Profit Maximization and Decision Making Approach : A Managerial Case Study

D. S. DAVE AND B. B. JANI
Gujarat University, Ahmedabad

The paper deals with a managerial case study for a business firm where the units for a commodity are produced, stored and sold under the given market situation. The profit maximisation model is presented and is utilized to meet the targeted demand for future production.

The optimisation framework has been used very widely in decision making procedures. An important task of management is to choose an optimum course of action from among a given set of identified actions. Practitioners and research workers have given considerable attention to problems involving maximisation of profit as well as minimisation of cost.

The total cost along with total revenue determines the profit level of a business concern. Management tries to generate optimum levels of output, use the least cost combination factors of production, increase factor productivities and improve organisational efficiency. Hence, cost and production analysis plays a significant role in managerial decision making. Production analysis frequently proceeds in physical terms while the cost analysis proceeds in monetary terms [9]. Moreover, inventory costs related to production planning, scheduling and inventory control may include the costs of handling the product in and out of inventory. The costs shall represent only those out of pocket expenditures or foregone opportunities for profit whose magnitude is affected by the schedule or plan [7]. However, production and inventory control decisions are typically relatively insensitive to small variations in cost factors (indeed many cost elements can not be determined accurately), hence it is worthwhile and interesting to consider production and inventory costs together to maximise the profit for the system as a whole.

In this paper the linear programming approach [2] for profit maximisation for a firm is

studied. The profit is determined by the total revenue together with the total cost which includes the production cost as well as the total inventory cost. From the analysis of the past data, under deterministic and known demand, using the resources that are available, the optimum values of the corresponding labour, capital and production are determined to achieve the maximum profit for the firm.

2. Basic variables

Let us define :

Q = The units of production of the commodity X at time t (t = 1, 2,.........N).

K = Invested capital in the production of the commodity X at time t (t = 1, 2, ...N).

L = Labour employed in the production of the commodity X at time t (t = 1, 2,.........N)

C = Cost per unit of production at time t (t = 1, 2,.........N).

p = Price per unit of commodity produced at time t (t = 1, 2,.........N).

R = Demand rate for the period t (t = 1, 2, ...N).

Q = Number of units in inventory (lot size) at time t (t = 1, 2,.........N).

3. Assumptions :

The mathematical model is derived under the following assumptions :

(1) The firm produces a single commodity for which the demand is deterministic and known.

(2) The production function for the single commodity X produced by the firm is assumed to be linear.

(3) Warehouse attached to the production unit follows lot size inventory model.

(4) Shortages are not allowed to occur.

(5) The lot size q is functionally specified with the total production by the relation :
$$q = f(Q), (q > 0, Q > 0)..........................(1).$$
which is a function of capital and labour.

Hence, the lot size is a function of capital and labour. Thus in general we may have,
$$q = \phi(K, L), (K > 0, L > 0).....................(2).$$

(6) Unit cost of production C, inventory holding cost C_1 and replacement cost C_3 are known constants.

(7) Selling price per unit of the commodity produced remains almost steady under the given market situations.

(8) The enterpreneur has to take care of the limited amounts of labour and capital resources that are available.

4. Mathematical Model

Let us consider the production function as :
$$Q = \alpha K + \beta L, (\alpha > 0, \beta > 0)..............(3).$$
where, α and β are respectively the marginal physical product of capital and marginal physical product of labour. The elasticity of substitution of factors of production for this production function is infinite.

The productive firm produces the single commodity in question. The produced commodity is stored in the form of inventory by the firm and it is also sold by the firm according to the market demand.

With the average cost of production equal to C per unit, the total cost of production is given by $C(\alpha K + \beta L)$.

The total inventory cost for this lot size system is given by [8] $\dfrac{C_1 q}{2} + \dfrac{C_3 R}{q}$

Hence, the total cost of production and storage of the commodity produced and stored by the firm is given by :
$$C^* = c(\alpha K + \beta L) + \frac{C_1 q}{2} + \frac{C_3 R}{q} ....(4).$$

According to Hanssman [3], if the produced units are stored and sold by the firm itself at the unit selling price of p, the total profit (net revenue) of this firm is given by :
$$\pi = Rp - \left[C\alpha K + \beta L) + \frac{C_1 q}{2} + \frac{C_3 R}{q} \right] .....(5).$$

By assumption (5), since $q = \phi(K,L)$, the functional relationship for q may be considered as,

$$q = \delta . e^{mk+nl} , \quad (m > o, n > o, \delta > o) \ldots\ldots\ldots(6).$$

This suggests that a change in capital and labour employed brings in a corresponding change in output and the lot size q will be affected accordingly.

Hence from (5),

$$\pi = R \cdot p - \left[C(\alpha K + \beta L) + \frac{C_1 \delta e^{mk+nl}}{2} + \frac{C_3 R \cdot e^{-(mk+nl)}}{\delta} \right] \ldots\ldots(7).$$

A simplified approach for the above profit function (7) can be considered by approximating the above function under the assumption $mk + nl \leqslant 1$, so that a linear approximation will simplify (7) as :

$$\pi_1 = E - D\alpha \cdot K - D\beta L \ldots\ldots\ldots\ldots (8).$$

where,

$$E = R \cdot p - \frac{\delta C_1}{2} - \frac{C_3 R}{\delta}$$
$$D\alpha = C\alpha + Dm$$
$$D\beta = C\beta + Dn$$
$$D = \frac{C_1 \delta}{2} - \frac{C_3 R}{\delta}$$
$$\left.\right\} \ldots\ldots\ldots(9).$$

A decision making approach leads to determine the optimum amounts of labour and capital inputs so that the profit

π_1 for the firm is maximum.

If all the variables are measured in value terms, (8) can be maximised using the linear programming method [2].

To solve this problem to determine the optimum use of input factors of production, a linear programming problem may be formulated first by considering the constraints as under :

(a)   Capacity constraint of the firm

(b)   Production constraint

(c)   Labour utilisation constraint

(a)   Capacity constraint

Here we may put a constraint representing the limited resources that are available. Thus the constraint for labour and capital that can be utilised is given by :

$$K + L \leqslant IC \ldots\ldots\ldots\ldots\ldots(10).$$

where, IC = Total investment capacity of the firm.

(b)   Production constraint

The total amount produced should meet at least with the known targeted demand rate R*.

Thus $Q \geqslant R^*$ which leads to,

$$\alpha^* K + B^* L \geqslant R^* \ldots\ldots\ldots\ldots(11).$$

(c)   Labour utilisation constraint

The amount of labour employed should be atleast equal to a given minimum number of employees equal to $\int$. This leads to the constraint (in value terms) as :

$$L \geqslant \int \ldots\ldots\ldots\ldots\ldots(12).$$

Hence the linear programming formulation for this profit maximisation problem is given by :

$$\begin{array}{l} \text{Maximise} : \pi_1 = E - D\alpha K - D\beta L \\ \text{Subject to, } K + L \leqslant IC \\ \qquad \alpha^* K + \beta^* L \geqslant R^* \\ \qquad L \geqslant \int \\ \qquad K \geqslant O, L \geqslant O \end{array} \left.\right\} \ldots\ldots(13).$$

5.   Application

"ABC Manufacturing Co., Ltd.," produces a certain commodity X. From the past data the production function of the product is found to be linear and it is estimated by the relation :

$$Q = (54.6)K + (3.1)L \ldots\ldots\ldots\ldots (14).$$

Similarly, the lot size q follows the law which is estimated as :

$$q = (122.056).\exp\{(0.00567)K + (0.000421)L\} \ldots\ldots\ldots(15).$$

Table 1

Ingredients of production and cost for the profit maximisation Model : Case Study of ABC Co.

Year	No. of Machinery (K)	No. of Employees (L)	Production (in Units) (Q)	Price Per Unit (P) ('000 Rs.)	Labour Employed ('000 Rs.)	Value of production ('000 Rs.)	Capital Invested ('000 Rs.)	Lot Size	Demand Rate (R)	Cost of Production per unit of commodity ('000 Rs.)	Total Cost of Production ('000 Rs.)	Total Inventory Cost ('000 Rs.)	Net Profit ('000 Rs.)
1970	29	584	3394	0.1855	185.712	629.5870	186.2844	184	3210	0.1451	492.4694	9.6488	93.3368
1971	30	590	3467	0.1856	189.980	643.4752	193.4430	186	3283	0.1452	503.4084	9.7578	96.1586
1972	32	598	3601	0.1857	197.340	668.7057	207.440	188	3415	0.1452	522.8652	9.9510	101.3493
1973	34	609	3744	0.1858	206.451	695.6352	221.0374	191	3556	0.1453	544.0032	10.1542	106.5474
1974	36	623	3896	0.1858	217.427	723 8768	235.0476	196	3705	0.1453	556.0888	10.3650	111.9352
1975	39	641	4116	0.1860	230.760	765.5760	255.3759	199	3920	0.1454	598.4664	10.6612	119.9924
1976	42	663	4348	0.1860	245.973	808.7280	275.6922	205	4149	0.1456	633.0688	10.9682	127.6770
1977	45	690	4596	0.1861	262.890	855.3156	296.1855	211	4391	0.1458	670.0968	11.2835	135.7848
1978	49	722	4914	0.1861	283.024	914.4954	323.5568	218	4703	0.1459	716.9526	11.6776	146.5981
1979	53	760	5249	0.1862	305.520	977.3638	351.0770	227	5031	0.1461	766.8789	12.0778	157.8155

The production data and other numerical details for the company are given in Table 1.

