the total number of resources were used to identify the communication channels. Stakeholders primary position, interest, power, and engagement were assessed. The project team will make use of technologies such as instant messaging, voice over IP (VoIP), e-mail, and video-conferencing. Alignment of activities is key and will be reached by quarterly strategic meetings and monthly team ownership meetings.
- The Risk Management Plan was created to conduct risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on the project. The Risk Breakdown Structure was created including a hierarchical representation of potential sources of risk up to three levels of detail. The risks register includes details of identified individual project risks and will be updated each time new risks are identified. Probability and impact scales were used to classify and prioritize the project risks. The four high priority risks identified are: Required works/labor exceed budgeted costs for the project; Availability of adequate skilled staff delays landscaping, botanical, horticultural, educational activities; Lack of regulations to protect botanic gardens; Inadequate revenues generated from services provided by the botanic garden. The strategies that were identified, primarily mitigation, include adjustments to the project plan and the inclusion of mechanisms for effective project management that limit or reduce the potential impacts. The costs of the impact should the risk occur were estimated, which vary between $200.00 and $150,000.00 for individual risks.
- The Procurement Management Plant to purchase or acquire products, services, or results needed from outside the project team was developed. The

main procurement activities to be conducted for the project are: Construction of a 2.5 ha botanic garden including site clearing and earthworks, and the construction of a plant nursery by contractors; Construction of a building to house four departments and an event venue to be carried out by a contractor; Collection and purchase of plant material locally to be conducted by a team of field experts, and certain seeds will be acquired from other botanic gardens and seed suppliers outside the country; Procurement of goods and services locally and internationally to develop the plant collections. Contracts will be developed and negotiated in the Conduct Procurement process. Change requests and orders will be dealt with in the Control Procurement process.

- The Stakeholder Management Plan was developed for effective engagement of stakeholders in project decisions and execution. The Power-Interest Matrix shows that the stakeholders to be managed closely are the Project Sponsor and the Steering Group. The stakeholders that have little power and interest in the project are the Ministers of education and Physical Planning, yet they should be monitored for they still have the potential to impact the project by shifting their interest as the project progresses. The Impact-Influence Matrix shows that the stakeholders with the highest impact and influence are the Steering Group and the University Board. Their views and opinions must be given the highest level of consideration because their opposition can make or break the project. Stakeholder engagement will be monitored by changing their position according to the changes in the power-interest and impact-influence matrices. To prevent the stakeholders from evolving into risk and issues for the project, their expectations, perspectives, concerns, needs and wants should be managed correctly and in a timely fashion.

6 RECOMMENDATIONS

- The Suriname National Botanic Garden management team should apply formal Project Management methods to increase the likelihood of success in the development of projects targeting the expansion of the botanic garden and its collections.
- The Suriname National Botanic Garden Steering Group should develop standard project management initiation and planning documents prior to the execution of projects.
- The Suriname National Botanic Garden project management team should manage all their projects by being equipped with the right tools and techniques for adequate project planning and appropriate project documents.
- The Suriname National Botanic Garden project management team should apply quantitative risk analyses for all projects in order to identify appropriate risk responses.
- The Suriname National Botanic Garden project management team should have a storage system in place for project knowledge and lessons-learned for future use and review.
- The Suriname National Botanic Garden Steering Group should make use of the existing international network of botanic gardens for continuous improvement of project processes and activities.
- The Suriname National Botanic Garden management team must make commitments with both the team and the external companies how to manage and control quality throughout the project duration, while training team members to maintain quality and making them incorporate quality decisions in every process and activity.
- The Suriname National Botanic Garden management team should incorporate environmental sustainability and social responsibility in all the project management processes.

