



# IMPLEMENTATION OF IMPROVED LANDSCAPING PROCESS BASED ON ISO 21500:2021 AT SOUTH EASTERN UNIVERSITY OF SRI LANKA

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## ABSTRACT

*Landscaping of the South Eastern University of Sri Lanka faces problem in achieving its standard quality due to, environmental challenges lack of planning and resource allocation. In order to improve the landscaping activities by adopting with ISO 21500:2021 project planning and portfolio Management-Concepts and practices were suggested as an appropriate practice. ISO 21500:2021 is a systematic method used in project planning and implementation.*

*The objective of this study is to create improved lawn maintenance and landscaping method using ISO 21500:2021. In order to succeed in this project total landscaping area were divided into eight manageable plots and resources were reallocated in a way to attain the completion of grass cut and landscape cycle within a specified period. Accelerated process can be incorporated accordance with time to time requirements.*

*According to the identified critical path and non-Critical path, the resources were allocated and used in optimum level. The cycle time has been reduced and the quality output has been achieved.*

**KEY WORDS:** ISO 21500:2021, Critical path, Non- Critical path, Lawn maintenance, Landscaping

## INTRODUCTION

The Landscaping of a University is a vital part not only to attract people, but also it contributes a lot in teaching, learning and research activities by providing a conducive environment. Lawn maintenance is the main factor in overall landscaping. Lawns are open green spaces, highly accepted and massively prefabricated landscape design elements. (Ignatieva & Hedblom, 2018).

South Eastern University of Sri Lanka is located in the coastal belt of the Ampara district which falls under the Agro climatic zone DL2. Climate is a meager challenge to maintain the Landscape of South Eastern University of Sri Lanka. As per the land valuation in 2011 the total extent of land area in the Oluvil premises of the South Eastern University is 178.98 acres (Annual Report, 2018) out of which 120.25 acres is the area with have green cover. Since the University is in Dry zone, it experiences extreme dry seasons in April to August and monsoon rain during November to February. Therefore, there are two types of Landscape exposed to customers depending on prevailing climatic conditions that are the brown landscape in the dry season and green landscape in the rainy season. Proper maintenance of the lawn is important to protect the aesthetic value of Landscape in both seasons.

Lawn pattern of this University is complicated. In some of the areas like in the entrance, in front of Administrative Blocks and in front of the Faculty offices have turf grass. This is homogenous and easy to maintain. Other areas are being covered with conventional grasses and wild grasses. They are heterogeneous in nature and the land pattern also undulates. Therefore, the growth rate and flowering pattern of the plants are differing. Therefore, it is very difficult to maintain the status of the lawn with a pleasant look.

Maintenance of this lawn has been operated at South Eastern University of Sri Lanka in two ways. One is on a regular basis. Moving the Lawn mower and Brush cutter starting from one end to other end and completing a full round. Here the problem is before the completion of a round, the starting areas get over growth of the grass.

The second way is priority basis. On a special request for special events like conducting symposium, opening ceremony, convocation etc. particular area considered and maintained on priority basis.



**Research problems**

In order to make a successful landscape and good appearance of land throughout the year, maintenance of the lawn with proper grass height is important. But in an undulated land with naturally erect conventional grasses, it is a difficult job. Due to different growth rate and flowering style of grasses, it needs frequent and systematic maintenance to keep up the standard. Due to lack of planning in the maintenance process of the lawn, it gets glee less appearance before the completion of every regular cycle of lawn maintenance operation.

According to the current lawn maintenance records and practices at the landscape division of the SEUSL, the current operation cycle is not based on plant growth patterns and flowering style. It is commonly handled considering the priority of locations and time to time requests obtained from the departments concerned. This kind of improper maintenance of the lawn frequently breaks the regular cycle of the clearance of lawn and leads to some areas with good appearance and the other area with dull appearance. Therefore, a systematic methodology is required to address this problem.

| Current status                              | Desired status                     |
|---|------------------------------------|
| Existence of elongated peduncle with flower | No elongated peduncle with flowers |
| Existence of different size grass growth    | Evenly grown grass                 |
| Existence of unmanaged areas                | Minimize unmanaged areas           |

Table 1: Current status and desired status of Landscaping

**Needs for new management system for desire State**

1. Elongated peduncles with flowers make an unpleasant appearance of the lawn. Therefore, it should be maintained in a regular planned manner.
2. Due to delays in operating the current grass cut cycle, some areas get uneven plant growth. Therefore, regularizing the cycle according to the growth pattern is needed.

