CHAPTER I

INTRODUCTION

1.1 Background

Every organisation such as business, education, military, hospitals and so on, is tending towards improvement of its structure and activities by emulation of modern management principles and techniques. This is more so relevant in organised sector of industries. The agromachinery industries unlike the automobile, machine-tool and consumer-goods industries are struggling as a neglected group for their existence. The small scale industries receive less importance from government agencies and other research institutions in comparison to large and medium scale industries. Further the little-known small scale agromachinery industries get still lesser importance in comparison to other small scale industries. But the potentialities of this category can not be undermined. The farm machinery directory (ISAE, 1978) lists nearly 1500 agromachinery industries in India. Singh and Ojha (1986) place the figure around 8000, which includes tiny industries too, besides a million of artisan level industries in country side. Basically as an agrarian country, the Indian economy is based on agricultural industries such as production and processing of crop and the production of various inputs to agriculture like implements, seeds, fertilizer, and pesticides. Agricultural implements, and equipment used in crop production, processing, handling and transportation form an important component of machanised agriculture and thus the agromachinery industries have an important role in the present and future Indian economy.

There are several aspects in which improvement may be possible, namely production, financial, marketing, sale, credit facilities and so on for the overall improvement of the status of agromachinery industries. This dissertation considers some aspects of production planning only. The following sections describe the

present status of agromachinery industries to get a better insight into their problems.

1.2 Present Status of Indian Agromachinery Industries

Das (1985) has described the present status of agromachinery industries in India, which can be highlighted in the following sections.

1.2.1 Historical Growth

The history of growth of agromachinery industries is connected with the development of implements as well as the industrial revolution in India. Small hand tools had been developed when agriculture became the maiden industry of the civilisation. The material of construction changed from primitive stone to wood, and metal. Village artisans made them in their small forging and carpentry shops. Industrial revolution brought a revolutionary change in fabrication techniques, yet the status of artisan level industry remains unchanged. By the turn of the century, Kirloskar brothers started production of animal drawn steel plough (imported). Metal foundries, forging and machine shops also started in Calcutta and Bombay at the same time to cater to the needs of textile, jute and other big industries but the situation with agromachinery did not improve. There were some improvements in post-independence period when emphasis on industrialisation was laid in the first five-year plan programme. As agroimplements became popular in agriculture, some industries started their production in a small way. The peripheral industries like those manufacturing tractors, power tillers, irrigation pumps, power sprayers, levellers, and earth moving equipments grew healthily whereas the core industries catering the direct needs in crop production remained neglected. This may be due to the scale of production and a poor market for quality and costly implements.

As a followup of the recommendations of the Royal Commission on agriculture in 1922 and those of the National Commission on agriculture, the Government of India sponsored in sixties and early

seventies one agroindustrial development corporation in every state to meet the growing demands of agricultural inputs that included quality agroimplements too. This was the first national level effort towards planned growth of agromachinery industries. The state agroindustrial development corporations carry out processing of food materials, as well as production of implements through their plants established at strategic locations, and their marketing. Small firms provide subcontracting services to these agroindustries. The first official survey was conducted in 1967 by a panel of experts on agricultural implements setup by the ministry of industrial development to study the status of agromachinery industries. Two decades have passed since then, there has been no such official survey again.

1.2.2 Classification

Harris (1982) has divided the agromachinery industries in two broad categories based on their nature of services rendered to agriculture. The large and medium scale industries manufacturing equipments that have no direct relationship with crop production are called peripheral agromachinery industries. The second category called core industries provides implements that are directly used in crop production, harvesting and threshing.

Another classification of agromachinery industries is based on economical consideration. Though every state follows a different norm, the differences among these norms are marginal. As for example, the state of Madhya Pradesh makes the following general classification of industries based on the financial investments on plants and machinery.