The company wants to expand its business and the target for future production is to be planned so as to fulfill the demand for this commodity research to $R^* = 5690$ units.

The optimum production using the optimum capital that can be invested by the number of machines and optimum number of machines and optimum number of employees that can be employed are determined by the linear programming method.

Table 2 represents the different values of the constraints for the next targeted production planning.

Table 2

Constraints for targeted production planning

Symbol	Description	Numerical Value
C_1	Inventory holding cost per unit of commodity per year.	0.0533 ('000 Rs.)
C_3	Replenishment cost per lot per year.	0.272 ('000 Rs)

C	Expected cost per unit of commodity for planning period.	0.1462 ('000 Rs.)
p	Expected price per unit of commodity for planning period.	0.1864 ('000 Rs.)
W	Expected wage rate for planning period	0.479 ('000 Rs.)
C_k	Expected cost per machine for planning period.	6.7027 ('000 Rs.)
IC	Capacity constraint of the firm in terms of the production investment.	900 ('000 Rs.)
R^*	Expected demand rate in value terms	1060.616 ('000 Rs.)
$\int$	Expected minimum labour requirement in value terms to fulfill the desired objectives.	376.74 ('000 Rs.)
α^*	The lower bound of the marginal products of capital for the production target.	1.4732

$$\left\{ \alpha^* = \frac{1}{n-1} \sum_{t=1}^{n-1} \frac{\triangle Kt/Kt}{\triangle Qt/Qt} \right\}$$

β^* The lower bound of the marginal   1.1249
products of labour for the pro-
duction target.

$$\left\{ \beta^* = \frac{1}{n-1} \sum_{t=1}^{n-1} \frac{\Delta Lt/Lt}{\Delta Qt/Qt} \right\}$$

The management of the firm wants to maximise the profit. The problem is to determine the optimum values of capital, labour and production so as to realise the maximum profit.

From the past data and for the targeted planning, the linear programming problem can be stated as :

Maximise :
$\pi 1 = 1044.6831 - (7.929067)K - (0.449251)L$
Subject to,
$K + L \geqslant 900$
$(1.4732)K + (1.1249)L \geqslant 1060.61$ (16)
$L \geqslant 376.742$
$K \geqslant 0, \ L \geqslant 0$

Using graphical method, the profit is maximised at the point A, whose co-ordinates are (417.0969, 396.612) as shown in the diagram. The number of machines and the number of employees are determined using the expected wage rate and the expected cost per machine during the planning period. The numerical data for various ingredients of price and cost are given in Table 2.

The optimum values of the decision variables using this method are given as follows :

Optimum number of machines	= 62
Optimum number of employees	= 828 persons
Optimum production	= 5962 Units
Optimum lot size	= 246 Units
Optimum profit	= 181.5656 ('000 Rs.)

6. Sensitivity

It may be interesting to observe the effect of changes in the values of the cost and price
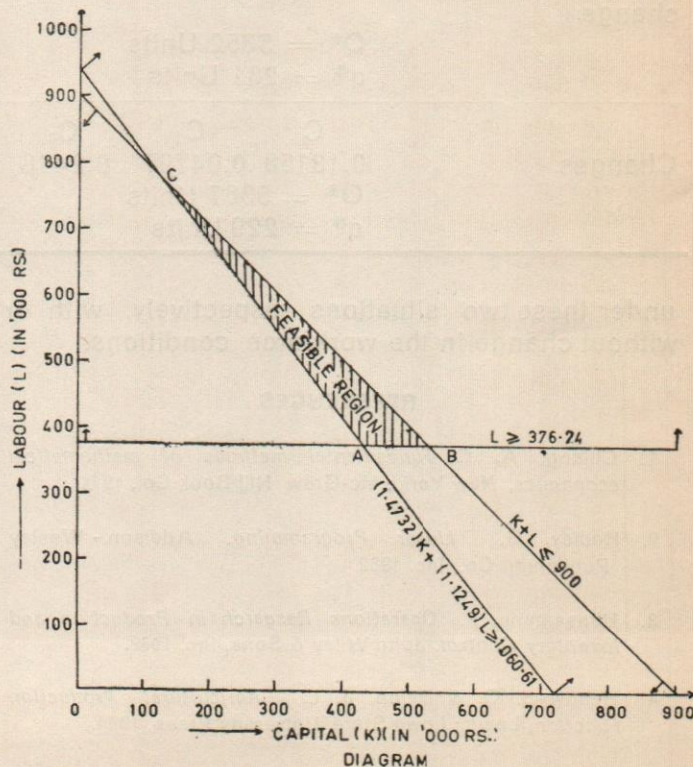
parameters in the model on the overall profit for the system. This is achieved by the sensitivity analysis [6], where all the parameters decrease or increase simultaneously by a fixed amount of 10%. This takes care of the inflationary and deflationary situations for the price of the commodity. These situations are represented in Table 3 and Table 4 respectivly.

7. Concluding Remarks :

From the above sensitivity analysis, it can be concluded that while the labour conditions do not change, the optimum profit of the firm increases by 20.95% under inflationary situations; whereas the optimum profit increases by 22.38% when the labour requirement changes. Under the deflationary situation, when the labour requirements do not change, the optimum profit decreases by 20.75% and when the labour requirement observes a corresponding change, the optimum profit under this situation decreases by 21.77%. There is not much significant change in the optimum output as well as the optimum lot size

Fig. 1 Profit Maximisation

Table 3
Sensitivity : Optimum Solution in Inflationary Situation

Condition Imposed upon work force	Increase in the values by 10% uniformly								
	C	C_1	C_3	C_k	w	P	Ic	R*	$\int$
Does not change	0.16082	0.05863	0.2992	7.3729	0.5269	0.20504	990.0	6259	828

$Q^* = 6553$ (Units)
$q^* = 262$ (Units)
$Z^* = 219.6059$ ('000 Rs.) (20.95% increase)

Changes	C	C_1	C_3	C_k	W	P	Ic	R*	$\int$
	0.16082	0.05863	0.2992	0.16082	0.5269	0.20504	990.0	6259	911

$Q^* = 6537$ (Units) $q^* = 263$ (Units) $z^* = 222.2084$ ('000 Rs.)
(22.38% increase)

Table 4
Sensitivity : Optimum Solution in Deflationary Situation

Condition Imposed upon work force	Decrease in the values by 10% uniformly								
	C	C_1	C_3	C_k	W	P	Ic	R*	$\int$
Does not change	0.13158	0.04797	0.2448	6.03243	0.4311	0.16776	810	5121	828

$Q^* = 5352$ Units $Z^* = 143.8868$ (20.75% decrease)
$q^* = 231$ Units   ('000 Rs.)

Changes	C	C_1	C_3	C_k	W	P	Ic	R*	$\int$
	0.13158	0.04797	0.2448	6.03243	0.4311	0.16776	810	5121	745

$Q^* = 5367$ Units $Z^* = 142.0292$ ('000 Rs.)
$q^* = 229$ Units   (21.77% decrease)

under these two situations respectively, with or without change in the workforce conditions.

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Realities of Participation :
The Case of an Engineering Industry

BHABATOSH SAHU
Indian Institute of Science, Bangalore

Although the different participative schemes introduced by the Government have not met with the desired success, the results of this study indicate that participative management, if properly designed and implemented, can achieve very important objecttives and thereby increase organisational effectiveness and efficiency.

Participation is an overeaching concept which includes a variety of forms and practices. Included among those are practices associated with industrial democracy, with the enlargement and enrichment of operational tasks and with management styles which seek to improve effectiveness through the involvement of workers at all levels in the decision-making process (Hedben and Shaw, 1977). In USA, (and to some extent elsewhere), participation is currently thought of primarily in terms of informal interaction. Outside USA, participation tends to mean workers' participation in management, usually in the form of formal mechanisms which permit representatives of workers to influence or even control organisation decisions. Almost everywhere the supporters of participation claim that it is not only morally sound, but it reduces alienation and improves morale (Straus and Rosenstein, 1970). Further it enhances productive efficiency, fosters industrial harmony, and enriches the human personality (Derber, 1970).

Workers' participation has become a major political, social and economic issue in many countries. Yugoslavia, West Germany, United Kingdom, United States, Sweden, France, Belgium, Denmark, etc. have been among those experimenting with this theme, though it has assumed different forms in different countries in order to meet their special needs. The Indian version of workers' participation can be dated as far back as 1920 when the workers and employers in Ahmedabad Textile Industry agreed to settle disputes by mutual discussion. The concept of workers' participation in management has also

become a part of government labour policy since Independence onward. Several attempts have been made to experiment with various forms of participation like Works Committees (1947), Joint Management Councils (1958), workers in the Board of Directors in Port Trusts and Nationalised Banks (by legislation in 1963 and 1970 respectively), Shop and Plant Councils (1975 Scheme), but there has been very little success in promoting effective working of participative forums. However, one thing very clear from the current literature is that all countries which tried one or the other form of workers' participation in management are still keen to continue with their scheme and improve upon them and also in most of the countries, a certain amount of governmental support through legislation or other forms is being extended in promoting participative management.

Some Research Studies

Ever since the findings of the Mayo experiments, participative management has remained a favourite theme with the social scientist. Numerous field studies, experiments, case studies and surveys have been conducted in the organizational setting to understand the dynamics of participation.

In his conceptual framework for participation, Kenneth Walker (1974) has discussed the role of situational and human factors in determining the extent of actual participation. Walker acknowledged the significance of employees' participatory desire by maintaining that though situational factors determine the participation potential of a particular enterprise, the human factors (like participatory desire) determine the extent to which this potential can be realised.

