

CHAPTER - 1

INTRODUCTION AND OVERVIEW

1.1 Objective of the Study:

This thesis presents an analysis of factors affecting the problems of short term price fluctuations and long term growth of Indian Tea Industry with the help of a system dynamics model and recommends policies to overcome them. The system dynamics model is supported by group opinion precollected through a Delphi study and by systematic sensitivity testing. The other important feature of the thesis is the development of DYMO-SIM, a Fortran based software package, to simulate the system dynamics models.

1.2 Problems of Commodity Industries:

It is well known that commodities play a very significant role in the economy of any less developed country. They usually provide chief sources of export earning and thus greatly alleviate the balance of payment problems commonly faced by these countries now-a-days due to their ambitious development schemes which are mostly based on foreign assistance. However, management of commodity industries provides unique challenges, primarily stemming from fluctuation of their prices in the market.

Although, in a perfectly competitive situation, commodity price fluctuation is the result of direct interaction of supply and demand, the factors affecting supply and demand of commodities are very diverse and interconnected

in time. For example, supply of commodities may be affected by short term phenomena such as available inventory, order backlog and price expectation; medium term phenomena such as various productivity improvement measures controlled by liquidity position of the industry leading to budget allocation; and long term phenomena such as capital investment which, in turn, is influenced by profitability, long term debt facility and the hope for the existence of an assured future market. Supply is also affected, either directly or indirectly, by government's intervention in the form of taxes, duties, development subsidies and various types of ceilings to protect the weaker sections of the economy. Demand for commodities reflected at the producer's level is usually affected by the customer's inventory level, his price expectation and the order backlog (in case of an intermediate customer in a distribution channel), etc. In addition, any primary commodity industry is also greatly susceptible to developments such as change in consumption pattern due to substitution by other commodities, new competitors adding massive supply to the market, or afflicted supply position due to natural calamities, etc.

The above discussion clearly indicates an inevitable price fluctuation of the commodity leading to unstable revenue accrual to the industry resulting in a strain on the management for planning capital investment for long term growth. Many developing countries have been conspicuous for their loathsome way of commodity industry management which has accentuated price destabilization and impeded the industry's growth. Thus,

management of any commodity industry presents a very delicate problem of capacity augmenting investment planning for long term growth in the face of continuing income fluctuations resulting from commodity price instability.

Commodity price stabilization has been a very alluring field of investigation for the economists for many decades in the past. The Cobweb model by Ezekiel (1) and its various ramifications (Akerman (2), Nerlove (3)) indicate the lead the economists have taken in realizing this important problem and in offering geometrical and mathematical models to explain price instability. However, the assumptions underlying the Cobweb models have been criticised for their simplicity and inability to reflect realism (Weymar (4), Meadows (5)). Weymar (4) was unique in using the traditional econometric modelling on the setting of dynamic feedback loop mechanisms for explaining monthly price fluctuations of cocoa in the world market. However, the emphasis on price elasticities of supply and demand by Weymar (4), or, for that matter, by other economists on price theory literature, has been criticized by Meadows (5) as being misplaced since 'the precise values of these elasticities are relatively unimportant in choosing among stabilization policies.' Again, Weymar (4) does not consider the effect of either production or capacity acquisitions additional to the existing productive facilities nor tests any stabilization policy. Meadows (5) presented for the first time a general dynamic commodity model with which he successfully tested the hog, chicken, and cattle systems for

U.S.A. This work had the focus on a unifying methodology to explain price fluctuations rather than on making specific recommendations and has inspired the author most to inquire into a specific commodity industry in great detail. The author, however, is unaware of any literature which investigates into the long term growth aspect of a commodity industry which is beset with wide price fluctuations. In this context, therefore, the work reported in this thesis may be considered as quite useful.

Keeping the objectives of the presentation in view and in the light of observations on management of commodity prices and growth in commodity industries, an overview of the performance of Indian Tea Industry here, will not be out of place.

1.3 Importance of Tea Industry in Indian Economy:

The importance of tea industry in Indian economy can not be overemphasized. This agro-based industry is employment intensive and export oriented. It employs nearly 400,000 men and 400,000 women, providing women of India with their single biggest organized employment avenue, and contributes to the welfare of less developed regions and classes. Indirectly it provides employment to nearly 1 million people. In 1977-78 tea contributed nearly Rs. 900 crores to GNP, including the foreign exchange earnings of Rs. 560 crores. Besides, the industry contributes to the national exchequer by way of paying substantial central and state taxes, excise duty, and cess. The tea industry also helps growth of several other industries in



the country. The tea industry consumes considerable amount of fertilizers and manures, pesticide, insecticide, weedicide etc. thus creating demands for these products of chemical industries. It is also a bulk user of plywood for packing purposes, which has helped the plywood industry grow alongwith the tea industry. The huge quantity of tea produced in the remote interior areas requires transportation facilities not only to carry the produce from the gardens to the auction market but also for its distribution till it reaches the final consumers. The industry uses all modes of transportation, viz. road, railways, waterways, and airways. While contributing thus to the national economy, the industry provides the common man with a pleasant, non-alcoholic beverage at a very cheap price.

