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AN ECONOMIC STUDY OF POTENTIAL PRODUCTION-PROMOTING SUGARCANE AND SUGAR POLICIES IN SRI LANKA: SOME RECOMMENDATIONS IN THE LIGHT OF INDIAN AND THAI POLICY LESSONS

By

Dinesh Kodituwakku

A Thesis Submitted in Fulfilment of the Requirements for the Degree of

Master of Agriculture

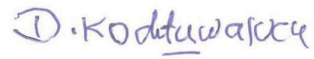School of Agriculture and Food Technology

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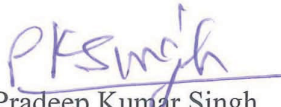December 2013

DECLARATION OF ORGINALITY

Except otherwise acknowledged in the text, this thesis represents the author's original research. The materials contained herein have not been submitted elsewhere, either in part or full, for any degree at this or any other university.

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I hereby confirm the declaration of originality by Dinesh Kodituwakku (S11086566), the author of this thesis, who worked under my supervision.

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Date: 29-11-2013

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CACP – Commission for Agricultural Costs and Prices

CCS – Commercial Cane Sugar

CIF – Cost Insurance and Freight

EBP – Evidence –based Policy

ECA – Essential Commodity Act

EU – European Union

FAO – Food and Agriculture Organisation

FRP – Fair and Remunerative Price

GOI – Government of India

GOT – Government of Thailand

ha – Hectare

IDRA – Industrial Development Regulation Act

INR – Indian Rupees

ISMA – Indian Sugar Mills Association

Kg – Kilogram

LIFFE – London International Financial Futures and Options Exchange

LKR – Sri Lankan Rupees

MEP – Minimum Efficiency Price

OECD – Organisation for Economic Co-operation and Development

OGL – Open General License

OSCB – Office of Cane and Sugar Board

PDS – Public Distribution System

SDF – Sugar Development Fund

SIA – Sugar Industry Act

SMP – Statutory Minimum Price

TCD – Tonnes Crushed per Day

TCSC – Thailand Cane and Sugar Cooperation

THB – Thai Baht (Thai currency)

TRQ – Tariff Rate Quota

USA – United States of America

UK – United Kingdom

US $ - United States dollar

USDA – United States Department of Agriculture

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ABSTRACT

This study was undertaken to review the existing production-promoting sugarcane and sugar policies in Sri Lanka and recommend policy for increasing the production of sugar in the country. Even though the country has sugar industry operating for nearly six decades, her sugar production is insignificant compared to domestic demand, which has been costing the country considerable amounts of foreign exchange every year. In this regard, it is pertinent to mention that the Sri Lankan government has set a target for increasing the domestic sugar production up to 40 per cent of the domestic demand by the year 2020.

In order to help the Sri Lankan government to formulate appropriate production promoting policies, this study reviewed the sugarcane and sugar sector policies of India and Thailand over a period of 2005 to 2010. Both India and Thailand have policies to regulate different aspects of sugarcane and sugar production including the price and trade. They effectively used their policy instruments for the development of the sugar industry. An analysis of the factors affecting the sugar production in Sri Lanka indicated that the retail prices of sugar were insignificant in influencing the production of sugar and sugarcane and the cane area harvested. Since the present sugarcane pricing system in the country does not represent the sugar price, the sugar production therefore was not price responsive to the sugarcane production which was in short supply. Further, the analysis of the profitability of the sugarcane crop revealed that it was relatively competitive in the irrigated region of the country than that in the rain-fed region.

For the development of the sugar industry like in India and Thailand, Sri Lanka also needs a regulatory mechanism for the price of sugarcane as well as sugar. Policy interventions are also required in the areas of development of technology on sugarcane cultivation and sugar manufacture and provision of infrastructure facilities.

CHAPTER 1

INTRODUCTION AND BACKGROUND

Sugar has long been an important agriculture related commodity. It is extensively used as a sweetening agent around the world (International Policy Council, 1996). In addition, sugar is an important sub-sector in the economy of many developing countries, which provides considerable employment opportunities and contributes significantly to their balance of payments position (Larson and Borrell, 2001).

1.1   World Sugar Production and Consumption Situation

During the year 2011-2012, world sugar production and consumption were 172 million tonnes and 159 million tonnes respectively (Food and Agriculture Organisation (FAO), 2012). Sugar is produced in temperate climates using sugar beet while in tropical climates, it is produced from sugarcane. About 72 per cent of world sugar produced and over 80 per cent of sugar traded is cane-sugar. Beet-sugar is mainly produced by the European Union (EU), while cane-sugar is mainly produced in Brazil, India, Australia, China and Thailand (Wagner, 2007). According to the United States Department of Agriculture (USDA) (2012), nearly 50 per cent of the global sugar production comes from three major producing countries, namely, Brazil, India and the EU (Figure 1-1). Hence, sugar is one of the most volatile commodities in the world trade in terms of price and production as shown in Table 1-1.

Figure 1-1 Global Sugar Production, 2011
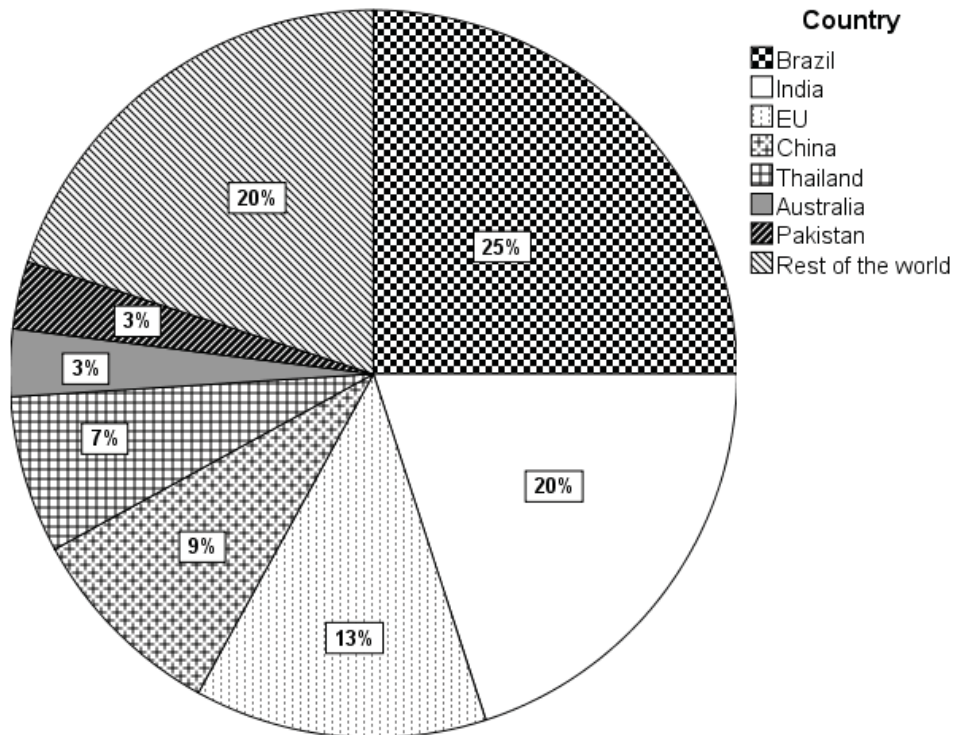
Source**:** USDA, Sugar: World Market and Trade, 2012.

Table 1-1 World Sugar Situation, 2006 – 2011

Year	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Sugar production (000' tonnes)	167036	168871	143888	153517	161762	172148
Sugar consumption (000'tonnes)	153034	158385	153389	154126	154851	159456
Average world sugar prices (US$/tonne)	411	334	348	423	594	731

Sources**:** Licht, World Sugar Year Book, 2009; USDA, Sugar: World Market and Trade, 2012 and London International Financial Futures and Options Exchange (LIFFE), 2013.

1.2   Sugarcane and Sugar Sectors in Leading Asian Countries and Sri Lanka

India, Thailand and China are the major cane-sugar producing countries in the Asian region. India is the second largest sugar-producing country in the world and accounts for about 20 per cent of the world sugar production followed by EU, China and Thailand. In terms of sugar trade, however, Thailand is the second largest sugar-exporting country in the world and accounts for about 13 per cent of the global sugar exports (USDA, 2012).

Both India and Thailand produce sugar mainly from sugarcane. There are two common sugar-producing technologies namely, open-pan (*Khandasari sugar* and *Gur*) and vacuum-pan. In India, about 85 per cent of sugar is produced using the latter technology (Ray, 2012). Similarly, Thailand also mainly uses this technology where as Sri Lanka uses only this technology to produce sugar.

Since India and Thailand are two major cane-sugar-producing countries in Asia and they mainly use the vacuum-pan technology to produce sugar, this study considered India and Thailand in identifying production-promoting cane-sugar policies for Sri Lanka.

As shown in Table 1-2 , India faced reduction of sugar production during the period from 2006 to 2009 due to low sugar prices in domestic and international markets and poor competiveness of sugarcane crop vis-à-vis other crops (Reddy, 2011). To reverse this, the Government of India (GoI) during 2009 to 2010 period declared higher sugarcane price through its *fair and remunerative price* (FRP) mechanism.   In

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addition, sugar millers were also allowed to import sugar under tariff concessions to meet the sugar deficits (Indian Sugar Mills Association (ISMA), 2013). Such a fiscal support also helped sugar mills to cover a part of their operational costs. These measures resulted in increased sugar production in the country during 2010 and 2011. Such timely corrective policy decisions of the Government mitigated the financial hardships of both sugarcane growers and millers.

Table 1-2 Cane-sugar Production in Selected Asian Countries, (000' tonnes)

Year	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
India	30766	28649	16100	20637	26574	28100
China	13038	16131	13510	11429	11199	12314
Thailand	7007	8059	7472	6930	9663	10600
Sri Lanka	56	29	38	32	31	35

Sources: Licht, World Sugar Year Book, 2009; USDA, Sugar: World Market and Trade, 2012 and Central Bank of Sri Lanka (CBSL), Annual Report, 2012.

In Sri Lanka, sugar is an important sub-sector of the economy and makes significant contribution to its national balance of payments through huge sugar import bills. In 2012, the sugar import bills in the country were US$ 385 million and accounted for 1.8 per cent of its total import bills (CBSL, 2012). This sector offers a vast potential for employment and income generation in the country particularly in the development of dry zone which consists of about 60 per cent of the arable lands of the country (Keerthipala, 2007). Meanwhile, the sugar production in Sri Lanka has also gone down from a peak of 56 thousand tonnes in 2006-2007 to an average of about 33

thousand tonnes during the last three years (Table 1-2). The plausible main reasons for this reduction may be poor competitiveness of sugarcane compared to other crops (Kodituwakku, 2010). The problems of the Sri Lankan sugarcane and sugar sub-sectors and the possible policy measures to increase the production are discussed in the Sub-sections on Conceptual Framework (1.4) and Research Problem (1.5).

1.3　National Agricultural and Sugar Policies

The product of agricultural sector has some special characters. The output is largely raw material that needs further processing, bulkier and more perishable. The quality of the output also varies from year to year and from season to season. These product characteristics have their effect on the facilities necessary to market them.

Government interventions in production and marketing of agricultural commodities therefore are common all over the world. Policy interventions in agriculture have also been justified widely due to market failures (Cafiero, 2003). The main forms of market failures and their corrective measures relevant for this study are discussed below and in Sub-section 2.1.1 of Chapter on Review of Literature.

Cafiero (2003) argues that market failures are the reasons that prevent the economy to realise the optimal use of resources and to provide socially optimal level of goods and services. Market failures are common in the agriculture sector of developing countries due to imperfections and inefficiencies of agricultural industries. Inefficiency leads to higher unit costs of production and makes agricultural industry relatively uncompetitive in the international market (Ganewatta and Edward, 2000).

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Government policies are therefore needed to promote long-term development of the agriculture sector by reducing market failures (Brook, 2010). Cafiero (2003) further claimed that the main reasons for market failures in agriculture based industries are failures of competition, nature of certain goods and services (the public goods) and incomplete markets. These reasons for the market failures have been discussed in the following sections.

a. **Failure of competition:** Competitive behaviour of individual participants in the market is a necessary condition for achieving efficiency. Imperfect competitions may arise if there is one buyer (monopsony) or seller (monopoly) as stated by Cafiero (2003). Therefore Government intervention may be desirable to facilitate the competition in the market. Such an intervention in agricultural industry may arise at two different levels viz., to correct the failures in the domestic market and to improve the competitions in the international markets (Ganewatta and Edward, 2000).

In most of the cane-sugar-producing countries, sugar mills enjoy monopsony power as sugarcane buyer from large number of sugarcane growers. Hence, governments over time have introduced various sugarcane price policy measures such as floor prices to protect the interest of sugarcane farmers.

The Government of Thailand (GoT) has a mechanism of administering price for sugarcane called *net proceeds sharing* (NPS). Under the NPS, sugarcane growers receive 70 per cent of the revenue from domestic and export sales of sugar and molasses (Arjchariyaatong, 2006). This mechanism has been further described in Section 4.2.1.

b. **Public goods:** Infrastructure facilities, agricultural research, development and provision of extension services are the goods and services accessible to all members of a given public without paying for it (Ellis, 1992) and therefore market fails to provide them (Cafiero, 2003). Thus, the government has to come forward to provide these facilities and services to enhance the competitiveness of the farmers and help them to realise remunerative returns from their products.

Provision of infrastructure facilities such as passable roads is needed to reduce the transport cost. Likewise, irrigation facilities results in increased production at lower average costs. In most sugarcane cultivation areas, these infrastructure facilities are poorly developed. The World Bank (1998) stated that the generation of knowledge and dissemination of information is important in the process of economic development. However, since knowledge is a public good, it tends to be undersupplied. It is, therefore, imperative for the government to intervene in providing effective extension services to disseminate the improved technical knowhow to sugarcane producers. The GoI supports training of sugarcane farmers and the transfer of new sugarcane varieties and improved production technologies (Reddy, 2011).

c. **Incomplete markets:** The market does not provide some goods and services adequately even though the costs of providing these are less than what the individuals are willing to pay. Insurance and capital markets (Stiglitz, 1986) as well as the development of technology, infrastructure facilities and extension advisory services are the examples of such incomplete markets and therefore

government support is needed to encourage their provision and use to the potential. Since, establishment of sugar mills and technological improvements are capital intensive, the involvement of the Government of Sri Lanka (GoSL) is desirable to attract investment and to make the industry more competitive. The GoI provide soft loans through Sugar Development Fund (SDF) for the rehabilitation and modernisation of sugar mills (ISMA, 2013). Hence, it will be appropriate for Sri Lanka also to follow on the Indian experience wherein the GoI played a productive role and used the financial markets to provide resources for the development of the sugar industry.

1.4   Conceptual Framework

This section presents in brief the outlook of the Sri Lankan sugarcane and sugar sub-sectors and also gives the theoretical background for the need of having suitable policies.

