

**THE USE OF SPATIAL TECHNIQUES IN THE DECISION  
MAKING OF PLANTATION MANAGEMENT  
: A CASE STUDY AT PENRITH ESTATE  
SRI LANKA**

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## DECLARATION OF THE CANDIDATE

I do hereby declare that work described in this thesis was carried out by me under the supervision of Dr. D. P. S Chandrakumara and Mr. Prabath J Malavige. I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any University and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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**ABSTRACT**

Productivity of plantations remains stagnant with low yields. This is one of the challenges faced by the Plantation industry at present. Efficient utilization of available lands with proper soil conservation measures and environmental protection are mandatory to increase productivity. Geo-Information Technologies (GIT) are tools that can be used efficiently for the management Crop plantations. Geographic Information System (GIS) and Remote Sensing (RS) techniques can be efficiently used to create a management information system to support decision-making process in the plantation sector.

A case study was undertaken with the objectives of creating a Spatial Decision Supporting System (SDSS) for the Penrith estate, Avissawella, Sri Lanka. High Resolution satellite images, topographic maps (1: 10,000) and field data were used to prepare a base data set. Visual interpretation techniques and other GIS techniques were used to prepare these data layers. Some of resulted layers are; field map, land use map, road map. Hydrlogy map, building map and the Crop distribution map of the estate. These base layers were integrated in order to create, a digital map for Penrith estate. By utilizing these maps and other socio-economic data, GIS based SDSS was created.

Finally, some analysis was carried out to investigate the applicability of the SDSS for the day-to-day plantation management. Proximity to the water resources and steep area identification was done and identified sensitive areas that need protection, are presented in a map.

**Keywords:** *Web-based GIS, Online Consulting portal, Crop-land suitability, Decision Supporting System, geo-information technologies, geographic information system, overlying analysis techniques, proximity analysis, remote Sensing techniques, visual interpretation techniques*

# CHAPTER ONE

## INTRODUCTION

### 1.1 Introduction to Research

Plantation\* sector is one of the major foreign income producer in Sri Lanka covering large amount of land mass and involving significant amount of i.e. approximately one million workforce engage in this sector; All Managers in this sector have a major role to play for the sustainability of the Industry. In the era of Globalization and Liberalization, Managers of plantation has to change or modify existing Policies, Programs, Procedures and Standards accordingly. In this drastic change, managers are facing two basic problems i.e. how to bear change and how to make employees adopt the change or mitigate their resistance. (Sivaram,2000).

*(\* The term "plantation" is subject to various definitions, one of the most accepted interpretations being "an economic unit producing agricultural commodities (field crops or horticultural products, but not livestock) for sale and employing a relatively large number of unskilled laborers whose activities are closely supervised. Plantations usually employ a year-round labor crew of some size, and they usually specialize in the production of only one or two marketable products. They differ from other kinds farms in the way in which the factors of production, primarily management and labor, are combined" It is to be noted that this definition goes back to the late 1960s when the estate sector to be overwhelming and the role of smallholders engaged in plantation crop to be less pronounced. Another feature is that in the current situation, Plantation workers can hardly be referred to as being in the unskilled category. Yet, this is a useful definition to go by)*

### Plantations in Sri Lanka

In Sri Lanka, the plantation sector comprises of the traditional triples – Tea, Rubber, and Coconut, and Sugar, Oil palm, Cashew and Palmyra. The main thrust of the plantation sector is to increase the productivity and the profitability of both corporate and the small-

holding sector of the plantation industry through product and market integration – agro-based industries, aiming at long-term sustainability. The plantation sector that to be privately owned to be nationalized in the mid-1970s. The two government sector