7 BIBLIOGRAPHY

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8 APPENDICES

Appendix 1: FGP Charter

PROJECT CHARTER

Process inputs: business case, statement of work, agreements, enterprise environmental factors, organizational project assets.
Tools and techniques: expert judgment, facilitation techniques.
Outputs: Charter

PROJECT CHARTER **Formalizes the project start and confers the project manager with the authority to assign company resources to the project activities. Benefits: it provides a clear start and well defined project boundaries.**	
Date	**Project Name:**
May 26, 2019	Project Management Plan for the Establishment of a National Botanic Garden Project
Knowledge Areas / Processes	**Applicacion Area (Sector / Activity)**
Knowledge areas: Project Integration Management, Project Scope Management, Project Schedule Management, Project Cost Management, Project Quality Mangement, Project Resource Mangement, Project Communications Management, Project Risk Management, Project Procurement Management, Project Stakeholder Management. **Process groups:** Initiating Process Group, Planning Process Group, Implementing Process Group, Monitoring and Controlling Process Group, Closing Process Group	Conservation, Research and Education
Start date	**Finish date**
May 26, 2019	November 8, 2019
Project Objectives (general and specific)	
General objective: To develop a Project Management Plan to guide the establishment of a National Botanic Garden Project Specific objectives: 1 To develop an Integration Management Plan to manage the integration within the project and to coordinate the various project management activities, including the creation of a project charter to formally authorize the project and to provide the project manager with the authority to apply organizational resources to the project and to produce the project management plan.	

2 To create a Scope Management Plan to ensure tha project includes all the work required, and only the work required, to complete the project successfully
3 To create a Schedule Managemen Plan to manage the timely completion of the project
4 To create a Cost Management Plan to complete the project within the approved budget
5 To develop a Quality Management Plan to meet stakeholders' expectations by accurately identifying their requirements
6 To create a Resource Management Plan to complete the project successfully
7 To develop a Communications Management Plan to ensure timely and appropriate management of project information
8 To create a Risk Management Plan to conduct risk mangement planning, identification, analysis, response planning, response implementation, and monitoring risk on a project
9 To develop a Procurement Managemen Plant to purchase or acquire products, services, or results needed from outside the project team
10 To develop a Stakeholder Management Plan for effective engagement of stakeholders in project decisions and execution

Project purpose or justification (merit and expected results)

The project to develop the Project Management Plan for the establishment of the National Botanic Garden requires to effectively create the documents that will be used by the project management team during the execution, monitoring and controlling, and closing processes

The scientific purpose of a botanic garden is to present the systematic classification of plants. Furthermore these plants cannot be collected but can only be used to study, so a living plant collection conserves these specimen and their genetic resources. Not having a Botanic Garden will eventually be time consuming and expensive for students, researchers and educational institutions.

It is expected that establishing a botanic garden will facilitate scientific research, contribute to conservation of plant species, save students and lecturers from different educational institutions time and money, and display the country's plant diversity.

The project manager and the project management team understand the importance of the planning process and the project management plan for the successful completion of the project. During this project, the project manager will plan to develop the subsidiaries of the project management plan for the establishment of the Nastional Botanic Garden to meet the time, cost, schedule, and quality constraints.

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

1 Project Integration Management Plan and Project Charter
2 Project Scope Management Plan
3 Project Schedule Management Plan
4 Project Cost Management Plan
5 Project Quality Management Plan
6 Project Resource Management Plan
7 Project Communications Management Plan
8 Project Risk Management Plan
9 Project Procurement Management Plan
10 Project Stakeholder Management Plan

Assumptions

1 The project can be completed within three months
2 The budget required to complete the timely deliverables of the project.is available
3 The project can be completed by one person

Constraints

1 The time limit for the project is three months.
2 Each advance in the process of the development of the FGP will be reviewed by the tutor in a time period of eight working days.
3 The readers have a period of ten working days to return, with their comments, the FGP that will be submitted to them.

Preliminary risks

1 If the project schedule is not followed, the project management plan may not be completed in three months.
2 If feedback from the tutor and reviewers is not prompt, the project management plan may not be completed in a timely manner, impacting the project's end date.

Budget

The budget will comprise of the costs for printing, binding, and transporting the Final Graduation Project to Costa Rica.