The Indian tea industry enjoys a few distinctions in the world tea scene. India is the largest producer, consumer, and exporter of tea (production and consumption data for China are not available). She has the largest area under tea cultivation and has the distinction of achieving the highest yield per hectare of plantation. From quality point of view the flavour of Darjeeling tea and the liquor from Assam second flush are unique in the world. Indian tea industry has the honour of establishing new facts and developing new technology for the efficient operation of the tea industry as a whole.

The Indian tea industry, inevitably, plays an important role in the world tea scene as well. Variations in export quota of tea, delay in arrival of Indian tea at the foreign market, or even speculation about changes in Indian supply to the world

market often creates major imbalance in the world tea market. Considering India's leading position in the world tea industry, it is quite likely that any change in policy decisions in Indian tea industry will affect the world tea scene.

1.4 Challenges Faced by the Industry:

The past performance and distinctions notwithstanding, the industry now faces certain disturbing recent trends. The central problem is to meet the future demand in a manner which will ensure the industry remunerative prices, while at the same time the vast domestic consumers can get quality tea at a reasonable price. Besides, the export market has also to be maintained, if not expanded. Though the Indian tea production is growing at a very fast rate, the domestic market is growing even at a faster rate. Compared to the tea consumption of around 150 million Kg. in 1964, the consumption went up to around 300 million Kg. in 1977. This rising trend in the domestic consumption has affected the export of tea and subsequently the foreign exchange earning.

Under these circumstances it is imperative that suitable strategies be formulated to meet the challenges in a planned way. Formulation of any effective strategies demands futuristic thinking, and analytical projections followed by rigorous planning. It, therefore, needs deep understanding of the system, its components, the interacting forces, and the environment. This calls for a long-term dynamic planning which will take into account the time-varying behaviour of the industry and its environment. In addition to the understanding and planning

of the overall system growth, it is also essential to study the intrinsic short-term behaviour of the system or system components. Before taking up any long term plan for growth it is required to identify the inherent problems of the system and to see their effects on the system performance.

The Indian tea industry, like all commodity industries, is experiencing a major problem in the form of price fluctuations. In the past tea prices have shown two types of fluctuations - (a) short-term fluctuation with a periodicity of one year, possibly due to the harvesting pattern, and (b) long-term fluctuation with a periodicity of around 7-10 years (Roy (6)), possibly due to new plantations which take around 5 years to have considerable yield per bush. However, this thesis focuses on the short-term price fluctuations and its impact on the overall growth of the industry. Hence, hereafter "price fluctuations" would mean "short-term price fluctuation" and the words "short-term" will be dropped. Fig. 1.1 shows the fluctuation of average monthly price of tea at Calcutta Auction for the years 1971 to 1973. It is clear from the figure that the price comes down to the rock-bottom level in the month of March each year and reaches the peak level in the month of July each year. It is worth mentioning at this point that, on the contrary, the production is at the peak from middle of July through end of September, and is at the trough from November through February each year.

This thesis is particularly concerned with the development of strategies for a planned growth of the Tea Industry with the help of a system dynamics model while explaining the