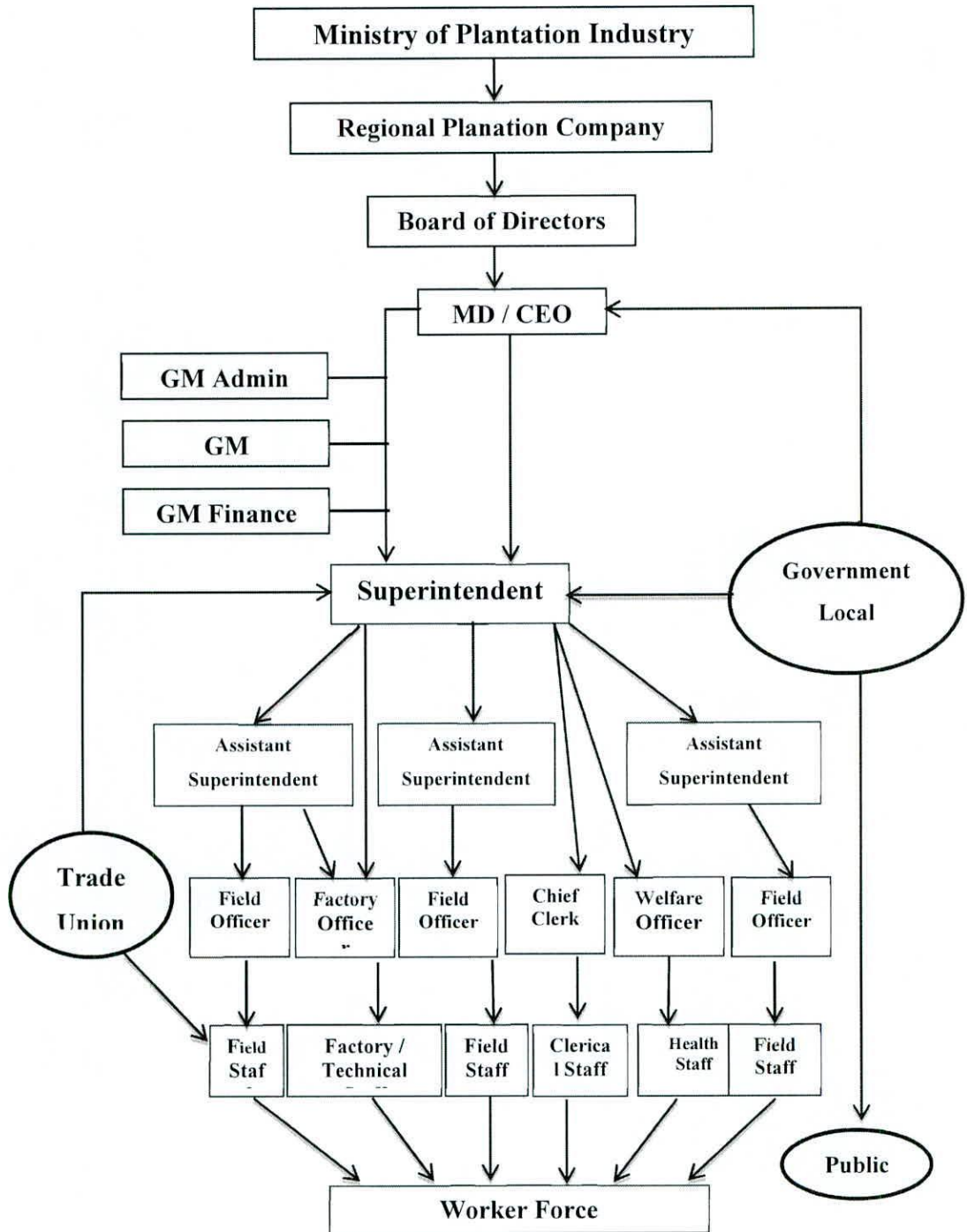
Corporations (JEDB and SLPC), which managed the plantations since the nationalization for nearly two decades with huge losses and greater burden to the national economy, were once more partially privatized between 1995 and 1997. The ownership to be transferred to 23 Regional Plantation Companies (RPCs) on the basis of a 53-year lease. A structure of a Regional Plantation Company shows in Figure 1.

As the highest foreign exchange earner, plantation industry to be the leading industry until about the mid-eighties when it to be overtaken by foreign employment, garments and tourism, but it still plays a significant role. The total land extent utilized in the plantation sector is about 750,000 hectares.

This study would highlight various managerial skills require by Estate Managers to perform various complex tasks or implement various policies, skills are essential to utilize the scarce resources effectively and efficiently. A researcher by Robert L. Katz found that managers needed three important skills i.e. Conceptual, Human and Technical.

Managerial skills sets of qualities and attributes in the personality of managers that enable them to effectively manage the working of a firm. Good managerial skills can create a world of difference in the efficiency and performance of the organization. Traditional Manager's Skills wouldn't bring favorable change at the workplace; So Manager has to learn some special skills that bear on employee's behavior and attitudes hence that an organization can much benefit by their employees.