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

1 Project Integration Management Plan and Project Charter
2 Project Scope Management Plan
3 Project Schedule Management Plan
4 Project Cost Management Plan
5 Project Quality Management Plan
6 Project Resource Management Plan
7 Project Communications Management Plan
8 Project Risk Management Plan
9 Project Procurement Management Plan
10 Project Stakeholder Management Plan

Milestones and dates

Milestone	Start date	End date
1 FGP start	May 13, 2019	May 13, 2019
2 Graduation Seminar	May 13, 2019	June 16, 2019
3 Tutoring Process	June 17, 2019	September 15, 2019
4 Tutor approval	September 15, 2019	September 15, 2019
5 Reading by reviewers	September 16, 2019	October 6, 2019
6 Adjustments	October 7, 2019	November 3, 2019
7 Presentation to Board of Examiners	November 4, 2019	November 8, 2019
8 FGP end	November 8, 2018	November 8, 2019

Relevant historical information

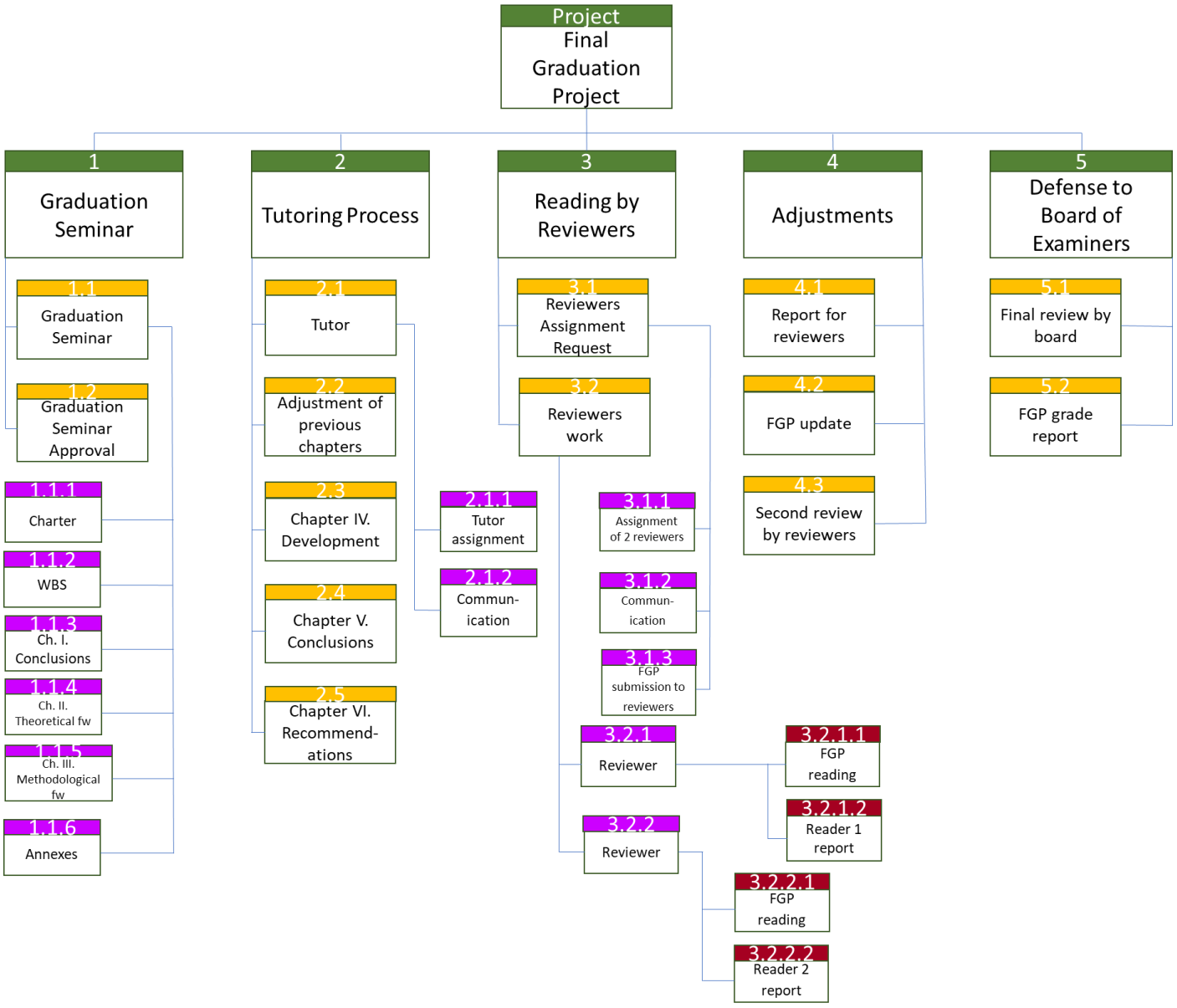
Not applicable.