The cane-sugar industry in Sri Lanka has two major sub sectors: a) sugarcane production which is the main raw material for sugar production and b) sugar production which is the final product of the industry. Therefore, in aiming for the development of the industry, the conceptual framework needs to address issues associated with both sub-sectors.

The important factors affecting the sugarcane production in Sri Lanka are the land area used for its production and the productivity of the crop. The extent used for this commercial crop mainly depends on its profitability compared to the other competing

crops. However, returns from the sugarcane depend not only on the selling price but also on the cost of production and the crop yield.

Government intervention through policies may help the sugarcane farmers to realise higher productivity at lower unit costs for better returns. India has formulated price policies to support sugarcane producers to get a remunerative price. The development of infrastructure facilities like all-weather roads, irrigation, and extension and training facilities and technology development have shifted the supply function to the right and the average cost function downward. Such measures have also provided incentives to the sugar mills in the form of better sugar recovery and, in turn, have benefitted the sugar industry in general.

In addition, few of the fiscal and technological interventions have also benefitted sugar mills by providing incentives for value addition to different by-products like molasses, bagasses, etc. The sugarcane and sugar sub-sectors of Sri Lanka can learn from the experiences of India and Thailand with respect to the formulation and implementation of policies for the development of its sugar industry.

In the paragraphs above, we tried to review selected type of government interventions that may influence sugarcane and sugar prices. Such programmes require some types of administration and are viewed broadly as falling in the category of administered prices. Not all government programmes, however directly set prices. There is large volume of literature on agricultural policy and the effects of these policies, and our discussion is limited to consequences of price behaviour of some such programmes. The economic effects of government programmes designed to support and raise farm

prices depend on *inter alia* the level of support and on the methods employed to raise prices. It is also possible to enhance farm incomes via direct payments or subsidies, such payments may influence prices indirectly via their effects on farmers' incentives to produce.

From the view point of Sri Lanka that is targeting to support its domestic sugarcane and sugar prices, tariffs, variable levies (such as used by India), and import quotas have similar effects on internal prices and the volume of imports. They make it possible to maintain domestic prices above import or world prices (this assumes, of course, that imports are important source of supply to meet domestic demand). The effects on the volume of imports depend on the slopes or elasticities of the demand and supply functions of the importing nation.

Therefore, fundamental questions like how to influence the competitiveness of sugarcane crop, growth in sugarcane and sugar production technologies and their permeation, development of infrastructure facilities and other goods and services of the nature of public goods are important. Answers to such questions are influenced by economic policies of the nation. Changes in monetary and fiscal policies, in environmental policies, in trade policies, in exchange policies, in industrial and agricultural policies, etc., are among the variables that can affect the sugarcane and sugar production in Sri Lanka.

Within the global economy, individual countries have their own agricultural, trade, and macro-economic policies. Agricultural policies influence production incentives and trade policies influence the demand for and supply of exports and imports.

Macro-economic policies influence prices through their effect on interest rates and incomes. Policies that influence the supply and demand for credit can also affect exchange rates assuming that they are free to respond to market forces.

Detailed discussion about all those policy measures and their role in bringing desired influence on the sugar sector of Sri Lanka is beyond the scope of this research. This research, however, has concentrated only on the few policy instruments relevant for influencing the cane-sugar production in Sri Lanka. All such selected interventions have been identified as part of production-promoting sugarcane and sugar policies.

1.5   Research Problem

Being a sugar deficit country the sugar import bills of Sri Lanka are huge. In order to reduce its reliance on the imported sugar the country has to increase the production of sugarcane and hence the sugar. This section presents a statement of the problem justifying the need for research.

The sugar sector development policy statement of the Ministry of Plantation Industries of Sri Lanka (2004) has recognised the potential of the sugar industry for the development of livelihood of rural areas in dry and intermediate zones in the country. During the year 2011-2012, Sri Lankan sugar production fulfilled only nearly six per cent of the domestic sugar demand (CBSL, 2012) with sugar import bills amounting to US$385 million in 2012. Having realised the importance of the sugar industry, the GoSL has created a separate Ministry for the development of the industry named as Ministry of Sugar Industry Development. Furthermore, according

to the Ministry of Finance and Planning (2010), the GoSL has also planned to increase sugar production up to 40 per cent self-sufficiency by the year 2020. To achieve the target, the area under sugarcane cultivation and the crushing capacity of sugar mills need to be expanded to 87,000 ha and 21,000 tonnes cane crushed per day (TCD) at the current levels of yields of sugarcane and sugar respectively. Further, there is also scope to increase the area under sugarcane crop as has been revealed in a recent survey conducted by the Sugarcane Research Institute of Sri Lanka (2010). The findings of the survey revealed that about 200 thousand hectares of unutilised lands available in the country could be brought under sugarcane cultivation. As such, Sri Lanka has a potential to increase its sugar production.

As stated earlier, important factors affecting sugarcane production are area and yield of the crop. Sugarcane area mainly depends on relative profitability from the crop while yield depends on technologies adopted, whereas sugar production mainly depends on sugar recovery and the sugar price.

Realisation of the sugar production target set by the Ministry of Finance and Planning therefore, necessitates the development of both the sugarcane and sugar sub-sectors. It affirms the need for Sri Lanka to formulate and implement production-promoting policies.

The Ministry of Plantation Industries of Sri Lanka (2004) has also indicated of the need for consistent policies particularly sugarcane and sugar price policies. Keerthipala (1997) also pointed out that the neglect of sugar-related policies at national and industry-level has contributed to the low productivity and profitability of

the sugar industry in Sri Lanka. The sugarcane and sugar price policies have been identified as important instruments in this regard. Therefore, there is a need for the Government to formulate policies to provide public goods and services, correct the imperfections present in both sugarcane and sugar markets. The Government is also expected to facilitate the use of provisions and facilities which at present is being inhibited due to the incompleteness of markets. The production-promoting policies exemplified in both India and Thailand therefore would be helpful to Sri Lanka to identify appropriate policy framework.

1.6   Objectives

The general objective of this study was to investigate production-promoting policies of sugarcane and sugar sub-sectors in India and Thailand and explore their applicability to Sri Lanka.

The specific objectives were as under:

a. Identify production-promoting sugarcane and sugar policies in India and Thailand during the five year period from 2006 to 2010.

b. Study the measures adopted by India and Thailand to stabilise and increase sugarcane and sugar production during the above period.

c. Study the effects and relationships among the factors affecting sugarcane and sugar production and examine the profitability of sugarcane crop in Sri Lanka vis-à-vis the competing crops.

d. Suggest production-promoting policies that can be applied for improving the sugarcane and sugar sub-sectors in Sri Lanka.

1.7   Organisation of the Thesis

This thesis has been organised into five chapters. The first chapter explains the world sugar production and consumption situation, cane-sugar industry in Asian countries, national agriculture and sugar policies, conceptual framework, research problem and objectives of the study. The concepts, definitions and literature related to policies and cane-sugar industry in India, Thailand and Sri Lanka have been reviewed in Chapter 2. Chapter 3 demonstrates the study area, data required, sources of data and methods used for the analysis. Results of the study with necessary discussions have been presented in Chapter 4. The final chapter contains summary, conclusions and policy implications.

CHAPTER 2

REVIEW OF LITERATURE

This chapter presents an overview of sugarcane and sugar sub-sectors in the Asian countries India, Thailand and Sri Lanka. In order to provide a better understanding of the production-promoting cane-sugar policies, policy needs and existing production-promoting policies and policy formulation approaches are explored. Relevant literature has also been reviewed on the factors of sugar production and competitiveness of sugarcane crop.

2.1 Cane-sugar Industry in Selected Asian Countries

2.1.1 India

In India, sugar industry is the second largest agro-based industry after textile (Reddy, 2011). The state of *Uttar Pradesh* of the country contributes almost 60 per cent of India's total sugar production. Other important states for the commodity are Tamil Nadu, Karnataka, Maharashtra and Madhya Pradesh (RAY, 2012).

The Indian sugar industry has the co-existence of different ownership and management patterns. There are sugar mills owned and operated by the state and under the private and co-operative sectors. The country has about 400 operating sugar mills with crushing capacities ranging from below 1,250 TCD of sugarcane to 10,000 TCD (RAY, 2012). The production of sugarcane is primarily in the private sector. The average sugarcane and sugar recovery in the country during the last five years have averaged about 61 tonnes/ha and 10.3 percent respectively (USDA, 2012).

2.1.2 Thailand

According to the USDA (2012), sugar production and exports in Thailand during 2011-12 was 10.2 million tonnes and over 7.5 million tonnes respectively. The country has 47 sugar mills with a total milling capacity of 0.9 million TCD. The production of sugarcane is primarily done by private sector, under two different farming systems, i.e., large capitalistic farms and small farm types (Arjchariyaatong, 2006). Sugarcane and sugar yield in the last five years averaged about 65 tonnes/ha and 10.55 percent respectively (USDA 2012).

2.1.3 Sri Lanka

The cane-sugar industry in Sri Lanka started during the middle of the 19th century and currently, only three sugar mills namely, *Sevenagala, Pelwatte* and *Hingurana*, are operating. Their production meets about six per cent of the total annual domestic demand of sugar which is about 650,000 tonnes (CBSL, 2012). The total area under sugarcane cultivation and domestic sugar production during 2012 was 11,000 ha and 36,000 tonnes respectively. About 569,000 tonnes of sugar was imported in 2012 costing US$345 million equivalent to about 1.8 per cent of the total import bill. The sugarcane yield and sugar recovery in Sri Lanka have averaged 50 to 55 tonnes/ha and 8.2 per cent respectively in the last five years. The sugarcane price is determined by individual sugar factories and does not represent the sugarcane quality with respect to sugar content and the ex-factory sugar price. The ex-factory price of sugar is decided based on the price of the import sugar and taxes (Ministry of Plantation Industries, Sri Lanka, 2004). In addition, the above report indicated that there is a need for consistent

policies to develop the sugar industry in Sri Lanka, particularly sugarcane and sugar price policies.

According to the *Mahinda chinthana vision for the future,* the policy framework prepared by the Ministry of Finance and Planning (2010), the GoSL has also planned to increase sugar production up to 40 per cent of the requirement by the year 2020. The sugar industry development policy statement of the Ministry of Plantation Industries of Sri Lanka (2004) has recognised the potential of the industry for the development of livelihood of rural areas in dry and intermediate zones in the country. A recent survey conducted by the Sugarcane Research Institute of Sri Lanka (2010) on the availability of land for sugarcane cultivation revealed that about 200 thousand hectares of unutilised land is available in dry and intermediate zones in the country. Thus, Sri Lanka has a potential to develop its cane-sugar industry.

2.2.   Policy-concept

The term policy is explained and defined in many ways. According to FAO (2013), the word "policy" is not a tightly defined concept. It is a highly flexible one used in different ways and on different occasions, such as:

i.   A definite course or method of action selected by government, institution, group or individual. This course of actions is selected from alternatives in the light of given conditions to guide and determine present and future decisions.

ii. Such a specific decision or set of decisions together with the related actions designed to implement them.

iii. A projected programme consisting of desired objectives and the means to achieve them.

All of the above definitions included decisions, program of actions and ways to implement these. There are various types and forms of policies such as broad policies which enunciate government-wide direction; more specific policies which may be developed for a particular sector (the sugar sector) or issue-area (sugar production); operational policies which may guide decisions on programs and project selection (Auditor General, Canada, 2003). In addition, government policies are reflected most typically in legislations, regulations, and programs. These are often referred to as policy instruments.

When analysing policies, it is often helpful to distinguish between two elements which are essential parts of any policy:

a. **Policy objectives:** These are the "ends" of a policy and reflect the overall purpose or long-term aim.
b. **Policy instruments:** The "means" of a policy, the actions used to carry it out and the methods by which objectives are achieved (FAO, 2013).

The above distinction is useful because the same objective can often be served by several alternative instruments. Conversely, a single policy instrument may affect several policy objectives. For example, an instrument used to raise sugar prices will normally affect the welfare of producers and consumers as well as the level of sugar production. It is only by distinguishing between objectives and instruments that one can begin to assess the relative efficiency of different instruments (FAO, 2013).

2.2.1. Policy needs for agriculture and sugar sectors

Government intervention, in production and marketing of agricultural goods, is common all over the world. In general, government interventions are economically justified when private markets fail to provide socially-optimal level of goods and services (Ganewatta and Edward, 2000). According to Cafiero (2003), policies of governments in agriculture have been justified widely in developing countries under market failure framework.

The reasons that prevent the economy to settle on optimal use of resources and provide socially optimal level of goods and services have been termed as market failures (Cafiero, 2003). Ganewatta and Edward (2000) attributed market failures to inefficiencies of the agricultural industries. World Bank (1998) highlighted that successful growth of agriculture sector depends on the state and its capacity to correct the market failures that are pervasive in the sector. Market failures are common in the agriculture sector in developing countries like Sri Lanka, India and Thailand.

Since inefficiency leads to higher cost of production, the agricultural sector in developing countries become uncompetitive especially in the international market. Hence, government policies are needed to promote long-term development of agriculture based industries by addressing market failures, ideally by tackling them at source (Brook, 2010). Main arguments for market failures are failure of competition, public goods, information failure and incomplete markets (Cafiero, 2003).

a. **Failure of competition:** Social benefits are optimum when the market for any good is operating in a perfect competitive situation. Competitive behavior of individual participants in the market is a necessary condition for achieving efficiency. Imperfect competition might prevail in markets where there is either one buyer (monopsony) and or seller (monopoly) or few buyers (oligopsony) and sellers (oligopoly). Government interventions in sugarcane and sugar sub-sectors therefore may be desirable. It may be at two different levels. First, due to failures in the domestic market and second, to meet the challenges in the global market.

Most of the sugar mills in sugar producing countries have monopsony power of buying sugarcane in the identified sugarcane belt. Hence, governments implement various sugarcane pricing policies to protect sugarcane farmers. Government of India administers a *fair and remunerative price* (FRP) system for sugarcane which acts as a floor price (Indian Sugar Mills Association (ISMA), 2013).

b. **Public goods argument:** Public goods such as infrastructure facilities and research and technology development are freely accessible to all members of a given public (Ellis, 1992). Since these goods and services are common to all users market fails to provide them.