According to Moulder (1971) motivation is the most important determinant of participation. Moulder has argued that in most countries (he cites studies conducted in Netherlands, Yugoslavia, etc.), employees have a low desire to participate in managerial decision-making. Thus there is a need to study objectively the extent of employees' willingness to participate in organisational decision-making and the areas in which they want to participate.

Several studies of workers' participation in management in India reveal that there is a great deal of misconception and confusion amongst the parties with regard to the usefulness of the scheme itself. In addition, there is hardly any clarity regarding the method of creating an environment of participativeness (Thakur and Sethi, 1972). Studies conducted by Das (1964), Van Dusen Kennedy (1966), Subramaniam (1967), Pandit (1962), Mhetras (1966), Alexander (1972) have also revealed that the various government schemes did not meet the desired success. Sheth (1972) conducted a study in six industries and came out with the conclusion that JMC would develop into an effective and viable participative forum if it could meet the perceived needs of the management and the employees at the lowest level of organization. In India very little attempt has been made to investigate participatory desire empirically at the micro level.

The Case of an Engineering Industry

Aims : The present case study in an engineering industry is designed to :

(i) determine the existing organizational climate for participative management,

(ii) identify the main objective of participative management as perceived by management personnel and workers,

(iii) assess the perceived and desired level of workers' influence in different decisions taken in the organization at various levels as expressed by management personnel and workers and also to identify the desired way of involvement of workers in different decisions,

(iv) identify the desired forms of participative management as expressed by management personnel and workers,

(v) evaluate the functioning of different participative forums in the organization.

About the Organization: The industry is situated in Bangalore and is a leading electrical equipment manufacturer. It started functioning in 1961 under the direct control of the industries department of the State Government and later it was converted into a State Government owned public sector undertaking. The industry

employs 5400 personnel of which 720 are supervisory and management staff. Majority of the employees (85%) are from urban area. Workers are adequately skilled and at least 60% of them have studied upto Matriculation. The technical staff (management) are also well equipped with professional knowledge. The industrial relations climate is quite cordial. The workers are strongly unionised, approximately 90% of the employees are union members, divided between three different unions affiliated to AITUC, BMS and INTUC. The wage rate of the workers is at par with other leading industries of the State. The statistics of sales turnover and profit margin reveals that the industry's performance is quite satisfactory.

Methodology

The information about the organisation, its product, nature of work force, trade unionism and industrial relations climate, the details of various participative forums working etc. were collected from various records and documents furnished by the industry and also through discussion with various authorities.

Appropriate questionnaires were developed to measure the views of various groups of management personnel and workers regarding the organization climate for participative management, objective of participative management, workers influence on various decisions (perceived and desired) and the desired way of taking these decisions, preference for different forms of participative management and effectiveness of functioning of present participative forums, etc. Thirty management personnel and 30 workers were personally interviewed on these scheduled questionnaries. Care was taken to include in the sample managers of all functions at different levels and also a few office bearers of different joint committees/participative bodies. Similarly the workers sample contained trade union office bearers, a few office bearers of different joint committees and employees of different categories. The confidentiality of individual responses was guaranteed.

RESULTS AND DISCUSSION

I. Organisation Climate for Participation

The workers' views were obtained on five items as given in Table I (a) and Management personnels views are taken on ten items as given in Table I (b).

The results in Table I (a) and I (b) indicate that the existing organisation climate is quite conducive for participative style of management.

Table I (a)

Perceived Views of the Workers (N=30)

Items

1.	Liking their own job	— 80% very much
2.	Relationship with supervisors/managers	— 55% cordial and 33% fairly cordial
3.	Relationship with co-workers	— 65% cordial, 30% fairly cordial
4.	Free to approach supervisors/managers	— 70% fully and 20% to some extent
5.	Opinion about top management	— 70% supportive to some extent

Table I (b)

Perceived Views of Management Personnel (N=30)

Items		Mean Score*
a.	Subordinates are given a share in decision-making	2.9
b.	Subordinates are informed of the true situations good or bad under all circumstances	3.2
c.	Management remains aware of the state of the organization's morale and does every thing possible to make it high	3.0
d.	Supervisors/managers are easily approachable	3.9
e.	Managers/supervisors counsel, train and develop subordinates	3.2
f.	Managers/supervisors communicate effectively with subordinates	8.5
g.	Managers/supervisors show thoughtfulness for others	3.2
h.	Managers/supervisors make changes in way of doing things	2.8
i.	Managers/supervisors support subordinates when they make mistake not due to negligence or without any bad intentions	3.3
j.	Managers/supervisors express appreciation when subordinates do a good job.	3.4
	Average mean	3.24 st. dev.=0.3

*   The Scale : Never = 1, Seldom = 2, To some extent = 3, Usually = 4, Always = 5.

II. Objective of Participative Management

Table II shows the first five objectives of participative management as perceived by management personnel and workers. Twelve alternative objectives were given out of which the respondents were asked to identify only five objectives rankwise. Amongst the first five ranks, identified by both groups, there are four common objectives. Management personnel feel increasing employee commitment to organisation is one of the first five objectives whereas workers feel deriving better amenities and service conditions by having influence in the decision-

Table : II

Objective of Participate Management : First Five Rankwise as Perceived by Management Personnel and Workers.

Rank** (Overall)	Objectives	Management Personnel (N=30)			Objectives	Workers (N=30)		
		Score*	% of max. score	% opted for		Score	% of max. score	% opted for
1	Increase productivity, job satisfaction, decrease absenteeism and reduce waste	123	82	90	Increase productivity improve job satisfaction, decrease absenteeism & reduce waste	128	85.3	93
2	Improve team work	63	42	80	Help employees to know about the running of an industry and thereby provide a democratic setup.	64	42.6	80
3	Increase employee commitment to organization	45	30	50	Improve team work	60	40.0	80
4	Help employees to know about running of an industry & thereby provide a democratic setup	33	22	60	Provide more peaceful, manager-subordinate & union management relations	60	40	60
5	Provide peaceful manager-subordinate & union-management relation	33	22	30	To derive better amenity & service condition for workers by having influence in the decision-making process	46	30.6	53

*   Max. score possible is 150, scoring is done as follows :
1st = 5, 2nd = 4, 3rd = 3, 4th = 2, 5th = 1.

** For overall rank 1st consideration is score, if scores are same then percentage opted for is considered as the criteria.

efficient use of raw materials like using thinner coatings on tin covers and alkyd resins which are rated good on tin covers and asbestoscement. We will have to serve markets for specialised materials like container coatings, marine paints, anti-corrosive coats, traffic marking paints, artist's colours, bituminous paints, fungical coatings and fire retarding paints. While massive attempts are being made to standardise both raw materials and finished formulations there is always what is known as special in the case of pigments used in paints, printing works, paper coatings, rubber and plastics. There is much to learn in this respect from abroad and to see to what extent R&D can make their contribution for making the role of the small sector useful and substantial in the economy. The industry abroad is concentrated in transnational corporations as well as being integrated forwards and backwards to a considerable degree producing standardised products with sophisticated machinery to cope with increasing labour costs and energy problems We should therefore concentrate on raising our productivity particularly in specialised and small paints for export markets. Quantity wise specialised paints are the least important but are the most highly priced materials on the market.

Industry sponsored campaigns promote paint consciousness generally stimulating internal consumption and saving of wastage caused by forces of erosion. Some of the progressive companies could make joint efforts for increased usage of paint in the country, particularly in the rural areas by developing cheap coatings. Foreign exchange should be made available for promotional expenses for export drive. We could increase our exports from 1.20 crores in 1979 to 2 crores in 1980-81 and more in the years to come by mounting aggressive publicity and sales campaigns abroad. There is good potential in the future for those concerns which are prepared to market cheap and quality paints in an active way as opposed merely to supplying to customers on request. We should promote use of paint as do-it-yourself product.

The nature of the paint industry is such that it requires more intensive market research than most other technology based industries. This is because paints serve diverse markets ranging from retail markets to the highly sophisticated industrialised finishing industries. The Central Glass and Ceramic Research Institute Jadavpur has developed a number of paints based on mica. These paints are claimed to be not only cheaper than conventional ones but have better storage properties and improved performance. They are anti-corrossive and may be used for roadmarking and as fire retardant paint. The National Development and Research Council will provide the know how for the manufacture of the paints against a payment of royalty. An economic unit for mica based paint is 10,000 litres per annum and the industry can be set up in the small sector. India is rich in mica resources, being the largest exporter of mica in the world and has achieved a high degree of expertise in mining, grading and marketing of this mineral. The geological survey of India has informed about the existence of considerable quantities of good red oxide and red earth in the Bellary-Hospet area of Karnataka. If a regular and economic supply of thinners and extenders like linseed oil, tung oil, mineral spirits, etc. from the adjoining Andhra Pradesh is available and a local market assured it should be possible to start a factory on moderate scale for the manufacture of red pigments. Tungabhadra Dam site area with numerous buildings, abundant supply of water, easy transportation by rail and road would be an ideal place for location of the paint industry.