Stakeholders

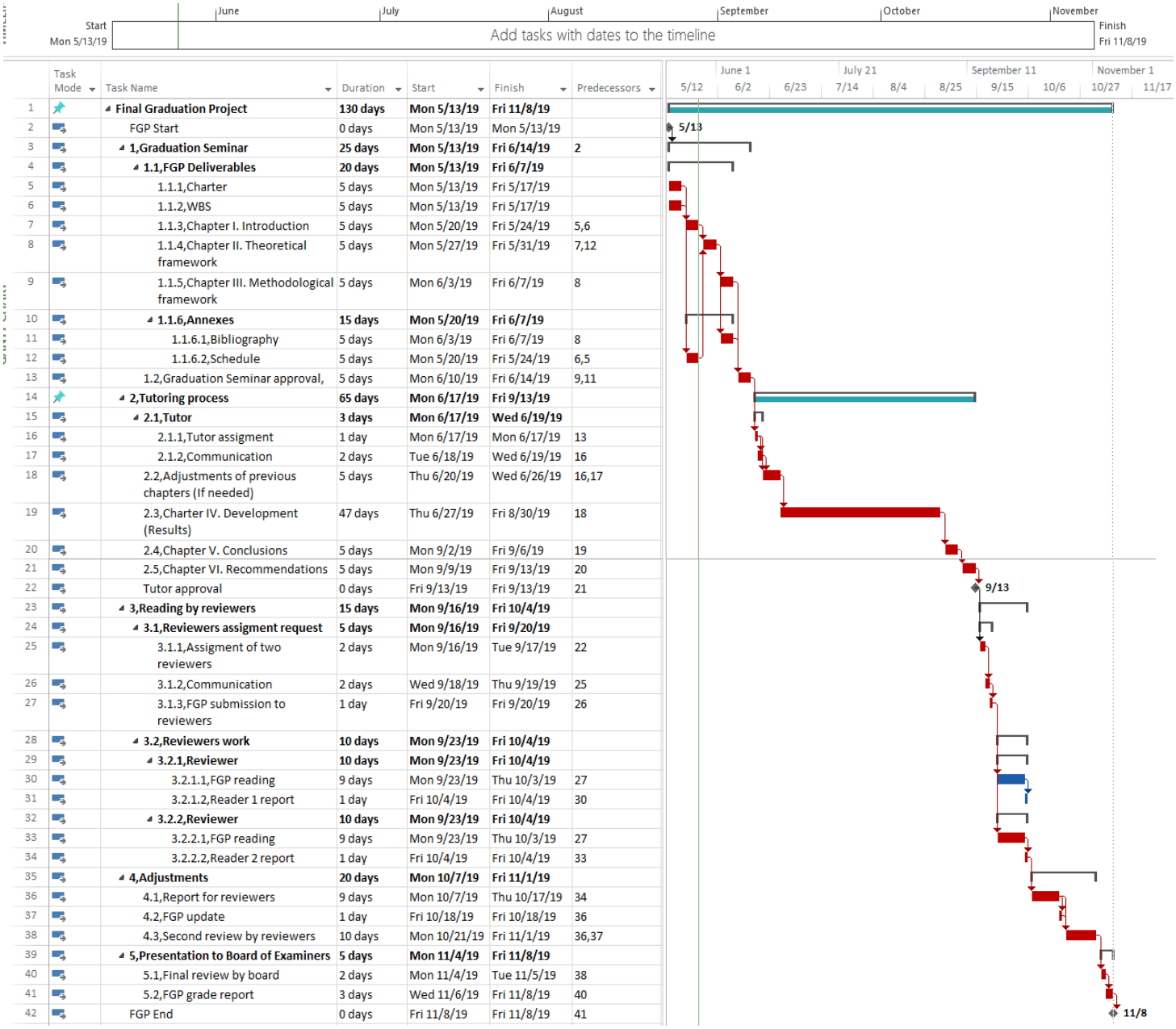
Direct stakeholders:
FGP Lecturer – Mr. C. Brenes
Tutor
Project Manager – Ms. E. Zschuschen