**Objective of the study**

The general objective of this study is to create improved lawn maintenance and landscaping method to keep it up to the standard using ISO 21500:2021. It can be implemented by reallocating the resources by separating the critical path activities and non-critical path activities and reducing the total cycle time. The objective of this study is broken into three parts as given in the following table.

| Standard  | Performance  | Conditions  |
|---|--|---|
| <ul style="list-style-type: none"> <li>• 3-4 inches grass height every time all over the area in general.</li> </ul>                          | <ul style="list-style-type: none"> <li>• Maintaining grass height in an appropriate level in all over the area.</li> </ul>   | <ul style="list-style-type: none"> <li>• Using system chart and Gantt chart based on the standards of ISO 21500:2021 International Standard for Project Management. Without affecting the quality of the process</li> </ul>                                 |
| <ul style="list-style-type: none"> <li>• Operate a system with an operation cycle according to studied grass growth and condition.</li> </ul> | <ul style="list-style-type: none"> <li>• Operate through identified operation cycle with manageable plot size according to growth pattern and priority of location.</li> </ul> | <ul style="list-style-type: none"> <li>• Using system chart and Gantt chart based on the standards of ISO 21500:2021 International Standard for Project Management. Plot size should match with the total coverage time and resources available.</li> </ul> |

Table 2: Objectives of the study

**Significant of the Study**

This study is based on the ISO 21500:2021 International Standard for Project Management. This study is important to reduce the operation cycle time of the lawn maintenance at South Eastern University of Sri Lanka and make a systematic maintenance schedule to keep ever beautiful grassland.

**REVIEW OF LITERATURE**

**Important of Landscape in Universities**

The function of University’s landscape is not only to merely beautify the surrounding and to provide shade or canopy cover. But it should also assist the learning process. Landscape by the way of plenty of green plants and lawn cover reduces the temperature of the environment. Refresh the air by producing oxygen and taking carbon dioxide from the air, during the photosynthesis process (Wells, 2000). Even landscape helps to a certain extent to reduce environmental temperature and also plays a role as a



security element, contributing to establish students' mental and psychological steadiness. Landscape provides aesthetic value (Mohd Hisyam Rasidi et al., 2013). Landscape plays an important significant role in reducing emotional pressure among students (Ke-Tsung Han, 2009). Students' interaction with plants could contribute to reduce the negative emotions, increase positive thoughts, reduce physical pressure and develop the student's interest towards learning (Taylor et.al. (2001); Harting et al. (1991); Kaplan & Ryan (1998) and Wells (2000)).

The interaction between man and elements of the natural environment such as plants, water or outdoor surroundings, make the mind of students towards experiencing peace, feel freehand and relaxed (Kaplan & Ryan 1998). The theory of evolutionary psychology is about the emotional reaction which plays a significant role in determining an individual's attitude towards the environment (Ulrich 1983; Matsuoka 2010).

### **Maintenance of lawn**

In General lawns are categorized as two types. They are natural lawns and artificial lawn. From the very beginning of the public parks movement in the mid-19<sup>th</sup> century lawns have served the function of public recreation (Jenkins, 1994). Developments of lawns have required both space (land) and labour to provide constant management. Lawn are developed for aesthetic pleasure, as well as for sports or other outdoor recreational purpose (Beard and Green,1994). The lawn has become a central element in landscapes. (Wong and Harivandi, 2009). Lawns are utilized as a playing surface as it controls erosion and dust generated by huge foot traffic. Further lawns are used as a cushion for players in sports such as rugby, football, soccer, cricket, baseball, golf, tennis, and hockey (Reynolds and Flint, 2009).

Lawn care is crucial, despite the fact that it seems like a difficult chore for most homeowners. Effective lawn maintenance increases air quality while keeping their home's appearance (Sachs, 1996). Grass maintenance guarantees that their lawn can survive the challenges from weeds and insects that might harm it. By having a thorough lawn care and maintenance regime, you can ensure that your customers' flowers, herbs, grass, and hedges are disease-resistant (Owen and Lanier, 2010).

### **ISO 21500**

ISO 21500 is an International Standard, provides high-level description of concepts and processes that are considered to form good practice in project management. Projects are placed in the context of programmes and Project portfolios; however, this International Standard does not provide detailed guidance on the management of programmes and project portfolios (ISO, 2012). It was intended to provide generic guidance, explain core principles and what constitutes good practice in project management (retrieved from <https://www.iso.org/standard/75704.html>).

### **PCDA cycle of ISO 21500**

The outcome of the management system develops based on the above international standard will be achieved using the PDCA (P-Plan, D- Do, C- Check, A- Action). PCDA cycle is heart of the ISO standard.

### **ISO 21500 in project Management**

There are number of methodologies used for project management. These methodologies are usually based on organizational characteristics and good practice standards. In the particular case of the standard ISO 21500 (ISO, 2012), in particular focused on sharing knowledge and developing relevant International Standards that support innovation and provide solutions to global challenges. The standard provides concepts about organizational strategy, life cycle and the difference between projects and operations (Nilton Takagi and Joao Varajao, 2021)

## **METHODOLOGY**

### **Data Collection Methods**

Data were collected using the following methods:

1. Field Visit and direct observations
2. Discussion with the responsible parties.

The process of lawn maintenance at South Eastern University of Sri Lanka has been observed directly during field visits and discussed with the Curator, Landscape Supervisors and Work Aides (Skilled and unskilled).

### **Population and Sampling**

Out of total landscaping area of the South Eastern University, all landscaping process of the lawn area maintenance was selected as purpose sampling, to prepare an improved landscaping to address this issue.

### **Instrumentation of Data Collection**

Data were collected by answering the following questionnaire based on ISO 21500 Standard and the ISO 9001:2015.