The paint industry has a bright future in India. Paint technologists are bending their energies to trimming raw material costs. At present oil bound distempers are most popular and 80 per cent of paints in India are based on alkyd resins reserved for small sector and exempted from tax. The share of sophisticated coatings like plastic emulsion is small and needs to be enlarged. Raw material used in India consist of 40 per cent vegetable oils, 40 per cent resins and monomers and 20 per cent minerals. Expansion of oil seed production is under way. Adequate feed stocks from Bombay High, etc are available and there is sufficiency of mineral wealth in India comprising ilmenite micaeous iron oxide, etc. The evolution of a more modern and more technologically sophisticated paint industry in India will make it a power in world markets, turning out products based on low material costs and aimed at new customers looking for products that are non-pollutant, durable, energy cheap, authentic, aesthetically pleasing and unique. Besides, there will be even distribution of incomes and vastly varying tastes in products, services and styles—

an interesting projection of perspectives in the paint industry carrying a message of considerable importance to India.

Production costs in the paint industry can be lowered by closer attention to purely technical personnel processes under the supervision of a technician directly independent of the dictates of the laboratory. He should concentrate on two areas, namely, a simplification of laboratory formulas backed by expert knowledge of the properties of pigments, extenders and additives specially those of wetting agents such as lenithin and a more effective use of machinery. Grindometres commonly result in false measurements. A microscopic examiner or the Garmsen method

for pigment particle size determination is fraught with fewer errors. The required fineness of grind must be considered. Poor Pump performance often leads to fluctuating and declining output. Waste in filling and packing can be eliminated by automatic systems for large quantities. The advanced technology that is now available in the country can effectively serve the needs of our paint industry and be utilised in preserving for posterity, the attractive monuments, temples and other antique structures that dot the length and breadth of India and are in various stages of dilapitation. Indian paint industry should exploit the opportunities for expansion in both types of organic coatings decorative as well as industrial that are available at present.

Constraints to Productivity Increase in Potato Farms in Nilgiris

V. PUHAZHENDHI
Tamil Nadu Agricultural University, Coimbatore

This study highlights the effects of positive attitudes of potato farmers towards new, appropriate technology and the reason for non-adoption of improved farming practices. The reasons include inadequate and untimely availability of High Yielding Varieties and quality seeds, micronutrients and credit facilities. Excessive use of fertilizer also contributed to increased cost of cultivation.

One of the most important tasks facing the country is that of fighting malnutrition among the vulnerable sections of the society. India's nutritional problems are mainly inadequacy of calories and over dependence on cereals as a source of calories. One way of providing nutrition is to provide protein at low cost and in acceptable form. Potatoes, having a high nutritive value and superior quality protein, have the potential of forming a viable subsidiary food crop in India to remove the nutritional imbalances. It is now increasingly recognised by nutritional experts that about 6 kgs of annual per capita consumption of potato in India should be increased to a much higher level. The experts agree that potato in processed form constitutes a comparatively less expensive and acceptable source of protein.

Potato is an established staple food in various forms in our country and one of the major crops, with annual production of 6,171,100 tonnes from an estimated area of 594,000 ha in 1978-79. Tamil Nadu ranks seventh among potato producing states in the country with the Nilgiris District, which is selected for the study, occupying 67 per cent of potato area in the state. The economy of the district mainly depends on potato production. The time series data on potato production and productivity of the district indicated that the productivity was increased to 48 per cent during a period of 10 years. Though productivity has been increased, the experimental station yield and demonstration yield data showed that potential exists to further increase productivity by 1.50 tonnes per acre. Many socio economic and technological factors are constraining the pro-

ductivity increase. To quantify the above factors the present study was conducted with the specific objectives (i) to estimate the productivity gap in potato among experimental stations, demonstration plots and actual farms and (ii) to identify the socio economic and teconological constraints responsible for the productivity gap.

Methodology

Among the four blocks in Nilgiris District, Ootacamund block was selected since 73 per cent of the total potato area of the district is concentrated in this block. The data on potato yields as recorded in the Research Station at Vijayanagaram and demonstration centres were collected to study productivity gap. Based on the demonstration trials three villages and 45 sample farms equally distributed in three villages were selected at random and details on socioeconomic constraints responsible for productivity gap were collected with the help of a pretested questionnaire. For the present study the highest experimental station yield is taken and it is compared with actual yield in sample farms. Instead of comparing the actual farm yield directly to the experimental station yield the potential yield gap concept was introduced and is the yield obtainable in the farmers field from the improved technology.

Different socio-economic and technological factors are identified through previous studies and preliminary survey. The identified constraints are related to the productivity gap and the contribution of each factor to the productivity gap is estimated. The following linear function was specified to quantify the above factors.

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + e$$

Where

Y = Productivity gap (potential yield—actual yield) per acre

X_1 = Varieties—dummy variable

X_2 = Value of seeds in rupees per acre

X_3 = Value of fertilizers in rupees per acre

X_4 = Value of pesticides in rupees per acre

X_5 = Credit borrowed in rupees per acre

X_6 = Attitude towards new technology (Index)

e = Error term

$a, b_1, b_2 \ldots b_6$ are regression coefficients to be estimated.

A dummy variable (X_1) was included in the function to show the influence of the High Yielding Varieties (HYV) in productivity gap. The value of unity was given to HYV and zero for improved varieties. Attitude towards new technology (X_6) was estimated by an index of numbers assigned for different characters like education level, frequency of contact with extension officials, perception of new technology and knowledge of new technology.

For estimating the impact of different socioeconomic problems for different size groups the selected farms were stratified into three size group as small (less than 2.50 acre), medium (2.50—5.00 acre) and large (5.00 and above). The analysis of variance showed significant differences among them.

RESULTS

Productivity Gap

The estimated productivity gap which is the difference of yield between experimental station, demonstration centres and actual farm yields are presented in Table I. The analysis showed that productivity gap I is small compared to productivity gap II and potential yield was only 2 to 3 per cent higher than the yield of the experimental station. With regard to seasonal fluctuations, the productivity gap in all the villages was less in main and Autumn season than during the Irrigated season. This may be due to the fact that during these two seasons the crops were raised in rainfed condition and hence the natural environment would be the sole factor influencing the yield. But during irrigated season since the crop was raised under irrigated conditions which did not depend on environment. the yield was influenced by the adoption of improved practices. These practices are employed in the experimental station and demonstration fields but are lacking in farmer fields and so the gap was more in

Table I

Estimation of Productivity Gap in Potato—Seasonwise and Villagewise yield in Kg Per Acre 1979-80

Village/Season	Experimental Station yield	Potential yield Demonstration plot	Farmers yield (average)	Productivity Gap	
				I	II
Nanjanad					
Main					
April-July	6300	6105	4965	195	1140
Autumn					
July-Oct.	5200	4930	4010	270	920
Irrigated					
Nov.-Feb.	8646	7976	6976	670	1670
Muthorai					
Main					
April-July	6300	6150	5120	150	1030
Autumn					
July-Oct.	5200	5010	4865	190	335
Irrigated					
Nov. Feb.	8646	7975	7075	671	1571
Thummanati					
Main					
April-July	6300	6172	5160	128	1140
Autumn					
July-Oct.	5200	5100	4675	100	525
Irrigated					
Nov.-Feb.	8646	8460	7659	186	987

Productivity gap   I--Experimental Station yield — Potential yield
Productivity gap   II—Potential yield   Farmers yield.

demonstration centres when compared to farmer fields. Thus, there appears to be ample scope to reduce the productivity gap during the irrigated season by the adoption of appropriate technology and improved practices.

Socio–economic Constraints

The study on the socio-economic constraints in farms will throw light on the reasons for non-adoption of the improved practices recommended and the consequent failure to match the expected yield. Different socio-economic constraints like varieties, quality of seeds, manures and fertilizers, micronutrient application and credit availability were identified and the reasons expressed by farmers for not getting the expected yield were analysed.

The analysis of different varieties in different size groups showed that only 9.5 per cent of small farmers were adopting high yielding varieties (HYV). Similarly, for medium and large farms the figures were 26.67 per cent and 33.33 per cent. Overall for the sample as a whole the

adoption of HYV was 22.22 per cent which is indicative of the vast scope for introduction of HYV of potato in the study area. It is essential to assess the reasons for such a wide gap in adoption of HYV even after several years of implementing Indo-General Nilgiris Development Project. A few identified reasons were put forth to sample farmers and 81 per cent of them stated that heavy investment requirement was the reason for non-adoption of HYV. This is quite expected since seed cost is one of the major components in cost of production and constituted 30 per cent of the total cost. Though a few small farmers were interested in raising HYV, inadequate seed quantity was yet another major problem as expressed by 57.14 per cent of the farmers. Also nearly 25 to 30 per cent of them expressed other reasons like non-suitability of HYV in the area, and poor quality of purchased seed. Medium and large farmers expressed inadequate seed quantity as the major reason for their non-adoption and it was expressed by 86.66 per cent and 77.77 per cent of the farmers respectively. Improving credit facilities to small farmers and ensuring organized, timely supply of HYV

seeds to all farmers will help the spread of HYV and consequently the productivity gap could be narrowed.

The quality of seeds depends on their size and freedom from diseases. The study showed that only 35.66 per cent of sample farmers are aware of the importance of seed quality. The analysis of problems in using quality seeds indicated that inadequate quantity of quality seeds supplied by the Department of Agriculture and non availability of these seeds at the required time were the major resons for not using quality seeds. These reasons were expressed by more than 80 per cent of farmers in all size groups. Hence supply of quality seeds in time, at reasonable price and with facilities to buy them on credit will definitely help to raise productivity of potato in the study area.