Research is a public good in many industries especially for sugarcane and sugar sub-sectors. As research and development is a necessary requirement for the progress of these sub-sectors and also for economic growth, governments in many developing countries are involved in the research and development process (Ganewatta and Edward, 2000). In addition to the research, provision of other

public goods such as motor-able roads and irrigation facilities are also needed to enhance production and lower unit costs. Infrastructure facilities also complement other developmental efforts.

c. **Information failure:** Competitive markets typically rest upon the assumption of perfect information. It is assumed that consumers and producers are fully aware of the required information. Such an assumption is unrealistic partly because the cost of obtaining such information outweighs the expected benefits. Generation of knowledge and dissemination of the information is very important in the process of economic development (The World Bank, 1998). The public good nature of the knowledge causes it to be undersupplied in the absence of government intervention. Hence, effective agricultural extension services are needed for developing the sugarcane crop and sugar.

d. **Incomplete markets:** The market does not provide some goods and services adequately even though the costs of providing these are less than the individual's willingness to pay. Insurance and capital markets are the common examples of the incomplete markets that need government intervention to provide the socially desirable level of such commodities (Stiglitz, 1986).

In Sri Lanka, the existing sugar mills need development to make the industry more competitive. As establishment and renovations of sugar factories are capital intensive and there may not be enough financial resources available for the investment thus, government should come forward to provide the required capital.

In India, the GoI provides soft loans to sugar mills through the Sugar Development Fund for their rehabilitation and modernisation (ISMA, 2013).

2.2.2   Production-promoting sugar policies

Sugar policies in sugar producing, importing and exporting countries have been given great importance since sugar is an important subsector in their economies (Spence & Hannah, 1996). However, the final objectives of sugar policies in different countries have varied and targeted at income distribution, price stabilisation, efficient resource use, generation of tax revenue, economic development and food security objectives as well as the power and local politics (Keerthipala & Dharmawardene, 2000).

According to Hannah and Spence (1996) sugar policy tools can be categorised as border measures, domestic production measures, domestic consumption measures and international measures. Border measures and domestic production measures are the most important production-promoting sugar policies as they affect the sugar and sugarcane prices and the productivity of sugar and sugarcane.

a. **Border measures:** Tariffs, import quotas, tariff rate quota (TRQ), import and export licensing are some of the common border measures (Keerthipala & Dharmawardene, 2000). Tariff is a fixed amount per unit or percent of the value of the unit. However, under WTO guidelines all non-tariff barriers have been converted in to tariffs which are bound and each country has to commit itself to ceiling on its tariffs.

b. **Domestic production measures:** These are government policies or programs intended to effect local sugar production and these has to be as per the WTO guidelines. According to Hannah and Spence (1996), important measures can be categorised as follows:

i.   Official minimum or maximum prices for sugarcane and sugar

ii. Taxes on production or subsidies such as export subsidies or price premiums paid by purchasing agencies

iii. Input or credit subsidies

iv. Deficiency payments directly to producers

Understanding of the policies of other sugar producing countries and their implementation under Sri Lankan conditions as per the WTO guidelines is important for initiating domestic market reforms. In the opinion of Larson and Borrell (2001) the producer groups often make arguments for getting government protection on the basis of policies of other countries and secondly, many market interventions are long-lived. Size and volume of domestic supports to the sugar sub-sector in Sri Lanka have to be according to the *Agreement on Agriculture* recommendations of WTO.

2.2.3   *Production-promoting sugar policies in India and Thailand*

India had a number of production-promoting policies for cane-sugar industry. The key policy interventions were:

i.   Central and state governments price support policies for sugarcane

ii. Central government regulations of sugar under levy and free-sale and buffer stock limits

iii. Central government regulations of sugar trade

iv. Other domestic marketing restrictions such as private storage limits

The above policy interventions are further discussed in Chapter 4.

Lands (2010) stated that India's sugarcane area and sugar production depend largely on policy interventions including sugarcane support price policies set by the central and state governments as well as sugar storage and trade policies set by the central government. Gadgil (2008) showed that the production of sugarcane in India has been profitable compared to other crops mainly due to price support policies. India also operated a credit programme for small irrigation schemes and provided low-interest loans for sugarcane crop and medium duration loans to encourage mechanisation (FAO, 2012).

In Thailand, the government estimates production, internal needs and export commitments for each season and then allocates sugar supplies to three quotas viz., Quota A (domestic consumption), Quota B (export under long-term contract) and Quota C (export at world price) (Arjchariyaatong, 2006). Sugarcane price is decided according to a revenue-sharing scheme between growers and mills. Upon delivery of cane to mills, growers receive an initial payment calculated on a base price negotiated by the government. The government directly negotiates initial sugarcane prices with growers and mills. The balance is paid at the end of the season or next season (FAO, 1997). The sugarcane price regulations and quota system for sugar are further discussed in Chapter 4.

2.2.4 Policy formulation

Different people have suggested different methods for policy formulation depending on the situation. Government of United Kingdom (UK) introduced the concept of Evidence-Based Policy (EBP). This is a toolkit which can be used by policy makers and policy advisors in the public sector. EBP is rigorous rational approach that gathers, critically appraise and uses high quality research-based evidence to inform policy making and professional practice (Sutcliffe & court, 2006). The EBP also lays emphasis on international comparisons in policy making tool kit, learning lessons from other countries, and use of international comparisons of policies.

According to Centre for Ageing Research and Development (CARD) in Ireland (2010), research based policy recommendation is a written policy advice prepared for some group or person who has authority to make or to influence policy decisions. A successful agricultural policy needs to be carefully designed and implemented to be effective. To do so, it requires a sound understanding of the objectives that such policy wanted to pursue and of the constraints that the agriculture sector faces. For example, if there is limited infrastructure for processing and transportation of agriculture outputs, higher prices for outputs may not sufficiently stimulate the agricultural production (Cafiero, 2003).

Wilcox and Hirschfield (2007) stated that policy design is concerned with identifying and planning appropriate responses based on theory, anticipated mechanisms, intended beneficiaries and desired outcomes. It is about identifying a relevant intervention or package of measures to impact upon a problem. The emphasis is on

the content of the intervention; what actions to be taken and which tactics to be used; when, how, where, for whom and by whom. In practice, the interventions need to be the right course of action given the nature of the problem and the context within which it occurs.

The trade structure and production characteristics of sugar sub-sector are different and need special considerations when developing production-promoting policies for their development. Larson and Borrell (2001) have identified the following common differences of the sub-sector:

i.   International markets are highly dominated by policy interventions.

ii. The inherent tension between sugar mills and sugarcane growers created by sugar's joint-production characteristics (sugarcane and sugar production).

iii. The local monopoly and monopsony relationship between the growers and the mills.

Authors have opined that due to these factors, government interventions are common in many sugar producing countries (Larson and Borrell, 2001).

2.3 Effects of and Relationships among the Factors Affecting Production of Sugarcane and Sugar and Examination of the Competitiveness of Sugarcane Crop

Keerthipala (2000) used time series data of 22 years about the factors affecting the sugar production in Sri Lanka. His observations over the period of 1978 to 2000 were as follows:

i. The price of sugar had a significant positive relationship with the harvested area of sugarcane.

ii. Quantity of cane crushed was significantly related to sugar produced and average sugar recovery rate was eight percent.

iii. Sugarcane production was significantly positively related to the area harvested and the average cane yield was 58.41 tonnes/ha.

Competitiveness may be defined from a number of different perspectives. Economists often look at privilege cost and price aspects of the competitiveness (Financial Management Association, 2006). There may not be any one "best" measure of competitiveness. The comparison of sugarcane production and competing crops in Thailand, as discussed by Arjchariyaatong (2006), showed that there were four main competing crops for sugarcane, i.e., rice, pineapple, cassava and maize. The total revenue and profit was highest for pineapple, followed by the first and second ratoon of sugarcane, rice, cassava and maize. However, ratoon crop was the new sugarcane which grows from the stubble left behind after harvesting and the above report did not consider the profit for the plant crop of sugarcane on the first year which was a weakness in the analysis. Nevertheless, sugarcane in Thailand was considered as the key crop for farmers, because other crops cannot be appropriate substitutes for sugarcane due to soil moisture and market conditions (Arjchariyaatong, 2006).

Reddy (2011) stated that competing cropping systems for sugarcane in India were paddy-maize in the state of South India, cotton in *Maharastra* and paddy-wheat in Uttar Pradesh states. Generally in all regions, net returns from sugarcane were higher than that of competing crops but sugarcane crop also required higher investment. The

margin from the crop was much higher in *Maharastra*, because sugarcane was irrigated whereas the competing crops were grown as rain-fed crops. In addition, the benefit cost ratio of sugarcane was higher compared to other competing cropping systems except for paddy-maize in the southern states.

In Sri Lanka, the sugarcane cultivation was less profitable compared to the competing crops, namely paddy and banana (Kodituwakku and Keerthipala, 2010). The three-year average costs and returns of banana, paddy and sugarcane crops showed that paddy had the highest benefit-cost ratio (BCR) of 2.27. The BCR was the lowest for sugarcane at 1.38.

CHAPTER 3

METHODOLOGY

Chapter on Methodology is divided into three main sub-sections. Sub-section 3.1 demonstrates the study area. Data collection is presented in Sub-section 3.2. Sub-section 3.3 illustrates the methods of data analysis.

3.1. Study Area

This study aims to suggest production-promoting policies for the development of sugar industry in Sri Lanka. Sri Lanka is an island in Asia which produces about 6 per cent of its domestic sugar consumption requirement. Two major cane-sugar producing countries in Asia, namely, India and Thailand were chosen to investigate their different production-promoting sugar sector policies and find out their potential applicability to Sri Lankan situation. Figure 3-1 shows the study areas in dark colour.

Figure3-1 Map Showing the Study Area: India, Thailand and Sri Lanka

Figure 3.2 shows the map of Sri Lanka with the areas chosen for detailed investigation on the competitiveness of sugarcane in its growing areas.

Figure 3-2 Map of Sri Lanka, Showing Selected Sugarcane Growing Areas for the Farmers' Survey
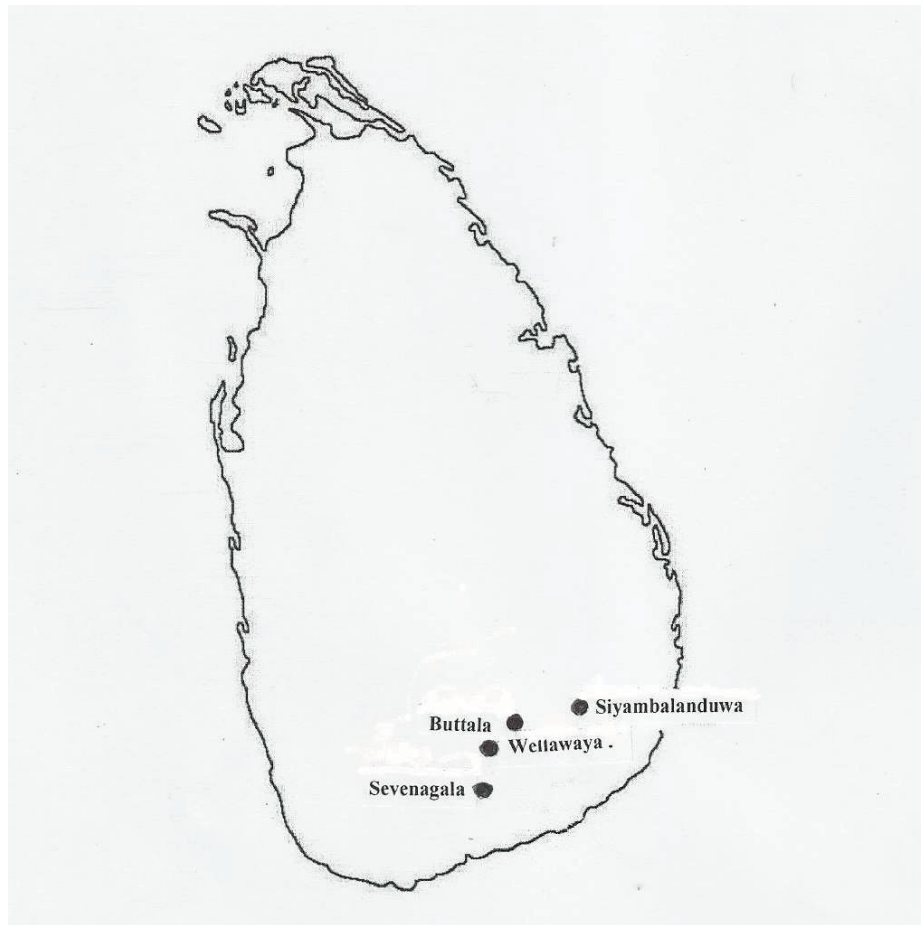
The country has two distinct sugarcane-growing regions namely, rain-fed region and irrigated region. About 80 per cent of the sugarcane area of the irrigated region was situated in the divisional secretariat of *Sevenagala*. More than 70 percent of the rain-fed sugarcane region belonged to the three divisional secrateriats namely *Buttala, Siyambalanduwa* and *Wellawaya.* Accordingly, the required primary data for the analysis of competitiveness of sugarcane in irrigated

region were collected from the farmers of *Sevenagala* divisional secretariat. The required data for the rain-fed region were collected from the farmers in divisional secretariats of *Buttala, Siyambalanduwa* and *Wellawaya.*

3.2.   Data Collection

This study has made use of both primary and secondary data. Details of the variables, sources of data and the reference periods of each type of data are discussed below.

a.   **Primary data:** One of the objectives of this study was to examine the profitability of sugarcane production. Fulfilling this objective requires data on the cost of production, yield and prices of both sugarcane and competing crops in irrigated as well as rain-fed conditions. The required primary data were collected from the sampled farmers from both the rain-fed and irrigated regions of Sri Lanka.

The main competing crops of sugarcane in the irrigated region were paddy and two strains of banana namely, *Kolikuttu* strain and *Ambul* strain. Data on production costs and revenues for 2009 to 2012 period were collected for both sugarcane plant and three ratoon crops and on the two strains of banana. On the other hand, paddy was cultivated in two seasons of the year, namely, May to August and November to February. Accordingly, data on costs and returns from the paddy crop over two growing seasons were gathered for the year 2012.

In the rain-fed sugarcane region, the main competing crops were maize and cowpea. Due to agronomic constraints, these crops were grown from the months

of November to February only so available data was only for a season during the year. The required data on costs and returns were collected for a period of four years from 2009 to 2012 for sugarcane plant and three ratoons and also for maize and cowpea crops.

Simple random samples (SRS) of 30 sugarcane farmers were selected from each region. In addition, SRS of 30 farmers for each competing crop, namely paddy, *Kolikuttu, Ambul*, maize and cowpea were selected. Thus, the total sample size consisted of 210 farmers (Table 3-1). The required data were gathered by interviewing the sampled farmers through pre-tested questionnaires (Annex I and II).

Table 3-1 Sample for the Farmers' Survey

Crop	Number of farmers
Sugarcane rain-fed region	30
Sugarcane irrigated region	30
Banana *Kolikuttu* strain	30
Banana *Ambul* strain	30
Paddy	30
Maize	30
Cowpea	30
Total	210

b. **Secondary data:** The data on production-promoting sugarcane and sugar policies such as regulations of sugarcane prices, trade controls of sugar and provision of

research and extension services in India and Thailand were gathered from different sources for the period 2006 through 2010. Responses of variables such as sugar production, sugarcane area, sugar recovery and average sugarcane yields to the changes of the policy measures during the same period were also collected. Main sources of required data were from different reports brought out by the FAO and USDA as well as the reports of the local sugar industry of the studied countries.