1. Who are the external/internal customers? (External/Internal customers)
2. What are the requirements of external/internal customers? (Output)

3. What is the purpose of the intended system? (Outcome)
4. What are the resources available for the intended system? (Resources)
5. What is the system boundary? (Scope)
6. What is the process to transform the resources (input) to achieve the objective (outcome) of the system? (Transformation)
7. How to compare the desired results (outcome) and the achieved results and identify the gap? (Stimulus)
8. How to respond with the resources to bridge the above gap for having the desired results? (Response)
9. How to establish records to provide evidence of conformity to above requirements? (Control of records)
10. How to audit the above steps to ensure continual improvement? (System audit)

### Conceptual Framework (Analysis Plan)

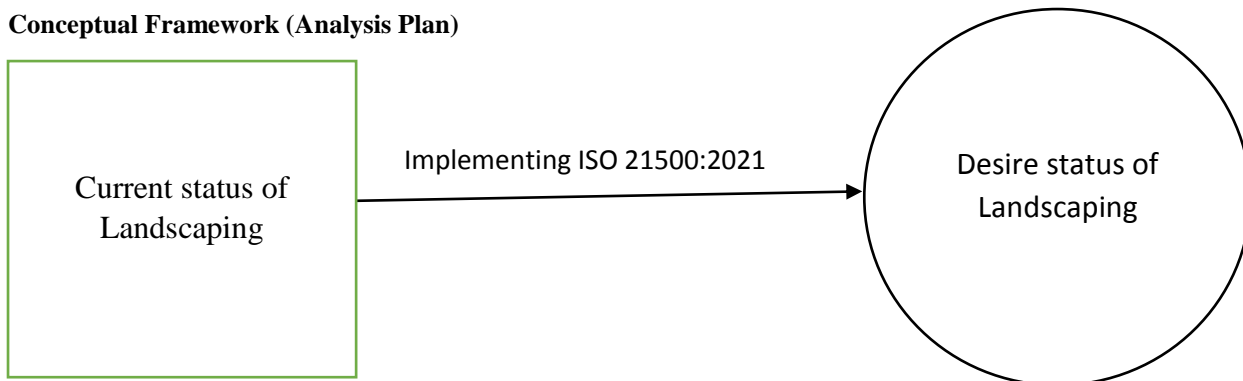


Figure 1

### Project Planning Process

1. Set the purpose of the project - **Project Outcome.**
2. Identify the available resources and categorize them - **Resource Pool (3Ms)**
3. Write the process begin to end - **Process Chart**
4. Write the process end to begin - **System Chart**
5. Send the customer requirements across the process - **Kanban System (Management Information System)**
6. Build Quality standard into each activity of the process - **Quality Plan**
7. Develop an effective & efficient method for each activity by giving top priority for quality standards - **Method Database**
8. Allocate optimum resources into each activity by considering the identified method - **Allocate Resources**
9. Develop the expected time standard for each activity - **Time Plan**
10. Align the resources with time by considering connectivity of activities (series and parallel) and identify critical activities - **Resource Schedule with Critical Path (Gantt Chart)**
11. Balance the resources for maximum utilization of resources and reducing the project duration. - **Balanced Resource Schedule with new critical path. (Revised Gantt Chart)**
12. Add more resources to critical activities and crash the programme - **Accelerated Project**
13. Use appropriate technology and reengineer the project process - **Reengineered Project**
14. Check the actual performance of each activity against the standard performances - **Project Monitoring System**
15. Identify the possible stimuli from the above check and identify the appropriate actions. - **Management Response System**

### Using ISO 21500 to plan Lawn Maintenance:

In this study, in order to develop an improved lawn Maintenance system, the total area has been evaluated for the requirement of the landscape. According to the type of grass, flowering style of the grasses and prominence of the area, the total landscaping area has been divided into small manageable plots. Available resources and time duration were considered when estimating the plot area. According to the above factors, the cycle time has been estimated through a system chart.

The following rules have been considered while drawing the system chart.

- There should be only one output from a given activity, but there can be many inputs to a given activity.
- Underline the variables and take the variables backward from the activity box.

Following standards have been followed throughout drawing the system chart and the Gantt chart.

- The presentation of the resources has to be presented at the top of the square. Resources should be included in the hexagon.

The following formats have been used to draw the ideal system management chart.

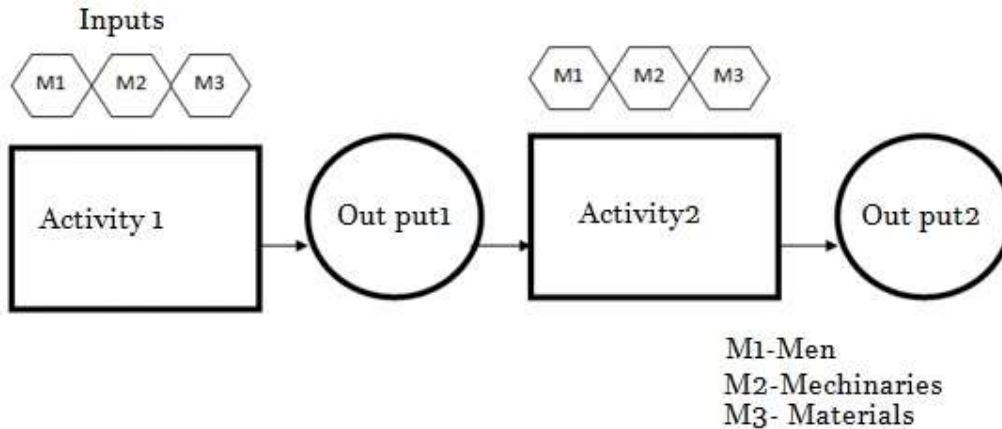


Figure 2: System chart format

This project was conducted according to the ISO 21500:2021 international project management standard under the following framework.

