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Contents

Focus

Impact of Technology Policy on Productivity Growth: An Econometric Study of Pharmaceutical Industry In India

Anita Kumari

As part of India's major economic reforms in 1991, there has been vast changes in technology policy in India for improving the productivity and competitiveness of firms. The study analysed the impact of these changes in technology policy on productivity growth of firms in Indian Pharmaceutical industry, the most-vibrant knowledge based industry which is going to be affected most by the changes in the technology policy in India and globalisation of world economy. The study shows that liberalization of technology policy has played an important role in the productivity performance of firms in Indian pharmaceutical industry in the post reform period.

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Introduction

"In India, major economic reforms were undertaken since 1991 with the objective of transforming the regime of regulated economy to competitive regime for accelerating economic growth. The major focus of these reforms was on technology policy for injecting the desired level of technological dynamism in Indian industry for improving the productivity and competitiveness of firms. The technology policy provided the firms freer access to imported inputs, capital goods and technology. Foreign investment has also been liberalized for facilitating the transfer of technology as well. These reforms have made imported inputs cheaper and more accessible for firms and have exposed the firms to both domestic and international competition. Apart from liberalizing import of technology there has also been incentives to promote in-house R&D (Research and Development) activity in industry, such as weighted deduction of 125% of income from business for research programme which has later been increased to 150%. Also after an agreement on TRIPS (Trade-Related Aspects of Intellectual Property Rights) under WTO in April 15, 1994, the need for R&D was felt relatively more by firms. Thus after more than a decade of reforms, it is important to analyse the impact of these vast changes in technology policy on productivity growth of firms in Indian industry to draw policy conclusions for Indian industry, and in general for other developing countries as well, to improve its competitive strength through increase in productivity. The study focuses on pharmaceutical industry, the most-vibrant knowledge based industry. The pharmaceutical industry in India is expected to be affected most by the changes in the technology policy in India and globalisation of world economy. The study thus analyses the impact of technology policy on productivity growth of firms in Indian pharmaceutical industry after reforms. The technology policy consists of

acquiring imported technology through arms length purchase or embodied in imported inputs or capital goods, doing R&D for either adapting the imported technology or innovating new products. The technology policy also consists of transferring imported technology through foreign equity participation. An econometric model was estimated on a panel of firms to analyse the impact of these components of technology policy along with other control variables such as growth of scale of production, export intensity and capital intensity on productivity growth.

The rest of the paper is organised as follows. Section 2 discusses the evolution of technology policy in India. Section 3 gives a brief review of literature discussing the theoretical basis and hypothesis and section 4 provides analytical framework for studying the impact of technology policy on productivity growth. Section 5 discusses the findings of the study, followed by conclusion in section 6.

Evolution of Technology Policy

The technology policy in India has undergone sea changes in India since reforms of 1991. In the pre reform period, Indian technology policy was restricted and more selective (Panchamukhi et al. 1994). It consisted of import substituting strategy and permitted foreign technology only if local technology has not been available and protected local technology from imported technology where local technology was available. Regarding import of capital goods also, the import of capital goods was banned where these were available locally. Some capital goods were allowed through open general license by direct users. The policy further required Indian consultants to be given prime role even if foreign consultants were also required and to utilize exclusively Indian consultancy wherever Indian consultancy was available. Those importing technology were also required to demonstrate the necessity of the import of that technology. The technology policy also required a firm's commitment on indigenisation of imported technology through adequate investment in R&D for absorption, adaptation, and subsequent development of imported technology. Further the technology imported was required to be available for sublicensing within the country. Also the technology imported had restricted clauses with respect to exports, source of capital goods, raw materials, or spares.

Foreign investment was considered a channel of technology transfer with the emphasis on majority ownership and control by Indians. Foreign collaborations approval procedures wherever allowed were subject to complex procedures regarding ceiling on foreign investment and royalty payments and also restricted to very few industries only. Foreign investment was also restricted to high technology and capital intensive industries. Also the relaxation of general ceiling on foreign collaboration was given in high technology and export oriented activities. Use of foreign brand names for sale in the domestic market was not allowed. Foreign collaborations could also not be renewed or extended beyond a certain limit.

Liberalization of India's technology policy started in 1979. Designs were allowed to be imported against import replenishment licenses without government's prior approval and capital goods import has been liberalized by expanding list of open general licenses. The procedure for approving foreign collaboration were also liberalized.

As part of India's major economic reforms in 1991, technology policy has further been liberalized with a change in focus. Before liberalization, import of technology by firms was not easy. There were restrictions on the industrial licensing, import of technology, and technology embodying inputs and transfer of technology through foreign investment. There was focus mainly on indigenization of imported technology through adequate investment in R&D. But since 1991 with the objective of increasing competitiveness of Indian firms, technology acquisition through technology import either disembodied or embodied in inputs and capital goods or through foreign investment has been made easy and cheaper, through reduction in tariff rates, to build technological capability of Indian firms to face international competition with globalization of Indian economy. There have also been incentives to promote in-house Research and Development activity in industry to face challenges in the TRIPS regime that will make a major change in the product patenting. The pharmaceutical industry will be the most affected by these changes. Thus this study analyses the impact of these changes in technology policy on productivity growth of firms in Indian pharmaceutical industry to draw policy conclusions for improving the competitive strength of firms through increase in productivity in Indian industry and in general for other countries as well.

Literature Review: Theoretical Basis and Hypothesis

Technology has received important place in economic growth and competitiveness in the globalised era as competitiveness of the firms explain most variations in economic growth. (Porter and Christensen, 1998). In Neoclassical theory, technology is considered as

exogenous that is given to the economic system. But in new growth theories, technology is considered to be endogenous (Lucas, 1988; Romer, 1986). The role of technology has also been considered important in international trade in the neo-technology theories of trade (Posner, 1961; Vernon, 1966). The importance of technology has thus been widely accepted in the literature especially in developing countries in the liberalized era. Propensity to seek technology depends on the technological capability (Amsden, 1989; Cooper, 1995; Dahlman et al., 1987; Enos, 1991; Kumar and Siddharthan, 1994), opportunity and appropriability conditions (Basant, 1997), perception of cost, risk, and benefit of the technology (Caves, 1982; Kumar, 1990; Robinson, 1988). Thus for developing countries in the period of globalization, technological capability is the key to development through producing more efficiently, apart from other factors (Dahlman et al., 1987). In India, the main focus of the economic reforms was also on technology policy for acquiring technological dynamism in Indian firms for improving productivity and competitiveness of firms to compete with in and with the rest of the world. This section therefore discusses the literature regarding hypothesis for impact of technology policy along with other determinants of productivity growth.

Technology Policy

The liberalization of Indian economy, globalization of world economy, and challenges put forward by new obligations under TRIPS have affected the pharmaceutical industry in many ways. The firms have been opened up for competition, both domestic as well as international. The liberalization of technology policy has opened up various options for firms to face these challenges. The main aim of the technology policy has been to make available the imported technology freely to Indian firms. The imported technology may be acquired either through arms length purchase i.e., making payments for know how, of drawings, designs, etc. or embodied in imported inputs or capital goods, or transferred through foreign equity participation. Research and development expenditure has also been an important component of technology policy as it is required for either adapting the imported technology or innovating new products. The new improved technology helps in the introduction of new products and processes. This also helps in developing new dosage and formulation of drugs either existing or new drugs. These lead to better quality improvement and increases productivity of firms through reduction in costs and increasing the demand of the product. A survey by Keller 2004 has shown that technology transfer is widely recognized as one of the major ways by which productivity can rise. Several other studies, such as Coe and Helpman (1995); Coe, Helpman, and Hoffmaister (1997), Litchenberg and Van Pottelsberghe de la Potterie (1998) have assessed that availability of embodied technology in imported capital goods and inputs allows for a degree of specialization in the production which has an enhancing impact on the productivity growth of firms. Falvey et al. 2004 have also suggested that imports do promote knowledge flows that promote growth. While a study by Keller (1998) has shown that imports may not act as a source of technology spillover. But we hypothesize that to face the challenges in the liberalized era and obligations under TRIPS, firms acquiring imported technology will have higher productivity growth as compared to firms not acquiring imported technology.

The technology transfer through foreign collaboration is also an important means of transfer of technology. Indeed, foreign collaboration in equity seems to bring relatively efficient technologies into host country and thus increases the productivity of the host country. Foreign collaboration also provides management and organizational competence. These assets have spillover effects on the rest of the economy. The foreign collaborator puts pressure and assists the local companies to improve their technology and the product quality. Foreign collaboration also helps the host country in improving its export competitiveness by increasing productivity and by improving the product quality. Because of international linkages of foreign collaborators, host country gets better access to foreign markets. Foreign collaboration also contributes to exports directly if equity investments have been made with the specific intention of sourcing parts or components from the host country to take advantage of low cost conditions there. The export expansion also overcomes the demand side constraints on growth. Foreign collaboration via equity flows is considered as a long term investment since returns to foreign investor from remitted profits and dividends accrues to him after a time. Caves' (1974), Globerman (1979), Blomstrom and Persson (1983), Kokko (1994), and Blomstrom and Wolff (1994) have found that foreign firms have a positive impact on productivity growth. But Xu and Wang (2000), Haskel et al. (2002), Keller and Yeaple (2003), Haddad and Harrison (1993) have found that foreign presence has no significant effect on productivity. However, technology strategy of firms may be different in different industries. For pharmaceutical industry, it has been hypothesized that technology transfer through foreign investment will have a significant effect on

productivity growth of firms because of the liberalization and in lieu of challenges put forwarded after implementation of TRIPS, foreign firms can transfer the technology and can get their product patented.

Technology acquisition often amounts to adapting existing methods to local circumstances Evenson and Westphall (1995). Once the advanced technology has been acquired, the recipient firm has to make efforts for adaptation and development of the technology and gain mastery over it for achieving the productivity potential of the advanced technology. Research and development (R&D) expenditure is an important part of the competitive strategy of the company as it helps in assimilation and adaptation of foreign technology and making it suitable for indigenous use. R&D effort also increases the variety of intermediate inputs or their quality (Grossman and Helpman, 1991). Research and development (R&D) expenditures also helps in developing new processes or new products that are different or better than those already existing. The productivity of the company will increase as R&D will change the conditions under which the company operates in markets and also if these goods are exported. Scherer (1982), Griliches (1984), Odagiri (1985), Jaffe (1988), Dosi et al. (1990), Coe and Helpman (1995), Coe et al. (1997) and many others have studied the nexus between productivity, research and development and have revealed that advances in the technology result in the improvement of productivity growth. In case of pharmaceutical industry in India also, research and development expenditure is expected to play a significant role in increasing the productivity.

Output Growth

A positive link between productivity growth and output growth has been well established in the literature. The faster a company grows the more it has the opportunity to exploit the benefits of economies of scale. These are often stated as specialization and division of labour in production, the existence of indivisibilities, the economies of increased physical dimension of some plant and economies of massed resources. Some of these economies are obtained because of technological progress while others are obtained because of specialization either within the same industry or in the input supplying industry.

The rapid expansion of growth of output allows for the introduction of new techniques because of large scale of production. In situations where the output of company is not expanding rapidly and excess capacity is there, the expansion in the level of operations allows for the utilization of such capacity. This results in better efficiency of factor use. Also, rapid growth of output shortens the time lag in the application of new technological advances. The new technological advances are applied to production scales and utilize better skills. This increases productivity growth. When the output growth is faster, endogenous technological progress also occurs and improvement in the methods of production takes place. Several studies, Kaldor (1967), Kendrick (1961), Kendrick (1973), Kendrick and Grossman (1980), Goldar (1986) and Ahluwalia (1991) and many other studies found a strong positive association between output growth and productivity growth. This study also expects a positive association between output growth and productivity growth.

Export Orientation

The international trade plays an important role in raising productivity through various channels. Exports serve as a conduit for technology transfer from abroad and generate competitive pressure on companies which generates productivity. Chen and Tang (1987), Haddad (1993), Aw and Hwang (1995), Tybout and Westbrook (1995), Aw and Batra (1998) have shown that productivity of exporting companies are more than their counterparts that sell primarily in the domestic market. The productivity improvements may also result from learning by exporting. Evenson and Westphal (1995), Grossman and Helpman (1991), World Bank (1993) and Clerides et al. (1998) hold the view that exporters learn from their contacts in the export market and as a result they adopt better production methods and achieve higher productivity. Technology may also diffuse from exporters to non-exporters in the same industry through demonstration effects, skilled worker training or expertise imparted to their local suppliers. Clerides et al. (1998) found that when many firms have been exporting from a particular region, all firms in that region tend to enjoy lower average costs. Exports also have an effect on productivity growth through growth of demand. It enables the company to exploit the economies of scale which increases productivity growth. The impact of exports may also be different for firms in different industries. It is hypothesized in this study that exports play a significant role in raising productivity growth of firms in Indian pharmaceutical industry.

Capital Intensity

Ahluwalia (1991) argued that firms with relatively high capital intensity will be the ones with more chances of embodied technical progress which will thus have significant effect on productivity growth. It is therefore hypothesized that

capital intensive firms attain higher rates of productivity growth.

Analytical Framework

Based on the hypothesis discussed above and developments in the Indian economy in the technology policy, the model which we have formulated for analyzing impact of technology policy on productivity growth of firms in Indian pharmaceutical industry after reforms is specified below. The technology policy consists of acquiring imported technology through arms length purchase i.e., making payments for know how, of drawings, designs, etc. or embodied in imported inputs or capital goods, doing R&D for either adapting the imported technology or innovating new products. The technology policy also consists of transferring imported technology through foreign equity participation. An econometric model specified below was estimated on a panel of firms to analyse the impact of these components of technology policy along with other control variables such as growth of scale of production, export intensity and capital intensity on productivity growth.