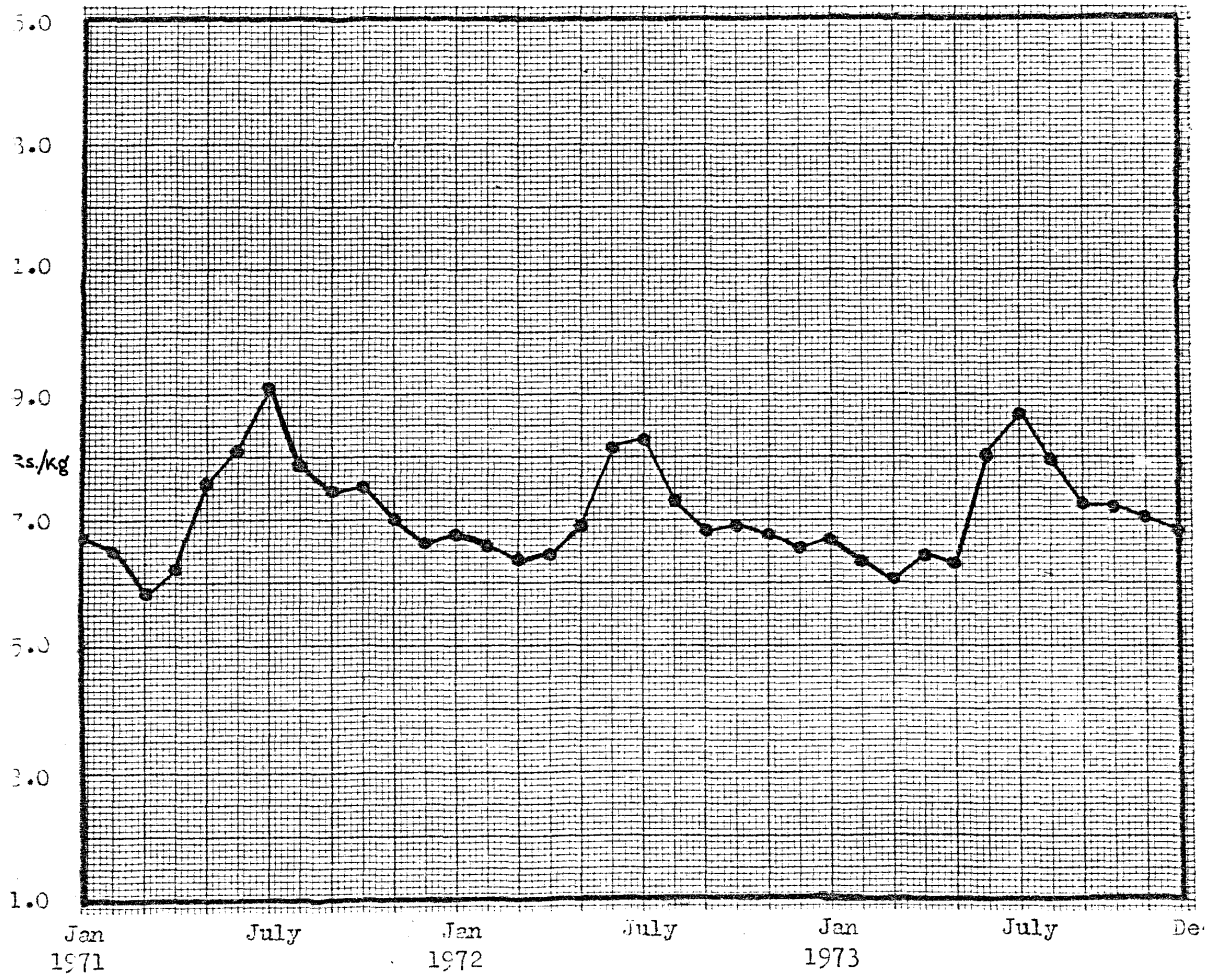


Fig.1.1 Monthly Price Fluctuation of Tea (Rs/Kg.) at Calcutta Auction

Source : Tea Statistics, J. Thomas & Co., 1974 - 75 Issue.

underlying causes of the price fluctuations and suggesting policies for its stabilization. An overview of the contents of the various chapters of the thesis is presented in the following section.

1.5 An Overview of the Thesis:

In Chapter 1 the importance of commodity industries in the economy of less developed countries in general and of Tea Industry in the India's economy in particular has been emphasized. Planning long term investment in the face of revenue fluctuation resulting from price instability has been shown to be a very important problem in this industry.

Chapter 2 highlights the past performance of Indian Tea Industry and discusses in brief the factors affecting its performance. A short review of reported studies on the industry is also given in this chapter.

Chapter 3 outlines a general discussion in defence of System Dynamics as the methodology to investigate into the problems of Indian Tea Industry. It then presents the essential features of SD very briefly. It also highlights the general characteristics of a Delphi exercise which can help in accessing group opinion and consensus on various issues related to the study and in building the model with greater relevance to the actual system. Lastly, it introduces DYMOSIM, a Fortran based software package, which is developed by the author for simulating SD models.

Chapter 4 discusses the characteristics of the DYMOSIM

software package and provides guidelines to use it. Various subprograms of the package are also discussed. The advantages and shortcomings of this package relative to other popular compilers are also indicated. Provision of obtaining utility statistics of table and limiting functions is shown to be a beautiful feature of the package.

Chapter 5 presents the results of the Delphi study on Indian Tea Industry. Issues raised, the responses and numerical scores provided by the panelists are discussed in great detail. Statements are ranked with the help of statistical hypothesis testing conducted in sequence. The chapter ends with a discussion on use of a Delphi study on building up of a system dynamics model.

Chapter 6 presents in detail the structure of the basic system dynamics model which is divided into four major sectors, each sector being further sub-divided into subsectors. Discussion on each subsector comprises of background description followed up by relevant submodel structure containing important model equations, aggregative influence diagram and a detailed analogue representation.

Chapter 7 analyses the model and gives the results of extensive model validation and sensitivity tests. Emphasis is put on sector-wise as well as on full model validation. Various validation criteria are discussed. Sensitivity tests are carried out for variation in parameter values, table functions, initial values, input variables, structural connections, and computational parameter value.

Chapter 8 discusses the merits of various price stabilisation and investment policies for long term growth. Each policy and combination of policies are tested for two cases, viz.

(i) when the present pattern continues to prevail in the future, and (ii) when certain unforeseen developments anticipated by Delphi panelists occur in the future. It is shown that creation of buffer stock at auction centres coupled with long term investment planning based on future projection of factors like demand and yield, and on average profit margin is likely to satisfy the dual objectives of price stability and viable long term growth.

Chapter 9 gives a summary of the investigation carried out in this thesis. The scope for future work is also discussed.

The thesis ends with a set of appendices.

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