Extensive data obtained from the reports brought out by the Central Bank of Sri Lanka and the Department of Census and Statistics of Sri Lanka were used to analyse the factors affecting sugar production in Sri Lanka. These included harvested sugarcane area, average cane yields, sugar recovery rates, sugar production, cane crushing capacity of sugar mills, privatisation of sugar mills and retail sugar prices for the period 1990 to 2012.

3.3. Data Analysis

The data collected were analysed by using three methods: variable response analysis, analysis of sugar production model and analysis of profitability of sugarcane.

a. **Variable response analysis:** The responses of variables such as sugar production, sugarcane area, sugar recovery and average sugarcane yields to the changes of production-promoting cane-sugar policy measures in India and Thailand were analysed by working out percentage changes and averages of the variables during the period 2006 to 2010 (Tables 4-1 and 4-2).

b. **Sugar production model:** A conceptual model to represent possible relationships between different factors affecting sugar production in Sri Lanka was developed (See Figure 3-3).

Figure 3-3 Conceptual Model of Sugar Production in Sri Lanka
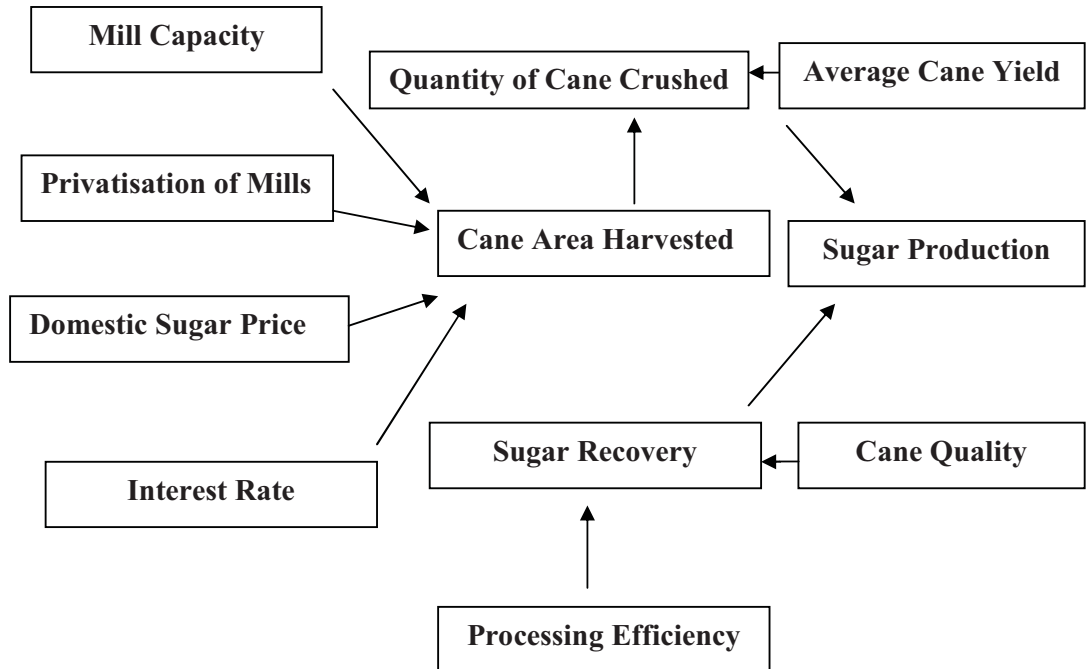
Based on the conceptual model, the following algebraic model was fitted to study the response of sugar production to important factors like retail sugar prices, sugarcane area harvested, cane crushed, real interest rates, mill capacity, privatisation, and trend for the period 1990 to 2012 (Equations 1, 2 and 3). It is likely that real prices of sugar may be different from the market prices due to inflation. Therefore, to eliminate the effect of inflation, the prices and interest rates data were deflated to the base year of 1990 by using gross domestic product deflators. In addition, sugarcane takes more than twelve months from planting to harvesting, hence, it was hypothesised that the use of one-year lagged real sugar

prices and real interest rates will determine the identified dependent variables better.

$$QS_t = f(QC_t, PS_t, R_t, T) \qquad (1)$$

$$QC_t = f(AC_t, Y_t, PS_t, T) \qquad (2)$$

$$AC_t = f(PS_{t-1}, G_t, I_{t-1}, CP_t, T) \qquad (3)$$

Where,

QS_t = Quantity of sugar produced in year t (tonne)

QC_t = Quantity of cane crushed in year t (tonne)

R_t = Sugar recovery rate in year t

AC_t = Cane area harvested in year t (ha)

Y_t = Average sugarcane yield in year t (tonnes/ha)

PS_t = Real retail prices of sugar in year t (Rs/kg)

PS_{t-1} = Real retail prices of sugar, lagged by one year (Rs/kg)

I_{t-1} = Real interest rates, lagged by one year (%)

CP_t = Mill capacity in year t (TCD)

G_t = Privatisation of sugar mills (Dummy variable (0) for government control and

(1) for private control)

T = Trend variable and t = 1, 2, ……..23 (1990 – 2012)

Subscript 't' denotes year.

It was assumed that quantity of sugar produced is related to quantity of cane crushed, recovery of sugar and the prices of sugar. The amount of sugarcane crushed is also affected by the sugar prices. Retail prices of sugar were used as a proxy to the wholesale sugar prices (Equation-1). Equation-2 represents the sugarcane supply to the mill as a function of area harvested, average sugarcane yield and retail sugar prices. Area response function (Equation-3) assured sugarcane area harvested may have a positive relationship with mill capacity and sugarcane prices. One year lagged retail sugar prices were used as a proxy to sugarcane prices. In addition, Equation-3 tried to identify the effect of real interest rates and privatisation of sugar mills on sugarcane area harvested. The coefficients of the three equations were estimated using least squares method.

For computation purposes, statistical package SPSS 14 was used. The coefficient of multiple determinations (R^2) was used to choose the best fit of the functional forms of the equations. The significance of coefficients of the factors on sugar production was tested by using the student t test values. Presence of auto correlation among the factors was tested by using the Durbin-watson statistics. Similarly, the presence of multicollinearity among the independent variables was tested by calculating correlation matrix. It was expected that separate analysis of these factors can provide more meaningful basis to suggest production-promoting policy measures for Sri Lankan sugarcane and sugar sub-sectors.

c. **Profitability of sugarcane:** Profitability of a crop produced indicates its competitiveness vis-à-vis other crops. The profitability of producing sugarcane relative to other competing crops was determined by comparing the four-year sample averages of total costs, net returns, gross returns and return per Sri Lankan

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rupee spent on purchased inputs (R/LKR spent). Methods of calculating the total costs, gross returns, net returns and R/LKR ratio are presented below.

Total cost = total fixed capital cost + total variable cost + imputed value of owned inputs

Gross return = total income from the sales of harvest + imputed value of owned seed planting material and animal feeds.

Net return = gross return – total cost

Return per LKR spent = gross return / (total cost – imputed value of owned inputs)

Costs of different agronomic practices of sugarcane crop were analysed by adding the total fixed cost, total variable cost and imputed value of owned inputs.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter discusses the results of data analysis and findings of the study. presents results and discussions of the study. Sub-sections 4.1 and 4.2 are devoted respectively to discussing the production-promoting sugarcane and sugar policies in India and Thailand. Sub-sections 4.3 and 4.4 examine the impacts of those policies on the sugar production in those countries. Results of analysis of factors affecting the sugar production and the competitiveness of sugarcane crop in Sri Lanka have been presented in Sub-sections 4.5 and 4.6. Sub-section 4.7 illustrates policy suggestions for the development of the sugarcane and sugar sub-sectors in Sri Lanka.

As stated earlier the sugar industry is a very important sector of the economy of India and Thailand. In India, it is also a politically sensitive sector. India has a long history of interventions both by the central and different state governments. Government interventions have been in the form of various price, trade, commercial, monetary, fiscal, agricultural, etc., policy frame works. Likewise, in Thailand also the Government has adopted many policy measures to fulfil the economic and political objectives. Discussions of all those policy measures however are beyond the scope of this research. This research has therefore concentrated on the production-promoting policies of cane-sugar in these two important countries.

4.1 Production-promoting Sugarcane and Sugar Policies in India (2005 - 2010)

India produces sugar using two technologies namely vacuum-pan and open-pan. The main product of the former is crystal sugar, and the latter produces *khandsari* and *gur*. Therefore, the sugar and *khandsari* and *gur* are in a way competing products and they compete for sugarcane, the main input in their production. In this section, the policy issues related to vacuum-pan sugar production have been presented as Sri Lanka also uses this technology to produce sugar.

Sugar industry in India is a regulated industry and the GoI uses four different instruments to regulate it. These instruments are Industrial Development Regulation Act (IDRA), Essential Commodity Act (ECA) 1955, Sugar (control) Order 1966 and Sugarcane (control) Order 1966. The policies based on these instruments cover all aspects of sugar business, viz., the establishment and operation of sugar mills, fixation of prices of both sugarcane crop and sugar and regulation of sugar trade (Ray, 2012). In line with the policies of the GoI, the governments of different states also formulate their policies which in turn influence the production of sugarcane and eventually the sugar production. This section presents only the results and their discussions about the production- oriented policies of the GoI during 2005 to 2010 period. Focus of the section is on regulation of sugar mills, prices of sugarcane, prices and sales of sugar, sugar imports, sugar development fund and the research and extension services.

4.1.1 Sugar mills

Over the time, the GoI has introduced several policies and legislations related to the establishment and operation of sugar mills, which are discussed below.

a. **Demarcation of sugarcane area:** Capacity utilisation of sugar mills is an important factor which affects the cost of sugar production. There should be adequate sugarcane crop to be processed since lower capacity utilisation leads to higher unit costs of sugar production. Rangarajan (2012) stated that the GoI ensured a minimum distance of 15 km between two sugar factories and accordingly has administered sugarcane reservation areas for all sugar mills. Sugarcane reservation areas are decided according to sugarcane availability, crushing capacity and sugar recovery rate of each mill. This reservation area is intended to ensure minimum supply of sugarcane to each mill (Rangarajan, 2012).

b. **Gestation period (GP) for new sugar mills:** Establishment of a sugar mill is highly capital intensive. According to Ray (2012), the newly-established sugar mills are given a three-year gestation period and allow them to sell their sugar in free market without being restricted by quota regulation (see Sub-section 4.1.3). The sugar mills which expand their capacity up to 5,000 TCD are also allowed the same facility. The aim of this policy is to encourage new investments in sugar production.

4.1.2 Sugarcane prices

Prior to 2009, the GoI administered s*tatutory minimum prices* (SMP) for sugarcane as a sort of floor price. At the beginning of each sugarcane cultivation season, the Commission for Agricultural Costs and Prices (CACP) announced SMP based on a minimum sugar recovery rate (ISMA, 2013). However, these SMPs did not account for the risk bearing and entrepreneurial abilities of the farmers. In 2009, the Government therefore introduced the *fair and remunerative prices* (FRP). These prices rewarded the farmers for their risk bearing ability, provided them the normal profit and were also inclusive of minimum sugar recovery rate (Ministry of Consumer Affairs Food and Public Distribution, 2013). Such an FRP assured the margins on account of profit and risk to farmers, irrespective of the profits made by the sugar mills. Sugarcane pricing policy in India thus protected sugarcane growers from monopsony powers of sugar mills as well as provided them with remunerative prices for sugarcane.

4.1.3 Sugar prices and sales

India practised a dual pricing system for sugar. A certain percentage of sugar produced by the sugar mills was bought at a fixed price by the Government as compulsory levy at a fixed price. This fixed price is usually lower than the free market prices. The levied sugar was distributed among the poor people, at a regulated retail price, by the government through its *public distribution system* (PDS) (Ray, 2012). The mills were allowed to sell the remaining sugar in the open market as per the quantity release announcements of the GoI. This market mechanism is called the

partial control and dual pricing. According to ISMA (2013), sugar price policy of GoI aimed to ensure fair prices to consumers and reasonable income to millers.

4.1.4   Sugar imports

The GoI imposed an excise duty on the importation of sugar. The revenue collected through this policy was transferred to the Sugar Development Fund (SDF). During the periods of sugar shortage, the GoI allowed sugar millers to import raw sugar under a duty concession quota system (year 2009). The amount of import quota allocated to each mill was decided according to their past sugar production records. In addition, these raw sugar imports were subjected to future export commitments by the sugar mills. This system was called *advanced license scheme* (ALS) for sugar import (Ray, 2012). The ALS not only provided additional income for sugar millers to cover their operational costs during low production periods but also encouraged them to produce more sugar.

4.1.5   Sugar development fund (SDF)

The sugar mills and sugarcane and sugar research organisations are entitled to receive grants or loans from SDF to carryout sugarcane and sugar related research activities. These funds are also available for such sugar production activities as value addition to by-products, installation of bagasse-based power generation and molasses-based ethanol production plants. In addition, sugar mills can use these funds for sugarcane sector development works, viz., mechanisation of harvesting operations (ISMA, 2012).

4.1.6   Research and extension

The Indian Council of Agricultural Research (ICAR) conducts research on sugarcane and sugar at the national level. State agricultural universities, regional research institutions and state agricultural extension agencies support these efforts at the regional and state levels (Ray, 2012). Apart from these, the governments at different levels also support sugarcane growers by ensuring the availability of credit and other inputs at lower prices.

The GoI also supports and encourages research, development and training of sugarcane farmers and provide incentives for the introduction of new varieties and other improved production technologies to raise sugarcane productivities and improve sugar recovery (Rangarajan, 2012).

4.2   Production-promoting Sugarcane and Sugar Policies in Thailand (2005 – 2010)

The sugar sector in Thailand is regulated under the 1984 Sugar Industry Act (SIA). The Office of Cane and Sugar Board (OCSB), a Government agency is the main decision-maker for the sugar industry. The OCSB comprises of representatives from sugarcane growers, the government and the millers (NaRanong, 2000). Below are discussed the sugarcane and sugar policies undertaken by the government of Thailand during 2005-2010.

4.2.1 Sugarcane price determination

Thailand is a leading sugar exporter and international sugar prices are highly volatile. Big fluctuations in prices affect the profitability of sugarcane crop and income of farmers. Competitiveness of sugarcane crop mainly depends on the sugarcane price which is the main concern of the farmers. The Government of Thailand has therefore introduced a net proceeds sharing system for sugarcane farmers and millers whereby sugarcane growers receive 70 per cent of the revenue from the sales of sugar and molasses and millers get the remaining 30 per cent.

