CHAPTER -7

SUMMARY AND SUGGESTIONS

An earnest attempt is made in this chapter to present a summary of conclusions arrived at and to make suggestions to improve the profitability performance of sample mills. In addition, issues for further research in future are indicated.

1.0   Summary of Findings

1.1   Cotton textile spinning mills

Cotton textile industry is one of the oldest and premier organized large scale industries of India. It is one of the most important sectors in   the Indian economy in terms of output, employment creation, income generation, economic value added and foreign exchange earnings. The first cotton textile mill was set up in Kolkata in 1880. There are 1100 mills with 28 million spindles and 2 lakh looms in the country. The cotton textile industry comprises ginning, spinning, wearing, finishing and   apparel-making units. There were 1566 spinning and 223

composite mills. Private sector accounts for a lion's share in the industry. Among the states and union territories in the country, Tamil Nadu ranks firsts in terms of number of mills. The capacity utilization in spinning is 87 per cent while 86 per cent in weaving. Of the total production, yam accounts for a major share. In the case of production of cloth, decentralized sector accounts for a major share. There is a significant growth in the per capita availability of cloth and man-made fibres. In the global exports, the proportion of India varies between 2 per cent and 4 per cent while in clothes 2-3 per cent.

Cotton textile industry occupies a pivotal place in the industrial economy of Andhra Pradesh. The first cotton textile mill was established in East Gadavari district. In A.P, during 2006, there were 101 spinning mills with 21.58 lakh spindles and one composite mill with 520 looms. There are regional variations in the distribution of mills in the state. The mills are confronted with a number of problems like sickness, competition from synthetic fibres, low profitability, power shortage, inadequate funds, heavy excise duty etc.

1.2 Paper mills

Paper industry is one of the key and major industries of India. This industry is vital for social, cultural, educational and economic development of a country. The process of manufacture is carried out in a sequence of operations. Different varieties of paper such as printing, writing, card board, wrapping, packing are manufactured. The first paper mill was set up in Kashmir in 1417 A.D. With a rapid demand, it spread over to different parts of the country. It was accorded "core"

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sector status since paper is categorical as an essential commodity. The industry passed through ups and downs over its long history. In India, during 2005, there were 667 paper mills with an installed capacity of 76 lakh tonnes. The capacity utilization was 76.16 per cent. The per capita consumption of paper in the country during 2005 was 5.50 kgs as against 332 kgs in US. There are variations in the number of mills across the regions in the country.

Paper industry is one of the oldest and major industries of A.P. The first paper mill was established at Rajamundry in 1924. Under factor sector, there were 46 factories in the state. Among the regions in the state, Coastal Andhra accounts for 26 mills followed by Telangana (16) and Rayalaseema (4). Of the districts in the state, East Godavari ranks first (13) and absent in Anantapur and Kadapa districts. The paper mills face a number of problems such as shortage of capital, insufficient materials, poor capacity utilization, power-cuts, non-availability of skilled-labour, modernization, pollution, low-profitability etc. There is a bright future for paper industry in the years to come.

1.3 Research design and methodology

There are many studies concerning cotton textile and paper industries at the macro and micro levels in the nation. The studies have focused on history, location, size, structure, trend in progress, industrial relations financial management, human resource management, capacity utilization, productivity, employment potential, income generation, marketing, export earnings, per capita availability, technology, profitability performance, problems and prospects at the

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national, regional and area specific. A few studies are also organized at micro/firm level covering the aforesaid aspects. The studies on optimal product mix in the cotton textile spinning and paper mills are almost absent. There is no specific study on the maximization of profit contribution at the level of industry firm and plant as far as the knowledge and understanding of the researcher is concerned. Therefore, a modest attempt is made in that direction at the plant level. The main objective of the present study is to analyse maximization of profit contribution. For this purpose, of the cotton textile spinning mills in A.P, one mill from each of private and public sectors is purposely drawn into the sample. Similarly, one paper mill from each of private and joint sectors is conveniently brought into the sample. The study has made use of both the primary and secondary sources of data. The information collected is processed, tabulated, analysed and interpreted with the help of appropriate tools and techniques. The report is divided into seven chapters.