The following econometric model has been developed to examine the impact of technology policy and various other factors determining productivity growth:

GP = f (TIMPA, TIMPK, TIMPIN, TFE, RI, GSCALE, EI, KI)

where,

GP = productivity growth, TIMPA = technology transferred through arms length purchase of technology, TIMPK=technology transferred through imported capital goods, TIMPIN= technology transferred through imported intermediate inputs, TFE = technology transferred through foreign equity participation, RI = research intensity, GSCALE = growth of scale of production, EI= export intensity, KI = capital intensity. All the variables have been measured in current prices. This partly covers price changes due to qualitative improvements in capital goods and products. To capture year specific effects, a set of year dummies have also been included in the model. The model has been estimated after correcting for heteroskedasticity using Eviews package.

The Data and Measurement of Variables

The above model has been estimated by using the data on companies from Capital line data set brought out by Capital Market Publishers India Pvt. Ltd. The model has been estimated for the period 1992 to 2004. The sample consists of 1310 observations belonging to pharmaceutical industry. The measurements of different variables used in the analysis are mentioned below:

GP = Productivity growth is measured by total factor productivity growth by two input translog method,

TIMPA = Technology imports through arms length purchase has been measured by payments for royalty and technical fees made abroad to ratio of sales,

TIMPK = Technology transferred through imported capital goods has been measured by payments made for import of capital goods as a ratio of sales,

TIMPIN = Technology transferred through imported intermediate inputs has been measured as payments for imports of materials, spares, components, etc. to total sales,

TFE = Technology transferred through foreign equity participation has been measured by share of dividends declared in foreign currency to total dividends paid,

RI = Research intensity has been measured by ratio of research and development expenditure to sales.

GSCALE = Growth of scale of production has been measured by growth of gross value added,

EI = Export intensity is measured by exports as a ratio of sales,

KI = Capital intensity is measured by ratio of capital to labour.

Findings

Table 1 gives the estimates of average productivity growth for firms in Indian Pharmaceutical industry from 1992 to 2004. Total factor productivity growth for firms importing technology through arms length purchase have been found to have very high productivity growth of 3.2 per cent per annum as against –1.3 per cent per annum for firms not importing technology through arms length purchase. For firms importing capital goods also, average productivity growth has been found to be higher being 0.9 per cent per annum as against –1.6 per cent per annum for firms not importing capital goods. Productivity growth has also been found to be higher for firms importing intermediate inputs being 0.4 per cent per annum as against –4.0 per cent per

Table 1: Productivity Growth for Firms in Indian Pharmaceutical Industry from 1992 to 2004

(in Percentage)

	Firms Importing Technology	Firms Not Importing Technology
Disembodied (TIMPA)	3.16 (39.2)	-1.26 (52.9)
Embodied in Capital Goods (TIMPK)	0.95 (36.7)	-1.58 (58.7)
Embodied in Intermediate Input (TIMPIN)	0.35 (49.2)	-4.01 (57.3)
Transferred Through Foreign Equity (TFE)	3.23 (26.1)	-1.54 (55.6)
Adapted through Research and Development (RI)	1.50 (37.1)	-1.47 (56.1)

annum for firms not importing intermediate inputs. Interestingly, firms having foreign equity participation have productivity growth of 3.2 per cent per annum but firms not having foreign equity have been reporting productivity growth of –1.5 per cent per annum. Firm's spending on research and development expenditure have been found to have productivity growth of 1.5 per cent per annum which is higher than that for firms not spending on research and development being –1.5 per cent per annum. Thus firms importing technology either disembodied or embodied in capital goods and intermediate inputs have been found to have higher productivity growth. Also firms having technology transferred through foreign equity participation have been having higher productivity growth. Further research and development expenditure has also resulted in increasing productivity growth of firms.

Table 2 reports the results of econometric model estimated after correcting for heteroskedasticity. Among technology policy variables, the coefficient of technology imports through arms length purchase has turned out to be positive and significant at 5 per cent level of significance. Thus those firms which imported technology through arms length purchase were able to increase their productivity better than those not importing technology. On the other hand, the coefficient of technology imports embodied in intermediate inputs has not turned out to be significant. This shows that prior to liberalisation of technology policy, firms had to import intermediate inputs to technologically improve the production of their product. But with the liberalization of technology policy, firms had the option to import the technology and thus firms started importing technology to improve the quality of domestically produced inputs also to compete with the imported inputs. However, the coefficient of technology imports embodied in capital goods has turned out to negative and significant indicating that in lieu of liberalisation firms started importing capital goods which had the larger capacity than demand generated in the Indian pharmaceutical industry. The coefficient of technology imports transferred through foreign equity has also come out to be insignificant in generating productivity growth. This may have been because earlier only those firms were able to have access to imported technology which had foreign equity but in lieu of liberalisation of technology policy even firms not having foreign equity also had access to imported technology and thus could generate higher productivity growth. The coefficient of research intensity has also turned out to be insignificant. The insignificant coefficient of research intensity may be because still very few firms are spending

Table 2: Estimates of Econometric Model for Determining Productivity Growth of Firms in Indian Pharmaceutical Industry

Variables	Coefficient	t-Statistic
C	0.0263	0.4637
TIMPA	4.7270**	2.1156
TIMPK	-1.3524***	-3.6471
TIMPIN	0.0350	0.2875
TFE	0.0793	1.0879
RI	-0.3777	-1.1009
GSCALE	0.0879***	3.0874
EI	0.0280	0.4689
KI	0.0002	0.1835
D93	-0.0695	-1.0882
D94	-0.0702	-1.0050
D95	-0.0398	-0.6053
D96	-0.1887***	-2.6191
D97	-0.1117	-1.5570
D98	-0.0877	-1.3890
D99	-0.0185	-0.2629
D00	-0.0408	-0.6225
D01	-0.2132***	-2.8399
D02	-0.0483	-0.7568
D03	-0.1502	-2.2000
D04	0.0028	0.0440
R SQ	0.28	
Adjusted R Sq	0.27	
F Statistics	25.54***	
Observations	1310	

Note: ** significant at 5%, *** significant at 1 %. D93, D94, —, D04 indicate various year dummies

on research and development, though domestic R&D intensity has improved during the later part of the 1990s, the overall level of investment has remained very low (Pradhan, 2003). But after January 2005, when TRIPS has been implemented, more firms have to start spending on research and development to produce the new drugs to compete.

Regarding other variables, it is noted that the coefficient of growth of scale of production is positive and highly significant. Thus it may be argued that increase in the growth of scale of production has also been increasing productivity growth of firms in pharmaceutical industry for the period after liberalisation of technology policy in 1991. Thus growth in output has provided an opportunity for employing techniques of production which are more efficient and generates higher growth in productivity. The coefficient of export intensity has not been found to be significant. Thus, export orientation does not seem to play a significant role with respect to increasing productivity growth of firms in Indian pharmaceutical industry. This may be because in the era of globalisation not only firms having export orientation but those selling in domestic market also need to be efficient to compete. Also before liberalization the technology imports were not available freely and also there were restrictions on expanding the production which had been deterrent to firms in improving the productivity growth and thus before liberalisation of technology policy, exports were seen as a means to serve as a conduit for technology transfer from abroad. Further exports were also considered to provide an opportunity for learning by exporting and gain knowledge and expertise as a result of its experience in the export market which gives the opportunity to have access to new product designs and production methods where as the firms that did not export could not have the access to these technical expertise. But with the liberalisation of technology policy in 1991, not only the imports of designs but the technical know how also was made freely available. All these measures contributed in increasing the productivity growth of firms selling in the domestic market as well. The coefficient of capital intensity has also turned out to be insignificant. This may have been because pharmaceutical industry is not capital intensive industry but it is high knowledge based industry.

Conclusions

The study analysed the impact of technology policy on productivity growth of firms in Indian Pharmaceutical industry which is going to be affected most by changes in the technology policy. The study is based on firm level data after reforms of 1991. The study found that productivity growth of firms has been on an average higher for firms having acquired imported technology either through arms length purchase or embodied in imported inputs and imported capital goods. Average productivity growth of firms has also been higher for even those firms which have got technology transferred through foreign equity participation. Interestingly, average productivity growth for firms doing R&D has also been higher than those not doing R&D. Regression analysis revealed that among all the components of technology policy, only technology import through arms length has been significantly increasing productivity growth. Growth of scale of production has been found to be positive and significant where as export intensity and capital intensity have been found to be insignificant in affecting productivity growth.

Policy Implication

This analysis shows that liberalisation of technology policy has played an important role in the productivity performance of firms in Indian pharmaceutical industry in the post reform period. Thus in the TRIPS regime, when technology component is going to be the driving force in the growth of Indian industry in general and pharmaceutical industry in particular with the introduction of product patent, firms have to improve their technology for producing new products in the globalised era. Research and development efforts should also be further increased for the production of new chemical entities. Further firms should also increase their scale of production by growing larger through mergers, acquisitions or partnership with either larger domestic firms or foreign firm to be competitive.

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Action is the foundational key to all success.

— Pablo Picasso

A Study of the Interrelationship between Total Quality Management and Productivity

Tushar N. Desai and Akhil Teja Erubothu

Companies often fear that adopting Total Quality Management or certain other quality policies always results in the drop in productivity. This article tries to do away with that notion by first orienting the reader to TQM and later explaining the linkage between TQM and productivity. This article discusses the evolution of TQM and its benefits, the interrelationship between elements of TQM and productivity and briefly explains the critical success factors of TQM. This article concludes that with the right approach towards quality, an organizations' quality may not only be maintained but drastically enhanced.

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Quality Management

During the last two decades, quality management has been put forward by a number of its promoters as a new management theory. Quality management can be described as a revolutionary philosophy of management, a new way of thinking about the management of organizations, a paradigm shift, a comprehensive way to improve total organizational performance or as a framework for competitive management.

Definition of quality has evolved from focus on "conformance to specifications" to focus on "customer delight" and beyond. Total quality is no more a winning criterion in the global market place but it has become a qualifying criterion. Indian companies have to prepare themselves to take up the challenge of competing in the global marketplace. The practice of TQM acts as a catalyst for taking up this challenge.

Total Quality Management (TQM) is an integrative philosophy of management, an organization wide philosophy implemented for continuously improving the quality of products and processes in order to gain competitive advantage in today's dynamic markets and to achieve customer satisfaction. It is based on the premise that an organization must build quality into its products and processes, and that everyone in the organization has a responsibility in this effort. The customer is the focus of all the efforts to improve the product and process quality. The basic philosophy of TQM can be applied to will of range of organizations, manufacturing or service, small, medium or large, public or private.

Total Quality Management

"TQM is considered as a combination of various processes representing the dynamic behaviour of an organization. For this, an organization is referred to as a total system (socio-technical), where the activities carried out are geared towards meeting customer requirements with efficiency and effectiveness in mind and where the health of business is considered by measuring costs / returns at each stage of the business cycle"

(Mohanty and Lakhe, 1994)

"The TQM policy has two components: defect free product/service supplied on time to customers and advancing the state-of-the-art, which is a development process – to meet the rising expectations of customer's requirements".

- S.M. Sundara Raju

"Both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. The key to an effective TQM program is to listen to the voice of the customer"

- Dictionary of advanced manufacturing technology

TQM is both a philosophy and a set of guidelines that form the basis for continuous and gradual quality improvement of the total organization whereby planning of improvement activities, implementation of these plans, evaluating and undertaking actions, is continuously taking place. This philosophy includes a method to improve the entire organization in a step by step, structured and systematic manner, and with the help of available quality improvement tools and techniques. The TQM concept is concerned with the continuous and gradual improvement of all employees at all levels within the organization, in order to improve their personal efficiency and effectiveness on a daily basis. It provides a framework within which the employees continuously and routinely improve everything they do in order to better meet internal and external customer needs, and to continuously increase share holder value. TQM is a never ending journey towards improvement. By making continuous improvement a part of employees' daily activities, they will integrate it into all aspects of their work.

TQM is an alternative to a system of management where performance is ensured by rigid, hierarchical control. It comprehensively improves the overall performance and total quality of the organization.

Visible examples of organizations practicing TQM are those that are reputed to be customer oriented. A humanistic and systematic approach to the management of the organization in a synchronized manner is the foundation of this practice.

TQM implementation is a process that is customized for an organization but its fundamentals are borrowed from established organizational practices and then improved. Figure 1 indicates how an organization's TQM philosophies are to be shaped considering various factors. TQM is a systematic approach to radical changes in traditional management practices, organizational change, strategic goals, belief system, behavior and individual attitudes. The main property of TQM is that it has to be molded into an organization rather than simply cast around it. Figure 2 represents how, through TQM, various factors, that sometimes can diminish the strength of an organization, can be converted to additional performance. The uniqueness of TQM is that it defines the goal, quality, horizontal relationships, managerial demonstration, employee standing and involvement, pan - organizational unity and the aspect of change in the following manner:

Aspect of change: Change in culture, in the need for satisfaction of process and the learning cap are of priority. TQM makes the employees dynamic but the level of quality static.

Goal: An organization ready and willing to implement TQM must understand the long term effectiveness and survival benefits of quality enhancement and set it as a priority.

Quality: Quality is to satisfy the needs of the customer and exceed his wants and expectations.

Horizontal relationships: TQM redefines the integration of various components of the supply chain by pushing companies to consider the external components of the supply chain (vendors, suppliers, etc.) as a part of the process system and spilling the practice of TQM and its benefits horizontally.