Class of industry	Financial limit, rupees
Tiny industry	< 0.2 million
Small scale industry	0.2 to 3.5 million
Ancillary industry	3.5 to 4.5 million
Medium scale industry	4.5 to 50 million
Large scale industry	> 50 million

According to this classification, the tiny sector includes most of the so-called service industries, repair shops, cottage

industries and village artisans. And these are described as petty production units and exist both in workshops characterised by detail work and specialised skill and in artisan shops characterised by craft-work and composite skills (Bademli, 1977). It may not be exaggerated to extend Marx view of calling these industries as nonfactory production (man-u-facture) in which production is the output of labour cooperation principally. Only the small scale and upper strata of core industries are registered with the directorate of industry and commerce. It is the industry in tiny sector, that is mostly not registered. The owners of registered core agromachinery industries are generally professional industrialists whereas those of tiny sector core industries are artisans, agriculturalists, or non-professionals. The tiny sector industries exist all over the country in all the three forms of subcontracting, tied subcontracting and job work industries.

1.2.3 Characteristic Features

Harris (1982) has listed the structural and operational features of lower forms of production, which equally hold good for the tiny sector core industries to a great extent as well as the small scale units to some extent.

The structural features are as follows :

1. A majority of industries are owned by a single person or by a single household. Some of these factories employ workers between ten and twenty on daily wage basis.

2. The small scale units registered with the directorate of industries are mostly started by professionals or persons with managerial or business background or acumen. On the other hand units not registered are possibly started by workers or artisans. Generally units belonging to the managerial or professional people are often side businesses.

The technical features that deserve mention are :

1. Demands of agromachinery are mostly seasonal in nature. The volume - variety ratio is small. Delivery lead time is small. Both forms

of production, namely, to order and to stock are in practice. In some parts of the country subcontractor uses the production facilities and his men and manufactures farm machinery in the premises of the factory owner.

2. Flexible workers and general purpose machines turn out production in job-shop. The workers are self-made or are trained by the subcontractor. Labour-intensive outdated fabrication techniques, obsolete machines, improper shed, and layout of machines and facilities are some of the common features of these industries. Scientific production planning is not a practice at present. Concepts of methods engineering, value engineering and industrial management are of little concern to the owner as well as to the contractor.

3. Specimen or prototype model is used instead of assembly drawings. Fits and tolerances get little consideration. Concepts of accuracy, precisionship, quality control and interchangeability are followed in a limited factories only. Repeated machining, drilling, hammering, filing and grinding make the machine structurally weak and aesthetically displeasing in appearance and sometimes poor performing (Singh et al., 1978).

1.2.4 Problems

The problems outlined by Ansari (1973) in respect of small scale industries relate to finance, standard raw materials, production management, machinery and equipment, factory space, quality and cost standards, marketing, etc. By a careful observation, these problems can be found common to agromachinery industries too.

1. The credit flow is insufficient to the increasing needs of agromachinery industries especially in small scale sector.

2. Discrimination in supply of raw materials as well as price anomaly exist between the small scale and large scale units. Small units seldom get their quota and therefore depend heavily on local market.

3. Wide spread prevalence of obsolescence of machinery and equipment and outdated techniques of production result in greater wastage, higher production cost, and substandard quality of products. Formalised production planning is almost absent.

4. Technical and management consultancy services available from the handful of consultancy firms are not adequate. For example, there are six firms for agroindustries (ISAE, 1978) and one unit of Small Industries Research Institute (under control of Development Commissioner, Small Scale Industries) in each state.

5. Though there does exist almost a seller's market for agro-machinery products, a strong marketing network might further strengthen the production - distribution system. This would create an awareness for modernisation of agromachinery enterprises.

The additional problems raised by Patwardhan (1978) in respect of the poor performance and stagnation of small units can be summarised as :

(i) desire of agromachinery units to go in for cheap and second-hand machines ;

(ii) lack of technical skill ;

(iii) absence of price and production controls ;

(iv) lack of research and development infrastructure ;

(v) shortage of working capital and delay in bank loan ; and

(vi) lack of management proficiency on the whole and in production planning in particular.