It is interesting to observe that 82 per cent of the sample farmers were using fertilizer and pesticide in excess of the recommended level. While discussing the reasons for the above trend they expressed their traditional belief in using excess manure. It is essential to make them aware of the optimum use of fertilizer and pesticides so that cost could be reduced and more investment could be made on quality seeds and other inputs like Temic 10G (Nemanticide) and micronutrients. 61 per cent of them stated that these inputs are not available in time and adequate quantity.

Since nearly 78 per cent of the sample farmers felt that financial constraints were the major reason for non-adoption of modern varieties, the problem in credit availability was analysed. The results showed that 50 per cent of the farmers felt that credit was not available in time and 33 per cent of them felt that getting credit was risky. This problem requires only administrative action of the institution concerned, for early solution. Government may provide policy support.

The analysis of the attitudes of the sample farmers towards new technology showed that 82 per cent of the sample farmers expressed an interest in adoption of improved practices and getting higher yields and 42.67 per cent of them already have the required knowledge about the appropriate technology. Thus the extension agencies in the study area are doing effective work and have made an impact on the farmers.

But there is still scope for further improvement in their impact on farmers attitudes to new innovations.

Functional Analysis

The productivity gap was related to six variables identified as varieties, value of seeds, manures and fertilizers, pesticides, share of credit to total cost per acre and attitude towards new technology. Regression coefficients are estimated through ordinary least square method. The result is :

$$Y = 1202.5745$$
$$- \underset{(290.0551)}{1110.5087\ X_1^{**}} + \underset{(0.4184)}{0.1283\ X_2} + \underset{(0.3838)}{1.2436\ X_3^{**}}$$
$$- \underset{(0.5830)}{0.5451\ X_4} - \underset{(0.1808)}{0.0812\ X_5} - \underset{(43958)}{127.8748\ X_6^{**}}$$
$$R^2 = 0.6855 \qquad n = 40$$

The above analysis showed that yield gap had a significant positive relationship with the varieties (dummy variable) and a negative relationship with attitude towards new technology. It indicated that raising HYV and adoption of new technology will reduce the productivity gap. It is interesting to note that the value of fertilizer showed significant positive relationship with productivity gap. The result revealed that by increasing fertilizer value by one rupee, the productivity gap will increase by 1.24 kg keeping other things constant. This demonstrated the sensitivity of productivity gap to the cost of fertilizer and called for suitable policy for pricing of fertilizer. The R^2 value showed that only 68.55 per cent of the variations is explained by the specified variables and the balance is due to variables that could not be quantified for inclusion in the functional relationship.

Conclusion and Policy Implication

The production of potato has increased by 48 per cent with a 10 per cent increase in productivity over the years. Still there exists a wide gap between the actual farmers yield and potential yield that can be obtained at farmers field. There is possibility of increasing productivity to 1.5 tonnes per acre with adoption of HYV and modern technology. The major constraints for increasing productivity were inadequate and untimely

availability of HYV and quality seeds and micronutrients. Financial constraint was another major reason for productivity gap due to inadequate and untimely availability of credit. By avoiding the excess use of fertilizer and pesticides, the savings could be invested in other operations. Thus the causes of yield gap are mostly institutional and administrative. They highlight the scope for bridging the gap through strengthening of infrastructural facilities, particularly for timely and adequate supply of quality seeds, credit and nemanticide and to spread the application of micronutrients.

The extension agencies should concentrate on bringing more area under HYV of seeds. To provide an adequate supply of seed, many seed production centres should be established at different villages. The credit system should be linked with crop seasons and required credit should be supplied to farmer prior to crop seasons. Thus administrative action of development departments in the district and policy support by Government can help to bridge the productivity gap.

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Rural Marketing Environment in India

V. D. SRIVASTAVA
National Productivity Council, Patna

Rapidly growing farm production, population size of the current rural markets and their potential have offered a challenge to marketing organisations in India. Today we see the emergence of a new class of rural consumer whose main characteristic is receptivity to new concepts, new values and new products.

India is on the threshold of tremendous transformation and, in fact, has already entered the era of socio-economic and environmental change. In this context, the Marketing function assumes particular significance as an instrument of social change and social justice.

If we consider the figures of National Market (1970-71 price), we find that out of the total consumer expenditure of Rs. 30,550 crores, the share of rural consumers amounted to 73% (Rs. 22,300 crores) as against 27% (Rs. 8,250 crores) of the urban consumers. Further, in 1975-76, this percentage was 72% (Rs. 30,500 crores) and 28% (Rs. 11,800 crores) among the rural and urban consumers respectively. The estimates for 1980-81 have put the total consumer expenditure at Rs. 58,000 crores to be shared 71% (Rs. 41,600 crores) and 29% (Rs. 16,400 crores) by rural and urban consumers respectively.

In non-food markets, too, in 1970-71, the rural consumer had 67% share (Rs. 6,690 crores) against 33% (Rs. 3,300 crores) share of their urban counterparts. Further, in 1975-76, against the total consumer expenditure of Rs. 13,870 crores, the rural consumers had 66% share (Rs. 9, 150 crores) against 34% share (Rs. 4,720 crores) of the urban consumers. The estimates for 1980-81 have put the total consumer expenditure at Rs. 19,280 crores with 65% (Rs. 12,480 crores) and 35% (Rs. 6,800 crores) share of rural and urban consumers respectively.

Rapidly growing farm production, population size of the current rural markets and their

potential as reflected in the progress made by rural areas in different fields, have offered a challenge to marketing organisations in India, which has yet to be accepted whole-heartedly. India's vast rural markets are still unexplored and the process of economic development has barely begun. The efforts of marketing personnel in the rural area seem to be a 'dream of paradise, yet an area of darkness' crippled, as they are, with poor communication, illiteracy, ignorance, and lack of marketing infra-structure, etc.

Science and technology have brought changes in the outlook and attitudes of the rural population and their environment. Population growth in the rural sector and the growing dynamism have a definite bearing on economic and social behaviour which would be instrumental in determining the consumption pattern in the rural areas. Today, we see the emergence of a new class of rural consumer whose main characteristic is receptivity to new concepts, new values and new products.

The main problems faced by marketing institutions in the context of rural marketing are the buying behaviour of the rural sector, application of urban marketing techniques to rural areas, generating rural demand, selection of appropriate marketing strategy, poor communication, lack of marketing infrastructure, factors of rural economy, study of the character of rural sector, application of the marketing concepts and mass consumption techniques etc.

While formulating the rural marketing strategy, the factors to be taken into consideration could be the marketing skill and competence of the organisation, development of new rural marketing norms, social responsibility of marketing in the transformation of villages and narrowing down the gap between rural and urban incomes, survey of buying influences and purchasing habits of the rural consumers, devising effective distribution system, review of the role of advertising and consumer co-operatives in the rural sector etc.

In this gigantic task, the role of national organisations like the National Productivity Council (NPC) could be very significant. The NPC has done significant work in the area of rural marketing. The Rural Marketing Studies Project in the North Eastern Region and elsewhere in the country and the establishment of Rural Marketing and Service Centres constitute pioneer work in this field. Rural Marketing today has thrown down the gauntlet to our planners who have been brainstorming to introduce developmental schemes which could pave the way for marketing in rural areas.

SUBURBAN AND SLUM MARKETS

How Suburban and Slum Markets are born

The suburban and slum markets offer both challenges and opportunities to a marketer. The continuing influx of population from rural into urban areas has created a serious problem for urban planners and development authorities. Over-population and limited resources in the urban area have given birth to suburbs and slums where a vast multitude of humanity settles. In fact, in cities like Bombay, Calcutta, Madras and Delhi this problem has assumed gigantic proportions. The slums and suburbs represent concentration of under-privileged and low income segments of the population in general. Their per capita income is low, but their total purchasing power in India is several hundred crores of rupees. With the growth in their income and population, their purchasing power is also growing rapidly.

Characteristics

Robert F. Hartley has described some of the common characteristics of slum-dwellers, such as, inadequate cash on account of low-paid jobs, lack of mobility, poor transport facilities, mismanagement of money and nonavailability of credit because of less job security. (Hartley, 1976).

The high rates of shoplifting, robbery and vandalism make business difficult and costlier in slum markets than elsewhere. Besides, higher rentals, and operating costs, security and insurance risks also dissuade large reputed firms from entering these markets. As a result, business in such areas is left to small independent merchants who do not have to invest high capital in order to compete. Goods sold are of low quality and are priced high. There are seldom any regulations to check maximum markups, which are usually two or three times the original price. Formal control over credit — consumers include liens against property and salary, return of merchandise etc. Prices are misrepresented; a sale contract may have the price and terms left blank to be filled in

by the merchant after the customer, unaware, of the terms, has signed the contract.

Profitability

Regarding the profitability factor in the slum markets, it is observed that low income market retailers sell inferior quality items and charge very heavily so that the average retail price is considerably higher than the original price. However, if we examine the profitability of these markets from the point of view of return on investment, we find that the high prices charged are neutralised by the higher costs of doing business. Lack of volume selling also does not lead to high return on investment profits. However, in low income markets, retailers make higher profits, on an average, than retailers in general.

The low income slum and suburban markets have provided challenges and opportunities to the marketing function. But understanding of the culture, environment and psychological aspects of the people inhibiting such areas, should make it possible for marketing managers to accept these challenges and opportunities and set up super markets, drug and variety stores. They can play a significant role not only in beautifying the location but also in providing a better standard of living to people, an objective which is in line with the concept of social responsibility. The carefully planned marketing strategy can surmount hostile attitudes and engender strong support and cooperation from those people. However, the firm trying to enter such markets has to take into account the fact that its employment practices, advertising and its attitude toward the consumers have, necessarily, to be favourable and progresive. The marketing programme has to be tailored to the specific needs, customs, traditions and culture of the locality and it should provide job opportunities to the local people. Any business organisation with a dynamic marketing strategy will find considerable opportunities and challenges in the suburban and slum markets.