The Government used to announce a sugarcane price before the commencement of the harvesting season and the sugarcane growers receive an initial payment upon delivery of cane to the sugar mill on the basis of the government announced sugarcane price. At the end of the season, *season average price* (SAP) is determined based on formulae (see Equation 4 below). If the SAP turns out to be lower than the forecast price, millers reimburse the difference from the Cane and Sugar Fund (Arjchariyaatong, 2006).

The formulae:

$$P_1 = 0.7 \, (R_1 + R_2) / Q_c \qquad\qquad (4)$$

Where,

P_1 = Season average price of sugarcane, THB/ ton

R_1 = Net proceeds from domestic sugar sale (Gross proceeds minus sale expenses and taxes)

R_2 = Net proceeds from sugar export (Gross proceeds minus sale expenses and taxes)

Q_c = Total sugarcane quantity milled in each season (tons)

Note: Under the net proceed sharing system the growers of the sugarcane crop receive a 70 per cent share of the revenue realised from the sales of sugar and molasses. Hence the weight of 0.7 is used in the formulae.

The Commercial Cane Sugar (CCS) value referred to the total recoverable sugar per cent in the sugarcane. The SAP was based on the standard CCS value announced by the Government. The final sugarcane payment for each farmer depended on the CCS value of their sugarcane and value of the molasses produced from the cane as determined from the formulae below.

$$P_f = P_1 + P_2 * CCS + M \qquad\qquad (5)$$

Where, P_f = Final sugarcane prices per metric ton

P_1 = Sugarcane prices according to Equation 4

P_2 = Rate paid for an additional CCS value

M = Net income proceed from sales of molasses per ton of sugarcane

CCS = Difference between individual farmers' CCS and standard CCS values

Main objective of the sugarcane pricing system in Thailand is to assure fair price to the farmers producing the crop in the country. The CCS value of sugarcane is one of the main factors which determined the sugar recovery of the mill. The sugarcane pricing system in Thailand provided an incentive for the farmers to produce sugarcane with higher CCS values.

4.2.2   Trade regulations and quota system for sugar

Sugar trade in Thailand is controlled by the Government using a quota system. In each season, the OCSB estimates sugar production, internal needs and export commitments and then allocate these quotas to different mills according to the three quotas viz., Quota A, B and C (Arjchariyaatong, 2006). These quotas are discussed below.

Quota A – This quota is concerned with the domestic consumption of refined sugar and is allocated to sugar mills on the basis of their production capacity. Sugar under this quota is mandated to be sold to government-approved wholesalers at the price fixed by the government.

Quota B – This quota concerns long-term contracts. The trade houses store and sell sugar on behalf of the Thailand Cane and Sugar Corporation (TCSC), which has overall responsibility for pricing and selling of raw sugar under this quota.

Quota C – Finally, this quota deals with the exportable surplus. The sugar mills are allowed to sell exportable surplus at their own prices.

Mills must meet the production targets for Quotas A and B before exporting under Quota C.

In Thailand, sugar imports were insignificant due to sufficient availability of domestic supply (Arjchariyaatong, 2006).

4.2.3 Sugar prices

Sugar price in the country is regulated by the government through Quota A. During periods of low sugar prices in the international market, the retail sugar prices in Thailand are usually kept higher than the world prices through imposing taxes on the sugar retail prices (Arjchariyaatong, 2006). This is a policy called subsiding producers by taxing the consumers. The purpose of this policy is to stabilise sugar prices in order to reduce the risk of share decline in domestic production.

4.2.4 Financial supports

The Government helped sugarcane farmers to obtain loans from banks at lower interest rates. The farmers can use these loans for sugarcane production, mechanised harvesting and investment in irrigation facilities (Naranong, 2000). The provisions under Cane and Sugar Fund (CSF) are used to support both farmers and millers during the periods of low returns caused either by low prices and or poor weather conditions. The Government also has a mechanism of supplementing the fund with the revenues earned from the value added taxes as well.

Policies related to sugar sector of Thailand are mainly meant for supporting the sector rather than maintaining competitive and comparable consumer prices. The Thai government's main objective is to ensure an adequate return to the sugarcane farmers and millers (Larson and Borrell, 2001). As Thailand is a leading sugar exporter, its sugarcane and sugar pricing systems helped both growers and millers to stabilise their income against highly volatile sugar prices in international markets (Naranong, 2000).

4.3   Production-promoting Policy Measures in India and their Impact on the Sugarcane and Sugar Sub-sectors (2005 – 2010)

Production-promoting policy measures in India often change depending on the quantity of sugar produced and the situations of surpluses and deficits in the domestic market. According to Lands (2010), the sugarcane area and sugar production quantities in India are driven by policy interventions including sugarcane support price policies set by the central and state governments as well as sugar storage and trade policies set by the GoI. This was evident in the strong relationship between the SMPs for sugarcane and sugar production (Table 4-1).

Table 4-1 Year wise Sugarcane Area, Yield, Production, Sugar Recovery and Production and Policy Measures in India, 2006 - 2010

	2006	2007	2008	2009	2010
Cane area (million hectares)	5.15	5.06	4.40	4.3	4.9
Cane production (million tonnes)	355.5	348.2	285	274.7	305
Sugar production (million tonnes)	28.2	26.3	14.5	18.9	24.4
SMP/FRP for cane (INR/tonne)	803	812	812	1298	1391
Minimum recovery for SMP/FRP (%)	9.0	9.0	9.0	9.5	9.5
Premium for every 0. 1% increase of sugar recovery (INR/tonne)	9.00	9.00	9.00	11.30	11.46
Cane yield (tonnes/hectare)	69	68.8	64.8	63.9	70.1
Sugar recovery (%)	10.2	10.6	10.3	10.3	10.2
Levy sugar obligation (%)	10	10	10	20	10
Levy sugar price (INR/kg)	18	18	18	20	20
Open market sugar price (INR/kg)	11-18	11-14	17-18	30-32	35-39
World sugar price (US$/tonne)	411	334	348	423	594

Note: INR – Indian rupees

Source: Indian Sugar Mills Association (2013), http://www.indiansugar.com/stat

Table 4.1 shows that sugar production in India was relatively higher during 2006 and 2007, which might have resulted in lower local sugar prices during the period. In 2008, total sugar production decreased by 45 per cent compared to 2007. According to the Indian Ministry of Agriculture (2008), this reduction in sugar production may have resulted from non increase of SMP, increased competition from other crops and unfavourable weather conditions.

The low sugar production and higher domestic sugar prices in 2008 resulted in the GoI replacing SMP with FRP in 2009. In order to increase the sugarcane area and making it more competitive, the Government also increased the FRP by 60 per cent in 2009 and further by seven per cent more in 2010. As a result, sugarcane area increased by 11 per cent in 2010 compared to 2008. The Government took various steps to relax restrictions on sugar imports in order to ameliorate the sugar shortage in 2008 and 2009. As discussed in Sub-section 4.1.4 on Sugar Imports, GoI allowed sugar millers to import raw sugar under the a*dvanced license scheme* (ALS). In addition, millers were allowed to import raw sugar at zero duty under an o*pen general license scheme* (OGLS) which had no future export commitments unlike in ALS (Reddy, 2011). OGLS and ALS helped sugar mills to cover their operational costs during the period of low sugar production. Thus, the GoI took timely corrective measures to lessen hardships to sugarcane growers and millers.

4.4 Production-promoting Policy Measures in Thailand and their Impact to Sugarcane and Sugar Sub-sectors (2005 – 2010)

Production-promoting policy measures in Thailand have also changed over time depending on the needs to influence sugarcane area, sugar production and adjust to world sugar prices (Arjchariyaartong, 2006).

Kaewtrakulpong (2007) reported that the Government of Thailand (GoT) set a higher initial price for sugarcane in 2006 (see Table 4-2) because of competition from other crops, namely cassava, palm oil and rubber. This resulted in the *season average price* (SAP) for sugarcane being lower than the initial price announced, and government had to reimburse the additional payment made by the mills through Cane Sugar Fund (CSF). These corrective measures not only encouraged farmers to go for sugarcane cultivation but also protected the sugar millers.

As the SAP became lower compared to the initial price announced for sugarcane in 2006, in 2007 GoT set a lower initial price for sugarcane compared to 2006. The SAP was also low during 2007 due to low world sugar price. Hence, sugar cane area and sugar production went down in 2008.

Table 4-2 Year wise Sugarcane Area, Yield, Production, Sugar Recovery and Production and Policy Measures in Thailand, 2006 - 2010

	2006	2007	2008	2009	2010
Cane area (million hectares)	1.03	1.02	1.0	1.03	1.2
Cane production (million tons)	63.8	73.0	66.5	72	95.7
Sugar production (million tons)	7.0	8.0	7.5	7.7	9.6
Government's forecasted initial price for sugarcane (THB/ton)	820	638	830	965	945
Minimum CCS for SAP (%)	10	10	10	10	10
SAP for cane (THB/ton)	702	672	918	1000	1200
Cane yield (tonne/hectare)	61.6	70.2	66.5	69.9	75.7
Sugar recovery %	10.5	10.6	11.3	10.4	10.1
Retail plantation white sugar price (THB/kg)	16.5	16.5	21.85	21.85	21.85
World sugar price (US$/tonne)	411	334	348	423	594

Note: THB – Thai baht
Sources: OCSB (Thailand), Reports of various years; Licht, World Sugar Year Book 2009; USDA, Reports of various years.

The rising world sugar prices during the period 2008 to 2010 resulted in the GoT to increase initial sugarcane price and SAP. As a result, sugarcane area and sugar production increased by 20 per cent and 28 per cent respectively in 2010 compared to 2008. In contrast to these rising world sugar prices, the Government administered a constant retail sugar price in the domestic market during 2008 to 2010 as an export promotion strategy (USDA, 2012).

In 2010, the Government approved a three-year soft loan of THB 3.0 billion (US$100 million) for sugarcane growers to buy harvesters. This was done to increase

harvesting efficiency and also overcome shortages of labour during the harvesting seasons (USDA, 2012).

4.5 Sugarcane and Sugar Production in Sri Lanka

Sugar industry in Sri Lanka has been in existence for nearly six decades. In its report the Ministry of Plantation Industries (2004) has identified that the sugar industry in Sri Lanka has not realised its potential. This might be due to lack of appropriate policies and organisations to plan, regulate, monitor and promote the development of the industry on a sustainable basis. The discussions examine the policies and conditions of sugarcane and sugar production in Sri Lanka during 1990 to 2012. In this country sugarcane is cultivated mainly by small holder farmers and production of sugar and its by-products is done by sugar mills. Quantitative analysis of factors related to sugar industry is therefore important from the point of view of designing production-promoting sugar policies.

4.5.1 Factors related to sugarcane and sugar production (1990-2012)

The vacuum-pan sugar production in Sri Lanka started in the early 1960's. Since then many structural changes have taken place, which include privatisation of state owned sugar mills, their closures and reopening etc. All the four sugar mills in Sri Lanka namely, *Kantale, Hingurana, Pelwatte and Sevenagala* had a combined daily sugarcane crushing capacity of 7250 TCD. As these mills were functioning below their crushing capacity, two of them, *Kantale* and *Hingurana* were shut down gradually in 1992 and 1997 respectively. The *Pelwatte* and *Sevenagala* mills were

privatised in 2002 and reacquired in 2011. *Hingurana* sugar mill was ultimately recommissioned and made functional in 2012.

Sugar that is marketed in retail shops has two major production components, viz., production of sugarcane as raw material and the production of sugar as the final product. Production of both the components is influenced by many factors. Harvested area and average yield of sugarcane are major factors affecting the sugarcane production, while sugar prices and recovery are the main factors affecting the production of sugar.

Harvested area of sugarcane in Sri Lanka has declined from 13,865ha in 1990 to 8,214ha in 2012 leading to about 41 per cent decrease in crop area over 23 years' period (see Annex IV). The possible reason for this decline was the closure of *Kantale* and *Hingurana* mills due to civil war, changes of management from public to private and again to public sector and the low sugarcane prices. Meanwhile, fluctuations in average yield of the crop may have been due to the changes in sugarcane price, technology, prices of inputs and weather conditions. The average sugarcane yields in Sri Lanka at 51.4 tonne/ha was lower than that in India and Thailand. Averages per hectare yields of sugarcane in these two countries were 67.3 and 68.8 tonnes respectively during 2006 to 2010 (see Table 4-1 and 4-2). The lower yields in Sri Lanka may be due to the poor crop technology and extension advisory services.

In 1990, sugar production in the country was 57,165 tonnes which declined to 36,000 tonnes during 2012, a fall of about 37 per cent (see Annex V). The sugar recovery in Sri Lanka averaged eight per cent in the last ten years (2003 to 2012) compared to

10.3 per cent in India and 10.6 per cent in Thailand (see Tables 4-1 and 4-2). The plausible reasons for the decline in sugar production in Sri Lanka may be partly attributed to lack of production-promoting policies while low sugar recovery may have been due to poor technologies and inefficiencies of sugar mills. However, the retail prices of sugar have increased by an average of 10.55 per cent per year during 1990 to 2012 due to fluctuations in world prices (Annex V).

4.5.2   Sugar production model

Assuming a linear relationship between the variables affecting sugar production, the coefficients of the three models were estimated using the ordinary least squares technique. The best fit was chosen considering the value of R^2, sign of the coefficients estimated as implied by economic theory and the significance of the estimated coefficients.

The calculated Durbin-watson statistics for the three equations were close to two which indicates that the problems of autocorrelation are minimal (Table 4-3). The correlation coefficients estimated for the independent variables indicated that the problem of multicollinearity is low (see Annexes V, VI and VII).

Table 4-3 Coefficients of the Sugar Production Model

Variables	QS_t	QC_t	AC_t
Constant	-30651.71***	-150128.51^{NS}	16819.479***
	(-3.041)	(-0.987)	(1.878)
QC_t	0.085***		
	(21.71)		
R_t	3885.28***		
	(4.126)		
PS_t	-42.952^{NS}	-735.36^{NS}	
	(-0.941)	(-0.747)	
AC_t		31.972***	
		(5.776)	
Y_t		9780.78***	
		(7.401)	
PS_{t-1}			-12.542^{NS}
			(-0.345)
G_t			-965.017^{NS}
			(-1.050)
T	-48.207^{NS}	-7374.23**	-327.124**
	(-0.386)	(-2.53)	(-3.665)
Adjusted R^2	0.988	0.941	0.664
Durbin-Watson statistic	1.758	1.927	1.428

Figures in the parentheses are t statistics
NS Not significant   ** Significant at 5% probability *** Significant at 1% probability

The results of Equation -1 revealed that the quantity of cane crushed and sugar recovery had a positive and significant influence on the quantity of sugar produced. The average sugar recovery was only 85 kgs per tonne of cane crushed and indicated that the mills in Sri Lanka had a poor rate of sugar recovery. This equation was able to explain 98.8 per cent of the total variation of sugar production (R^2 = 0.988). The real retail prices of sugar exhibited a negative though insignificant effect on sugar production (Table 4-3).