The present status of agromachinery industries in areas of standardisation, quality control, research and development and marketing are also briefly summarised below :

(a) Standardisation

As a basic principle of industrial engineering, standardisation means a procedure to set norms to perform a task. In agroindustrial production, standardisation can be applied to products, parts, processes, raw materials and tools. Although the agricultural machinery and tractor committee of the Indian Standards Institution (ISI) has been working since 1959, the handful of standards developed till now are confined to agromachinery products

only and none of standard designs of plants and factory layout to take care of dynamic situation of product demand, machinery obsolescence and product diversification. Techniques of work simplification, value engineering and methods engineering can equally be introduced in standardising methods, process routes, machines and job design in order to improve working environment, product quality as well as productivity.

(b) Quality control

Inspection at none of the stages of production from raw material procurement to packing of finished product is at all done. Neither inspection gauges and tools, and quality control personnel have been considered important nor are the industries enterprising to bear such burden. These industries are neither keen to consult the existing advisory services on quality control and testing of their products nor prepared to cover their products under ISI quality certification.

(c) Research and Development

The agromachinery units depend for their products mostly on the research institutes and imported prototypes. Although there does exist an endeavour to modify their products, yet the approach is slow, unscientific and unorganised. The little R and D activity that exists is only an eye-wash to take advantage of monetary relief.

(d) Marketing

The marketing of finished goods is highly localised and unorganised. Market competition is not so tough. The marketing network is absent. Sales promotion technique is yet to catch up with these industries. Buying of implements is presently done through bank loan and therefore the sincerity to buy quality product lacks in farmers.

Agromachinery industries are, on the whole, lagging far behind their contemporary industries. There is a need to revolutionise the agromachinery industry system in all areas of industrial activities, right from financing, material availability, material procurement

policy, production planning, quality control, pricing policy, market development policy, research and development to distribution so that these units could be better organised, made more productive and profit making and improve their ability to deliver quality products. The country expects a lot from these units in accomplishing the national agromechanisation objectives in the coming decades.

1.3 Present Study

One can see the production problem of the agromachinery industries from the management point of view. Of the total spectrum of production management function, it is worthwhile to concentrate, to begin with, on some aspects of production planning for efficient management of men, materials, machines, and money (Hitomi, 1979, p.25). As for instance , the intermediate range production planning is the operational level planning that translates the medium range corporate goals into a monthly production programme (aggregate production plan) and then disaggregates the aggregate decision into the master schedule. It is this master schedule which specifies the production plan of the individual products and their optimal production quantities during the current month. The master schedule is converted further into weekly, daily and hourly schedules.

For the production plan, the production planning activity interacts with the marketing and production functions because without the knowledge of the demand of the current month, the present inventory position, workforce level, machine capacity and cost components associated with production and inventory, an optimum decision about the aggregate plan is not feasible. Further decisions such as production breakups like regular, incentive, overtime and subcontract production are made on the basis of the production plan.

The machine component grouping into cells, group flow line and group layout are the corporate decisions taken once in five to ten years depending upon their redundancy. An appropriate grouping followed by an efficient group layout is a necessary material flow line system to ensure the effective execution of the

master schedule. The problems of agromachinery industries in India discussed in this dissertation consist of the following :

1. Development of a simple technique that can estimate the conversion factors of product types in a situation of multi-item production, limited data availability and the inability of the enterprise to bear the cost of qualified and trained time-study personnel. This conversion factor is essential in aggregate production planning model for product aggregation.

2. Development of an integrated extrapolative technique for time-series analysis of product sales to estimate forecasts for use in aggregate production planning model.

3. Development of an aggregate production planning model that can be suitable to seasonal multi-item discrete-product system without consideration of a specific cost structure.

4. Development of a simple computer-based technique for cell formation in group technology with the minimum intercell flow.