Kotler (1979) provides a deeper insight into the role of marketing in the years to come. He records, "as human history moves towards the year 2000, with its awe inspiring problems and opportunities, the subject of marketing is attracting increasing attention from companies, institutions, and nations. Marketing has evolved from its early origins in distribution and selling into a comprehensive philosophy for relating any organisation dynamically to its markets............Nonprofit organisations such as museums, universities, churches and government agencies are seeing marketing as a new way of looking at their relations with their publics. Developing nations are examining marketing principles to see how their domestic distribution system can be improved and how they can compete more effectively in world markets. Socialist nations are begining to study how they could use marketing research, advertising, and pricing to increase their effectiveness in planning and distributing their goods" (1979). This task would need dynamic leadership. One of the most quoted articles published in the Harvard Business Review is Theodora Levitt's thought provoking 'Marketing Myopia.' He sets forth tasks for the organisation and its marketing men. To quote him : "In short, the organisation must learn to think of itself not as producing goods or services but as buying customers, as doing the things that will make people want to do busines with it. And the chief executive himself has the inescapable responsibility for creating this environment, this viewpoint, this attitude, this aspiration. He himself must set the company's style, its direction, and its goals. This means he has to know precisely where he himself wants to go and to make sure the whole organisation is enthusiastically aware of where that is. This is a first requisite of leadership, for unless he knows where he is going, any road will take him there" (1972).

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Output Variations and Labour Productivity in Small-Scale Gujarat Industries

R. V. DADIBHAVI
M. S. University, Baroda

The study compares Gujarat with other states in terms of total number of units, employment, investment in fixed assets and gross output of small-scale units. Highest contribution to the total gross output of the small-scale sector is made by relatively low investment and small worker size groups. This implies that investment in more number of low investment units will help to increase the overall output of this sector.

Small-scale industries play an important role in providing employment opportunities and also in the dispersion of industries in order to achieve the objectives of balanced development. The varied products produced in the small-scale sector, the regional dispersal of units, their production and the employment provided by such units is the essential information required by planners. Such information is vital in deciding the concessions and facilities to be extended for the development of small-scale industries, both for the central as well as state governments.

The state of Gujarat has an excellent industrial climate based on long traditions of business and industry. Gujarat, since its re-organisation in 1960, has built a good infrastructure base, developed an integrated net work of agencies to support industrial ventures and discovered a wealth of mineral resources to feed and develop a wide spectrum of industries in the state. In fact, the discovery of oil and gas, the setting up of a refinery, fertilizer factories and petro-chemical complex in the state, have elevated Gujarat to second place in the industrial map of India.

There has been a phenomenal growth of industries in Gujarat since 1960. On 31st Dec. 1960, there were 3,647 working factories providing employment to 3.30 lakh persons. The number of these factories nearly doubled by the end of 1973 and tripled by the end of 1978. The employment provided by them doubled by the end of 1978. Along with these factories

there has been a steep rise in the growth of small-scale industries in the state. The total number of small-scale units registered with Industries Department in 1961 was 2,169. This number has increased seven-fold and 14 times by the end of 1971 and 1980 respectively. As a result, the study of the dispersal and the growth pattern of these small-scale units are of vital importance in the formulation of policies for further development.

In the present context, the small-scale units refers to those units employing capital of Rs. 7.5 lakh or less in original value of plant and machinery and Rs. 10 lakhs or less in the ancillary small units. The necessary data for the study are obtained from "Report on Census of Small-Scale Industrial Units" published by the Ministry of Industry, Govt. of India, New Delhi, January 1977. The study is confined to the year 1972, as it was not possible to obtain up-to-date data on dispersal of small scale industries in Gujarat. Further, the units selected for the study are restricted to units registered with the Directorate of Industries. Thus, it excludes several other small-scale industrial units operated by specialised bodies, committees and agencies.

The study compared Gujarat with other states in terms of total number of units, employment, investment in fixed assets, gross output of small-scale units. In India, a total of 1,39,577 small-scale units provided employment to 16.53 lakh persons in 1972. They had an output of Rs. 2,603 Cr. with an investment of Rs. 10,558 Cr. The highest concentration of units was found in Tamil Nadu (11.46%), followed by Maharashtra, West Bengal, Punjab, U. P. and Gujarat (7.10%). Nearly 59% of the small units were located in these six states. In terms of employment, though there is a little change in their relative ranks, these six states account for 62% of the total employment provided by small-scale units in India. Further, of the total investment of Rs. 1055 Cr. in small-scale units, nearly 41% of it is contributed by only 3 states viz., Maharashtra, Tamil-Nadu and Gujarat. Though Gujarat had 6th and 7th rank in terms of number of units and employment respectively, it is the third highest state in India to invest in small-scale industries. As regards gross output, however Gujarat is placed 6th which implies that performance of this state in terms of gross output and employment is not commensurate with investment in small-scale industries. Since, Gujarat contributes nearly 10%

to the total gross investment in fixed assets of small-scale units in the country, it is of added interest to know the dispersal of these small-scale units and their output in industry-wise categories.

(1) Number of Units and Output by Industry Group

All small-scale units producing varied products are classified into 16 broad industry group as follows :

(1) Food products (2) Beverages (3) Hosiery and Ready-made garments (4) Wood products (5) Paper Products and Printing (6) Leather products (7) Rubber and plastics (8) Chemicals (9) Mineral products (10) Basic metal and Alloy Industries (11) Metal products (12) Machinery and parts (13) Electrical, Machinery, Apparatus etc. (14) Transport equipment and parts (15) Miscellaneous, manufacturing industries (16) Repairs & Services.

The high or low concentration of one or more variety of industries in a particular region depends, besides other things, on the availability of varieties of raw materials, finance and other facilities. Table I indicates the dispersal of units and gross output of small-scale industries by broad industry group in Gujarat in 1972. From the table, it is clear that the concentration of units varies from 1858 in Metal product industries to 19 in Beverages. Units engaged in metal products, machinery and parts, chemicals industries account for 45% of the total industries in the State. Metal products, which has the highest concentration, alone, accounts for one-fifth of the total units. Beverage units have the lowest concentration which may be because of the total prohibition in the State. Food products, beverages, paper products and printing, leather products, electrical machinery apparatus etc.; transport equipment and parts; miscellaneous manufacturing industries; repairs and services industries, each, had less than 5% of total small units in Gujarat. The high concentration of metal, chemical and mineral based industries in the State indicates that there is a systematic exploitation of the resources available in the region.

Of Rs. 208 crores total gross output of small-scale Industries in Gujarat 17.67% is contributed by Chemical industries. Though, Chemicals

Table 1

Dispersal of small-scale units and their gross output by broad industry groups in Gujarat-1972

Sr. No.	Industry Group	Number of units (Nos.)	Gross output (Rs. in lakhs)	In Backward areas (Nos.)	In Industrial Estate area (Nos.)
		1	2	3	4	5
1.	Metal Products	1858(18.76)	3086(14.79)	538(21.90)	192(15.82)
2.	Machinery & Parts	1721(17.38)	3566(17.09)	255(10.37)	267(21.99)
3.	Chemicals	942(9.51)	3686(17.67)	230(9.35)	180(14.83)
4.	Mineral Products	837(8.45)	1418(6.80)	351(14.27)	52(4.28)
5.	Wood Products	690(6.97)	905(4.34)	248(10.09)	25(2.06)
6.	Rubber & Plastics	662(6.68)	1153(5.53)	88(3.58)	148(12.19)
7.	Basic Metal & Alloy Industries	588(5.94)	2553(12.24)	64(2.60)	99(8.15)
8.	Hosiery & Readymade Garments	544(5.49)	1002(4.80)	27(1.09)	12(0.98)
9.	Transport Equipment & Parts	408(4.12)	978(4.69)	49(1.99)	84(6.92)
10.	Paper Products & Printing	369(3.73)	565(2.71)	73(2.97)	26(2.14)
11.	Repairs & Services	338(3.42)	166(0.80)	149(6.06)	8(0.68)
12.	Miscellaneous Manufacturing Industry	331(3.34)	382(1.83)	196(7.97)	30(2.47)
13.	Food Products	329(3.32)	516(2.47)	136(5.53)	15(1.24)
14.	Electrical, Machinery, Apparatus, etc.	222(2.24)	689(3.30)	28(1.14)	73(6.01)
15.	Leather Products	46(0.46)	171(0.82)	20(0.81)	2(0.16)
16.	Beverages	19(0.19)	26(0.12)	7(0.28)	1(0.08)
	Total	9904(100)	20862(100)	2459(100)	1214(100)

Note : Figures in parentheses are in percentages.
Source : Report on Census of Small-Scale Industrial Units, Vol. I-II.

have the 3rd rank in terms of number of units, it has the top rank in respect of gross output. Machinery and parts, chemical products, basic metal and alloy industry which are the next three in importance, contribute 17.09%, 14.79% and 12.24% respectively to the total gross output. The remaining 12 broad industry groups taken together contributed only 38% of the total gross output of this small-scale sector. At the other end of the scale, we have, beverages, which contributes only .12% to the total gross output. It is interesting to note that, though, wood products has 5th rank in terms of number of units, it occupies 9th rank in terms of gross output.