### Scope and Limitation

In this study, attention paid only for the Lawn maintenance process and Landscaping of South Eastern university of Sri Lanka. Designing and establishing the Landscaping, plant propagation activities and nursery managements are not included in this process considering the time constraint.

### DATA PRESENTATION

#### Current Management System

##### 1. WHO ARE THE EXTERNAL AND INTERNAL CUSTOMERS?

Students and staff of South Eastern University of Sri Lanka, officers of relevant Ministry, Departments and Institutions and General public visiting the University are the External Customers.

Curator, Landscape Supervisors and the employees of the Landscape Division of South Eastern University of Sri Lanka are the internal customers.

##### 2. WHAT ARE THE REQUIREMENTS OF EXTERNAL CUSTOMERS? (OUTPUT)

Standard requirement of customers for an activity/ service is Right product with Right quality in Right time. In the case of landscaping, standard customer requirements are:

**Right product** : Aesthetic Environment

**Right quality** : Good quality of Landscaping and lawn maintenance

**Right time** : Ever

##### 3. WHAT IS THE PURPOSE OF THE INTENDED SYSTEM? (OUTCOME)

Improve the lawn maintenance up to standard level by reducing the overall total cycle time by a planned operation process.

##### 4. WHAT ARE THE RESOURCES AVAILABLE FOR THE INTENDED SYSTEM? (RESOURCES)

Resources used in a study can be categorized as Men (M1), Machines and Equipment (M2), and Material and Services (M3). In the South Eastern University of Sri Lanka following resources are available for the Landscaping division.

#### Human Resource (M1)

- |  |    |
|--|----|
| 1. Supervision Level Staff: Curator and Landscape Supervisors) | 02 |
| 2. Lawn Mower operators  | 03 |



|                               |    |
|-------------------------------|----|
| 3. Brush cutter operator      | 05 |
| 4. Gardener                   | 01 |
| 5. Tree cutter                | 01 |
| 6. Two wheel tractor operator | 01 |
| 7. Works Aide                 | 04 |

**Machines and Equipment (M2)**

|                         |    |
|-------------------------|----|
| 1. Lawn mower           | 03 |
| 2. Brush cutter machine | 05 |
| 3. Pole pruner          | 01 |
| 4. Garden equipment     | 10 |
| 5. Pruner               | 08 |
| 6. Secateurs            | 05 |
| 7. Lopper               | 05 |

**Material and Services (M3)**

1. Fuel
2. Gloves
3. Garden shoe
4. Repairing Services
5. Manure
6. Half moon
7. Trimmer line
8. Fertilizer
9. Chemicals

5. WHAT IS THE SYSTEM BOUNDARY? (SCOPE)

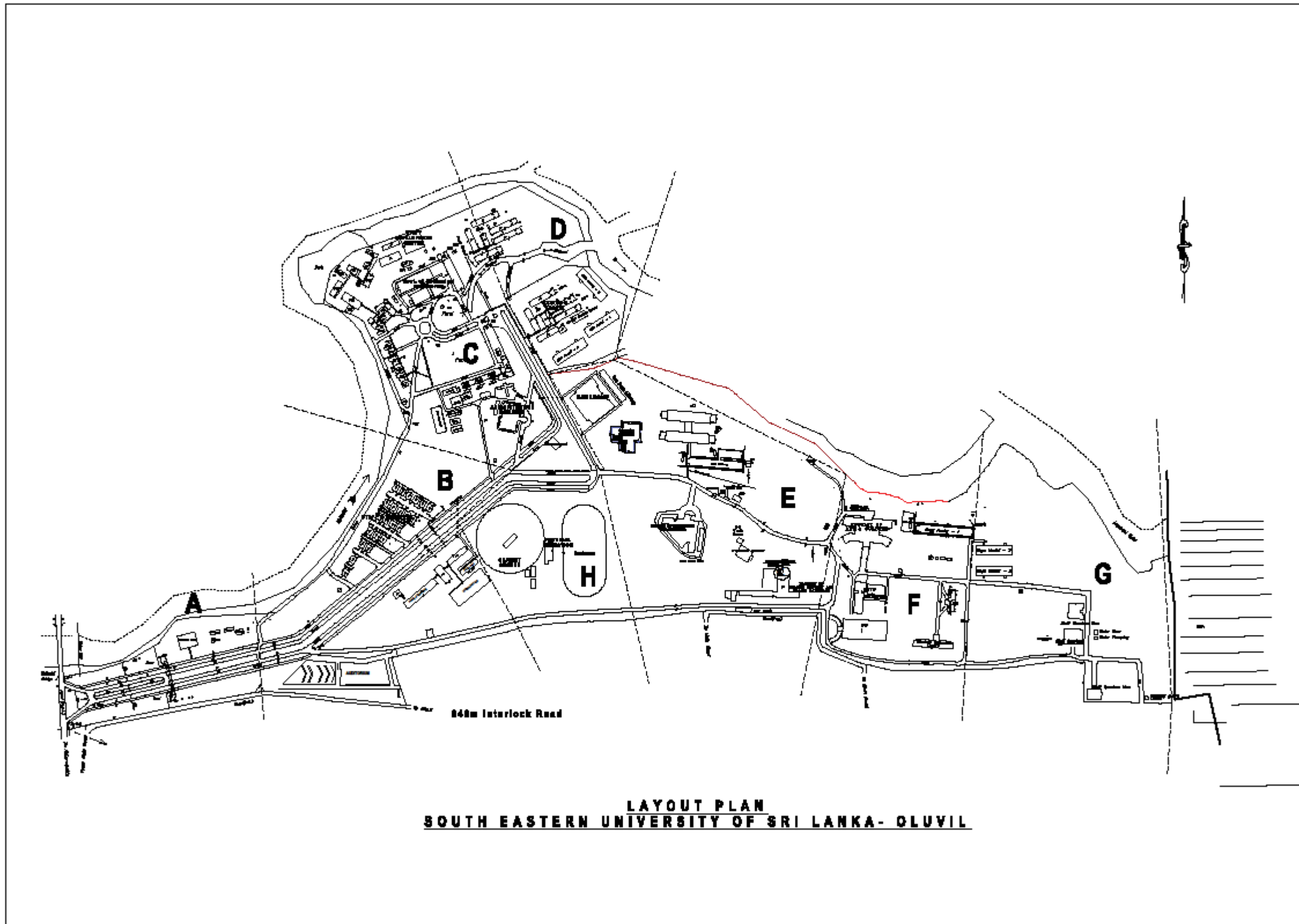
The system boundary of this project is planning of the landscape process to the completion of a full cycle of grass land maintenance.