1.4   Work sampling

To achieve the objectives of the present study, a work sampling analysis is carried out to find out effective machine capacities available in each department of sample mills. Utilization factors for all the departments are computed. A linear programming technique i.e. simplex method is employed. An optimum product mix is accomplished by constructing a linear objective function. Linear constraints representing the decision variables along with the profit contribution and process time respectively and also the quantum of

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scarce resources available are determined. After solving the original problem, its dual was formulated to find out machine hour cost for all the departments. Sensitivity analysis is also carried out in order to find out whether there can be any change in the product mix if the amounts of available resources are changed.

1.5   Production operations

In the private sector cotton textile spinning mill, there are eight departments with 202 machines, 4041 production units and 46936 total units.   Cotton lent passes through blow room, carding, combing, drawing, simplex, spinning, cone winding and reeling departments before becoming yarn.   The highest processing time is required in spinning department while the lowest in blow room department.   The available time for a month is maximum in spinning department whereas the lowest in blow room department. Among the products manufactured by private sector cotton textile spinning mill, profit contribution for 100 kgs of yarn is the highest in 64^sC (Rs.5790) whilst the lowest in 27^sK (Rs.2800).In the case of public sector cotton textile spinning mill, there are 9 departments with 127 machines, 3701 production units and 28787 total units. The process of manufacture is similar to private sector cotton textile spinning mill. Highest processing time is required for 60^sK and the least 20^9K. There is a significant variation in the number of hours available per month across the departments. The profit contribution per 100 kgs of yarn is maximum at Rs.4750 in 60^sK where as the minimum at Rs.2200 in 20^sK.

The private sector paper mill produces different varieties of paper in 4 departments such as pulp mill, stock preparation, paper making and finishing house. There are machines, production units and total units in the mill. The logs are converted into paper through a series of operations like chipper, digester, washing and bleaching, blending fibers/chest, refiners, wire part, press part, machine coating, pope reel, rewinding, rolling, sheeting and packing. This mill produces 6 varieties of paper such as writing and printing, photocopy, uncoated board, coated board, MG poster and kraft. The time required to produce one tonne of paper is the highest in MG poster while the lowest in coated board. The time available for manufacture is the highest in finishing house followed by paper making, stock preparation and pulp mill. Profit contribution is the highest in MG poster whereas the lowest in kraft paper.

The joint sector paper mill produces 5 varieties of paper like writing and printing, colour printing/process, MG poster, news print and kraft. There are 4 departments in this mill similar to that of private sector mill. The process of manufacture is one and the same. The number of machines, production units and total units varies across the departments. The processing time required to produce one tonne of paper is highest in writing and printing as compared to rest of the categories.

There is a variation in the product mix of private and public sector cotton textile spinning mills. On an overall basis, it can be said that the profit contribution for 100 kgs. of paper is relatively more in the

private sector cotton textile spinning mill except 40°C/40°K. The highest number is found in the private sector relative to joint sector.

1.6 formulation and solution of the problem

In the case of private sector cotton textile spinning mill, machine utilization factor is the highest in spinning department. It works out to 97.47 per cent. This department is critical in this sector of cotton textile industry. Utilization factor is least in reeling department (50.66 %) followed by combing department (80.00 %).In the case of public sector cotton textile spinning mill also utilization factor is maximum in the spinning department at 96.75 per cent. But the least utilization exists in drawing department (85 %).The managements of these mills have to initiate measures to increase machine utilization. It is possible by reducing machine break downs and end breaks since it is not possible to reduce the idle time in doffing and cleaning activities.

In the given factors of production of yarn, the profitable product mix that can be adopted as per optimal solution under simplex method for primal problem so as to maximize profit contribution in the private sector cotton textile mill is as follows.