(2) Concentration in Backward areas

As many as 10 districts of Gujarat are identified as industrially backward areas. To develop these areas, various incentives and facilities are provided by the Government to units located in backward, RIP and Industrial Estate areas. Hence, it is of interest to analyse the dispersal of small-scale units in the Backward, RIP and industrial Estate areas of Gujarat. As many as 35%, 15% and 5% of small units were located in backward, RIP and Industrial Estate areas respectively in the nation during 1972. In Gujarat, out of 9904 small units, 2459 i. e. 25% were located in backward areas, and 12% in the Industrial Estate areas. Though, the percentage of small-scale units located in the backward and Industrial Estate areas is less than the all-India percentages, it is important to study their distributions within the backward areas from the policy point of view. It can be observed, from Table 1, col. 4 and 6, that again it is the metal products which has the highest concentration (i.e. 21.90%) in the backward areas followed by mineral products, machinery and parts and wood products each, accounting for more than 10% of the total units of backward areas in Gujarat. These four group of industries account for 54% of total industries situated in backward areas. At the lower end of the scale, we have, beverages, leather products, hosiery and ready-made garments. There appears to be plenty of scope to develop industries producing traditional goods in the backward areas. Units producing machinery and parts, metal products, chemicals, rubber & plastics are concentrated in the Industrial estates areas. These 4 industry groups account for 65% of total units set-up in the industrial estate areas of the state. A high concentration of such industries, which are largely based on sophisticated technology, in industrial estates, may be, on account of the many facilities provided in the industrial estates. Beverages, leather products have negligible units in the Industrial Estates.

(3) Size and Labour Productivity

The study also analyzed the distribution of gross-output of small-scale sector among the different investment—employment size units of industries in the state. The Report on Census of small-scale industry units provides, data on total output and total units in 6 different investment, employment sizes. In terms of investment, we have, units employing less than Rs. 25 thousand, Rs 25 thousand to Rs. 50 thousand, Rs. 51 thousand to Rs. 1 lakh, Rs. 1.01 lakhs to Rs. 3 lakhs, Rs. 3.01 lakhs to Rs. 6 lakhs and above Rs. 6 lakhs. In term of employment, we have units employing 1-4, 5-9, 10-19, 20-49, 50-99, and above 100 workers. The percentage of output distributed in each investment—employment size units is presented in Table 2. From the table, it is clear that the highest percentage

Table 2

Distributions of output of small-scale industries by employment and investment size : Gujarat 1972.

(In Percentage)

Sr. No.	Investment input & machinery (Rs. '000)	Number of workers						Total
		1-4	5-9	10-19	20-49	50-99	100 & above	
1.	Upto 25	3.12	14.67	7.41	2.05	0.81	0.15	28.22
2.	26 to 50	0.45	5.70	5.11	2.26	0.18	0.22	13.91
3.	51 to 100	0.15	3.89	5.32	4.79	0.48	0.27	14.90
4.	101 to 300	0.11	2.31	5.79	8.67	4.58	2.35	23.82
5.	301 to 600	0.02	0.21	1.56	5.84	2.77	2.37	12.78
6.	Above 600	.0005	.04	0.64	1.89	1.71	2.11	6.37
	Total	3.85	26.82	25.83	25.50	10.53	7.47	100.00

Source : same as Table 1

(14.6%) of gross output is concentrated in the size group employing 5-9 workers with investment of less than Rs. 25 thousand which is followed by size group employing 20-49 workers with investment of Rs. 1.01 lakh to Rs. 3 lakhs. In other words, nearly 24% of gross output is distributed among these two groups only. The least concentration of output is found in the group investing Rs. 6 lakhs and above and employing 1-4 workers.

On the whole, highest contribution to the total gross output of small-scale sector is made by relatively low investment (i. e. less than Rs. 25 thousand) size group and lowest contribution by relatively high investment (Rs. 6 lakhs and above) size group in the state. And, the proportion of output, contributed to total output, by relatively small-worker size group is higher than the contributions of relatively large worker size groups.

What is the labour productivity in different size units ? Will there be increase or decrease in the productivity of a unit when it changes its size either by investment or by employment or by both, from the low level to high level ? What type of investment-worker size units of different industries need to be encouraged both from employment and productivity view point ? Such other pertinent questions may be asked at this stage, if at all the locational aspect of small-scale units is to be a guide for policy framing. An attempt is made to answer all these questions in the paragraphs to follow.

As stated earlier, the Census Report provides data on total output and units in different size units and does not contain any data on the total number of workers employed in each size group. In order to work out productivity in different size units, we have to develop a methodology to identify number of workers in different size groups. For this purpose, we have taken the mid point of each size, which in turn, when multiplied by total units in respective employment size group, will provide total workers in each size group. Having found out the total workers in each size group in this way, we have worked out productivity per worker in each size. However, there was a difficulty in finding out the mid-point of last employment size group (i. e. 100 and above) as the upper end point of the group is unknown. Hence, we have excluded productivity in this group from our productivity analysis. The study thus covers 92% of total output and 99% of total Census units of Gujarat State. Productivity in different investment (six sizes) workers (4 sizes) units is presented in Table 3.

Table 3

Product per worker of small-scale units by employment and Investment size in Gujarat State, 1972

(In Rs.)

Sr. No.	Investment in fixed assets in Rs. '000	1-9	10-19	Number of workers 20-49	50-99	% fall in Output
	1	2	3	4	5	6
1	Upto 25	13860	15920	9989	7901	50
2.	26 to 50	21012	17532	13149	7019	60
3.	51 to 100	26070	20417	17457	8889	56
4.	101 to 300	29477	26631	18143	15092	43
5.	301 to 600	30824	37965	34633	19423	49
6.	Above 600	24368	82881	37885	31825	62
	Total	16826	20118	18916	4967	75

Source : same as Table 1.

It is observed, from Table 3, that the product per worker is increasing with the increase in size of units in terms of investment, irrespective of their size in terms of employment. When a unit's size, employing 10-19 workers, is increased in terms of investment from Rs. 25 thousand to Rs. 6 lakhs, labour productivity is increased by 6 times. And such an increase is 4 times in case of a unit employing 50-99 workers. This means, that the capital intensity in all the units helps to increase the productivity per worker in small-scale industries.

On the other hand, we find a different picture of productivity when a unit's employment size alone changes. It is clear from the table, that in investment units of all sizes, productivity is continuously falling, when the employment size is increased from 10-19 to 20-49 and to 50-99. The product per worker falls from Rs. 15920 to Rs. 7901, when the employment size of a unit is changed from 10-19 workers to 50-99, even though the investment size of such a unit remains at less than Rs. 25 thousand. Similarly, a unit with an investment of Rs. 6 lakhs experiences a fall in output per worker from Rs. 82881 to Rs. 31825 when it changes its employment size from 10-19 workers to 50-99. However, when employment size is increased from 1–9 to 10–19, the product per worker increased in 1st,5th and 6th investment size units and the productivity falls in other investment size units. If we consider the first two employment size units as relatively small-scale and the other two as relatively large-scale units within the small-scale sector, we arrive at some interesting conclusions.

At this stage, it is a moot point to discuss what type of investment size—employment size combinations of industries need to be advocated to meet the twin objectives of employment and productivity. It is, in fact, a question of striking a fine balance between the two. From the view point of these objectives, it is necessary to observe, in which investment size units, fall in output per worker is least when employment size alone is increased. We have worked out the percentage of fall in output per worker, when employment size of units is enlarged from relatively small-scale i.e., 10-19 to relatively large-scale i. e. 50-99, in all investment size units of the study. This is done because, from 10-19 employment size onwards there is a continuous fall of output per worker. Such a fall of output from 10-19 worker size units

to 50-99 worker size units is shown in Table 3, col. 6. From this, it is clear that the fall in output per unit is highest i. e. 62% if the units size is enlarged from 10-19 workers to 50-99 workers with the investment of Rs. 6 lakhs and above. And such a fall is least when the employment size is increased in the units investing Rs. 1.01 lakhs to Rs. 3 lakhs. Thus, the small scale units investing Rs. 1.01, to Rs. 3 lakhs may be advocated on the grounds, that such units provide more employment, use relatively less capital and achieve high productivity. Of course, these conclusions are based on the availability of limited data.

Further it is also interesting to observe, that, as the investment increases from Rs. 25000 to more than Rs. 6 lakhs i. e. by more than 24 times, productivity rises not more than 6 times, whatever employment size group we consider. Now the question is, given the investment maxima (i. e. Rs. 7.5 lakhs) is it worthwhile to invest the entire amount in one large investment size unit only or spread it in over a number of small-investment-size units within the small-scale sector. In other words, we can either have only one unit of Rs. 6 lakhs size or 24 units of Rs. 2500 or 12 units of Rs. 26,000 to Rs. 50,000 investment size. Although, the relative product per worker in small investment size units is low, it is reasonable to expect, that the investment in more number of small-investment size units will provide more employment, and help to increase overall output of small-scale sector. The case for smaller units within small-scale sector, therefore, is not ruled out. However, these conclusions are tentative because of the restrictive nature of our data base. When, more information about investment, output, employment by industry group are available, this aspect may merit further investigations.

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Productivity and Small Industry

M. S. BHAGWATGITA
Small Industry Extension Training Institute, Hyderabad

This paper discusses the constraints vis-a-vis productivity in small industry and suggests measures to increase productivity in this sector. Studies of small scale units disclose that productivity is low due to poor technical know-how and paucity of finance. The government should come forward with remedial measures to these problems.