It is fact that Manager causes the productivity of employees and organization. The manager may directly influence the worker's attitude, interest, and aptitude or change their behavior toward the commitment to Goals and Objectives. Organization can stand to bear the challenges of change through only right Managerial Style & Behavior.



Source: Drafted by the Author - 2016

**Figure 1 - The Management Hierarchy of A Regional Plantation Company (RPC)**

## **GEO-Informational Technologies (GIT)**

Geo-Informational Technologies (GIT) provides an important tool for the management of plantations. Prior to the introduction of global positioning systems (GPS), Geographic information Systems (GIS) and Remote Sensing (RS), obtaining data on the field was difficult and in many cases inaccurate (Khairi et al., 2010). Furthermore, plantation management has to consider the changing nature of an estate that extends from initial land clearing, production stage and finally replanting or conversion phase. GIS differs from traditional methods by providing alternative tools which can monitor and analyze data. GIS can be used to improve the decision making process effective in resource management that contribute to increase productivity and profitability (Khairi et al., 2010).

Advantages of a GIS over a hard copy map are; digital maps include the ability to pan to observe different perspectives on subjects at oblique angles (Murai, 1999), with the ability to access additional information about a location or site, take measurements at any relative scale without the restriction of the printed map scale, and the ability to search the entire GIS. GIS are also relatively easy to integrate into various aspects of our modern lives in many forms to assist with a variety of functions where hard copy maps generally have a limited use (Murai, 1999). Efficient utilization of land available for several uses needs a variety of information pertaining to the land.

In this study, an attempt was made to apply GIS and RS technique in order to create a Geospatial Decision Supporting Model (DSM) to maximize estate profits by utilizing available lands on estates towards sustainable development by ensuring land use efficiency with proper soil conservation measures and environmental protection. The strength of IT in the form of GIS solutions is expected to give excellent results towards achieving this goal.

## **1.2 Research Problem**

In the present context lot of criticisms goes to plantations sector by through Media, Stakeholders and Analysts by highlighting low Productivity, low effectiveness, low Performance moreover questioning the sector's sustainability.

Further, they emphasize some of other inadequacies that observable in the Plantation sector such as High Work & Investment Risks, Work Overlaps, Stagnation and lack of innovations in Management styles, etc.

While carefully analyzing the facts that have been highlighted by various media, it is a clear indication of the overall organizational ineffectiveness of the Plantation sector. Lack of General (Management) Information System and poor decision-making and restricting into the colonial style manual monitoring systems and various other causational factors have adversely affected to industry downfall.

This study attempts to solve the problem that how best spatial techniques can be used in the decision-making process of plantation management more creatively to improve the overall effectiveness of a plantation unit.

## **1.3 Objectives**

The main objective of the research presented to study how Geospatial techniques to implement in the decision-making of plantation. The research has the following specific objectives:

- To build a comprehensive digital map for Penrith estate including all general data.
- To formulate estate database including important general attributes that give information on agronomy, socio-economic and environmental factors
- To publish data & map layers to a Web-GIS and to build a Geospatial Decision Support Model (GDSM)

#### **1.4 Significance of the Study**

The Plantation sector is a major contributor to the nation's growth and prosperity. The Plantation Companies have to maintain its standards to the acceptability of the international levels where Products, Labor Management, Environment Management and its process management are a concern. Enhancing Managers skill will improve productivity and effectiveness of the plantation sector. Enhancing the skills of the Managers and workforce will significantly contribute and supportive to be in competitive in the international markets and to be competitive internationally accepted norms.

This study will be a significant endeavor in promoting effective and productive work environment in the Plantations (Estates) and motivations of its employees. Plantation Companies can certainly be used this study as a guide (Model) in relation to Planning and Organizing of activities, Train their managerial staff accordingly towards successful and effective Leaders and managers. Very importantly, this research will be guidance in order to develop a Geospatial Decision Support Model (GDSM) of Regional Plantation Companies' towards the more productive workforce.

This study will also be beneficial to the students and personal that needs to understand the Plantation management structure of Sri Lankan Plantations. Also, this will benefit and help the future researchers as their guide.

#### **1.5 Research Limitations**

The entire plantation sector is too complicated for a study of this nature, therefore, the research focused only the single plantation unit in Avissawella, Sri Lanka i.e. Penrith Estate managed by Pussellawa Plantations Ltd.

Collection and extraction of data then arrange them in to tabular form was very tedious process and time consuming therefore only single year operational data could be used for this Geospatial Decision Making System (Model) during the period of research.