Indirect stakeholders: Reviewers Board of Examiners Academic assistant	
Project Manager: **Zschuschen, Eliza**	**Signature:**
Authorized by:	**Signature:**

Appendix 2: FGP WBS



Appendix 3: FGP Schedule



	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Final Graduation Project**	**130 days**	**Mon 5/13/19**	**Fri 11/8/19**	
2		FGP Start	0 days	Mon 5/13/19	Mon 5/13/19	
3		**1,Graduation Seminar**	**25 days**	**Mon 5/13/19**	**Fri 6/14/19**	**2**
4		**1.1,FGP Deliverables**	**20 days**	**Mon 5/13/19**	**Fri 6/7/19**	
5		1.1.1,Charter	5 days	Mon 5/13/19	Fri 5/17/19	
6		1.1.2,WBS	5 days	Mon 5/13/19	Fri 5/17/19	
7		1.1.3,Chapter I. Introduction	5 days	Mon 5/20/19	Fri 5/24/19	5,6
8		1.1.4,Chapter II. Theoretical framework	5 days	Mon 5/27/19	Fri 5/31/19	7,12
9		1.1.5,Chapter III. Methodological framework	5 days	Mon 6/3/19	Fri 6/7/19	8
10		**1.1.6,Annexes**	**15 days**	**Mon 5/20/19**	**Fri 6/7/19**	
11		1.1.6.1,Bibliography	5 days	Mon 6/3/19	Fri 6/7/19	8
12		1.1.6.2,Schedule	5 days	Mon 5/20/19	Fri 5/24/19	6,5
13		1.2,Graduation Seminar approval,	5 days	Mon 6/10/19	Fri 6/14/19	9,11
14		**2,Tutoring process**	**65 days**	**Mon 6/17/19**	**Fri 9/13/19**	
15		**2.1,Tutor**	**3 days**	**Mon 6/17/19**	**Wed 6/19/19**	
16		2.1.1,Tutor assigment	1 day	Mon 6/17/19	Mon 6/17/19	13
17		2.1.2,Communication	2 days	Tue 6/18/19	Wed 6/19/19	16
18		2.2,Adjustments of previous chapters (If needed)	5 days	Thu 6/20/19	Wed 6/26/19	16,17
19		2.3,Charter IV. Development (Results)	47 days	Thu 6/27/19	Fri 8/30/19	18
20		2.4,Chapter V. Conclusions	5 days	Mon 9/2/19	Fri 9/6/19	19
21		2.5,Chapter VI. Recommendations	5 days	Mon 9/9/19	Fri 9/13/19	20
22		Tutor approval	0 days	Fri 9/13/19	Fri 9/13/19	21
23		**3,Reading by reviewers**	**15 days**	**Mon 9/16/19**	**Fri 10/4/19**	
24		**3.1,Reviewers assigment request**	**5 days**	**Mon 9/16/19**	**Fri 9/20/19**	
25		3.1.1,Assigment of two reviewers	2 days	Mon 9/16/19	Tue 9/17/19	22
26		3.1.2,Communication	2 days	Wed 9/18/19	Thu 9/19/19	25
27		3.1.3,FGP submission to reviewers	1 day	Fri 9/20/19	Fri 9/20/19	26
28		**3.2,Reviewers work**	**10 days**	**Mon 9/23/19**	**Fri 10/4/19**	
29		**3.2.1,Reviewer**	**10 days**	**Mon 9/23/19**	**Fri 10/4/19**	
30		3.2.1.1,FGP reading	9 days	Mon 9/23/19	Thu 10/3/19	27
31		3.2.1.2,Reader 1 report	1 day	Fri 10/4/19	Fri 10/4/19	30
32		**3.2.2,Reviewer**	**10 days**	**Mon 9/23/19**	**Fri 10/4/19**	
33		3.2.2.1,FGP reading	9 days	Mon 9/23/19	Thu 10/3/19	27
34		3.2.2.2,Reader 2 report	1 day	Fri 10/4/19	Fri 10/4/19	33
35		**4,Adjustments**	**20 days**	**Mon 10/7/19**	**Fri 11/1/19**	
36		4.1,Report for reviewers	9 days	Mon 10/7/19	Thu 10/17/19	34
37		4.2,FGP update	1 day	Fri 10/18/19	Fri 10/18/19	36
38		4.3,Second review by reviewers	10 days	Mon 10/21/19	Fri 11/1/19	36,37
39		**5,Presentation to Board of Examiners**	**5 days**	**Mon 11/4/19**	**Fri 11/8/19**	
40		5.1,Final review by board	2 days	Mon 11/4/19	Tue 11/5/19	38
41		5.2,FGP grade report	3 days	Wed 11/6/19	Fri 11/8/19	40
42		FGP End	0 days	Fri 11/8/19	Fri 11/8/19	41