6. WHAT IS THE PROCESS TO TRANSFORM THE RESOURCES (INPUT) TO ACHIEVE THE OBJECTIVE (OUTCOME) OF THE SYSTEM? (TRANSFORMATION)

**Planning**

The total land area to be maintained with landscape set up has been identified. Accordingly, 145 Acres land area has been identified to be maintained with landscape cover. In Order to identify the actual land area Google mapping has been used. The identified Land area has been divided into manageable plots.

Based on the previous studies and experiences, the land area has been divided into eight Zones according to the handling capacity of a set of available resources. The plots were named as A, B, C, D, E, F, G, and H.

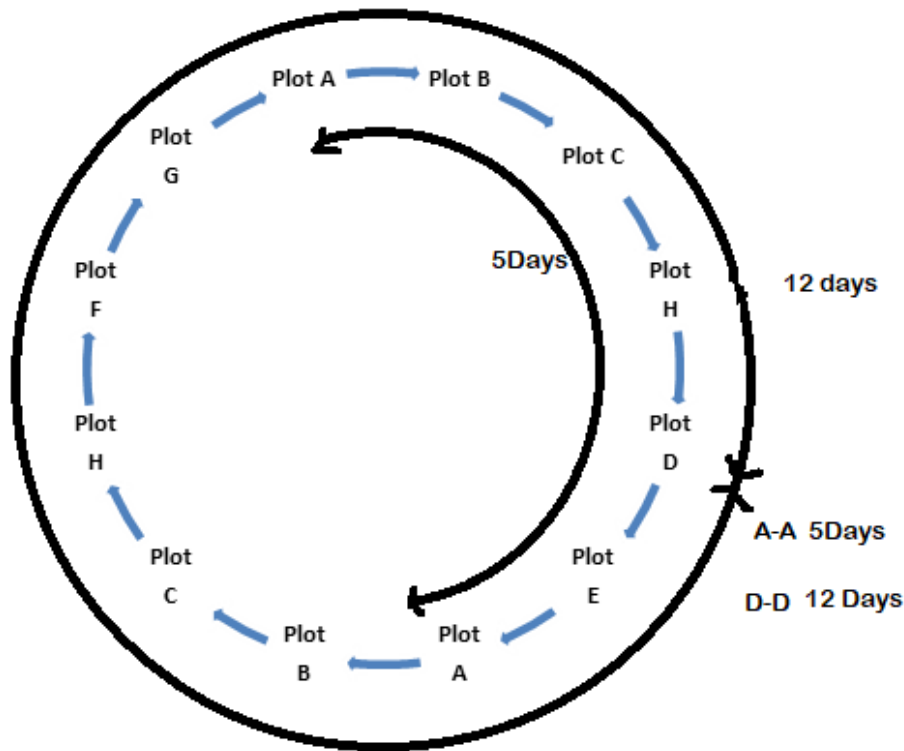




The divided plots were earmarked into two groups according to the intensity of grass cutting requirement. Plots A, B, C, H to be maintained in every 5-6 days interval since prominent Buildings, entrance and main faculties are there in these zones. Plots D, E, F, G to be maintained in every 12-15 days interval.