$x_1 = 27^s K$ (carded yarn) $\quad = \quad$ 256822 kgs

$x_4 = 38^s K$ (carded yarn) $\quad = \quad$ 15064 kgs

$x_6 = 40^c C$ (combed yarn) $\quad = \quad$ 71583 kgs

$x_8 = 64^c C$ (combed yarn) $\quad = \quad$ 50608kgs

In other words, the management may discontinue the production of certain varieties of yarn i.e., 32 carded, 34 carded hosiery and 38

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combed hosiery and 54 combed due to the fact that the profit contribution from these products is low and reduces the overall profit contribution of the mill as a whole. Similarly, $x6 = 42^sK$ (carded yarn) $=113264$ kgs and $x7 = 60^s$ K (carded yarn) $= 6416$ kgs are most profitable among the products that are produced by public sector cotton textile spinning mill. The mill should not produce $20^sK, 25^sK, 26^sK, 32^sK$ and 40^sK .This is based on the criterion of profit contribution. In other words, if these products are produced, profit contribution of the mill declines.

In the case of private sector cotton textile spinning mill, the duality analysis shows that the machine hour cost is the highest in draw frame department at Rs.673.85 while the lowest in cone winding department with Rs.212.20.A contrary situation exists in the public sector cotton textile spinning mill. In this mill, the former is Rs.275.21 whilst the latter Rs.862.50. It means that one hour of extra working in drawing department results in an increase in profit contribution by Rs.673.85 and Rs.275.21 in the private and public sector mills sequentially. This is due to variation in optimal product mix between private and public mills. Further, in the private sector cotton textile spinning mill, sensitivity analysis for the optimal product mix suggests the following upper and lower limits for the purpose of maximizing profit contribution.

$$2798.16 \leq C_1 \leq 2813.69 \text{ for product } x_1$$
$$3139.47 \leq C_4 \leq 3509.71 \text{ for product } x_4$$
$$3506.70 \leq C_6 \leq 3522.70 \text{ for product } x_6$$
$$5783.95 \leq C_8 \leq 5844.78 \text{ for product } x_8$$

Within these ranges, the mill may attain maximum contribution. For the public sector cotton textile spinning mill, the aforesaid is

$$4000 \leq C_6 \leq 4750 \text{ for product } x_6$$
$$4060 \leq C_7 \leq 4926.13 \text{ for product } x_7$$

If these changes are made within the limits in the objective function of optimal product mix, there would not be any change in the total profit contribution.

In the private sector paper mill, of the departments, machine utilization factor is the highest in paper-making (97.5%) whereas least in stock preparation department (70%).In the latter, half of the machines i.e., chest and refiners are idle. The former department is critical in this sector. A similar trend exists in the joint sector paper mill. In this mill, machine utilization in paper-making and stock preparation departments is 95.21 per cent and 76.14 per cent respectively. As already suggested, the management may initiate steps to increase machine utilization in paper making department by reducing machine break downs and end breaks coupled with rise in capacity utilization in stock preparation department. In other words, without increase in the utilization factor in the stock preparation, it is not possible to increase the capacity utilization in paper-making department.

Following the simplex method, optimal product mix within the volume of each product for maximum contribution in the private sector paper mill reads as follows. X_1=writing and printing paper=2377.612

tonnes: and X_4=coated board =37449.388 tonnes: The mill may discontinue the production of uncoated board and photo copy, machine glaze and kraft paper. If these are produced, the profit contribution declines. For the joint sector paper mill, the profitable product mix on the aforesaid lines is X_1=writing and printing paper=4591.62 tonnes, X_2=colour printing/process paper =2796.48 tonnes; and X_4=news print paper=4714.81 tonnes. On the other hand, machine glaze and kraft paper should not be produced .If produced, Profit contribution decreases.

The duality analysis is used to compute and evaluate machine-hour- cost in various departments .In the case of private sector paper mill, the machine hour cost is assigned to pulp mill and paper-making departments for Rs.95149.25 and Rs.223880.60. It shows that the machine hour cost is maximum in the latter whereas minimum in the former. Likewise, the duality analysis in the joint sector paper mill reveals that it is the highest in paper making department at Rs.82621.31 while the least in finishing department at Rs.131.36. Between the two paper mills, machine hour cost in paper making is higher in private sector paper mill as compared to joint sector paper mill. It means that one hour of working in paper making increases profit contribution by Rs.95149.25 and Rs.82621.31 for private and joint sector paper mills respectively.