Managerial practices: TQM reemphasizes that its success comes only when management continuously pushes the employees and showcases its commitment to achieve better quality of the product or service by reinforcing the need, reciting the vision and preaching better quality of service and also reminds the management that the root of poor failure is the management itself.

Employee standing and involvement: Employees are given greater authority, but the responsibility is reduced as TQM advocates team working. The employees are given authority to bridge boundaries, and attempt quality improvement measures with the right training and educational avenues.

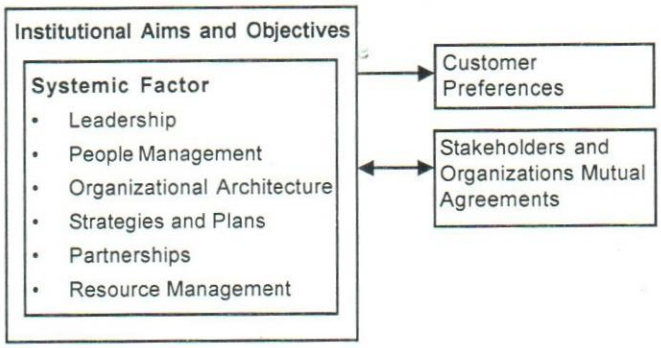

Fig. 1. Influences on Quality Philosophy of an Organization

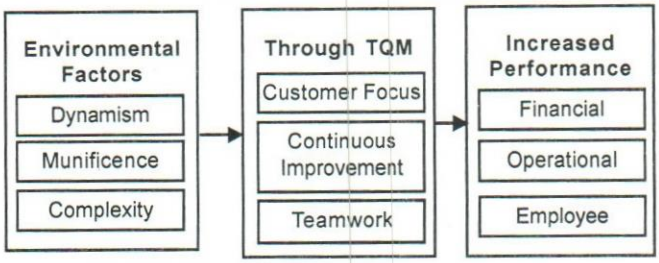

Fig. 2. Functional Benefits of TQM

Pan - organizational unity: Rather than verticality (managerial hierarchy) the organization functions horizontally where the focus of teams is on maintenance of process parameters and goals.

These factors are summarized in Table 1.

Table 1. Goals to be achieved by a successful organization

Organizational Achievements (OA)	Productivity (P)	Safety (S)
1. Achieving high returns on net assets (RONA). 2. Achieving high returns on capital employed (ROCE). 3. Improvement in productivity. 4. Improved market share of the organization. 5. Improvement in competitive image of the organization.	1. Improvement in equipment availability, reliability. 2. Reduction in setup time and unplanned down time. 3. Reduction in average autonomous maintenance. 4. Improvement in Overall Equipment Effectiveness (OEE).	1. Better health and safety of employees. 2. Deployment of Safe Operating Procedures (SOP) at all levels in the organization. 3. Influence of TPM initiatives to enhance safety and protect the environment.
	Morale (M) 1. Achieving multi-skilling and empowerment of employees. 2. Enhanced professionalism in the organization. 3. Influence of TPM initiatives on the competencies of employees towards the job.	
Cost (C)	**Delivery (D)**	**Quality (Q)**
1. Reduction in additional capital investments required. 2. Reduction in operating costs. 3. Reduction in energy consumption and overhead expenditure.	1. Achieving dependable and faster deliveries. 2. Reduction in cycle time to develop new products.	1. Improved manufacturing quality. 2. Improved customer order compliance. 3. Reduction in total process defects and rejections. 4. Reduction in number of customer warranty problems.

Table 2. Evolution of Total Quality Management

Dimension	Mechanistic Practices	Organismic Practices	Cultural Practices	TQM
Aspect of Change	Stability is valued but learning is prized.	Change and Learning assist in adaptation.	Change and Learning are inherent to the benefit of the system.	Change is a necessity and an unending process in the positive direction.
Organizational Goal	Organizational Efficiency and Performance.	Organizational Survival.	Meet individual needs and human development.	Customer Satisfaction.
Definition of Quality	Conformance to Standards.	Customer Satisfaction.	Constituent Satisfaction.	Satisfy Customer.
Horizontal Relationships	Objective/ Boundaries Present.	All aspects within the objective boundary.	Boundaries defined through relationships.	Boundary less.
Management Practices	Coordinate and provide visible control.	Coordinate and provide invisible control by creating a vision and value system.	Coordinate and provide mediate negotiations regarding vision, values, rewards. Controls are shared and values demonstrated.	Co-coordinative and distributive control. With the propagation and demonstration of the vision and value system.
Employee standing and involvement	Are to follow orders, passive objects in management.	Independent within system parameters.	Active and independent.	Independent to achieve targets. Team working.
Pan - organizational unity	Vertical chain of command. All decisions focus on technical rationality	Process based flow (verticality and horizontality are present) All decisions focus on organizational rationality.	Mutual recognition and rational acceptance of power. All decisions focus on politically rationality.	Distributed authority and demonstrative chain of command. Focus on vision and values.

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Evolution of TQM

TQM is a system that has evolved out of the appropriate combination of Mechanistic, Organismic and Cultural organizational practices (Spencer, 1994). This is represented in Table 2.

Mechanistic Practices are defined as those organizational practices where the end of the line employees only work as they are instructed to and are fully dependent on higher authorities for actions. Quality is solely dependent on the standards and quality set by the organizations.

Organismic Practices can be clearly seen in organizations whose systems are dependent on their environment for resources. It brings about the complexity of creating differentiated structures to respond to their environmental conditions. The operations of the organization are the conjugation of individual sub-organizations within the umbrella of the entire organization. The relation between the stakeholders, and individual processes is of symbiotic nature.

Cultural Practices occur in the form of cooperative agreements entered into by individuals with the maintenance of free will. In summary it is present in an environment where every individual is conducive, responsible for and the benefactor of organizational performance. The social and cultural environments are constructed by the employees themselves. This model can be best seen in cooperative sectors.

Benefits of Total Quality Management

Some of its potential benefits are:

- **Competitive advantage**: An organization yields strong processes, greater customer following and satisfied stakeholders through the implementation of TQM.

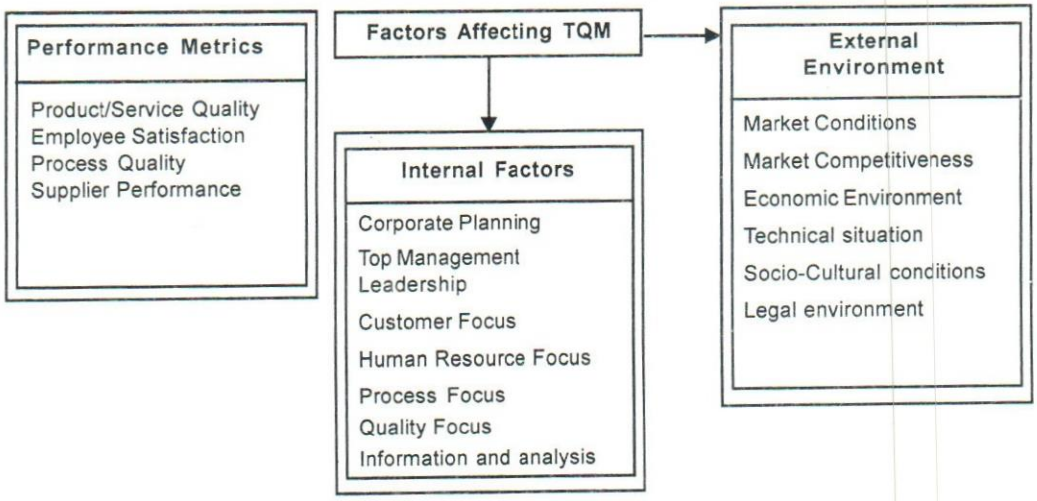

Fig. 3. Influencing Factors on TQM

- **Increased productivity**: TQM creates a more pleasant working environment. Due to QFD, lower levels are more involved in performance increment. TQM also calls for standardization of processes and there by reducing cycle times. This combination yields a dramatic increase in productivity. It helps to make critical examination of all processes to eliminate all non productive activities and waste in any form.
- **Improved customer satisfaction**: TQM focuses on understanding customer needs and expectations through open and cordial relationships and also division of the supply chain into a series of customer–supplier relationships. This brings about an increase in customer satisfaction levels.
- **Reduction in cost of poor quality**: Poor quality results in cost escalations in the form of reworks, sudden process upgradations, high scrap levels, and costs that are borne because of late deliveries, warranty lapses and replacement of sold products. These costs are reduced to a minimum level in a TQM environment.
- **Greater employee involvement**: Everyone in the organization has a clearer understanding of the organizational goals and the environment pushes manpower to deliver its fullest for the benefit of the system (organization). Through TQM, organizations experience greater team work, division of responsibility to control, manage, and improve processes.
- **Greater communication**: TQM calls for working of cross functional teams and their regular interactions and sharing of process centric data. This leads to open discussions, transparency and frequent communication.
- **Lower margin for error**: Defect and error occurrence reduction at lower levels itself, cause a rise in quality and fall in the demand for rework of processes.

Influencing Factors of TQM

There are two kinds of factors that have an influence on TQM—internal (emanating from within the TQM movement) and external (present in the environment that TQM is being implemented), Figure 3, illustrates these factors.

Total Quality Management and Productivity

Increasing competition in the global market demands that productivity acts as a measure of efficiency and effectiveness. The distinction between the two terms must be carefully understood. A company that produces according to process specifications may be using its resources efficiently, but unless it is producing what its customers want it may not be using them effectively. There is no point in producing well-made products that nobody wants. A concern must judge productivity and value from the perspective of the customer and not from the organizational point of view, to be profitable. Hence internal processes must only be geared towards producing products and services for which the customers find useful and valuable. The TQM philosophy ensures "effective

efficiency" by encouraging companies to plan products and develop systems that deliver products according to the expectations of the customer.

A number of studies have found that in the long run, companies that adopt TQM achieve greater productivity and ultimately higher profitability inventory pileup, cost of poor quality, and requirements of internal customers. Hence, customer focus enhances the productivity of an organization.

Importance of Productivity as part of various TQM philosophies

Customer Focus and Productivity

While fully understanding what a customer needs, a company automatically produces only what the customer requires, resulting in higher sales and operating profits (as customers will then be paying more for "quality in the products that they want"). The customers needs also determine the demand and hence restrict inventory pileup, cost of poor quality, and requirements of internal customers. Hence, customer focus enhances the productivity of an organization.

Total Employee Involvement and Productivity

The involvement of employees in delivering quality ensures that they take greater initiative to deliver quality goods, in the least possible time at the least possible cost to the company. This drastically enhances the productivity of an organization.

Continuous Improvement and Productivity

The main motive of the company must be to continuously expand its market share. This is made possible only through a strategy to continuously improve themselves to suffice dynamic customer demands. This is achieved only through greater responsiveness, shorter cycle times (production and delivery), creative and innovative processes (from procurement through to production up to marketing and delivery), and better quality products.

Systematic Management

The consistent coordination between planning and production can only be achieved through a systematic management approach. The systematic management approach also ensures that there is proper utilization of resources and efficiency in process.

Linkage between Quality and Productivity

TQM is being used successfully to improve both quality and productivity. In a TQM program, the focus is on quality improvement. This also results in significant productivity improvement. A TQM program utilizes methods such as making everyone in the company feel responsible for quality, establishing quality as the primary operational goal, a stress on quality improvement, focus on six sigma (nearly zero defects) and traceability. These methods are likely to yield productivity improvements as well as quality improvements.

Sink and Keats (1982) contend that productivity and quality are interrelated. Efforts to improve quality, if effective and efficient, can have significant impact on an organization's productivity.

Day (1988) feels that if wastages are reduced through quality, then the organizations become healthier and more competitive. This is the driving force in every organization today. Whitman (1990) contends that there must be senior management, middle management, staff and line commitment to ensure higher production and productivity.

Mefford (1991) highlights the three mechanisms which link quality and productivity.

1. Reducing defects in product and process, optimum resource utilization has a direct positive effect on the enhancement of productivity.
2. Any improvement in quality increases the productivity and vice versa.
3. Motivated workers help sustain high quality levels and maximize outputs. They become pastures where quality and productivity improvement can be reaped.

Mohanty (1992) feels that productivity management is, in most organizations, a top–down approach imposed on the rest of the organization. Involvement of all parties should be recognized as an essential aspect of the design of an effective productivity management process. Figure 4 highlights the relationship between productivity and TQM. TQM also emphasizes the involvement and commitment of one and all in the organization; hence TQM philosophy certainly will improve productivity, if implemented successfully.

Productivity Quality Trade-off?