Schedule a grass cut and maintenance cycle for earmarked area

- Grass cut cycle A-B-C-H-D-E-A-B-C-H-F-G



**Figure 3: Plot Maintenance Schedule**

According to the previous experience, field knowledge the border plants (hedges of Ixora and Duranda) have to be pruned once a month interval. The following places at South Eastern University are with Boarder plant hedges.

Main entrance (plot A), Faculty of Engineering (Plot B), Administrative building (Plot C), hostels (plots D, E and F) and Library (plot E).

The pruning cycle has been handled in the following order.  
 Plot A – Plot B - Plot C- Plot D – Plot E- Plot F.

**Implementation**

The Grass cutting has been commenced in a cycle manner starting from plot A to Plot G in the following order.

A-B-C-H-D-E-A-B-C-H-F-G

In order to complete a plot in a day period the following resources were assigned.

- a Curator
- b Landscape Supervisor
- c1 Lawn Mower operator 1





- c2 Lawn Mower operator 2  
 c3 Lawn Mower operator 3  
 d1 Brush cutter operator 1  
 d2 Brush cutter operator 2

Identify and prune the Boarder plants. Boarder plants have been maintained at the Administrative building (Plot C), Main entrance (plot A), hostels (plots E, D and F) Library (Plot E) and Faculty of Engineering (Plot B). Estimated time for the pruning of Boarder plants are:

A- 5days, B- 2days, C- 2days, D -3 Days, E-7days, F – 5days .

Do pruning, branch cutting in identified trees/area (underbrush) (8 days)

Prepare a manuring schedule for ornamental plants and grass land – It will be done along with pruning activities. Shape the beds and manuring of the ornamental plants and grass land. Manuring will be individually calculated in respect of the plant type.

Check for overall completion conducted twice per month. In mid of the month overall completion checking done by Curator and supervisors for first round of lawn maintenance and the end of the month pruning and manuring round completion was checked.

7. HOW TO COMPARE THE DESIRED RESULTS (OUTCOME) AND THE ACHIEVED RESULTS AND IDENTIFY THE GAP? (STIMULUS)

- Considering whether the target quantity of land area (plots) has been achieved.
- Considering whether the quality standards of the lawn maintenance have been achieved.
- Considering whether the cycle time standard is achieved

| Activity | Achieved Result  | Desired Result                            | Gap   |
|----------|--|---|---|
| Quality  | In some area excess growth of lawn have been identified                | Even and fully maintained lawn            | Reduced cycle period                            |
| Quantity | Some portion of the earmarked area have been not covered               | No unmanaged area                         | Time schedule to be followed                    |
| Time     | Cycle breakage due to non-availability of alternative HR and equipment | Completion of work in actual cycle period | Alternative trained staff and good repair serve |

Table 4 : Stimulus

8. HOW TO RESPOND WITH THE RESOURCES TO BRIDGE THE ABOVE GAP FOR HAVING THE DESIRED RESULTS? (RESPONSE)

After implementing the proposed system time taken for a complete cycle of landscape process has been reduced. Resource also allocated according to the need. The non-critical activities can be completed by parallel with critical activities. It can reduce the total time of the project.

9. HOW TO ESTABLISH RECORDS TO PROVIDE EVIDENCE OF CONFORMITY TO ABOVE REQUIREMENTS? (CONTROL OF RECORDS)

The records are taken by inspecting the actual completion of the process cycles. Lack of resources and excess resources are identified and adjusted plot by plot.

10. HOW TO AUDIT THE ABOVE STEPS TO ENSURE THE CONTINUAL IMPROVEMENT? (SYSTEM AUDIT)

The process implemented in different season and shortcoming in resources and other limitation were rectified.

## DATA ANALYSIS

1. Set the purpose of the project - **Project Outcome.**

Since the outcome of the Landscaping creates mental satisfaction to the customers, the purpose of the intended system is also valued in ordinal terms.

2. **Target product** :-Aesthetic / Pleasing environment
3. **Target quality** :- Fascinated the Visitors and Officers
4. **Target time** :- Ever

2. Identify the available resources and categorize them - **Resource Pool (3Ms)**

They were given with the following notations to use in the system charts and Gantt charts.

**Men (M1):**

| Notation | Resource                |
|----------|-------------------------|
| a        | Curator                 |
| b        | Landscape Supervisor    |
| c1       | Lawn Mower operator 1   |
| c2       | Lawn Mower operator 2   |
| c3       | Lawn Mower operator 3   |
| d1       | Brush cutter operator 1 |
| d2       | Brush cutter operator 2 |
| e1       | Gardener 1              |
| f        | Tree Cutter             |
| g1       | Works Aide1             |
| g2       | Works Aide              |

**Machines and Equipment (M2):**

| Notation | Resource               |
|----------|------------------------|
| j1       | Lawn mower 1           |
| j2       | Lawn mower 2           |
| j3       | Lawn mower 3           |
| k1       | Brush cutter machine 1 |
| k2       | Brush cutter machine 2 |
| m1       | Pole pruner            |
| m2       | Hedge trimmer          |
| m3       | Garden equipment       |
| m5       | Pruner                 |
| m6       | Secateurs              |

**Material and Services (M3):**

| Notation | Resource           |
|----------|--------------------|
| n        | Fuel               |
| o        | Gloves             |
| p        | Garden shoe        |
| q        | Repairing Services |
| r        | Manure             |
| s        | planning sheet     |
| t        | Half moon          |
| u        | Trimmer line       |