The sensitivity analysis in the private sector paper mill shows the following range for optimal product mix.

$43400 \le C_1 \le 50100$ for product of X_1, i.e., writing & printing paper

$26946.108 \le C_4 \le 34848.485$ for product of X_4 i.e., coated board

Similarly, in the joint sector paper mill, it is

$41167.08 \le C_1 \le 113583.13$ for product X_1 i.e., writing & printing paper

$38917 \le C_2 \le 41750.00$ for product X_2 i.e., colour printing/process paper.

$15417.72 \le C_4 \le 35064.32$ for product X_4 i.e., news print paper.

Within these ranges, a change either positive or negative in profit contribution per unit of optimal product mix would not cause a change in the optimal solution. In other words, profit per unit falls below the lower limit or greater than upper limit, the optimal solution would be different.

2. Suggestions

The following suggestions emerge from the present study.

2.1 The cotton textile spinning and paper mills should choose the optimal product mix by following the simplex method of LPP.

2.2 The top management should employ LPP technique to unravel potential products and non-potential products and allow the production manager to apply optimal product mix agenda to the shop floor.

2.3 The model is to be continuously updated to incorporate the changes so as to meet the changing needs of consumers.

2.4 The processing time, total cost, selling price and profit contribution records of products should be maintained properly to determine the optimal product mix easily and quickly.

2.5 Through password, unauthorized modification of operational and financial data can be prevented. Another way is to employ it internally to solve the problem.

2.6 The specialists of operations research should be trained to apply the model for the available data.

2.7 Private sector cotton textile spinning mill should produce 2,56,822 kgs. of 27^sK, 15,064 kgs of 38^sK, 71,583 kgs of 40^sC and 50,608 of 64^sC yarn only. In other words, it should discontinue the production of 32 and 34 carded hosiery, 38 combed hosiery and 54 combed yarn.

2.8 The public sector cotton textile spinning mill should produce 1,13,264 kgs of 42^sK and 6,416 kgs of 60^sK only. The rest of the products such as 20^sK, 25^sK, 26^sK, 32^sK and 40^sK should be avoided.

2.9 The private sector paper mill should produce writing and printing paper and coated board of 2377.612 tonnes and 37,449.388 tonnes respectively to earn maximum profit.

2.10 The Joint sector paper mill should produce 4591.62 tonnes of writing and printing paper, 2796.48 tonnes of colour printing/process paper and 4714.81 tonnes of news print only. The rest of papers such as machine glaze and kraft should be discontinued to maximize profit contribution.

2.11 In terms of duality analysis, private, public and joint sector mills should reduce unused working hours across the departments, whose shadow prices are zero before a shortage is experienced.

2.12 The sensitivity analysis to the objective function of optimal solution suggests that by increasing or reducing the profit contribution of basic

variables within the levels the maximum profit contribution cannot be changed.

2.13 When the aforesaid suggestions are implemented as package and not in isolation, they would result in maximization of profit contribution. If all this is done, there is no reason why the respondent mills earn fair profits and provide quality yarn and paper to consumers at reasonable prices. If these were initiated from their inception, profits would have been much more and availability of good quality yarn and paper and increase in the per capita consumption of cloth and paper in the country. Then, it would have served the public better than today.

3. **Hints for further research**

Further research may be conducted in future on technological innovations, which may result in the reduction of processing time of a product, provided the product is not in the optimal product mix. Studies may be organized to determine the combination of requirements for production from standard materials so as to minimize trim loss particularly in paper mills. Further, the feasibility of adding new products to the existing optimal product mix may be undertaken. A study may be organized to fix up the price for a particular product, which is not included in the optimal product mix but a customer likes to have that product and desires to pay over and above normal price. Furthermore, studies may be organised to evaluate minimum cost of production over a certain period of time for an item with fluctuations in demand by considering initial number of items in inventory, production capacity, production constraints, manpower requirements etc.