To remain competitive, organizations must continuously seek ways for productivity and quality improvement. But

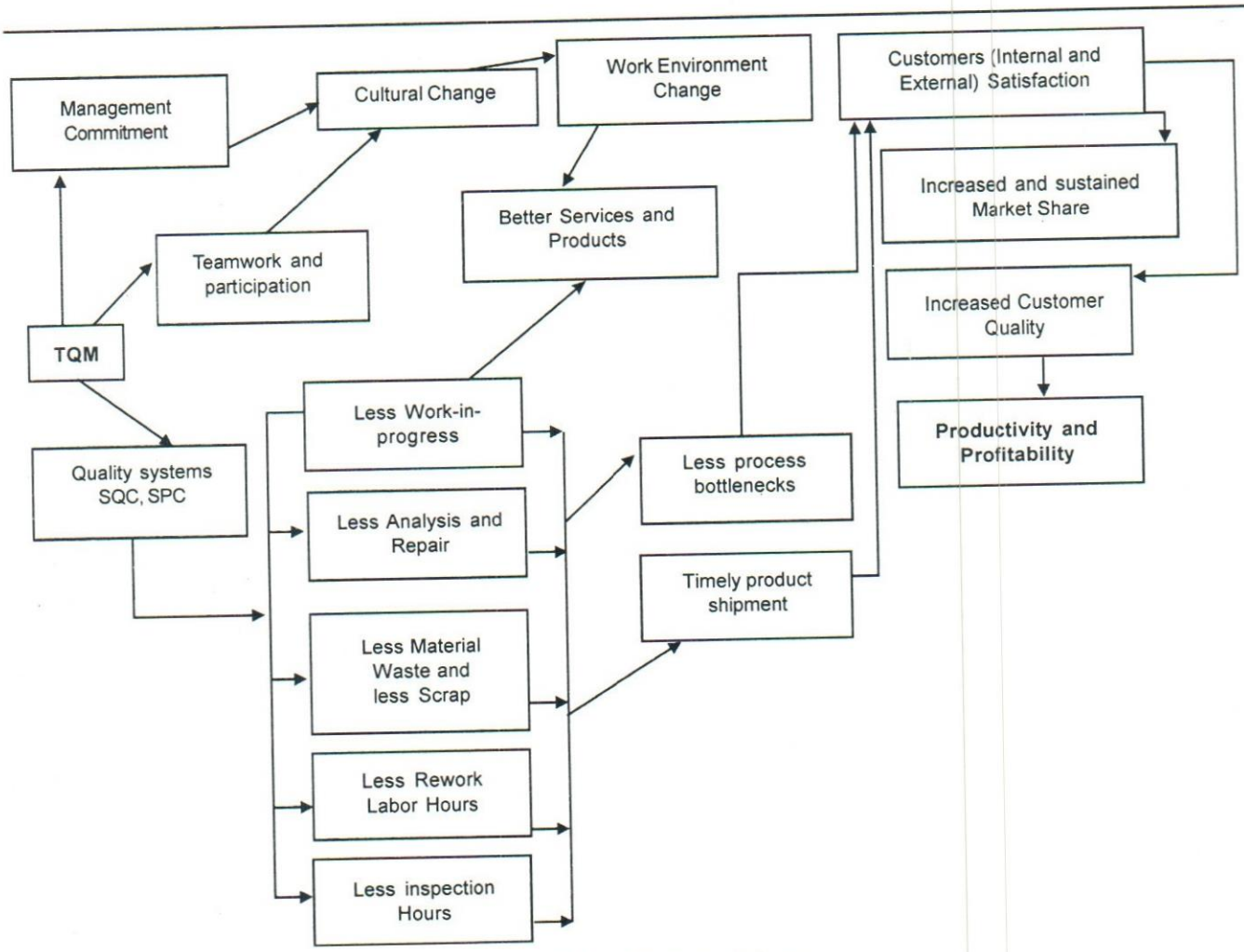

Fig. 4. TQM Productivity Linkage

Table 3. Performance Metrics to Indicate Productivity

Human Resources	**Financial Performance**	**Operating Performance**
• Organization • Employee morale • Safety • Employee satisfaction	• Inventory • Turnover • Cost of quality/quality audit fee • Finance • Waste/scrap rate • Expenses • Market share gain	• Technology • Flexibility • Durability • Reliability • Productivity • Design for assembly/Design quality • Maintenance • Quality of work
Product/Process service	**Customer Satisfaction**	**Innovation Technology**
• Product variation • Accuracy rate • Order process time	• Lead Time • Quality • Delivery time	• Technology • Cycle time

the effort may lead to a trade-off. The problem arises when productivity is increased at the expense of lowering the customers' requirements with regard to quality. Some organizations put too much emphasis on raising productivity so that they may unintentionally compromise or neglect quality.

Attempts to raise productivity and quality can be conflicting objectives but it is possible for firms to raise both productivity and quality without compromising any of the factors.

Essentially, to compete through productivity and quality, a firm is required to manage four components effectively: service providers, customers, capacity, and costs.

Table 3 and Figure 5 respectively summarize and represent the added benefits to productivity through TQM implementation.

Critical Success Factors for Quality and Productivity Enhancement through TQM

In the context of TQM, it is essential that the organizations identify a few key critical success factors, which should be given special attention for ensuring successful implementation of TQM program. The concept of critical success factors (CSFs) and their use in supporting planning efforts was originated from the approach associated with the development and implementation of management information systems. CSFs is a term used to mean the most important subgoals of a business organization. Management may decide the relative priority amongst various TQM initiatives using these factors.

The CSFs can also be used in a self-assessment mode by an organization to assess and improve upon these by making concentrated efforts after understanding the gaps. These factors can also be used in an award model for deciding the relative weightages for each factor.

This method can be very useful to an organization attempting to identify those characteristics often mentioned in the huge body of TQM literature that may provide an opportunity to increase the level of quality, productivity and improve performance. Managers use CSFs to obtain a sharper understanding of the existing quality management practices and link them with the performance measures. Managers can also benchmark themselves considering each CSF and identify the gaps. The CSFs may provide a rational basis for resource allocation for improvement and thereby productivity improvement. The model can also be used for deciding the weightages in a quality award model.

The critical factors of TQM can be described as best practices or ways in which firms and their employees undertake business activities in all key processes: Leadership planning, customers, suppliers, production, and supply of products and services, use of benchmarking, community relations, etc.

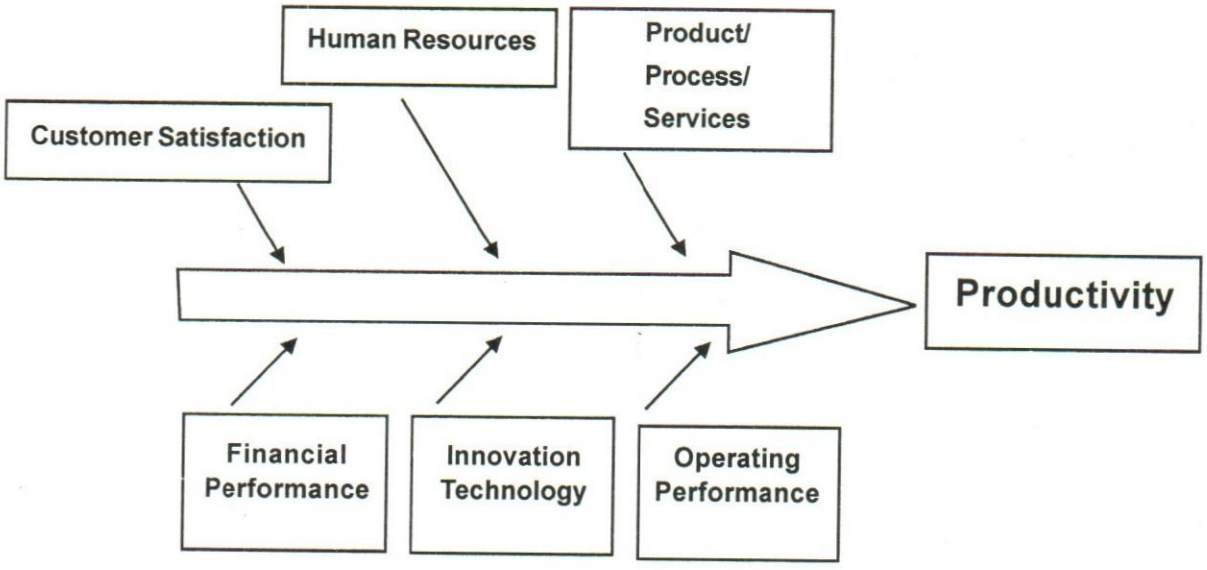

Fig. 5. Performance Factors Influencing Productivity

Table 4. Critical Success Factors of Total Quality Management

Customer-based approach
Channels for processing customer complaints, identifying customer needs (surveys, market investigation, reports from vendors), customer satisfaction survey, after-sales service, customer focus and satisfaction, customer involvement, customer orientation, customer relates with responding entity, customer interrelationship, customer satisfaction, customer satisfaction orientation, customer service, TQM link with customers, close customer leadership, closer to customers, relation with the customers, responding entity relates with customer, Overall customer focus in quality management, Extent of customer satisfaction survey feedback given to managers, Extent of the use of the customer feedback to improve product quality, and Availability of customer complaint information to managers.
Product Quality
Relative conformance of the product to specifications in comparison to other products in the industry, relative performance of the product in comparison to other products in the industry, relative reliability of the product in comparison to other products in the industry, relative durability of the product in comparison to other products in the industry, percent scrap generated and percent rework.
Management commitment and leadership
Top management commitment, quality council, support improvement activities, Top executive support, top management support, top management, committed leadership, visionary leadership, senior executive involvement, supervisory leadership, leadership creativity and quality strategy, management leadership, executive commitment. Clarity of quality goals for the organization, Relative importance given by top management to quality as a strategic issue, Allocation of adequate resources to quality improvement efforts, Relative importance given by top management to quality versus cost, Relative importance given by top management to quality versus production schedule, Performance evaluation of managers based on quality.
Quality planning
Mission/vision statement, quality policy, quality goals, business plan, communication strategies, control and improvement of plans, quality improvement measurement system, quality information, quality information availability, quality information flows, quality information systems, quality information usage measurement, and internal quality information usage, availability of the cost of quality data to managers, visual display of quality information at work stations, quality performance versus goals, availability of scrap data and rework data, dissemination of defects information to specific work stations.
Management based on facts
Quality audits, employee performance evaluation, employee satisfaction evaluation, business evaluation, quality costs, use of indicators.
Supplier management
Supplier co-operation, supplier development, supplier integration, supplier involvement, supplier partnership, supplier performance, supplier quality, supplier quality management practices, supplier relates with responding entity, supplier relationship, TQM link with suppliers, co-operative supplier relations, vendor quality management, closer to suppliers, relations with the supplier, responding entity relates with supplier, emphasis on long –term supplier relationships, relative importance placed by the organization on quality of purchased parts versus price, consideration of supplier's technical capability, consideration of supplier's financial capability, consideration of supplier's delivery capability, extent of technical assistance to suppliers, conformance of supplied parts to specifications, performance of supplied parts, reliability of supplied parts, and durability of the supplied parts.

Continuous improvement PDCA cycle, self-assessment activities (ISO 9000, EFQM model,), seven quality control tools, seven management tools, other tools and techniques for continuous improvement.
Human resource management & Involvement of all members in the organization Information communication, work teams, recognition and reward systems, cross-functional teams, quality circles, employee participation, employee satisfaction, employee empowerment, employee involvement, employee fulfillment, worker-manager interactions, workers encouraged to find and fix problems, workers authorized to inspect their own work, workers given assistance to fix problems, supporting infrastructure for problem solving, and technical assistance given to workers for solving problems, extended use of quality circles, employee suggestion implementation, encouragement for employees to give suggestions, framework for evaluating quality of participation, providing individual financial incentives, providing group financial incentives, and availability of profit – sharing programs.
Bench marking Bench marking on quality and service, benchmarking on cost, use of benchmarking, information and analysis (information and data management, information technology, information technology for quality), willingness of the organization to benchmark in the future, effectiveness of benchmarking in product quality improvement, effectiveness of benchmarking in product cost reduction, emphasis on benchmarking competitor's products and processes.
Training Individual training plan, training for job requirements, general training program, specialized training, education, availability for resources for training, a number of employees trained in the basic quality concepts, a number of employee levels participating in the training session, frequency of training and retraining an employee, satisfaction of employees with overall training.
Communication systems Bottom-up, top-down and horizontal communication among all the staff, work information, posters, slogans, personal letters.
Process management Quality manual, quality system procedures, work instructions, ISO 9001 certificate, supplier training, agreed quality, processes, process flow management, process improvement, production process, process control, process control and improvement, process design (SQC), flexible manufacturing, advanced manufacturing systems, use of JIT principles, inventory reduction, technology utilization, process quality, willingness of the organization to use SPC in the future, extent of use of SPC in manufacturing, knowledge of production employees in SPC tools, effectiveness of SPC in improving product quality.
Design and conformance Design and development of new products, design quality, design quality management, conformance and design, product cost, product durability, product improvement, product quality, product reliability, conformance quality, interdisciplinary approach to product design, use of Quality Function Deployment techniques, emphasis on shop floor experience of the design team, emphasis on marketing experience for the design team, use of Shingo's error-proofing techniques, use of Taguchi's design techniques.
Organizational awareness and concern for the social and environmental context Environmental manual, environmental system procedures, ISO 14001 certificate.

Conclusion

Considering the current state of global competition it is imperative for businesses to develop a customer-focused culture. This would ensure that their resources are efficiently and effectively utilized to produce only those products and services which the customer wants and is willing to pay a premium for. This points towards developing a total quality culture.

The TQ culture if applied correctly yields significantly better results in all the performance categories of financial results, customer satisfaction and employee satisfaction. TQM signals the start of a paradigm shift from a reactive culture to a proactive one with the overriding emphasis on delighting the customer.

Involvement and empowerment of every single employee within the organization—from the most humble to the most powerful is essential in order to develop ownership of the culture and to stem conflict.

TQM is an integrative management philosophy aimed at continuously improving the performance of products, processes, and services to achieve and exceed customer expectations. TQM will play a central role in future organizational development. TQM must remain focused on organizational practice and business goals, not only operational but also strategic. The TQM culture must be reinforced by supportive leadership, enabling organizations to reduce costs, increase flexibility, include customer responsiveness and the adaptation of new technologies to improve quality and productivity and thereby achieve competitive advantage. TQM paradigm applies to all enterprises, as quality management addresses the needs of both manufacturing and services.