Productivity is one of the management concepts which became popular in the country in the era of planned industrial development. Early in the fifties a network of productivity councils were established in different industrial centres in the country and delegations were sent mainly to the western countries to study the various tools and techniques of productivity available in those countries with a view to adopting them in our country.

Productivity concept involves the full, proper and efficient utilization of all the resources that go to build any industry. Productivity implies creating the best product with the minimum utilisation of industrial resources such as men, machines, materials, power in the money terms of investment. 'Productivity' is a relative concept and the emphasis on labour productivity and capital productivity would vary from country to country, from time to time and from industry to industry according to the level of development and the relative scarcity of the different factors of production.

The first welcome step to adopt productivity techniques to the situation in our country where capital is scarce and labour is abundant was the National Productivity Council's seminar in 1972. It was recommended that we should adopt a total approach to economic development and productivity with the national five year plans. Such an integrated plan may lay down the objectives, programmes and priorities so that entire economy achieves a self-sustaining growth rate. It was felt that we need productivity-oriented

industrial policy to adopt seperate plans, industry-wise for achieving the predetermined rate of productivity in economic growth.

It would appear that the productivity concepts need to be reviewed in this context when the Government of India envisages the creation of a society largely based on self-employment. It is proposed to bring forth forward looking small unit technology suited to our conditions and to give all possible encouragement to optimum utilisation of labour-intensive techniques of production.

The present paper discusses the various hurdles in the way of small industry productivity and suggests measures for increase in productivity.

Generally speaking there are two aspects of productivity :

1. The technical aspect covering techniques of production, better management, better inventions, better handling of resources and avoidance of waste, etc.

2. The psychological and human aspects involving better motivation, better attitudes, and better industrial relations.

While the two aspects are common to both large and small scale industries there are some important differences in the approaches to these units. The large units, can afford to employ or otherwise obtain the services of experts in the adoption of various tools and techniques of productivity in technical and behavioural aspects. The small scale units, on the other hand, can not afford to employ such experts and the entrepreneur himself has to imbibe the productivity attitude and acquire and practice productivity skills.

Hurdles

There are certain factors which restrict the scope of productivity in the small scale sector with its meagre finance and limited market opportunities. The small industrialists, particularly the educated and technician class, claim that they are spending far too much time in filling up forms, and in conforming to formalities and procedures, rather than in managing their units. Some experienced technical entrepreneurs have mentioned that they spend as much as 60 to 75 per cent of their time in attending to these routine procedures and formalities which detract them from their main business of production and productivity.

It is also claimed that the small scale unit is not always sure about the required supply or uniform quality of the raw material. In order to ensure quality output, it is necessary that the supply of raw material of desired specifications should be assured.

The small industrialists generally prefer conventional machines which are of multipurpose type. Many of these machines have to be modified for a specific requirement. This makes for economy in investment while giving an accepted output per man. However, more attention has to be given to the design and manufacture of appropriate tools, jigs and fixtures for these multipurpose machines. A special service to provide appropriate tools and technology seems to be necessary to increase productivity levels of the small units.

The small industry, with its meagre finances, finds its difficult to employ the skills essential to boost productivity. At the same time it lacks the potential to purchase sophisticated machines to produce more through semi-skilled or unskilled labour. Besides, such machines demand certain minimum quality of work to avoid incurring losses.

It is often felt that the main hurdle in the spreading of the productivity concept among small industrialists is a lack of management consciousness. The small industry proprietors do not adopt and implement productivity practices as they are more involved in day to day problems of securing raw materials or infrastructure facilities or in complying with the rules and regulations of the State Authorities. Productivity is considered as an activity of leisure time. It is, therefore, necessary to create among entrepreneurs productivity consciousness through proper training and publicity.

Breaking the Technological Barrier

The small scale industries, with few exceptions, are motivated to serve as a feeder industry.

In view of the overall development, this must be welcomed. But in many cases the entrepreneur is not quite certain about the nature of his work and his product. He has no control on the type of the job he would like to do and is rarely assured of work unless he has some equipment to produce with. As a consequence, and due to a paucity of finance, he prefers to go in for conventional machines only and finds them unsuitable for the work he is expected to do.

The situation needs speedy rectification. It is time that Government induces or even compels the large scale industries to get a bulk of their requirements through small scale industries. These parts should be evenly apportioned and distributed to the various small units. The rates of such parts have to be decided in the context of the prevailing cost structure and selling price of the main commodity produced finally in the large industry. If this is done, the small entrepreneur could clearly count upon the work he has to do.

Choice of Product—The Compulsive Factors

These fundamental factors are applicable to large as well as small scale industries. The factor of productivity must be taken into account from the design of a product. It goes without saying that better design is better productivity, but the small industry cannot afford to employ highly qualified persons to achieve better design. The only alternative left is to follow a product already established in the market. Even if the small scale industry is able to produce an exact replica of an established product it may not be in a position to sell it economically. In addition, it is deprived of a selling organisation which promotes the product.

This problem can be overcome only by making a better design available to the small scale industry. This calls for a major breakthrough in the design of conventional products and applications of the latest design practically will yield a more economical and more efficient product than the established product. If an established product is compared with a similar product in the small industry it is imperative that the latter is less in its weight content than the former.

Improvisation in the Production Process

In the production process, more stress needs to be given to improvisation. However, it should be borne in mind that with specially converted production machines, any improvisation is confined to the tools, the speeds, feeds and the methods employed. More attention needs to be paid to methods study than to time study. The time factor can be taken care of by utilisation of the optimum capacity of the machine tool by selecting proper speeds and feeds. This will help to increase machine productivity in relation to investment on the machine and manpower.

The method study will have greater bearing on the increased productivity. Even a proper sequence of operation will add to productivity. The method study, to start with, must confine itself more to the application of proven manufacturing techniques. Even these proven methods are not utilised properly in several small units. This can be attributed to many factors most important of which is that entrepreneurs in the small scale industries seem to lack the technological background, which is either acquired through experience or academic training.

Even where there is sufficient availability of technical knowledge, management techniques available to the small industries are not being used fully. So the need of the hour is to use these techniques and increase productivity.

The best way to overcome apathy and ignorance is to concentrate on the direct personal approach for spreading information regarding productivity technique.

The skill development can be within the means and resources of the small industry. The same can be done by area-wise small industries, through a common endeavour. It will be possible to develop diversified skill abilities through formation of productivity groups.

Suggestions

The small scale industries should keep themselves abreast of the activities of the various institutions and agencies and the schemes offered by them so as to secure benefits from these schemes. The agencies and institutions should also feel a moral obligation to render help to

the small scale industries in improving their operational efficiency, thereby adding to the national wealth. To achieve this the Government should strive to educate small industries about the existence of such agencies, their functions and procedures. The small scale industrialists should make use of the training programmes conducted by organisations like SISIs, SIET, etc.

The entrepreneur has to play a vital role in influencing the attitudes of his staff and workers in adopting sophisticated techniques. To promote manpower effectiveness and increase in productivity, such an approach should emphasize the integration of the interest of employees with those of the entrepreneur and should also provide the employee an opportunity for self-fulfillment. The problem of productivity is the problem of making more rational use of existing resources for achieving predetermined targets of output at the lowest capital cost. The raise in productivity should generate a genuine surplus for distribution among various interests involved in the productivity efforts.

The method study has an important bearing on increased productivity in the small industry. The improvement in production processes through method study can be encouraged by forming productivity groups among the small units engaged in allied fields. They may avail of the services of the local productivity councils or employ qualified and experienced persons to carry on methods analysis and suggest suitable changes. Before introducing productivity techniques in any small unit, training to the entrepreneur in industrial management in general and the concerned productivity techniques in particular appears to be a pre-requisite.

The general impression amongst administrators and practioners of productivity practices and the students of the subject seems to be that productivity is extremely low in the small scale sector. There are two views regarding the reasons for this low productivity. Some cross sectional studies of small scale units disclosed that productivity is low due to the poor technical know-how and financial difficulties of the entrepreneurs. It is therefore felt that the Government should come forward with remedial measures for these problems. The SISIs and other institutions have been set up to overcome

the technical know-how gap, and to offer liberalised financing schemes to help entrepreneurs tide over financial difficulties. However there is another view that the basic malady in the small scale sector is the lack of systematic managerial decision-making process and managerial inefficiency. Training programmes in the various management areas would be of particular value in eliminating these deficiencies.

In addition to the above the following action can be taken :

— Introduce new standards in quality by consulting various agencies

— Making training programmes more practical oriented rather them theoretical.

— Starting common testing and certification centres, where tests are carried out free of charge or at a nominal rate.

— Innovation of simpler, more reliable and low-cost machinery, etc.

— The DICs package assistance should be pressed into service. They should attend to the various problems of small scale industry in securing registration, licensing, obtaining various inputs including finance from institutions and marketing of their products.

— Technology transfer appropriate to the needs of the small industry should be made available to the entrepreneur for machinery, process control, packing and marketing of his product.

— Centralised services for marketing of products through a net work of mobile vehicles in urban as well as remote places of the country should be considered.

— Planning and review of industrial problems has been considerably handicaped by lack of up to date and reliable statistics about the industry. The DCSSI should make suitable arrangements for collecting of data through DICs to remove this deficiency.

The problem of productivity has to be tackled in an integrated manner. If the rise in productivity on the part of workers helps to enhance the return on investment, it will be possible for small units to retain skilled workers with a promise of higher emoluments. Quick returns on investments helps survival as well as expansion. This is not possible unless there is certainty of demand or a promise of quick turnover.

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For further details, contact :
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