As expected, sugarcane area harvested and average yields had positive and significant influence on sugarcane production. Equation-2 affirmed the 94 per cent of the variation of quantity of sugarcane crushed. Meanwhile, except for the trend, other factors in Equation-3, i.e., retail price of sugar and privatisation were not significantly related to sugarcane area harvested. Privatisation indicated a negative effect on sugarcane area, though insignificant. It may be due to the management inefficiencies and farmers negative attitude towards the management of private sector. The interest rate and capacity of mills as variable were dropped from the final analysis as they were found insignificant and their omission was expected to improve the fit of the equation.

Equation-3 accounted for 66 per cent of the variation of sugarcane area harvested. Farmers' decisions were influenced by prices of farm products, competitive crop enterprise, and the input prices.

Negative effects of sugar prices on sugar and sugarcane production indicated that even though their producers have economic opportunities and incentives to invest, but got discouraged due to problems such as monopsony enjoyed by millers, poor infrastructure, technology and extension advisory services.

4.6   Competitiveness of Sugarcane in Growing Areas of Sri Lanka

Sri Lanka has three sugar mills namely, *Pelwatte, Sevenagala* and *Hingurana* which are functional at present. These mills have a total sugarcane crushing capacity of 6,550 TCD. If they operate for 200 days during a year at full capacity, the total

requirement of sugarcane would be 1.3million tonnes. As against it, total amount of sugarcane crushed was only about 0.4million tonnes during 2012 (CBSL, 2012). Inadequate supply of sugarcane was a major constraint for the underperformance of the three sugar mills. Such under utilisation of the crushing capacity has lead to higher unit costs of production of sugar. One plausible solution to the problem is to increase sugarcane availability to sustain the use of the crushing capacity. Sugarcane availability to the mills can be increased either by increasing the sugarcane area or increasing average yields. Since agriculture lands are limited the non-cane grower farmers should be encouraged to cultivate sugarcane. Such a shift in crop pattern would depend on the profitability of sugarcane crop relative to the competing crops.

4.6.1 Profitability of irrigated sugarcane vis-à-vis its competing crops

Sevenagala divisional secretariat area was the main irrigated sugarcane-growing area in Sri Lanka. Table 4-4 compares the profitability of sugarcane cultivation in the irrigated region with the main competing crops viz., paddy and two strains of banana namely, *Ambul* and *Kolikuttu*.

The estimated four-year average total cost of production was maximum for banana and minimum for sugarcane. However, the paddy crop, even with the special provision of fertiliser subsidy and guaranteed prices yielded the lowest net returns. As against it, the *Kolikuttu* banana crop resulted in highest net returns in spite of largest total costs. Thus this crop yielded over 70 per cent more net returns on per hectare basis over the sugarcane crop. Based on returns per Sri Lankan Rupee of expenditure

on purchased inputs the sugarcane crop with a ratio of 2.61 was second only to the *Kolikuttu* banana with a ratio of 2.81.

Table 4-4 Average Costs and Returns from Irrigated Sugarcane and Competing Crops in LKR/ha/yr

Item	Sugarcane	Banana		Paddy
		Ambul	*Kolikuttu*	
Total costs	160147	219748	238628	160850
Gross returns	371000	420000	597750	267400
Net returns	210853	200252	359122	106550
Return/LKR for purchased inputs	2.61	2.08	2.81	1.90

Note: LKR – Sri Lankan rupees

4.6.2 *Profitability of rain-fed sugarcane and competing crops*

In Sri Lanka, more than 70 per cent of the sugarcane cultivation area was in the rain-fed region where its main competing crops were maize and cowpea. In this rain-fed region maize and cowpea were planted only in one season from November to February, due to lower moisture availability in the soil. In the region sugarcane recorded the highest average cost of production at LKR121429. The least cost of production which was less than half of that of sugarcane crop, was for the cowpea crop (Table 4-5).

Table 4-5 Average Costs and Returns from Rain-fed Sugarcane and Competing Crops in LKR/ha/yr

Item	Sugarcane	Maize	Cowpea
Total costs	121429	90550	55200
Gross returns	203000	165000	115500
Net returns	81571	74450	60300
Returns/LKR for purchased inputs	1.89	2.00	2.29

Note: LKR – Sri Lanka rupees

In the rain-fed region sugarcane earned higher gross and net returns of LKR203000 and LKR81571 respectively compared to cowpea and maize. However, as the crop was of long duration farmers have to wait for more than a year to realise returns from sugarcane crop compared to only about four months from maize and cowpea.

Sugarcane recorded a low ratio (1.89) of returns for each LKR invested on purchased inputs compared to the cowpea and maize (2.29 and 2.0). Thus due to lower yields in the rain-fed region the sugarcane was less competitive relative to other short duration crops. However, as major sugarcane-growing areas in Sri Lanka were in the rain-fed region, it would require special effort to help sugarcane to become competitive.

For sugarcane cultivation in the studied area, labour was an important input and formed a major cost component in both irrigated and rain-fed regions. Of the total expenses on hired labour, about 40 to 50 per cent cost was accounted for by the harvesting operation (Annex viii and ix). Any incentive to the growers to opt for

mechanised harvesting of the crop would lower the unit cost of production and thus improve its competitiveness.

4.7   Policies for the Improvement of Sugar Production in Sri Lanka

The governments of India and Thailand have implemented a number of policies that have helped boost up the performance of their sugar sectors. The policies include both sugarcane and sugar production sub-sectors. As mentioned earlier, sugarcane production in Sri Lanka is not competitive under rain-fed condition, which happens to be the major sugarcane growing region. Sugarcane yields and sugar recovery in Sri Lanka are lower compared to India and Thailand. All three sugar mills of the country are being operated under capacity, which has been contributing to higher sugar production costs. The main reason is the inadequate supply of sugarcane. Therefore, government's intervention through production-promoting policies is essential to develop both the sugarcane and sugar sub-sectors in Sri Lanka. In order to increase the sugarcane area and yield, policies should help sugarcane growers to realise remunerative prices for their crop and provide improved technologies and extension advisory services. For the sugar production sector, policies to increase the profitability of sugar production and product diversification would be helpful. In light of Indian and Thai experiences, the following sub-sections discuss the policies which might help to increase sugarcane and sugar production in Sri Lanka.

4.7.1. Regulation and development of the sugar industry

India and Thailand have implemented different Acts to effectively regulate and develop their cane-sugar industry. In Sri Lanka, there is also need to have a policy framework to support, regulate and encourage the development of a vibrant sugar industry. Such a framework should cover wide areas related to sugarcane and sugar sub-sectors like sugarcane cultivation, establishment and management of sugar mills, sugarcane prices and sugar trade.

For the development of its sugar industry, Thailand had established an institute, the OCSB in short, which enjoys regulatory powers as well. Sri Lanka may consider creating a similar institute with advisory roles on following core areas:

i. Regulation of all the aspects of cane-sugar industry such as sugarcane and sugar prices, sugar trade, research and development, establishment and management of sugar mills.

ii. Planning, implementation, monitoring and evaluation of sugar industry development programmes.

iii. Provide the leadership as well as co-ordinate the activities of sugar industry related institutions such as Sugarcane Research Institute, Sugar mills, Ministry of Sugar Industry Development, Ministry of Finance and farmers' organisations.

4.7.2   Remunerative sugarcane and sugar pricing system

Profitability of sugarcane and its competing crops are exhibited in Table 4-5. The table indicates that in the rain-fed region of Sri Lanka, sugarcane is comparatively less

competitive. As price of a produce is an important factor which determine its relative profitability, the prevailing pricing system in Sri Lanka does not represent the price of sugar and its by-products and hence, does not offer incentive to sugarcane producers to produce crop with better sugar contents.

The sugarcane price policy should provide remunerative prices to meet costs of production, as is the case in India, and give due value for the main and by-products. Such prices should also be considerate of the sugar recovery, profitability of other competing crops and trends of costs. Net proceeds sharing system in Thailand may be a good proposal as it provided due share from proceeds of sugar, molasses, a by-product, and motivated growers to produce their crop with higher CCS value. Sri Lanka can also develop its own sugarcane price system for sharing the proceeds with farmers considering the costs of production of both sugarcane crop and of sugar.

Experiences of India and Thailand reveal that in those countries the sugar producers were assured of price support. Any increase in domestic sugar prices, would not only enhance profit of mills but also increase the consumer's expenditure on the commodity. Retail sugar prices in Sri Lanka are directly related to world prices due to higher reliance on imports. Keerthipala (2000) has suggested a variable tax/deficiency payment system for the Sri Lankan sugar industry. Under this system, the variable tax/deficiency payment could be determined based on Minimum Efficiency Price (MEP) level for the domestically produced sugar. Such an MEP would cover the cost of production at the maximum attainable efficiency under local conditions with a margin for profit and risk bearing. The formulae for the estimation of MEP as suggested by Keerthipala (2000), is as under:

MEP = CE * (1+a) / (1+b)

Where, MEP = Minimum Efficiency Price in LKR/tone

CE = Cost of production of sugar at maximum attainable processing efficiency under
     local conditions in LKR/ tonne

a = Normal rate of profit including a risk margin (%)

b = Tax rate on sugar producers (%)

Hence, the sugar price policy as suggested above would improve the local sugar production without much adverse effects on the consumers' budget.

4.7.3   Infrastructure and technological development

The conditions of physical infrastructures, including roads, rails, irrigation facilities etc. are relatively poor in sugarcane-growing areas of Sri Lanka. For increasing sugarcane and sugar production, adequate measures need to be taken for improving the infrastructural conditions. It may not be astonishment that the irrigation facilities in the sugarcane growing areas are almost free for other crops but not for sugarcane. In order to improve the profitability and hence the competitiveness of sugarcane the irrigation water price policy should be uniform for all crops.

Presently, the main focus of the Sugarcane Research Institute of Sri Lanka is on research and technology development for sugarcane production. However, due to lack of financial, physical and trained human resources, the institute has not been able to make significant contributions in the areas of research and technology development in sugar production. Development of sugar-related production technologies would

benefit the industry by reducing the cost of sugar production and improving the sugar recovery of the mills.

The sugar production process results in the production of many by-products like molasses, bagasse, furnace ash, etc. The conversion of these low-value by-products in to high-value products such as ethanol and electricity, etc., would help the sugar mills to earn additional incomes. The Government of Sri Lanka should make available additional funds and resources for conducting research in this area. The sugar industry in the country is also constrained due to the inadequate extension and training facilities. It has also been observed that the poor performance and efforts of relevant ministries and departments responsible for development of the sugar sector in the country lack coordination.

4.7.4   Cane and sugar development fund

Both India and Thailand have created development funds to provide financial support for the improvement of their sugarcane and sugar sub-sectors. Sri Lanka might learn from their experiences. Such a fund may also be used for low-interest loans to the sugar mills so that they can undertake capital intensive investments such as:

i.   Renovation and modernisation of sugar mills to increase their production efficiency and improve sugar recovery.

ii.   Mechanisation of land preparation and harvesting operations of sugarcane crop.

iii. Value addition of by-products such as generation of electric power, production of power alcohol and animal feeds.

In addition, the provisions of tax exemptions for the import of machines and equipments would also facilitate the modernisation of the sugar industry.

The Government of Sri Lanka therefore, should work hand-in-hand with their development partners, research institutions, extension agencies, farmers' associations, the civil society and private sector for the task of increasing sugar production in the country. Likewise, it is not only the issue of producing additional sugar which needed to be dealt with. There should also be measures to enable different industry players particularly the smallholder farmers to get their due share. Thus, the government should endeavour to help small-scale sugarcane producers and sugar millers to realise better returns through appropriate policies that will increase the investments in cane-sugar industry and ultimately increase the sugar production in Sri Lanka.

CHAPTER 5

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

The Government of Sri Lanka has planned to increase the domestic sugar production up to 40 per cent of the domestic demand by the year 2020. This study was undertaken to examine the types of policy instruments the country need to achieve her objective. With this purpose, it reviews the sugarcane and sugar policies pursued by two leading Asian countries- India and Thailand- for the period 2005 to 2010. This was done under the impression that the lessons learnt by these countries might be useful for the Sri Lanka too.

Both India and Thailand have mechanisms to regulate their sugarcane and sugar sub-sectors. Those countries also implement programmes to ensure remunerative prices to their sugarcane growers and also provide financial support to the sugar mills for adopting modernisation.

Sri Lanka may also learn from these experiences and formulate its own policies and programmes to enhance the sugar production.

Sugar industry has two main sub-sectors namely, sugarcane production and production of sugar and its by-products. Many sugar-producing countries implement various production-promoting policies to protect both sugarcane and sugar producers from the market failures.

Even though sugar industry in Sri Lanka has been in existence for nearly six decades, it only produces six per cent of the domestic sugar demand. Meanwhile, the Government's target was to increase sugar production to 40 per cent of the demand by 2020. To meet the target the GoSL has to have a framework of policies. It can also learn from the experiences of both India and Thailand, two major cane-sugar producers of Asia. To promote the development of sugar industry, both India and Thailand have implemented a number of policies. Deep discussions about those policy measures are beyond the scope of this research, but this research has focused on those production-promoting sugar industry policies of India and Thailand, which may be vital for the growth of sugar industry in Sri Lanka.

The general objective of this study was to investigate production-promoting policies of cane-sugar industry in India and Thailand and explore their applicability to Sri Lanka.

As mentioned above, production-promoting cane-sugar policy measures of India and Thailand adopted during the period 2006 to 2010 were studied. Results indicated that both India and Thailand have formulated acts and regulatory bodies to support many aspects of their sugar industry. During 2008 and 2009, India realised low sugar production due to the factors, some of which originated within its economy such as better profitability of competing crops, low sugar prices in domestic market, adverse weather conditions in the sugarcane growing areas, but others which were external and originated in international economy like sugar prices in international markets, etc. However, the country was able to increase its sugar production in the following years of 2010 and 2011 by manipulating the prices of sugarcane and sugar import policy.

This study has attempted to analyse the changes in the factors influencing sugar production in Sri Lanka during 1990-2012 period. In Sri Lanka during the last ten years, the average sugarcane yield and sugar recovery were 55.4 tonne/ha and eight per cent respectively. These averages were relatively low in comparison to those realised by India and Thailand. The low sugarcane yield and sugar recovery in Sri Lanka may be due to the application of poor production technology and extension advisory services. In addition, the sugarcane pricing system in Sri Lanka did not provide incentive for the production of sugarcane crop with higher sugar content.

This research has used regression analysis technique to study the relationship between the factors of sugar production. The results indicated that in Sri Lanka the real retail prices of sugar were insignificant and thus showed no relation with sugar production, sugarcane production and sugarcane area harvested. The economic logic states that the producers respond positively to the higher product prices. But the results of the study indicated that the sugar mills were unable to respond to the higher sugar prices may be due to inadequate availability of sugarcane for crushing.