TQM is a long term campaign requiring significant input of financial, technical and human resource investments over several years, before payoffs can be obtained Its success depends on many variables, controllable and uncontrollable, many of which are specific to the company's culture, customer's capabilities, and infrastructure. Therefore, an organization should tailor the generic quality management methodology to exploit its unique strengths and focus on its particular weaknesses. The key to successful quality management lies in the intangible factors and the TQM tools and techniques viz., critical factors and productivity and performance indicators described in this paper. It is necessary to have a suitable culture in place to promote the role of top management leadership, customer focus, human resource focus and quality focus. Indeed, a successful implementation of TQM is a major organizational change and a long term paradigm shift which in turn, changes how people work together in an organization.

Abbreviations

TQM: Total Quality Management

SPC: Statistical Process Control

TQ: Total Quality

ISO: International Organization for Standards

SQC: Statistical Quality Control

CSFs: Critical Success Factors

QFD: Quality Function Deployment

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"Energy and persistence conquer all things."
— Benjamin Franklin

Research Issues and Consideration to Improve Truck Driver's Productivity

M.J. Sheikh and S.V. Bansod

This paper describes the research and development aspects for the improvement of truck driver's work station and working environment. The objective of this paper is to identify the various unsolved problems of driver's cabin that arises in practice. Thus by effective utilization of workstation component, that is, making the workstation and cabin to fit for the purpose the truck driver's productivity can be increased. It is observed that the majority of accidents in urban areas involve heavy vehicles like truck and buses. The human factor is the most significant factor in traffic accident. Truck drivers are highly exposed to fatigue and work related injuries . Truck driver's suffers from back problems, numbness and discomfort in buttocks, etc. A high percentage of this problem is due to adoption of an unhealthy posture because of inappropriate cabin design in which a workstation is the most important part. This paper proposed an optimize approach for driver's cabin from the consideration of anthropometry, comfort, reach, safety, and visibility so as to improve truck driver's productivity.

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Introduction

Global Accident Scenario

Accident can be defined as an unintentional mis-happening which results in injury, ill health, damage or loss to life, plant or material. A person is killed or sustains injuries in every 16 minutes in accidents involving trucks (Truck injuries.com). Everyday as many as 1,40,000 people are injured on the world's road. More than 3,000 died and nearly 15,000 become disabled for life (Mohan, 2004).The situation in India is not getting any better; instead getting much worse. The number of vehicles has increased from 3.06 lakhs in 1951 to 67 millions in 2003 in India. (Mishra, 2003). Official statistics show that in year 2005–06 about 1,00,000 persons died and more than 77,00,000 seriously injured on Indian road (Navbharat, 19 Nov. 2007).

The cost of accidents estimated during the year 1999–2000 in India is Rs 55,000 crores which constituted 3% of GDP for the year (Mishra, 2003). Due to accidents the yearly economical loss is estimated Worldwide as 100 million dollars and in India as 1375 crores dollars (Navbharat, 19 Nov. 2007).

The World Bank has conducted a study in which the annual number of road traffic deaths is projected to increased by 83% in the low income and middle income countries by 2020 (Mohan, 2004) and worldwide the road accident deaths is projected to be 2 crores by 2020 (Navbharat, 19 Nov. 2007).

The Causes of Accidents

It is found that 50% to 70% of the fatal road accidents are due to heavy vehicles like truck and buses in urban areas (Mohan, 2004). In an analysis carried out on the accident for the year 2003 shows that the main causes of road accidents are driver's fault (77.91%), pedestrian fault (1.36%), mechanical defect in vehicles (2.01%), bad roads

(1.32%) and other factors like bad weather, cattle coming in the way, fallen trees, road blockage, absence of rear reflector, road signage, non functioning of road signals etc. (17.40%) in India (Mishra, 2003).

Among all the factors listed above, the human factor is the most significant factor in traffic accident. The truck drivers are highly exposed to fatigue and work related injuries. Eglemen (1987) studied in detail 136 truck accidents in which the truck occupant was injured due to the impact with the interior components which may occur with or without intrusion due to cabin crash. The most common body part of the injured is the head with 55% of all injured occupants suffering from. Injuries to other body parts like arms and legs are second most common thing but not as serious. The most severe injuries are to the abdomen and thorax which are caused by the steering assembly. (Krishnaswami and Blower, 2003).

Truck drivers have to spend nearly 10 hours per day in the cabin and sitting motionless for long period of time results in back problems, numbness and discomfort in buttocks, etc. A high percentage of this problem is due to adoption of an unhealthy posture because of inappropriate workstation design. This incorrect design is due to the insufficient and absolute anthropometric data for Indian population for arranging and positioning components in the cabin. Of all the interior cabin objects causing injury, the steering wheel, dashboard, foot or leg area, driver's seat are main areas for design improvement efforts. Through this paper an optimized approach for the truck cabin is presented to increase the productivity of truck driver.

Design and Development from Ergonomic consideration

In order to avoid a tragic outcome of road accident we must focus our attention to truckdriver's workstation and his comfort. The seat has an important role to play in fulfilling these comfort expectation. Truck drivers require sitting for nearly 10 hours daily which is a long period of time. The extended period of sitting includes discomfort in back, numbness and discomfort in buttocks due to surface pressure under thighs. Cheefai et al. (2007) describes the research and development for vehicle seats based on literature review. The automotive industry strongly encourages research in the field of objective comfort assessment specially with respect to the seat and related posture. The research literature shows that the main factors that affect the seating comfort are seat interface pressure distribution, whole body vibration and pressure change rate. For the improvements the bolster design is required to increase stability and adjustments for back rest angle, contouring, and seat height to promote good posture. The development of air suspension system has made the seat to absorb vibration transferred from road surface to the driver in better way.

Olanrewaja et al. (2007) has conducted a cross sectional study to investigate worker exposure to postural demands, body vibrations as a risk for low back pain and manual material handling and observations were done taking 12 drivers during service route driving. The result showed that most bus drivers spend 60% their driving time either with their torso straight or unsupported and experience shock, discomfort, and vibrations. Slight low back pain was also found among such drivers. Therefore an ergonomic evaluation of driver's seat was suggested.

Driver fatigue has been one of the major cause of traffic accidents. The amount of time that drivers spend within vehicles has been increasing due to complex city life, traffic congestion, and particular occupational requirements. Therefore the fatigue and stress cannot be avoided. Sung et al. (2005) focused light on effect of oxygen concentrations on driver fatigue during simulated driving. The results revealed the subjective fatigue feeling was highest in the low rate (18%) oxygen condition, while in the high rate (30%) it decreased to a certain extent. It was suggested that the driver's fatigue can be reduced according to the supply of oxygen.

During field operational testing for driver behavior Eskandanian et al. suggested to improve the realism of truck cabin environment, and to install the vibrating actuator below the truck cabin . Kolich et al. (2004) found that seat interface pressure measures, anthropometric characteristics, demographic information and perceptions of seat appearance were related to an overall comfort index. They utilized two distinct modeling approaches—stepwise linear regression and artificial neural network. Verver et al. (2005) applied multi bodies technique for seat modeling; arbitrary surfaces, providing an accurate surface description, are attached to rigid bodies. The bodies are connected by kinematics joints representing the seat back recliner and head restrain joint. The response of the seat model agrees well with the experimental results.

Kumar (2004) determines the effect of vibration on seat pan which results in health hazards. Kaynakli and Kilic (2005) investigated the effects of thermal conditions on the human body and the interior environment of an automobile was simulated by computational method. Cai

and Lin (2007) focused on driver's skin conductance, heart rate, respiration rate, skin temperature, gripping force, and gripping position which is obtained by embedding small sensors into steering wheel and seat belt, leading to a so called smart wheel system; which can be used to explore better design.

Methods and Models from Analysis and Design Consideration

Read et al. (2003) predicted maximum reach using the software's kinematic reach envelop generation methods and by interactive manipulation. The prediction was compared to maximum reach envelops obtained experimentally. The findings indicate that several changes are needed in the procedures for obtaining maximum reach envelopes for seated tasks. Parkinson et al. (2003) simulated drivers' reach capability using digital human figure model. Parkinson et al (2006) analyzed posture and balance in truck shifter operation. The truck driver operating the shift lever of a manual transmission, excessive shift forces is required to pull the steering wheel with the other hand to maintain balance, creating a potentially unsafe condition. The results were dependent on initial driver position, reach posture and shoulder strength.

Mankine et al. (1996) considered optimization problem of the ride characteristics of a traveling truck. The results of optimization of the 3-D model of the truck and trailer combination indicated robustness of the procedure for a complex system with a large number of design variables and constraints. The design variables were identified for bus drivers and considering the anthropometric variables transit bus workstation design guidelines are presented. Pankinson et al. (2005) proposed design under uncertainty based on human variance models. They presented a case study involving the layout of the interior of a heavy truck cab, focusing on simultaneous placement of the seat and steering wheel adjustment ranges. The application of their techniques requires the collection of data describing the outcomes of interest and development of approximate statistically models.

Assessment and Consideration of Safety Equipment

Krishnaswami and Blower (2003) presented the analysis of crash data which showed that the majority of truck accidents were with smaller vehicles, the most serious injuries to truck occupants occur in collisions with either trucks or fixed road side objects. During the analysis they found that injuries to truck occupants can be reduced to a considerable extent by using airbags and safety belts. Williamson (2005) investigated a problem for which, during testing and simulation, notable interaction was seen between the seat belt and the upper backrest of seat structure.

Berg et al. (2000) presented real life crash analysis and results of crash test which shows that in heavy trucks safety belts have a high potential to save driver and passengers. The benefits of the use of seat belts is obvious. But a high percentage of truck drivers do not use their safety belts. It also has to be considered that the cabin is the working place of the truck driver. His life has to be saved and his injury risk has to be lowered as best as possible.

Productivity Enhancing Model and Discussion

The driving task is a multifunctional and complex task with a great responsibility. Truck drivers have a constant race against time and met number of complex and critical situation during driving.

The sitting posture of the driver is determined by the relationship between the body dimensions and the dimensions and location of various components at the workstation. In designing the driver's cabin the workspace, the workstation component in dimension and adjustability as well as the location of these components are very important. Anthropometrics helps to evaluate postures and the distances required to reach controls and specify the flexibility required for the comfort and efficient performance. The cabin and workstation should be suitable to the body size and the movement of trunk, shoulder, arm, and legs to perform the task effectively and efficiently.

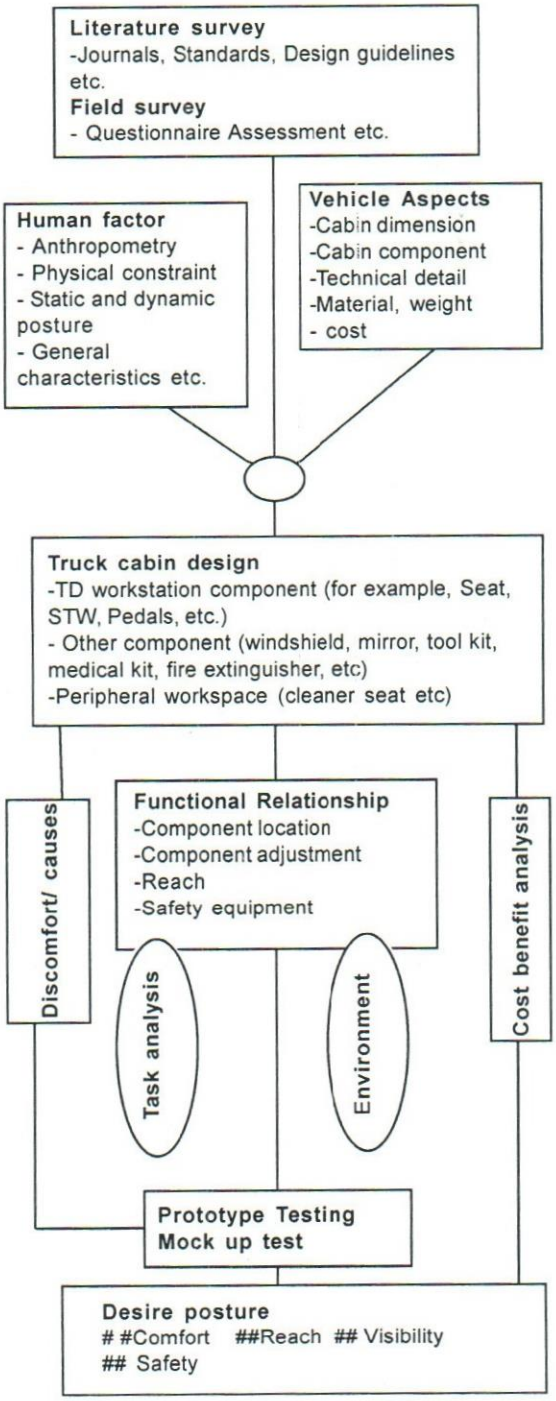
The model is proposed as shown for the design of driver's cabin with a purpose to achieve a comfortable and stable posture for the driving task.

Automotive seats which are in contact with the driver play an important role in improving comfort and work environment of driver. The improvement of automotive seating system for the drivers has been the subject of knee interest for many years. Seat considers that both big and small drivers can adopt comfortable driving postures so the range of adjustments of many seats needs to be enlarged. To achieve the contact with the backrest of most of the seats, they were tilted backward but excessive backward tilt increases flexion of spine.

The steering assembly is one of the important component of a driver's workstation. The position of holding the steering wheel of drivers of varying anthropometry is different. The steering wheel differs in dimension, inclination, and orientation for the trucks of different specifications. The driver may face discomfort in shoulder, abdominal, wrists, and hand because of dimension, orientation, and inclination which adversely affect their performance.

The truck is equipped with three different types of pedals. It is the starting for the control force which is applied from the driver's foot. Most of the drivers reports tingly leg, cramped leg, numbness, and heavy leg because of insufficient legroom and dimensions of pedals.