3. Write the process begin to end - **Process Chart****Planning**

- # Identify the grass land to be maintained (3 hours)
- # Divide the identified grass land into manageable plots (5 hours)
- # Earmark the divided plots according to the intensity of the grass cut need (0.5 day)
- # Schedule a grass cut and maintenance cycle for earmarked area (0.5 day)

**Implementation**

- # Do the grass cut in plots A-B-C-H-D-E-A-B-C-H-F-G (12 days). Two repeat cycles/ month
- # Do pruning of the Boarder plants In the order A-B-C-D-E-F (24 days)- Single cycle
- # Do pruning, branch cutting in identified trees/area (8 days)
- # Prepare a manuring schedule for ornamental plants and grass land (0.5 day)
- # Shape the beds and manuring of the ornamental plants and grass land
- Check for overall completion (4 days)
- # Overall Beautification and Cleaning of pruned and Grass cut plots (0.5 day)

4. Write the process end to begin - **System Chart**

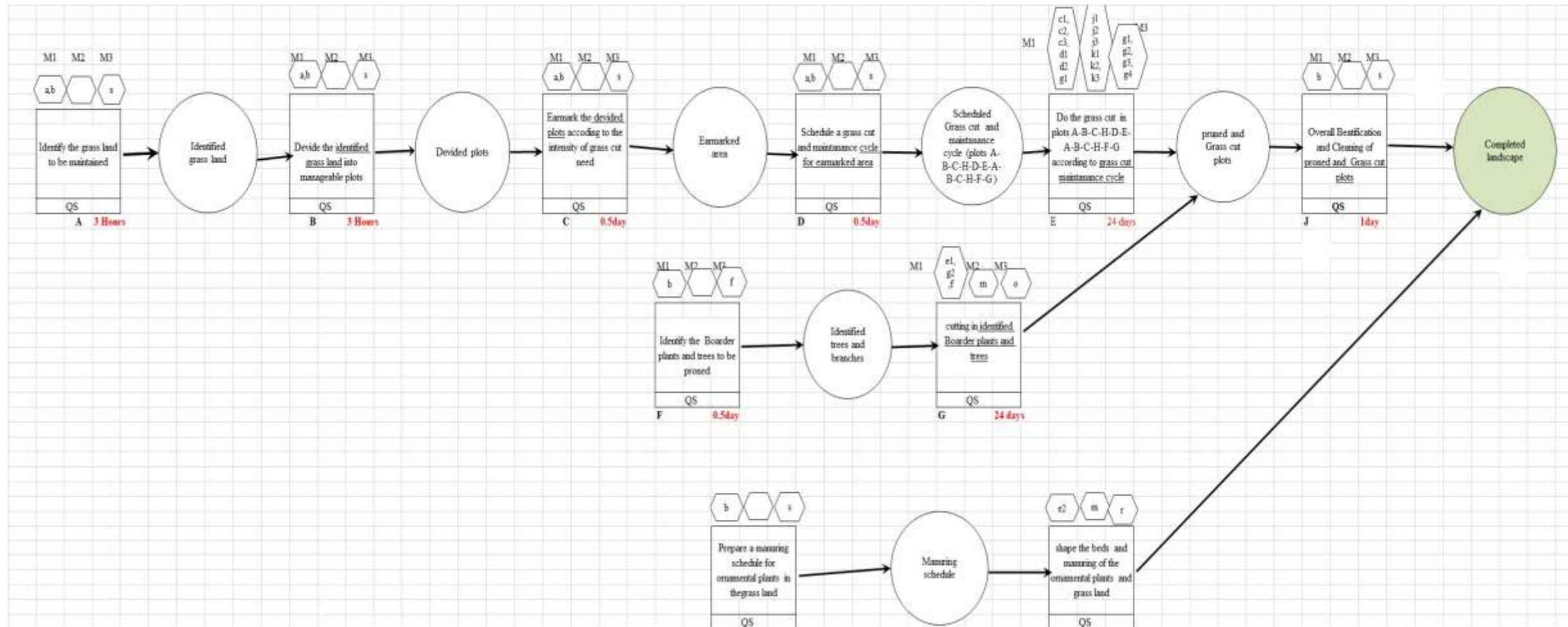


Figure 4: Whole system chart



5. Build Quality standard into each activity of the process - **Quality Plan**

| Activity | Desired Quality  |
|----------|--|
| A        | Identify actual grass land to be maintained.   |
| B        | Divide the area in to plots which is manageable in one-day using available resource set. |
| C        | Earmark the plots according to the intensity of grass cut actual cycle time.             |
| D        | Prepare Possible grass cut cycle according to the time duration.                         |
| E        | Complete a thorough and neat grass cut accordance with standard grass height.            |
| F        | Identify the area with board hedges and trees to be pruned.                              |
| G        | Did pruning and tree cutting with specified height.                                      |
| H        | Prepared Manuring schedule for ornamental in the grass in proper interval.               |
| I        | Shape the beds and adding correct manure at correct time at the recommended rates.       |
| J        | Final observation for beauties done by supervisors and standartizd.                      |

**Table 5: Quality plan**

7. Develop an effective & efficient method for each activity by giving top priority for quality standards - **Method Data Base**

In this data base, standard height of the grass and Boarder hedges to be specified. The pruning shape of the Border plants and other plants to be specified in detail. There may changes in the pruning pattern according to the seasonal differences. Manuring rates and time interval aslo should be specified.