The results showed that the sugarcane production was more profitable and thus competitive in irrigated region compared to the rain-fed regions. The latter regions were critical for sugarcane production in Sri Lanka as they accounted for more than two third of the crop area. Due to poor yields and higher cost of production the sugarcane crop, compared to other crops, was not competitive in those major sugarcane growing areas. Sugarcane was a labour intensive crop and its harvesting formed an important component of the cost of production. Mechanisation of the harvesting operation would lower the costs. Likewise, helping the sugarcane growers

to realise remunerative prices for their produce would also improve the competitiveness of sugarcane.

This study has following limitations:

i. Only India and Thailand were considered for studying production-promoting sugarcane and sugar policies due to constraints of time, funds, facilities, etc.

ii. The few economic aspects of the selected policies were considered in this study. Those policies may have other implications such as political and social implications.

iii. Profitability analysis of sugarcane in growing areas included only few main competing crops due to constraints of time, funds, etc.

Finally, in light of the results and discussion, the following areas should be considered in formulating the production-promoting sugar industry development policies for Sri Lanka:

i. Formulation of cane-sugar industry development act and a regulatory body to develop and control the sugar industry - it should provide the legal power and mechanism for the government to regulate the industry.

ii. Remunerative sugarcane and sugar pricing systems are needed to attract farmers for sugarcane cultivation and to promote investments in sugar industry.

iii. Infrastructure development in sugar mill areas and technological development in sugarcane and sugar production should be undertaken since most of the sugarcane growing areas have poorly developed infrastructure and there is a slag in developing technology especially for sugar and its by-product.

iv. Establishment of cane and sugar development fund is needed to meet the capital needs for investments in the development activities of the sugar industry.

This research has demonstrated that the under-development of Sri Lankan sugar industry and its underlying causes are complex. For the development of the industry the country can learn from the policy interventions undertaken by India and Thailand to overcome the challenges there. This means that, instead of going for an ad-hoc approach, Sri Lanka has to adopt and implement effective approaches that will involve multiple sectors and a range of different actors. Such an approach with effective planning, coordination and collaboration requires better governance and vision.

REFERENCES

Arjchariyaatong, W., 2006. *The competetiveness of Sugar Industry in Thailand.* Stuttgart, Germany: University of Hohenheim.

Brooks, J., 2010. *Aricultural Policy Choices in Developing Countries.* Paris, France: Organization for Economic Co-operation and Development (OECD).

Cafiero, C., 2003. *Agricultural Policies in Developing Countries.* Damascus, Syria: National Agriculture Policy Centre.

Center for Ageing Research and Development in Irland, 2010. *10 Guide lines for Writing Policy Recommendations.* Forest View, Purdy's Lane, Belfast, Irland: Center for Ageing Research and Development in Irland.

Central Bank of Sri Lanka, 2013. *Annual Report 2012.* Colombo, Sri Lanka: Central Bank of Sri Lanka.

Commonwealth of Australia, 2009. *Pacific Economic Survey Engaging with the World.* Canberra, Australia: Commonwealth of Australia.

Ellis, F., 1992. *Agricultural Policies in Developing Countries*. Great Britain: Cambridge University Press.

Licht, F. O., 2009. *International Sugar and Sweetner Report 2009.* Ratzeburg, Germany: F.O. Licht GMBH.

FAO (Food and Agriculture Organization), 1997. *Proceedings of the FAO/Fiji Asia Pacific Sugar Conference.* Sua, Fiji, 29-31 October 1997. [online]. Available at : http:// www.fao.org/docrep/005/x0513e00.htm. [Accessed Feb 20, 2013].

FAO, 2012. *FAO/Fiji Sugar conference: Impact of Thai Sugar Policy on the World Sugar Economy*. Westin Resort and Spa, Denarau, Fiji, 24-25 August 2012. Rome, Italy: FAO.

FAO, 2012. *Food Outlook.* [online]. Available at : http:// www.fao.org/docrep/014/GL198Ie00.Pdf. [Accessed Feb 20, 2013].

FAO, 2013. *Definition of Policy.* [online]. Available at : http://www.fao.org/wairdocs/ilri/x5547e/x5547e05.htm. [Accessed Feb 20, 2013].

FMA (Financial Management Association)., 2006. *Industrial Organization Theory and Competitiveness of International Banking and Financial Places: Application to the Industry Of Investment Funds*. USA: The Financial Management Association (FMA). [online]. Available at: http://www.fma.org/Siena/DSS/PHDProject.pdf [Accessed May, 2013].

Gadgil, D. R., 2008. *A Sugar Policy for India.* Pune, Maharashtra, India: The Gokhale Institute of Politics and Economics.

Ganewatta, G. and Edwards, G. W., 2000. The Sri Lankan Tea Industry: Economic Issues and Government Policy. In: University of Sydney, *44th Annual Conference of Australian Agricultural and Resources Economic Society.* Sydney, Australia, 23-25 January 2000. Victoria, Australia: School of Business, La Trobe University.

Hathaway, D., and Ingco, M., 1996. *Agricultural Liberalization and the Uruguay Round.* Cambridge: Cambridge University Press.

Indian Sugar Mills Association. (2013). *Sugarcane Control Act, 1966.* [Online] Available at: http://www.indiansugar.com/acts, [Accssed 27 April 2013].

Kaewtrakulpong, K., 2008. *Multi-objective Optimisation for Cost Reduction of Mechanical Sugarcane Harvesting and Transportation in Thailand.* Ph. D. Japan: The University of Tsukuba.

Keerthipala, A. P., 1997. *Sustainability of Small-holder Sugarcane-based Production Systems in Sri Lanka.* Ph. D. Scotland: University of Aberdeen.

Keerthipala, A. P., 2002. Impact of Macro-economic Policies on the Sugar Sector of Sri Lanka. *Sugar Tech ,* Vol 4, pp.87-96.

Keerthipala, A. P., 2007. Sugar Industry of Sri Lanka; Major Issues and Future Directions for Development. *Sugar Tech* , Vol 9, pp.1-10.

Keerthipala, A. P., and Dharmawardhana, N., 1998. *An Ex-factory Sugar Pricing Formula for Sri Lanka.* Udawalwe, Sri Lanka: Economic Publication Series 07, Sugacane Research Institute.

Keerthipala, A. P., and Dharmawardene, N., 2000. *Sugar policies.* Udawalawe, Sri Lanka: Sugarcane Research Institute of Sri Lanka.

Keerthipala, A. P., and Thomson, K. J., 1999. A Cane Payment Formula for Sugarcane Small Holders in Sri Lanka. *Sugar Tech ,* 1 (1&2), pp.1-9.

Kodituwakku, D., and Keerthipala, A. P., 2010. *Shifting Farmers from Sugarcane to Other Crops, Sevenagala, Sri Lanka.* Udawalawe, Sri Lanka: Economic Publication Series 11, Sugarcane Research Institute.

Kodituwakku, D., 2010. Soaring Global Sugar Prices; Causes, and an Opportunity for the Local Sugar Industry Development. *Economic Review, Sri Lanka,* July issue, pp. 23-25.

Landes, M. R., 2010. *Indian Sugar Sector Cycles Down, Poised to Rebound.* United States: Economic Research Service, United States Department of Agriculture (USDA).

Larson, D. F., and Borrell, B., 2001. *Sugar Policy and Reform.* Washington, DC: World Bank Policy Research Working Paper, No. 2602., Development Research Group, World Bank.

London Interational Financial Future and Options Exchange., 2013. *London Daily Prices for Refined Sugar.* [Online] Available at: http://www.investing.com/commodities/london-sugar., [Accessed 28 April 2013].

Ministry of Consumer Affairs Food and Public Distribution., 2013. *Sugarcane Control Ammendment Act 2009.* Department of Food and Public Distribution, [Online] Available at: http://www.dfpd.nic.in/sugarcane., [Accessed 27 April 2013].

Ministry of Finance and Planning, Sri Lanka., 2010. *The Development Policy Frame Work:Emerging Wonder of Asia.* Ministry of Finance and Planning,Government of Sri Lanka, [Online] Available at: http://www.treasury.gov.lk/publications/mahindachintanavision-2010full-eng.pdf., [Accessed 02 May 2013].

Ministry of Plantation Industries, Sri Lanka., 2004. *Workshop on Sugar Sector Policy in to Action: Sri Lanka Sugar Sector Development Policy.* BMICH, Colombo, Sri Lanka, 22 July 2004. Sri Lanka: Ministry of Plantation Industries.

Mitchell, D., 2003. *Sugar Policies: Opportunity for change.* Washington, DC, World Bank: Oxford University Press.

NaRanong, V., 2000. *The Thai Sugar Industry Crisis and Opportunities.* [Online] Available at: http://www.tdri.or.th/archives/download/quarterly/text/s00_2.htm, [Accessed 02 May 2013].

Nott, S., Betz, R., and Schwab, G. (2013). *How to Use Enterprise Budget.* United State of America, Michigan State University. [Online] Available at: http://www.msn.edu/~schwab/enterprise budgetj2000.ppt., [Accessed 15 June 2013].

OECD – FAO (Organization for Economic Co-operation and Development)., 2011. *Agriculture Outlook 2011 - 2020.* OECD - FAO. [Online] Available at: www.oecd.org/dataoecd/52/34/48202074.pdf [Accessed 15 July 2013].

Office of Auditor General., 2003. *A Guide to Policy Development.* Manitoba, Canada: Office of Auditor General, Portage Avenue.

Rangarajan, C., 2012. *Report of the Committee on the Regulation of Sugar Sector in India: The Way Forward.* New Delhi: Economic Advisory Council to Prime Minister, Government of India.

Ray, S., 2012. *Reviewing Performance of Indian Sugar Industry.* West Bengal, India: Dept. of Commerce, University of Culcutta.

Riley, G., 2009. *Protectionism and Barriers to Trade.* [Online] Available at: http://www.tutor2u.net/economics/revision_notes/az_macro_protectionism.html, , [Accessed 15 June 2013].

Spence, D., and Hannah, A. C., 1996. *The International Sugar Trade.* Cambridge, England: Woodhead Publishing Limited.

Stiglitz., 1986. *Economics of Public Sector.* New York: W. W. Norton Company.

Sutcliffe, S., and Court, J., 2006. *Tool Kit forProgressive Policy Makers in Developing Countries.* 111 Westminister Bridge Road, London: Research and Policy in Development Programme.

Trade Protectionism., 2010. [Online] Available at: http://www.economicsonline.co.uk/economics/global_economics/trade_protectionism .html, [Accessed 15 June 2013].

USDA (United States Department of Agriculture)., 2009. *Global Agricultural Information Network.* USDA Foreign Agriculture Service. [Online] Available at: http://gain.fas.usda.gov/Lists/Advanced%20Search/AllItems.aspx , [Accessed 15 June 2013].

USDA., 2009. *Sugar: World Production Supply and Distribution.* United States Department of Agriculture, Foreign Agricultural Services.[Online] Available at: http://usda01.library.cornell.edu/usda/fas/sugar//2010s/2011/sugar-05-23-2011.pdf [Accessed 15 June 2013].

USDA., 2012. *India, Sugar Annual.* USDA Foreign Agricultural Services, Global Agriculture Information Network. [Online] Available at:http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Sugar%20Annual_New%20Delhi_India_4-19-2012.pdf, [Accessed 15 June 2013].

USDA., 2012. *Thailand.* USDA Foreign Agricultural Services, Global Agriculture Information Network. [Online] Available at:http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Sugar%20Semi-annual_Bangkok_Thailand_9-27-2011.pdf, [Accessed 15 June 2013].

USDA., 2012. *Sugar: World Markets and Trade.* USDA Foreign Agricultural Services, Global Agriculture Information Network. [Online] Available at: http://usda01.library.cornell.edu/usda/current/sugar/sugar-09-11-2012.pdf [Accessed 15 June 2013].

Wagner, O. C., 2007. *Impetus, Options and Consequences for Sugar Policy Reform in the United States.* MSc. Virginia, United States of America: Virginia Polytechnic Institute and State university.

Wilcox, A., and Hirschfield, A., 2007. *A Framework for Developing Policy Implications from Research.* United Kingdom: The University of Hudders field.

World Bank., 1998. *World Development Report 1998.* Washington, DC: Oxford University Press.

World Bank., 2008. *World Economic Development Report 2008.* Washington, DC: Oxford University Press.

Glossary

Khandsari **sugar -** A low recovery centrifugal sugar prepared by open-pan
evaporation method.

Gur - A crude non-centrifugal sugar in lump form produced by open-pan evaporation
method. Mostly consumed in rural areas in India for household consumption
and feed use.

Levy sugar – The local sugar mills are required to supply GOI announced percentage
of their production to the government as "levy sugar" at below-market
prices, which the government distributes through the Public
Distribution System (PDS) to its below poverty line population at
subsidised rates.

Commercial Cane Sugar (C.C.S) - The commercial cane sugar (CCS) refers to the
total recoverable sugar percentage in the
cane. This could be calculated by the
following formula:

CCS (tons/ha) = [Yield (tons/ha) x Sugar Recovery (%)] /100

Sugar recovery (%) = [S - 0.4 (B - S)] x 0.73

Where, **S**= Sucrose % in juice and **B**= Corrected Brix (%)

- **Juice Brix:** Juice Brix refers to the total solids content present in the juice
expressed in percentage. Brix includes sugars as well as non-sugars. Brix can
be measured in the field itself in the standing cane crop using a Hand
Refractometer.

- **Juice sucrose or pol per cent:** The juice sucrose percentage is the actual cane sugar present in the juice. It is determined by using a polarimeter, hence sucrose per cent is also referred to as pol per cent. For all practical purposes pol % and sucrose % are synonyms.

Monopoly – A monopoly exists when a specific person or enterprise is the only supplier of a particular commodity. Monopolies are thus characterized by a lack of economic competition to produce the good or service and a lack of viable substitute goods. The verb "monopolize" refers to the process by which a company gains the ability to raise prices or exclude competitors. In economics, a monopoly is a single seller. In law, a monopoly is a business entity that has significant market power, that is, the power to charge high prices. Although monopolies may be big businesses, size is not a characteristic of a monopoly. A small business may still have the power to raise prices in a small industry (or market).

Monopsony - A monopoly is distinguished from a monopsony, in which there is only one buyer of a product or service.

Ratoon crop - Ratoon crop is the new sugarcane which grows from the stubble left behind after harvesting. This enables farmers to harvest several crops from sugarcane before replant.