Appendix 4: Certificate of Review from Language Specialist

CERTIFICATE OF REVIEW

FOR

ZSCHUSCHEN, ELIZA ESTELLITA

Final Graduation Projecty, Master in Project Management (MPM) Degree, 'Project Management Plan for Establishing a Botanic Garden in Paramaribo-Suriname'

I certify that I have read the Final Graduation Project Management Plan to Guide the Establishment of a National Botanic Garden in Paramaribo - Suriname in its final form for submission, and have found it impressive and very satisfactory. Zschuschen, Eliza Estellita has met all the requirements to submit her final project free of typographical, spelling and grammatical errors. The paper is coherent and convincing in its methodical approach and does an excellent job by addressing each aspect of the project.

H. Dinmohamed-Breeveld
Beëdigd tolk-vertaler
Sworn Translator

Hildegard Dinmohamed – Breeveld MO-B ENGLISH

Paramaribo – SURINAME ---- October 14, 2019 ----

Appendix 5: Resume Language Specialist

Curriculum Vitae

Name	: DINMOHAMED-BREEVELD
First name	: Hildegard
Status	: married
E-mail address	: hardin@sr.net

Education and experience :

1971 - Headmaster's certificate at the Teacher's Traning College Jan van Nassau in the Netherlands. Pastoral worker in the Moravian Church in Utrecht.

1971 Sworn qualified teacher

1971 – 1972 Teacher at the Schutsschool for secondary education (Moravian

1973 – 1983 Teacher at the Graaf von Zinzendorfschool (secondary education

1982 – MO-A English (Advanced Teachers Training Institute)

1983 – Teacher at Henry Dahlbergschool HAVO (Senior High-school) and ACI (Training College Nursery Schoolteacher)

1983 - 1992 Teacher at SPI (Training College for Teachers)

1990 - Training 'Construction of School Exams and Tests'

1992 - MO-B certificate English Language and Literature.

1992 - Teacher English Mr. Dr J.C. de Miranda College for pre university education.

1992 – to date : Member of different Examination Committees at the Examination Bureau

1992- Advisor of the Minister of Education Drs K. Ramsundersing

2000 – Translation of synopsis of the dissertation of Dr. Johannes Breeveld

2005 - Portuguese course (4 grades) at the Centre Estudos Brasileiros.

2006 - Sworn translator / interpretor

2006 - Chair person of the anniversary committee of the 40th anniversary of the Mr.Dr.J.C. de Miranda College in 2006. Member of the 'Lyco 40- years Foundation'

2006 - Co-Author of the historical record of '40 Years Mr.Dr.J.C. de Miranda College'

2006 - Member of the Education for All-HIV/AIDS Committee of BvL in cooperation with the Ministry of Education in to prepare an intensive program for teachers and students of senior high schools. Wrote projects in English. Attended and organized a three-day-training on HIV/AIDS (Train the Trainers) with foreign trainers. Interpreter at the training. Received certificate.

Partly translated the "Teachers' Exercise Book for HIV Prevention" Implemented in collaboration with the Committee Education for All-HIV/AIDS, an HIV prevention program.

2007 - Member of the committee Education for All-HIV/AIDS as Secretary and PR-Officer and trainer.