Fatigue as it relates to vibration is complex and there is limited research available. There is some field research that supports a relation between vibration and increased



fatigue or drowsiness. Truck drivers show many of these symptoms of adverse health effects associated with whole body vibration exposure. There is evidence that truck drivers have back complaints that could be partly attributed to whole body vibration exposure.

The safety equipment should be evaluated so that the drivers should be protected from unbearable risk of accident which may be a result of design, construction or performance. A high percentage of truck drivers do not use airbags and safety belts. The cabin is the working place of drivers by optimization the risk of injury can be minimize to a considerable extent.

The thermal effect also plays an important role in the driver's performance. The heat generated from the radiator and engine makes it unbearable for drivers to give their good performance. The generated heat often caused excessive sweating and dehydration to the drivers.

Truck drivers suffer from a high risk of accidents and deaths and give poor performance because of inappropriate anthropometry and erroneous design. The proposed model as shown consider the ergonomic aspect in relation with the optimization of design and location of various components of truck driver's workstation and cabin. The model shown directs us toward the novel concept of optimization of driver's cabin based on the principle fitting the job to the man. This model provides more accurate ways to interpret the efficiency of the driver and the workstation in improving the comfort and health.

Conclusion

A workstation based on inappropriate anthropometrics results in an erroneous design. As a result of this mismatch about 744 fatalities and 29,000 non fatal injuries are suffered by truck drivers annually (Krishnaswami and Blower, 2003). The seat, steering wheel, and pedals are the workstation components that the operator is required to stay in constant contact with these component.

Driver's posture is one of the most important issue to be considered in vehicle design process. Thus the steering wheel, seat , dashboard, leg area are main areas of design improvement effort. Therefore an optimize approach is required for a truck driver's cabin design as presented from the consideration of anthropometry, comfort, reach, safety and visibility. Such an approach will lead to a better understanding of the driver-seat-interior system and will also provide more accurate way to interpret the efficiency of new seat features in improving comfort and health. The safety equipment should also be evaluated so that public will protected against unbearable risk of accidents occurring as a result of design, construction or performance of trucks and is also protected against unreasonable risk of death.

Such a safer and comfortable work station results in the reduction in terms of insurance for injuries or death, loss to life, plant or material. After a few years, with this safer and comfortable work station, it would become apparent why the number of accidents and deaths could show secular decline with increasing vehicle population.

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"Formula for success: rise early, work hard, strike oil."

— J. Paul Getty

An Empirical Study of Trends and Determinants of Indian Agricultural Production for Pre and Post Reforms Period

Sanjay Tupe and Manoj Kamat

This paper examines the determinants of AGDP for pre and post economic reforms period and documents the impact of policy change and India's membership of WTO on Indian agriculture. Empirical findings reveal that institutional credit sources, consumption of fertilizer, and net area sown under the crops found as major determinants of AGDP for the whole period. However, institutional credit sources, use of pesticides and net area sown under the crops observed as major determinants of AGDP for the pre reforms period. After the post reforms period and India's membership of WTO, none of the variable finds as significant determinant of AGDP and besides this, Indian agriculture witnesses decreasing returns to scale.

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Introduction

The importance of agriculture sector in the process of economic development is indispensable. With this recognition, Indian planner had emphasized on the development of agricultural and allied sectors right from the beginning of planning in India. In the last 57 years, Indian agriculture has given significant contribution in the income propagation process and employment generation. Even today, 24% income of the total gross domestic of product (GDP) of India is being originated from the agriculture sector and 62% people still find direct and indirect employment in the agriculture sector. However, in the process of economic transformation of economy, agriculture sector loose its importance due to eroding contribution in national income (Lewis 1954, Syrgnin 1988). This has been happening in India as 55% income of the total National Income was originating from agriculture sector in 1951 and today, it is stuck to 24%. Structural transformation is inevitable in the country if the economic planning is pursed as a way of development. Several policy initiatives have brought out the changes in Indian agriculture in respect of production of foodgrains, cropping pattern, cultivation methods, agricultural labour and cultivable land relationship, and productivity of land.

New economic policy 1991 and formation of WTO brought the structural transformation in Indian agricultural sector. This paper makes an attempt to review trends in the Indian agriculture sector that have been taken place since 1970-71. It also examines the determinants of Agricultural Gross Domestic Product (AGDP) for the pre and post economic reforms and whole period. Section I examines the trends in the Indian agriculture that have been taken in the last 32 years with a special emphasis on the impacts of reforms and India's membership of WTO. Section II reviews the literature on the theme of the paper. Section III deals with data sources, methodology, and model selection. Section IV discusses the results. Section V summaries this paper with conclusions and policy suggestions.

Section I

Trends in Indian Agriculture

1. **Production of Food Grain:** In the earlier years of planning, food availability was a serious problem in India. Total food grain production was hardly 51 million tones in the year 1950–51, which increased to 216 million tones at the end of 2004–05. Ninth five year plan (1997–2002) emphasized on building of food stock to meet the challenge of famine and ever increasing demand of food grain from the masses. However, the average annual growth rate of agriculture and allied sector is found to be very low and volatile since Ninth five year plan. In the Eight five year plan (1992–97) average annual growth rate of agriculture was observed as 4.7 percent, which further declined to 2.1 percent during the Ninth five year plan (1992–2002). Tenth plan (2002–07) kept a target of 4 percent annual growth rate of agriculture sector, which seem to be difficult to achieve due to the severe drought faced in the year 2002–03 and some adversity which occurred during this plan.

   Table 1 reveals the trends in food grain production of major crops for the pre and post economic reforms period. It can be seen from the table that production of rice crop declined from 2.42 to 0.37 percent at the compounded annual growth rate (CAGR) in decade Eighties and again dropped to –0.08% for the Nineties. Production of wheat also declined from 4.37 to 1.37% for the period 1970–71 to 2002–03. Compounded annual growth rate of coarse cereals and pulses was observed to be negative in the decade 1970s. However, it has slightly picked up in the decade 1980s due to the constitution of Oil Seed Mission and sustained efforts of the government. Further it suffered in the decade 1990s. Total food grain production growth rate declined from 3.00 percent in 1980 to 0.67 percent CAGR in the decade 1990s. If this trend continues, food security will be a great challenge in India in the near future. Therefore, a need has aroused to have one more green revolution in India to attain the 10 percent growth rate of GDP to be achieved in 11th five year plan.

Table 1: Trends in Production of Major Food Grain Crops (percent)

Crops	Before Economic Reforms		After Reforms
	1970–71 to 1980–81	1981–82 to 1992–93	1993–94 to 2005–06
Rice	2.42	0.37	–2.38
Wheat	4.36	4.33	1.37
Coarse cereals	–0.5	1.64	0.75
Pulses	–1.06	0.65	–0.2
Total food grain production	1.80	3.00	0.67

Note: the compounded annual growth (CAGR) rate has been calculated by using the semi-log model such as $\ln Y_t = \beta_1 + \beta_2 t + \mu_t$.
Source: Hand Book on Indian statistics 2006–07, R.B.I.

2. **Trends in Cropping Pattern:** Change in cropping pattern means shifting of area under cultivation of major crops. Since 1950–51, area under food grain crops has been declining in India. It means that either the farmers prefer to grow non-food grain crops or they close down the profession of farming and migrates themselves to urban centers in search of jobs and livelihood. In 1950–51 area under food grain crop was 74 percent of the total cultivable land, which declined to 72 percent in 2002–03. The shift in cropping pattern was occurred due the remunerative prices to commercial crops and facility of better market access in the case of those crops.

   Trends in cropping pattern are shown in the Table 2. It can be seen from the table that after the introduction of the new economic policy, area under the cultivation of rice and wheat crops were decelerated from 0.66% and 2.02% CAGR respectively in the decade1970s to –0.08% and 0.51% CAGR respectively in the decade 1990s. However, area devoted under the coarse cereals and pulses increased from –0.5% and –1.06 to 1.64% and 0.66 by end of 1992–93. Further, it declined and

Table 2: CAGR of Area under Cultivation of Major Crops (percent)

Crops	Before Economic Reforms		After Reforms
	1970–71 to 1980–81	1981–82 to 1992–93	1993–94 to 2005–06
Rice	0.66	0.26	–0.08
Wheat	2.02	1.06	0.51
Coarse cereals	–0.79	–1.59	–1.09
Pulses	–0.04	0.64	0.09
Total area	0.19	–0.51	–0.28

Note: the compounded annual growth (CAGR) rate has been calculated by using the semi-log model such as $\ln Y_t = \beta_1 + \beta_2 t + \mu_t$.
Source: Hand Book on Indian statistics 2006–07, R.B.I.

turned negative due to the lexical attitude towards the agriculture during the regime of NDA government. Total area under the major crops also decreased from 0.19% to 0.28% CAGR for the period 1971 to 2005. This kind of shifting has been increasing the intensity of the problems of food security and food availability at reasonable prices to poor and middle class of India. The ultimate effect of this type of trends can be seen in the recent price hike of food items.

Section II

Literature Review

The impact of New Economic policy on the state of Indian agriculture with reference to socio-economic factors like poverty, farmers' suicides, food stock, input support, quantum of production, cropping pattern, etc. have been documented in the various studies. However, trends in credit disbursement to agriculture, determinants of agricultural production, relationship between AGDP and agricultural inputs, and shifting of phases of agricultural production were neglected in the earlier studies. Hence, this paper addresses this gap and explores the trends food grain stock and growth in area under food crops. India joined WTO as a member in 1995. Since then, the possible consequences are being discussed and debated among the politician and academic communities. With this, it is imperative to take stock of 10 years of membership and its impact on the production of agricultural and allied products. Another reason is that the impact of the WTO Membership on agricultural products is not documented in the earlier studies. The talks on subjects such as export subsidies, domestic support, agriculture tariff, Non-Agriculture Market Access (NAMA), and access in agriculture are underway. Agreements relating to terms and conditions of agricultural trade and monetary support are not yet finalized even though it has been discussed in the various conferences.

Recently, a WTO conference was held at Hong Kong, which remained inconclusive on several issues and agenda of WTO. Dubey (2006) concludes that the claims made by the Indian negotiators were grossly exaggerated and some of them were partially true. The biggest achievement of the conference was that a group of G-20 countries formed to pressurize the developed countries and raise the voice jointly. Further development that took place in the conference is that the European Union countries have agreed upon to eliminate the total export subsidy by 2013. First of all, this deadline is seven years away from the year 2006 and has been tactfully postponed for next 10 years by the developed countries after the formation of WTO. It shows their reluctance in following the main text of WTO. The developed nation group countries are pursuing dubious strategy for restricting flow of export from developing countries to their countries in future.

Khor (2005) points that the pounding pressure of the developed countries on developing countries for market entry into the developing nations to open their agricultural industrial and service sectors could not bring any success at the Doha round. In fact, a little priority has been accorded to the implementation issues relating to Uruguay Round and Special and Differential Treatment (SDT). These aspects were excluded from the list of discussions after the Cancun Conference 2003. Chand (2005) finds that pre WTO and post WTO reforms period shows decelerating and negative growth rates in 10 commodity groups out of 12. Exports have been adversely affected and imports increased rapidly. The efforts of food security got affected during the reform period. The growth of food grain production dropped from 1.51 percent (1991–1995) to 1.17 percent during the WTO reforms period (1996–2001).

Kalamkar and Narayanamoorthy (2003) examine the impact of the liberalization on the domestic prices of the different crops by covering various states. They observe that the growth rate real price for the crops like pulses and oilseeds has declined after liberalization of the economy in India. However, the real profit of other crops has increased during the post liberalization period in most of the states. Sahu and Rajshekar (2005) reveal the state and direction of agricultural credit to Indian farmers for the period 1981 to 2000 of scheduled commercial banks (SCB). They found that the share of agriculture credit in total net bank credit has significantly eroded from 13.84 percent in the year 1990 to 8.38 percent in 2000 after the banking sector reform in India. Satish (2006) takes the review of institutional credit, indebtedness and suicides in Punjab. He finds that the share of cooperative credit declined from 65.05% to 47.92% and the share of commercial bank rose from 34.91% to 52.08% during the period 1990–91 to 2002–03. He also finds that the indebtedness is not due to the lack of institutional credit supply but it is an outcome of the excessive consumption expenditure and declined retunes from the agriculture. Shriram (2006) reviews the recommendations of task force on the revival of rural cooperative credit intuitions. He is of the opinions that the state will not agree to clean up cooperatives due to the vested interest and political reasons. Mathur and Das (2006) analyze the determinants of agricultural growth at all India level for the period 1990–

91 to 2003–04. They conclude that the government investment in agriculture, subsidy, agriculture prices, and usage of electricity are the significant factors that decide flow of production of the Indian agriculture. Shaoo and Mohapatra (2008) explore the determinants of state domestic product for the period 1981–82 to 2002–03. They find that there is strong inequality of agricultural income among the states in India. Better performing states are mostly in the western and southern regions. On the other hands poor performing states are from eastern and northern regions. Further, their study reveals that agricultural growth rate has decelerated in the states like Punjab, Haryana, and Western Uttar Pradesh in the post reform period. Regression results of the study show that disparity in the agricultural output is significantly determined by variation in the fertilizer use and length of pacca road.