ANNEXES

Annex I

Questionnaire for the Sugarcane Farmers' Survey in Sri Lanka

QUESTIONNAIRE FOR THE ECONOMIC ASSESSMENT OF SUGARCANE FARMING IN IRRIGATED / RAIN-FED REGIONS

CROPPING YEAR 2011-12

1. **Personal Data**   Sevenagala/ Pelwatte/ Hingurana

    1.1. Name :   Region : Rain-fed/Irrigated

    1.2. Address :   Settler/Out-grower

    1.3. Contact No :   No :

2. **Data Related to Land**

    2.1 Field no :

    2.2 Extent (ha):

    2.3 Crop type : Plant/ Ratoon1/Ratoon2/ Ratoon3/…….

    2.4 Variety:

    2.5 Type of owner ship:

3. Plant/ Ratoon crop Management Data

    3.1 Land preparation

Operation	Tractor cost	Labour units		Cost/unit	Total
		Family	Hired		

3.2 Seed cane

Quantity	Price/ton	Transport costs	Labour for cutting and loading		
			Family	Hired	

3.3 Planting/ Ratooning costs

Labour units		Other costs
Family	Hired	

3.4 Fertiliser application

Item	Amount	Price/50kg bag	Transport costs	Labour units		
				Family	Hired	

3.5 Earthing- up

Number	Labour units		Other costs
	Family	Hired	

3.6 Weeding

Weedicides	Amount	Prices	Sprayer rentals	Labour	
				Family	Hired
Manual weeding					

3.7 Crop care

Item	Input	Amount	Costs	Labour	
				Family	Hired

3.8 Harvesting & loading

Cost(LKR/tonne)	Labour units and costs	
	Family	Hired

3.9 Transport

Cost(LKR/tonne)	Labour units and costs	
	Family	Hired

3.10 Other costs

Land rents	Credit	Interest	

4.0 Revenue from Sugarcane

Production (ton)	Price/ton	Revenue/ha	

Annex II

Questionnaire for the Competing Crops Farmers' Survey in Sri Lanka

QUESTIONNAIRE FOR THE ECONOMIC ASSESSMENT OF COMPETING CROPS IN IRRIGATED AND RAIN-FED REGIONS

CROPPING YEAR 2011-12

(Cost comparision with other competing crops)

1. Personal Data   Sevenagala/Pelwatte

    1.1. Name :   Sector : Rain-fed/Irrigated

    1.2. Address :   Settler/Out-grower

2. Data Related to Land

    Extent :

    Crop type : Banana/ Vegetable/ Paddy/Maize

    Variety:

    Type of owner ship:

3. Crop Management Data

3.1. Land preparation

Operation	Fixed capital services	Labour units		Cost/unit	Total
		Family	Hired		

3.2. Establishment

3.2.1. Planting material

Quantity	Prices	Transport costs	Labour for preparing planting material		
			Family	Hired	

3.2.2. Planting cost

Labour units and costs		Other costs
Family	Hired	

3.3. Fertiliser application

Item	Amount	Price/50kg bag	Transport costs	Labour units and costs		
				Family	Hired	

3.4. Weeding

Weedicides	Amount	prices	Spray rentals	Labour units and costs	
				Family	Hired
Manual weeding					

3.5. Crop care

Item	Input	Amount	Costs	Labour units and costs	
				Family	Hired

3.6. Harvesting & loading

Costs	Labour units and costs	
	Family	Hired

3.7. Threshing & winnowing

Operation	Fixed capital services	Labour units		Cost/unit	Total
		Family	Hired		

3.8. Transport

Costs	Labour units and costs	
	Family	Hired

3.9. Other costs

Land rents	Credit	Interest (%)	

4.0. Revenue

Production	Price/unit	Revenue/ha	

Annex III

Area Harvested and Average Yields of Sugarcane in Sri Lanka during 1990 - 2012

Year	Cane area harvested (hectares)	Average cane yield (tonne/ha)
1990	13865	56
1991	15320	58
1992	14611	49
1993	14687	56
1994	14050	67
1995	13773	67
1996	18042	48
1997	15339	55
1998	13537	54
1999	12758	68
2000	12613	68
2001	10290	55
2002	10000	43
2003	8207	61
2004	11732	56
2005	11310	58
2006	11893	56
2007	7979	48
2008	9071	56
2009	9042	47
2010	8240	50
2011	10266	45
2012	8214	56

Source: Various issues of annual reports of the Central Bank of Sri Lanka and Sri Lanka Sugar Corporation.

Annex IV

**Sugar Mill Capacity, Sugar Production, Sugar Recovery and Retail Sugar Prices
in Sri Lanka during 1990 – 2012**

Year	Mill capacity (TCD)	Sugar production (tonne)	Sugar recovery (%)	Retail sugar price (LKR/kg)
1990	7250	57165	7.5	29.35
1991	7250	66450	7.8	24.59
1992	7750	59710	7.5	25.28
1993	7750	68603	7.8	26.70
1994	6650	72275	8.2	29.35
1995	6650	70568	7.8	31.00
1996	6650	70414	8.0	32.45
1997	6650	63897	8.3	30.27
1998	4550	61549	8.6	30.58
1999	4550	65220	8.7	26.84
2000	4550	64000	8.1	29.86
2001	4550	48000	8.5	37.19
2002	4550	38000	8.8	35.16
2003	4550	57000	8.1	34.27
2004	4550	58000	8.8	37.55
2005	4550	54000	8.2	41.93
2006	4550	56000	8.5	60.20
2007	4550	29000	7.7	54.30
2008	4550	38000	7.3	63.19
2009	4550	32000	7.7	78.61
2010	4550	31000	7.6	93.79
2011	4550	35000	7.9	97.37
2012	6550	36000	8.2	100.63

Note: LKR – Sri Lankan rupees

Sources: Various issues of annual reports of the Central Bank of Sri Lanka and Sri
Lanka Sugar Corporation

Annex V

Results of the Least Square Analysis for Sugar Production Equation

$QS_t = -30651.71 + 0.085QC_t - 42.952PS_t + 3885.28R_t - 48.207T$
Where,

QS_t = Quantity of sugar produced in year t (tonne)
QC_t = Quantity of cane crushed in year t (tonne)
PS_t = Real retail prices of sugar in year t (LKR/kg)
R_t = Average sugar recovery in year t (%)
T = Trend variable and t = 1, 2,……..23 (1990 – 2012)
Subscript 't' denotes year.

Descriptive statistics

	Mean	Std. deviation	N
Sugar production	5.3559E4	14405.03878	23
Sugarcane crushed	6.52E5	166186.809	23
Sugar recovery	8.070	.4374	23
Real sugar price	46.4096	13.87913	23
Trend	12.0000	6.78233	23

Correlations matrix

		Sugar production	Sugarcane crushed	Sugar recovery	Real sugar Price	Trend
Pearson correlation	Sugar production	1.000	.986	.210	.462	-.815
	Sugarcane crushed	.986	1.000	.077	.548	-.848
	Sugar recovery	.210	.077	1.000	-.433	.063
	Real sugar price	.462	.548	-.433	1.000	-.757
	Trend	-.815	-.848	.063	-.757	1.000
Sig. (1-tailed)	Sugar production	.	.000	.169	.013	.000
	Sugarcane crushed	.000	.	.364	.003	.000
	Sugar recovery	.169	.364	.	.019	.388
	Real sugar price	.013	.003	.019	.	.000
	Trend	.000	.000	.388	.000	.

Variables entered and removed

Model	Variables entered	Variables removed	Method
1	Trend, Sugar recovery, Real sugar price, Sugarcane crushed		.Enter

a. All requested variables entered.

b. Dependent Variable: Sugar production

Model	R	R square	Adjusted R square	Durbin-Watson statistic
1	.995[a]	.991	.988	1.758

b. Dependent variable: Sugar production

ANOVA[b]

Model		Sum of squares	Df	Mean square	F	Significance .
1	Regression	4.522E9	4	1.131E9	473.260	.000[a]
	Residual	4.300E7	18	2388810.835		
	Total	4.565E9	22			

a. Predictors: (Constant), Trend, Sugar recovery, Real sugar price, Sugarcane crushed

b. Dependent variable: Sugar production

Model		Unstandardized coefficients		T	Significance
		B value	Std. error		
1	(Constant)	-30651.717	10078.238	-3.041	.007
	Sugarcane crushed	.085	.004	21.710	.000
	Sugar recovery	3885.281	941.674	4.126	.001
	Real sugar price	-42.952	45.663	-.941	.359
	Trend	-48.207	125.031	-.386	.704

a. Dependent variable: Sugar production

Annex VI

Results of Least Square Analysis for Quantity of Sugarcane Crushed Equation

$QC_t = -150128.51 + 31.972AC_t + 9780.78Y_t - 735.36PS_t - 7374.23T$

Where,

QC_t = Quantity of cane crushed in year t (tonne)
AC_t = Cane area harvested in year t (ha)
PS_t = Real retail price of sugar in year t (Rs/kg)
Y_t = Average sugarcane yield in year t (tonnes/ha)
T = Trend variable and t = 1, 2,……..23 (1990 – 2012)
Subscript 't' denotes year.

Descriptive Statistics

	Mean	Std. Deviation	N
Sugarcane crushed	6.52E5	166186.809	23
Sugarcane area harvested	1.1950E4	2809.38723	23
Average sugarcane yield	55.5217	7.22288	23
Real sugar price	46.4096	13.87913	23
Trend	12.0000	6.78233	23

Correlations matrix

		Sugarcane Crushed	Sugarcane area Harvested	Average sugarcane Yield	Real sugar price	Trend
Pearson Correlation	Sugarcane crushed	1.000	.846	.642	.548	-.848
	Sugarcane area harvested	.846	1.000	.223	.636	-.832
	Average sugarcane yield	.642	.223	1.000	.088	-.339
	Real sugar price	.548	.636	.088	1.000	-.757
	Trend	-.848	-.832	-.339	-.757	1.000
Sig. (1-tailed)	Sugarcane crushed	.	.000	.000	.003	.000
	Sugarcane area harvested	.000	.	.154	.001	.000
	Average sugarcane yield	.000	.154	.	.344	.057
	Real sugar price	.003	.001	.344	.	.000
	Trend	.000	.000	.057	.000	.

Variables entered/removed

Model	Variables entered	Variables removed	Method
1	Trend, Average sugarcane yield, Real sugar price, Sugarcane area harvested[a]		.Enter

a. All requested variables entered.

b. Dependent variable: Sugarcane crushed

Model	R	R Square	Adjusted R square	Durbin-Watson statistic
1	.976[a]	.952	.941	1.927

b. Dependent variable: Sugarcane crushed

ANOVA[b]

Model		Sum of squares	Df	Mean square	F	Significance
1	Regression	5.784E11	4	1.446E11	89.224	.000[a]
	Residual	2.917E10	18	1.621E9		
	Total	6.076E11	22			

a. Predictors: (Constant), Trend, Average sugarcane yield, Real sugar price, Sugarcane area harvested

b. Dependent variable: Sugarcane crushed

Model		Unstandardized coefficients		T	Significance
		B value	Std. Error		
1	(Constant)	-150128.510	152097.048	-.987	.337
	Sugarcane area harvested	31.972	5.545	5.766	.000
	Average sugarcane yield	9780.789	1321.505	7.401	.000
	Real sugar price	-735.364	983.968	-.747	.465
	Trend	-7374.227	2914.381	-2.530	.021

a. Dependent variable: Sugarcane crushed

Annex VII

Results of Least Square Analysis for Sugarcane Area Harvested Equation

$AC_t = 16819.479 - 12.542PS_{t-1} - 965.017G_t - 327.124T$

Where,

AC_t = Cane area harvested in year t (ha)
PS_{t-1} = Real retail price of sugar, lagged by one year (LKR/kg)
G_t = Privatisation of sugar mills (Dummy variable privatised (1), government (0))
T = Trend variable and t = 1, 2,……..23 (1990 – 2012)
Subscript 't' denotes year.

Descriptive statistics

	Mean	Std. deviation	N
Sugarcane area harvested	1.1950E4	2809.38723	23
One year lag real sugar price	48.5400	16.44611	23
Privatisation	.35	.487	23
Trend	12.0000	6.78233	23

Correlation matrix

		Sugarcane area harvested	One year lag real sugar price	Pivatisation	Trend
Pearson correlation	Sugarcane area harvested	1.000	.659	-.602	-.832
	One year lag real sugar price	.659	1.000	-.591	-.803
	Privatisation	-.602	-.591	1.000	.606
	Trend	-.832	-.803	.606	1.000
Sig. (1-tailed)	Sugarcane area harvested	.	.000	.001	.000
	One year lag real sugar price	.000	.	.001	.000
	Privatisation	.001	.001	.	.001
	Trend	.000	.000	.001	.

Variables entered/removed[b]

Model	Variables entered	Variables removed	Method
1	Trend, Privatisation, One year lag real sugar price[a]	.	Enter

a. All requested variables entered.

Variables entered/removed[b]

Model	Variables entered	Variables removed	Method
1	Trend, Privatisation, One year lag real sugar price[a]		. Enter

b. Dependent variable: Sugarcane area harvested

Model	R	R Square	Adjusted R Square	Durbin-Watson statistic
1	.842[a]	.709	.664	1.428

b. Dependent variable: Sugarcane area harvested

Model		Sum of squares	F	Significance
1	Regression	1.232E8	15.464	.000[a]
	Residual	5.045E7		
	Total	1.736E8		

Model		Unstandardized coefficients		T	Significance
		B value	Std. Error		
1	(Constant)	16819.479	2673.897	6.290	.000
	One year lag real sugar price	-12.542	36.313	-.345	.734
	Privatisation	-965.017	919.221	-1.050	.307
	Trend	-327.124	89.250	-3.665	.002

a. Dependent variable: Sugarcane area harvested

Annex VIII

Costs and Revenues (LKR/ha) for Sugarcane Cultivation in the Irrigated region of Sri Lanka (Crop management practice wise, plant crop and first ratoon)

Crop Management Practice	Plant crop	Ratoon crop 1
Land preparation	28175	
Seed cane (Planting material)	41650	
Planting/ Ratooning	16505	9950
Fertiliser application	19500	22274
Weed control	24580	14221
Pest and disease control	5200	5200
Irrigation	13500	8500
Harvesting	91375	81090
Interest	7560	1568
Total cost	248045	142803
Gross return	430000	381600
Net return	181955	238797

Note: Ratoon crop is the new sugarcane which grows from the stubble left behind after harvesting.

Annex IX

Costs and Revenues (LKR/ha) for Sugarcane Cultivation in the Rain-fed region of Sri Lanka (Crop management practice wise, plant crop and first ratoon)

Crop Management Practice	Plant crop	Ratoon crop 1
Land preparation	12000	
Seed cane (Planting material)	36000	
Planting/ Ratooning	15750	15240
Fertiliser application	12350	11850
Weed control	25628	20742
Pest and disease control	5625	5625
Harvesting	66000	53550
Interest for credit	1977	1271
Total cost	175330	108278
Gross return	210000	220500
Net return	34670	112222

Note: Ratoon crop is the new sugarcane which grows from the stubble left behind after harvesting.