8. Allocate optimum resources into each activity by considering the identified method - **Allocated Resources**

9. Develop the expected time standard for each activity - **Time Plan**

10. Align the recourses with time by considering connectivity of activities (series and parallel) and identify critical activities - **Resource Schedule with Critical Path (Gantt Chart)**



| Operation | Tasks | Resources | Resource Management |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Performance Evaluation |                  |              |   |   |                                   |  |   |   |                                   |         |
|-----------|-------|-----------|---------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------|--------------|---|---|-----------------------------------|--|---|---|-----------------------------------|---------|
|           |       |           | Time (Days)         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Quality Desired        | Quantity Desired | Time Desired | Method  | Quality Actual  | Quantity Actual                   | Time Actual  |   |   |                                   |         |
| A         | M1    | ab        | 2                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | Identify grass land to be maintained              | 120.25 acre   | 3 hours                           | Identify the land area by personal field visit                 | Identify grass land to be maintained  | 120.25 acre   | 3 hours                           |         |
|           | M2    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | Divide the area in to plots manageable in one-day | Plots A,B,C,D,E,F,G,H                                     | 5 hours                           | Divide manageable plots by visual observation and marked       | Divide the area in to plots manageable in one-day                           | Plots A,B,C,D,E,F,G,H                                     | 5 hours                           |         |
|           | M3    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   | Earmark the plots according to the intensity of grass cut | A,B,C,H- 5days<br>D,E,F,G-12 days | 0.5 day  | According to grass type and prominecy of the place the intensity is decided | Earmark the plots according to the intensity of grass cut | A,D,C,H- 5days<br>D,E,F,G-12 days | 0.5 day |
| B         | M1    | ab        |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | Possible grass cut cycle                          | A-B-C-H-D-E-A-B-C-H-F-G                                   | 0.5 day                           | According to the intensity of grass cut need cycle is designed | Possible grass cut cycle  | A-B-C-H-D-E-A-B-C-H-F-G<br>(two Repeat cycle/m)           | 0.5 day                           |         |
|           | M2    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | complete a thorough and neat grass cut            | 12 cycle points   | 12 days                           | Using cutting equipments                                       | Some areas lapse in neatness grass cut                                      | 12 cycle points   | 12 days<br>(12 work Days)         |         |
|           | M3    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   | Identify the Boarder plants and trees to be pruned        | check all 8 plots                 | 0.5 day  | Inspection visit to the field   | Identify the boarder plants to be pruned                  | check all 6 plots                 | 0.5 day |
| C         | M1    | ba        |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | Did pruning and tree cutting                      | in all 8 plots  | 24 days                           | Pruning equipments   | Did pruning and tree cutting  | 6 cycle points  | 24 Days cycle<br>(6 Work days)    |         |
|           | M2    | ba        |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   | prepared Manuring schedule for ornamental in the grass    | dates and amount                  | 0.5 day  | Scheduling  | prepared Manuring schedule for ornamental in the grass    | dates and amount                  | 0.5 day |
|           | M3    | ba        |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   | shape the beds and adding correct manure at correct time  | Interval and amount               | 4 days   | Manuring the ornamental plants  | shape the beds and adding correct manure at correct time  | Interval and amount               | 4 days  |
| D         | M1    | ab        |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              | Final observation for beauntiness                 | all 8 plots   | 0.5 day                           | Observation for finishing                                      | Missing in checking   | all 8 plots   | 0.5 day                           |         |
|           | M2    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   |   |                                   |  |   |   |                                   |         |
|           | M3    | a         |                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                  |              |   |   |                                   |  |   |   |                                   |         |

Figure 5: Whole Gantt chart



11. Balance the resources for maximum utilization of resources and reducing the project duration. - Balanced Resource Schedule with new critical path. **(Revised Gantt Chart)**

The revised Gantt chart would be developed with balanced resource schedule and new critical path in the repeating cycle of the projects.

12. Add more resources to critical activities and crash the programme -**Accelerated Project**

If there any accelerated project cycle needed additional resources can be added and crash programme can be implemented with expedited critical activities.

## CONCLUSION

ISO 21500:2021 is compatible to various project systems since it allows sequences and the adaptation of processes to be carried out in a flexible way. There is enough freedom to the designer to allocate resources in a flexibility manner to specify the processes. Normal path of the process, accelerated process and re-engineering with higher technologies also possible through ISO 21500.

In this study Lawn and landscaping of South Eastern University of Sri Lanka has been planned to manage by Using ISO 21500 techniques. Project cycle of the Lawn and landscape maintenance reorganized according to the ISO 21500 standard in order to reduce the cycle time and maximize the resource utilization. Critical path and non-critical path were correctly identified and Works have been carried out in a planned manner. Resource idling were eliminated. This study enabled to evaluate the proposed model, showing its feasibility and value added to the lawn maintenance and landscape based on ISO 21500.

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