Specific care is required to be taken in developing these techniques so that these techniques can be applied to real-life problems of small scale agromachinery industries.

5. Application of these techniques as a system to agromachinery industries.

1.4 Relevance of the Research Topic

It is seen in the foregoing sections that the problems and requirements of agromachinery industries are different from those of other categories of industries for which large number of forecasting and production planning models have been especially designed. Some aspects of production planning problem of these industries need to be solved in a manner such that the management will be willing to execute these techniques to their advantage with the least pains to understand them because the decisions which an experienced planner usually makes while using a model have all

been built into the system. As a matter of convenience, the forecasting method can be coupled with the aggregate production planning technique so that the task can be further simplified, but often the management would like to impinge his judgment on the quantitative forecasts. The technique of machine component group formation, on the other hand, also implies its relevance to the group technology oriented production in conventional job-shop type agromachinery industries for higher labour and machine productivity. On the whole, the entire research topic is a unified approach to the solution of some aspects of production planning problem of the typical class of agromachinery industries.

1.5 Objectives of the Research Work

Although the objectives of the research work has broadly become obvious in the previous sections, yet their crystallisation is intended to increase the understanding further. The objectives are an essential outgrowth of a systematic solution methodology of the problems of agromachinery industries, which are given as follows :

1. Of all facets of problems of an agromachinery industry, productivity and quality are the burning issues in production. Productivity can be improved by introducing production planning techniques. Since the characteristics of these industries are of a totally different nature, the existing models can not be directly applied. The first and foremost objective of this research work is, therefore, to develop a unified production planning model to solve the problem of low productivity and quality of products.

2. To develop these models in a way that will facilitate its adoption to the practical advantages of small scale agromachinery industries even in absence of such planning infrastructure and expertise on the part of the management.

1.6 Outline of the Thesis

This dissertation consists of nine chapters which have been organised in the manner outlined below.

Chapter I introduces the complete dissertation, starting with its background, present status of the typical class of small scale agromachinery industries, their multifaceted problems with special emphasis on their production and productivity, scope and objectives of the research work.

Chapter II presents a review of the research work done in the area of forecasting, the various approaches of forecasting with special emphasis on time-series analysis methods, criteria of consideration of accuracy, forecasting horizon, data requirement and type and the relevance of forecasting in production planning.

Chapter III presents a review of the published literature in the domain of production planning and the various techniques with special emphasis on aggregate production planning.

Chapter IV is devoted to the review of published literature in the realm of group technology starting with its historical background and the various approaches of cell formation with a comparative study of their benefits and limitations.

Chapter V proposes a simple technique of estimating conversion factors of products from the historical data of production and workforce to be suitable in a situation where the organisation can not afford to engage full-time time-study staff (Das et al., 1986). Its use in the model of aggregate production planning and master scheduling proposed in Chapter VII is emphasised.

Chapter VI proposes an integrated extrapolative forecasting method based on a combinatorial approach of exponential smoothing and stationary ARMA methods with an emphasis to its applicability to sales forecasting of a large number of patterns.

Chapter VII proposes an aggregate production planning technique designed especially to be suitable to small scale agromachinery industries manufacturing seasonal products based on the combinatorial approach of the linear decision rule of Holt et al. (1960) and the management coefficients model of

Bowman (1963) with disregard to a cost structure. It also illustrates through a real-life case study on a small scale agromachinery industry the application of the techniques proposed so far in Chapters V, VI, and in Chapter VII itself.

Chapter VIII proposes a machine component group formation technique (Das et al., 1985) on computer-based algorithm so that a moderate size of problem of an agromachinery industry can be solved with the minimum decomposition of machines. It also presents a real-life case study of cell formation of an agromachinery industry comprising of 26 components and 39 machines.

Chapter IX presents a summary of the research work covered in this dissertation and highlights the findings and the implementation potentialities to the typical class of agromachinery industries. This chapter concludes with a list of recommendations to be carried out in furtherance of the present work.