Section III

Data Sources and Methodology

Present study uses data given in the Handbook on Indian Statistics published by R.B.I Mumbai for the year 2006–07. Data on some variables is collected from the web site of planning commissions of India. This study is made for the period 1970–71 to 2005–06 for which latest data is available at hand and also at the respective sources. We divide the period of study into four periods: 1970–71 to 2005–06 (whole period); 1970–71 to 1980–81; 1981–82 to1991–92 (pre reforms); and 1992–93 to 2005–06 (post reforms period) to track down the state of Indian agriculture before liberalization and after the liberalization. To unearth the determinants of agricultural production before and after the liberalization and India's WTO membership, we use Cobb Douglas production function methodology (OLS). All the variables values are converted into natural log before running the regression.

Definition of the Variables used in Cobb Douglas Production Function Methodology

1. Institutional credit to agriculture (LNINCR): It consists of direct (short-term and long-term) credit issued by co-operative, state governments, scheduled commercial banks, and regional rural banks to agriculture and allied sectors in the rupee crore.
2. Irrigation facility (LNIRFA): Net irrigated area under the cultivation in million hectares.
3. Consumption of fertilizers (LNCOFE): Consumption of fertilizer includes N+P+K in lakh tones.
4. Use of pesticide (LNUSPE): Consumption of pesticides (technical grade material) in thousand tones.
5. Wheat support price (LNPRWH): Wheat support price is used as a proxy variable to denote price level of other agricultural commodities. Good support prices of food grain act as motivational factor to grow that variety on large scale. Wheat support price declared by agricultural price commission of India (APC) are captured. We used Wheat support price in rupee term.
6. Net area sowed (LNARSO): Net area brought under the cultivation of the crops in million tones is used for framing this variable.
7. Agricultural Gross Domestic Product (LNAGDP): This variable is employed as dependant variable which acts as proxy of productivity of Indian agriculture. We used old price series of 1993 of GDP at constant prices in rupee crore available at the source of data.

Model Specification

The relationship between agricultural inputs and output is documented in the earlier studies. In the several studies, Cobb Douglas (CD) production function is used to know the contribution of a particular input in the total production. Studies made earlier in India on the trends in the agriculture production and its determinants have used several independent variables such as land, labour, irrigation, fertilizer, etc. Mathur and Das (2006), Pattnayak and Nayak (2005), are the well documented studies on trends in agricultural production in India, in which agricultural production function is empirically studied using Cobb Douglas methodology.

In line with the earlier studies, this study uses Cobb Douglas production function to trace out the contribution of individual input in the agricultural gross domestic product of India (AGDP). This methodology enables us to check the phase of the production of the Indian agriculture for the pre and post reforms period. The study period is divided into three distinct periods for understanding the pre liberalization and post liberalization status of Indian agriculture and behaviour of production function. This exercise can shed light on the determinants of AGDP and their respective role. It is said that the flow of inputs is not keeping pace with the requirements of inputs from the farmers. New economic policy has forced the government to reduce the support given to farmers in the form of

subsidized inputs. Post reforms period analysis (1992–93 to 2005–06) can reveal the impact of economic reforms and India's membership of WTO on the trends in availability of agro inputs, its role in shaping the direction of output. This study uses the following model:

$$Y_i \text{ (LNAGDP)} = \beta_1 + \beta_2 \text{ (LNINCR}_i\text{)} + \beta_3 \text{ (LNIRFA}_i\text{)} + \beta_4 \text{ (LNCOFE}_i\text{)} + \beta_5 \text{ (LNUSPE}_i\text{)} + \beta_6 \text{ (LNPRWH}_i\text{)} + \beta_7 \text{ (LNARSO}_i\text{)} + \mu_i \quad (1)$$

All the variable values are taken in the natural log, where, Y_i=Agricultural GDP, β_1=Constant representing the technological change, LNINCR=Institutional credit to agriculture, LNIRFA=Net Irrigated land, LNCOFE= Consumption of fertilizer, LNUSPE =Use of pesticides, LNPRWH=Support prices declared by the central government for the wheat is used as a proxy of the price level of agricultural products, LNARSO=Net area sown, μ=stochastic disturbance term, LN=base of natural logarithm.

This model is linear in the parameters β_0, β_2, β_3, β_4, β_5, and β_6. Therefore it is a linear regression model and all parameters are the respective elasticities. The sign of parameters will show the relationship between inputs and total production. This model is also known as log-linear model. The parameters of model give information about the returns to scale. The response of output to a proportionate change in the inputs is measured in this model. If this sum of these parameters becomes 1, then it is assumed that there is a constant return to scale. Further, if the sum is observed as less than 1, then it is understood that there is decreasing returns to scale, and if the sum is found as greater than 1, then there is increasing returns to scale.

Section IV

Results from the Empirical Models and Its Association with Policy Decisions

Present study uses six explanatory variables to find out its relationship with output. These explanatory variables are: Institutional credit, irrigation facility, consumption of fertilizer, use of pesticides, support price of wheat, and

Table 3: Determinants of Agricultural Production in India (Cobb Douglas Production Function Methodology)

Period Model	1970–71 to 2005–06 I		1970–71 to 1980–81 II		1981–82 to 1991–92 III		1992–93 to 2005–06 IV	
	coefficient	t	coefficient	t	coefficient	t	coefficient	t
Constant	–3.60	–1.10	–8.95	–1.91***	0.55	0.24	–6.58	-0.47
LNINCR	0.21	3.45**	–4.98	0.32	0.14	2.84**	0.11	0.99
LNCOFE	–0.12	–1.85***	–0.12	–0.98	0.13	1.51	–4.20	-0.18
LNIRFA	0.50	1.27	0.35	1.27	–0.26	–0.4	–0.20	-0.16
LNUSPE					0.18	1.94***	–0.21	-0.76
LNARSO	2.52	3.34**	3.37	3.48**	2.02	3.51**	3.79	1.05
LNPRWH					–3.48	0.66	0.15	1.00
Adj.R^2	0.97		0.79		0.98		0.95	
F	325		9.67		110.56		32.91	
D/W	0.99$		1.88		2.35		2.36	
N	35		10		11		13	
Phase	IRS		NRS		NRS		NRS	

Notes: level of significance *, **, *** are denoted as 1 percent, 5 percent and 10 percent respectively. Sign $ points out that value is above CRDW RULE. **Dependant variable** = log of agricultural gross domestic product (LNAGDP); **Independent variables**: LNINCR = log of institutional credit sources, LNCOFE = log consumption of fertilizer, LNIRFA = log of net irrigated area, LNUSPE = log of use of pesticides, LNARSO = log of net area sown, LNPRWH = log support price of wheat. **Phases**: IRS= increasing returns to scale, CRS = constant returns to scale, NRS = negative returns to scale.

area sown. Said explanatory variables determine the AGDP of India. The production function of Indian agriculture is shown by four different models. Data on few variables are not founding after the year 2005–06 at the data source hence our study is confined to 2005–06 only. The data on the variables like use of pesticides and support prices of wheat is not available in beginning years of the present study. Therefore, we dropped them for the model I and model II. However, these two variables have been retained in the subsequent models such as III and IV. This study has not used labour as input variable due to data limitation. Ultimately, present study preferred to use only six explanatory variables, which is a limitation of this study. The results are shown in the Table 3.

The Cobb Douglas production function framework is used in this empirical study which estimates the output elasticites of different variables. The value of elasticity measures the percentage change in Agricultural Gross Domestic Product (AGDP) with 1 percent change in the independent variable. Each factor's (input) contribution in the total production function can be measured, holding other inputs constant. The sum of all $\beta_2+\beta_3\ldots$ (LNINCR+LNCOFE...) coefficients give information about returns to scale, which is the response of output to a proportionate change in inputs. In the Table 3 the results of the present study are reported with diagnostic test such as DW Statistics, F Test. The low value of DW statistics does not outperform the models measured by us in the present study because DW statistics of model III and IV are observed as above the 2 and in model II it is found as 1.88 which is close to 2. However, in model I it is found as 0.99 which is above 0.511 according to Cointegrating Regression Durbin Watson (CRDW RULE).

We measured the four models for knowing determinants of production for the Indian agricultural sector for the pre and post reform period. We also measured production function for the seventies decade to know the phase of production. Since 1970–71, several policy initiatives have been introduced by the government of India and all the state governments to step up the production of food grain and all-round development of Indian agricultural sector. This analysis throws light on the two distinct queries: in which phase of production Indian agriculture sector was passing through in the last three decades and especially after the introduction of new economic policy 1991. It also seeks answer on determinants of agricultural gross domestic product through the Cobb Douglas production function. The contribution of each variable is revealed by the coefficient of independent variables. This exercise can give the suggestions for taking necessary steps to correct the existing policy frame work.

Model 1 (1970–71 to 2005–06) uses only four variables for measuring the production function because as we stated that we could not get complete data on the remaining two variables. The results that appeared from the model 1 point out that institutional credit and net area sown showed positive and significant effect on the growth of AGDP. However, the consumption fertilizer has negative impact on agricultural AGDP. It means that though the consumption fertilizer is increased by 1 percent, AGDP shall decrease by 1.22 percent. Irrigation facility has positive effect on production of AGDP but its effect is not significant. The R^2 value of this model is 0.97 which can be concluded as about 97 percent of the variation in the AGDP is explained by the above four variables.

These results predict that there is urgent need of flow of necessary inputs to meet the problem of food security and over-all development of this sector. This model also shows that Indian agriculture had witnessed increasing returns to scale stage for the period 1970–71 to 2002–03. Finding drawn by us is correct because the food grain production has increased by 300 percent in India during the same period. The impact of new agricultural strategy pursued since 1966 is seen in realizing the huge production of food grains.

The results emerged from Model II and III that exhibit decreasing returns to scale stage of production for the decade seventy and eighty. From the results of model II and III, it can be concluded that the impact of new agricultural strategy was not remained continue in the agricultural sector of India. Model II reveals that variable institutional credit and consumption of fertilizer shows negative elasticity. However, irrigation facility and net area sown exhibits positive sign of elasticity. But none of the variables is significant except the variable net area sown, which shows positive significant elasticity. The results of model II can be interpreted as the flow of institutional credit and consumption of fertilizer has kept pace with demand for them. In Model III, variables such as institutional credit, use of pesticides and net area sown showed statistically significant and positive association with AGDP.

Variable consumption of fertilizer shows positive value of elasticity. However it is not statically significant. Other remaining variables like net area irrigated and wheat support prices depict negative value of elasticity that means AGDP does not respond to these two variables in a liner manner. Support prices declared by the government of India every year do not act as motivating factors to the farmers for increasing the area under cultivation of food grain crops. Model III is designed to examine the association between inputs and output before the 10 years of liberalization policy that were introduced in 1991. The result of model III shows that Indian agriculture sector has witnessed the decreasing stage of production. Findings of model III match with the conclusions drawn by the earlier studies conducted during the period of eighties.

Model IV is run for the period 1992–93 to 2005–06 to examine the impact of the new economic policy 1999 and India's membership of WTO on the determinants of AGDP. There is widespread complaint and understanding that government of India has reduced the subsidy support given to agriculture in the move of reducing public expenditure under the pressure of WTO. Banking reforms have also forced the banks to collect old debt for reducing their NPA and sanction new credit to farmers on selective basis. This move helps them in reducing the volume of risk for banks. With this backdrop, we examine the values of elasticity of various inputs and their respective contribution in AGDP. Findings that appeared show that not a single input is statically significant by showing either positive or negative sign. The values of the variables such as consumption of fertilizer, net irrigated area, and the use of pesticides take negative sign. The sign appeared of these variables reveal that their contribution in AGDP seems to be –4.2, –0.2, –0.2 percent respectively. The sign of other variables such as institutional credit sources, net area sown, and support price of wheat take positive values of elasticites. Findings emerged from this model can be interpreted as Indian agricultural sector has witnessed decreasing retunes to scale stage of production after the introduction of new economic reform and India's joining as a member of WTO.

Section V

Conclusions and Policy Suggestions

The findings that appeared from models II, III, IV show that Indian agricultural sector witnessed decreasing returns to scale phase during the decade seventies, eighties and nineties. However, model I reveals the increasing returns to scale of production for the whole period of analysis is observed in Indian agricultural sector. Another observation is that variables such as institutional credit and net area sown have displayed the statistically significant association with AGDP except the model IV. Remaining variables used in the different models display either positive or negative sign but all them are statistically insignificant. Before and after the introduction of the new economic policy, Indian agriculture sector was in decreasing returns to scale phase of production. In fact, this phase started in 1980–81. The results that appeared from the models and presence of decreasing returns to scale phase proved that input availability was under strain in India from 1980–81. Hence, there is an urgent need to increase the abundant and continuous flow of inputs so that problems such as food security, poverty reduction, unemployment, and increasing price level of food articles can be minimized. We therefore, advocate government to increase the flow of inputs for meeting the proposed target growth rate 10% of GDP of the economy and 4% growth rate of Indian agricultural sector.

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"Efficiency is doing things right; effectiveness is doing the right things."
— Peter Drucker

Focus

Uttar Pradesh's Manufacturing Sector: Status, Structure, and Performance

Nomita P. Kumar

Uttar Pradesh's relatively large size and the professed goals of the planners and policy makers to make it imperative for industries in the state to develop fast leaves the state economy fluttering to evolve out of bifurcation syndrome. Much is left to be achieved as the signs of industrial development are not encouraging on all the key parameters such as fixed capital investment, employment, net value added, and gross fixed capital formation. In terms of technical coefficients such as employment per unit, capital intensity, and labor productivity, the state's industry has remained way behind the national average.

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Introduction

"If Uttar Pradesh were a country, it would be the world's seventh largest. It is the most populous state of India and is host to one-sixth of the country's population. The large size of Uttar Pradesh is indicative of the large contribution that its manufacturing sector can make to the country's economic growth," noted the Planning Commission (2001). Uttar Pradesh's large size relative to other Indian states and the professed goals of its leaders and policy makers make it imperative for industries in this state to develop fast. However, recently there has been a marked deceleration in industrial growth which needs to be addressed by a strategically oriented industrial policy.