2008 - Training 'Psycho-Social Support for Kids living with HIV/AIDS' organized by Stichting Lobi in cooperation with Shared futures.

2008 - Workshop 'The Role Of The Education Sector In Response To HIV and AIDS : an Integral Approach' in 2007 organized by the Ministry of Education.

2007 - Training Behavior Change and Participation) BCC training organized

by the National Aids Program.

2007 - Training in St. Vincent on HIV/AIDS organized by Education International.

2007 - Training 'Group Education for HIV/AIDS' organized by the Dermatology department (obtained certificate)

2008 - Training 'Equity and equality in Female Leadership' organized by Education International.

2008 - Workshop ' HIV/AIDS in the workplace' organized by the Ministry of Labor to address the epidemic and develop concrete responses at enterprise, community, regional, sector, and national levels.

2008 July - Training 'Collective Bargaining'.

2008 - present day :Member of the CCM for the Global Fund in Suriname as a representative of the education sector.

2008 – Training 'How to handle pupils in the classroom who live with HIV/AIDS ' organized by the National Aids Program.

2007 Interpreter at the ' Dialogue Methodology Training' organized by the Democracy Unit of the University of Suriname .

2008 – Interpreter at the Conference : "Democracy as a vehicle for development"

2008 – November : Interpreter at the workshop 'Political Finance and State Funding Systems: An Overview'

2008 July 23 - Sworn in as translator/ interpreter of the English Language.

2009 - Organized 'Leadership Training for Teachers Trade Unions, financed by Education International.

2009 - Participated in the Workshop Leadership for Better Education, Advocacy for an Integral Approach of HIV/AIDS Education in the Caribbean.

2006- present day - Training to teachers and students in HIV/AIDS prevention skills and information in order to strengthen intervention to reduce infections and develop health promoting schools.

2007-2009: external examiner at the final exams English at the Night Commercial School (Night IMEAO)

2009 – Participated in the Education for All & HIV/AIDS Workshop at Rose Hall Resort and Spa Montego Bay St. James, Jamaica, sponsored by Education International & hosted by Jamaica Teachers' Association.

2010 – Participated in Workshop 'HIV/AIDS And The Workplace' ILO Recommendation No. 200 Concerning HIV and Aids and the World of Work

2010 – Participated in the 3-day Evaluation Workshop on Five Years Education for- HIV/AIDS in Suriname organized by Education International.

2010 – Hosted and organized a 2-day training to develop a Work Place Policy for Teachers' Unions in Suriname.

2011, February – Participated and facilitated the 3-day Regional EFAIDS Workshop in St Lucia organized by Education International. Received an award for passionate participation into the EFAIDS Program..

2011, June 28 – 30 : Participated in the 4th Partnership Forum in Sao Paulo, Brazil organized by the Global Fund TO FIGHT aids, Tuberculosis and Malaria.

2011 – Participated in the 5th Caribbean Human Resource Forum

2011 – Facilitated a 2-day- training on Moravian Teachers' Day (MDG)

2011, December 7-9 : Organized and participated in the 3-day Workshop on Human Rights, Education (HIV/AIDS) and Children's Rights and

Indigenous People sponsored by Education International and hosted by BVL, SOB and KOB.

2012 – 2016 Secretary of the Steering Committee Reform IMEAO

2017 – 2018 Secretary of the Committee National Institute Scholarships and Trainings of the Ministry of Education.

2012 – Participated in the Conference on the Belém Do Pará Convention on Women's Rights hosted by Moiwana, UNFPA, Ministry of Home Affairs and the Dutch Embassy.

2012 – Training Thieme Meulehof, Deviant, Malmberg

2012 to date – Teacher at Dental Health Institute, National Archive Suriname, and Customs Training Institute

2016 – Screening of the dissertation of Dr Kirtie Algoe

2016 – 18 Screening of thye disseertation of Dr Rosita Sobhie

2008 – 2019 Member of the Country Coordinating Mechanism (CCM) of the Global Fund. Attended many trainings and workshops to fight Aids, TB and Malaria.

2017 – 2019 Chair of the CCM.

Hobbies:

Reading, traveling, sport.