The reforms at the State level have been rather slow-moving and very ticklish. There are several reasons. First, limited decentralization of decision-making has meant that the State lacks the authority to formulate and implement policies which are under its control. Second, unlike the Centre, the State Governments do not have sufficient institutional back-up. Third, due to the short-terms of office that the State Governments have been holding, they are governed by short-term political considerations. Chief Ministers have changed frequently thereby leading to policy discontinuity (since 1967, Chief Ministers, on an average, have been in office for only 2.65 years). For instance, Uttar Pradesh has seen 27 Governments in 44 years. Fourth, populist policies have always been preferred to harsh reform measures (Bajpai and Sach, 2000).

In Uttar Pradesh, reform measures in the industrial sector started with the announcement of the Industrial Policy, 1998. The policy aimed at accelerating industrial growth by attracting a steady stream of investment by creating a congenial investment climate. As 90 percent of the industrial sector is made up of Small Scale

Table 1: Contribution of Uttar Pradesh to National Industrialisation

(in %)

	Number of Factories	Fixed Capital (Rs Lakh)	Number of Workers	Net Value Added (Rs Lakh)	Value of Output (Rs Lakh)	Gross Fixed Capital Formation (Rs Lakh)
1998-99	7.98	13.15	7.16	7.20	7.42	11.80
99-2000	7.83	9.39	6.83	6.60	6.80	7.27
2000-01	7.34	8.70	6.55	6.67	7.00	6.55
2001-02	7.12	6.99	6.43	6.93	6.97	5.17
2002-03	7.02	6.40	6.64	6.59	7.12	6.26
2003-04	7.42	6.66	7.44	7.05	7.26	8.93
2004-05	7.03	6.15	6.86	5.50	6.53	6.89
2005-06	7.49	6.20	7.01	5.27	6.23	7.25

Source: ASI.

industries, the major shifts in the State's policy are directed towards this sector only. Emphasis is placed on attracting private investment in software, hardware, and telecommunications. The private sector would be encouraged to set up technology parks and other infrastructure. It offers a varying investment subsidy, depending upon the amount of investment and employment generation, and other incentives. One of the major exercises undertaken recently (in 2004 Policy) is to synchronize the prevailing policy framework with contemporary international economic thinking. The government has, in the recent past, announced New Industrial Development and Service Sector Investment Policy–2004.

The Industrial policy so declared pointed towards the implementation of SINGLE TABLE SYSTEM, development of 7 Industrial Corridors, Regular Supply of Power to the Export Oriented Units, Abolition of Inspector Raj, Re-habilitation of SSI units, Technology Mission, Increase of Employment from 8 percent to 15 percent in Industrial Sector, Increase of Industrial Contribution in Gross Domestic Production from 20 to 25 percent, Suspension of Trade Tax Chaukis, Creation of Road Development Fund and Authorisation to Industrial Units for Selling the Electricity direct, etc. All possible measures were taken to put industrial policy into practice and it is worthwhile to mention that the achievement of 97 percent under single table system is indicative of successful implementation of the industrial policy.

This article seeks to analyze why this state has not been able to catch up with the industrialized states in spite of its proximity to abundant natural resources. The study is exploratory in nature and makes an attempt to identify the characteristic pattern of industrial progress in the state in the last few years since 1998–99 till date. Section II gives a brief account of the economic background of the state, present scenario at the industrial front and the promotional measures thus formulated to trigger growth in the sector. Section III discusses the possible sources of data on industrial sector of the state economy. Section IV lays down changes in structural parameters in the economy of Uttar Pradesh with Section V focusing on structural ratios and technical coefficients of the industrial sector. Section VI deals with impromptu status of performance gaps that lay open for policy makers to investigate, Section VII analyses the status of small scale industries in the state, and Section VIII finally concludes.

The Backdrop

Having vast fertile plains, rich natural resources, and a large population the state of Uttar Pradesh possesses a good potential for rapid industrial development. The economy of UP, despite being predominantly agrarian, has witnessed considerable growth and structural changes in recent years. Owning largely to an emerging industrial sector the share of secondary sector in the state income has shown considerable increase over the years—from 10.7 percent 1960–61, it increased to about 20 percent in 2000–01. Almost 80 percent increase in index of industrial production during 1985–86 to 1996–97 significantly reflects changes in the aggregate industrial activity in the state.

Endowed with fertile land, a salubrious-climate, and perennial river system, the state has long been the granary of India. Agriculture is the mainstay and major source of

income for about 72 percent of the population. The state is one of the leading producers of food grains and other commercial crops in the country. The state has a well-developed traditional industry besides mineral based industry. UP is now flexing its status as the leading agricultural state in the country to emerge as a preferred destination for the food-processing industry in the country. The state has some of the oldest powerhouses and currently is one of the largest power producers in the country. The state has good communication network including one of the longest rail and road lengths. It is keen to improve the industrial infrastructure and has developed integrated industrial townships like Noida with state-of-the-art facilities. Noida export zone enjoyed a good inflow of investment from many domestic and international players. The state has established four agro export zones and three Special Economic Zones (SEZs) that are under implementation. Centre for Monitoring Indian Economy (CMIE) index of Relative Development of Infrastructure of the state (2002–03) is at 103.3 against an all India figure of 100.

The state has a well-developed agro-based industry. Being one of the largest producers of sugar cane, the state is India's sugar bowl. UP accounts for 28.03 percent of India's sugar production. The affluence of agriculture spurred the growth of allied industries like cold storages and warehousing. In addition to industrial areas, many centres like Kanpur, Ghaziabad and Lucknow have an established traditional industry. The large livestock population allowed the leather industry to flourish in the state. Kanpur and Agra emerged as the hubs for leather goods in the country. Textile industry is the other promising sector in the state.

Uttar Pradesh is the largest producer of electronic goods and is the fourth largest exporter of software products in the country. UP accounted for close to 10 percent of IT & BPO exports in the country in 2003–04. With a productive and cost-effective manpower, the state has attracted some of the largest MNCs to set-up their manufacturing facilities—Coca-Cola, Pepsi, Glaxo, Daewoo, Honda, and Piaggio to name a few. The state with its human resource potential, proactive policies, and commitment to ensure encouraging climate to the investors is poised to emerge as a manufacturing hub in the country. The state has become a hub for corporate R&D with many domestic players and MNCs establishing their facilities.

The industrial panorama seems to be quite encouraging and reflects the emergence of considerable potential for further growth in the industrial sector of the state. Hence it is pertinent enough to gauge the status of policy prerogative of the state in terms of exactly the state has been doing in terms of promoting industries and to reap the benefits that might accrue from that potential.

Sources and Limitations of Data

For this analysis we have collated data on some key variables, relevant to the industrial sector, from various reports of the Annual Survey of industries (ASI) covering all factories registered under Sections 2m(i) and 2(ii) of the Factories Act, 1948, i.e., those factories employing 10 or more workers using power; and those employing 20 or more workers without using power. The latest data available on industrial statistics pertains to the accounting year 2005–06. We chose to take data from 1998–99 to 2005–06 and have tried to capture the structure of industrial growth for the period after the advent of reforms in the state economy.

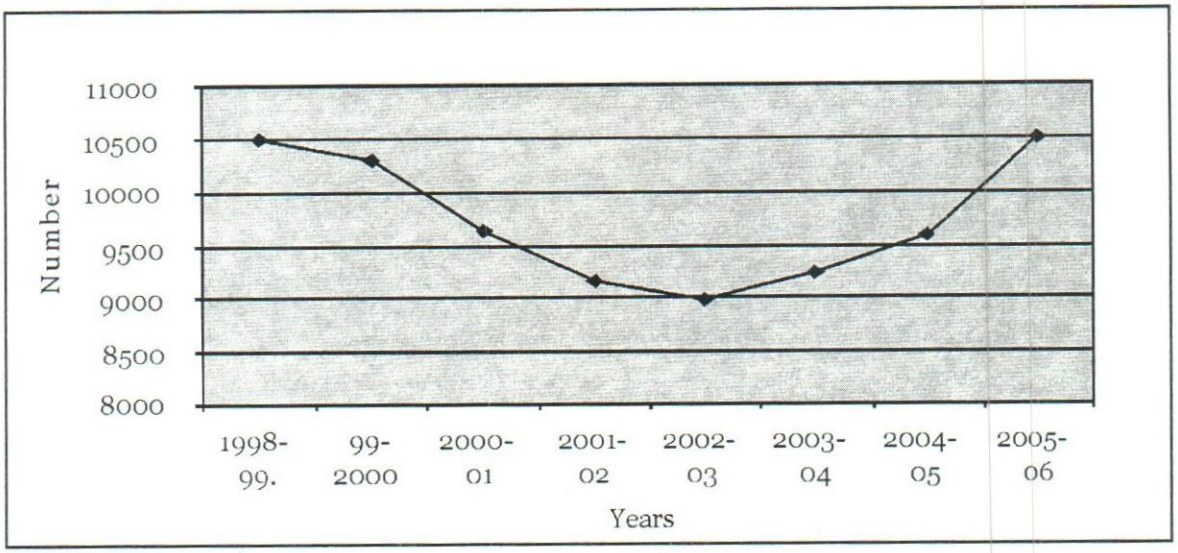
Changes in Structural Parameters

To carry forward our study we have chosen six variables that will reflect upon the industrial structure of Uttar Pradesh and India. The economic indicators selected are: number of factories, fixed capital, number of workers, value of output, net value added and gross fixed capital formation.

Number of Factories

In the Annual Survey of Industries "the primary unit of enumeration in the survey is a factory in the case of manufacturing ventures, a workshop in the case of repair services, an undertaking or a licensee in the case of electricity, gas and water supply undertakings and an establishment in the case of bidi and cigar industries." Secondly the reference period for ASI is the "accounting year of the industrial unit ending on any day during the fiscal year" (ASI reports). This reflects that in a particular accounting year if the number of factories has increased in comparison to the previous year it indicates that new factories have got registered in that particular year under section 2m(i) and 2m (ii) of the Factories Act, 1948 (Pani, 2007).

The picture that got reflected by the Figures 1 and 2 below made it quiet obvious that there is a decline in the number of factories established in both Uttar Pradesh and at all India level after 1998–99. In Uttar Pradesh the reform got vitalized after the implementation of Industrial policy in 1998—that brought reforms to the state. The figures



Source: www.ibef.org

Fig. 1. Number of Factories—U.P.

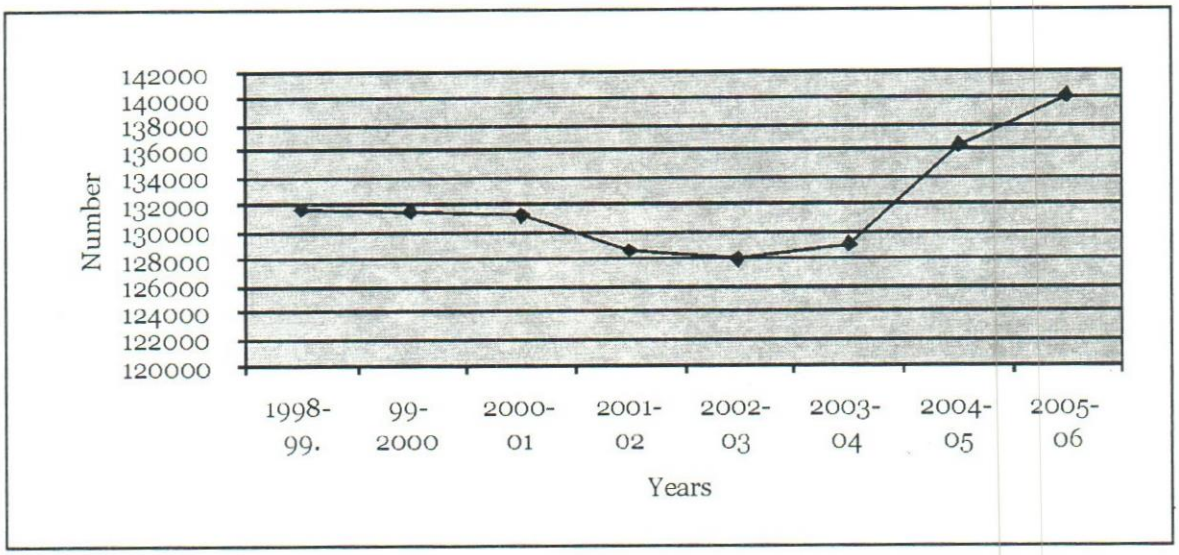


Fig. 2. Number of Factories—India

reveal that the New Industrial Policy of 2004 has given a boost to the industrial sector in UP or we may say the policy have currently started showing results.

Figures 1 and 2 both reveal similar trends showing decline in initial period and thereafter show an increase in the number of factories could be registered in the later period, i.e., after 2002–03. There is some difference in the slopes of the respective curves. It is interesting to note that during the declining phase the rate of decline was sharper in case of Uttar Pradesh as compared to all India scenario (Figure 1 and 2). In the era of upswing the rate of growth was more for Uttar Pradesh as compared to All India which conveys the issue of scope of UP being an attractive destination for investment.

What is remarkable to mention is that the rate of industrialization achieved negative growth before 2003–04 by after that it followed positive growth trend both in Uttar Pradesh and at the all India level. Looking at the figure 3 we find that the rate of growth of industries in Uttar Pradesh was well below the rate of growth as experienced at the national level. Change in the policy in 1998 perhaps slowed the growth which fell much below the all India growth rate only to rise again in 2003–04 and all time high in 2005–06.

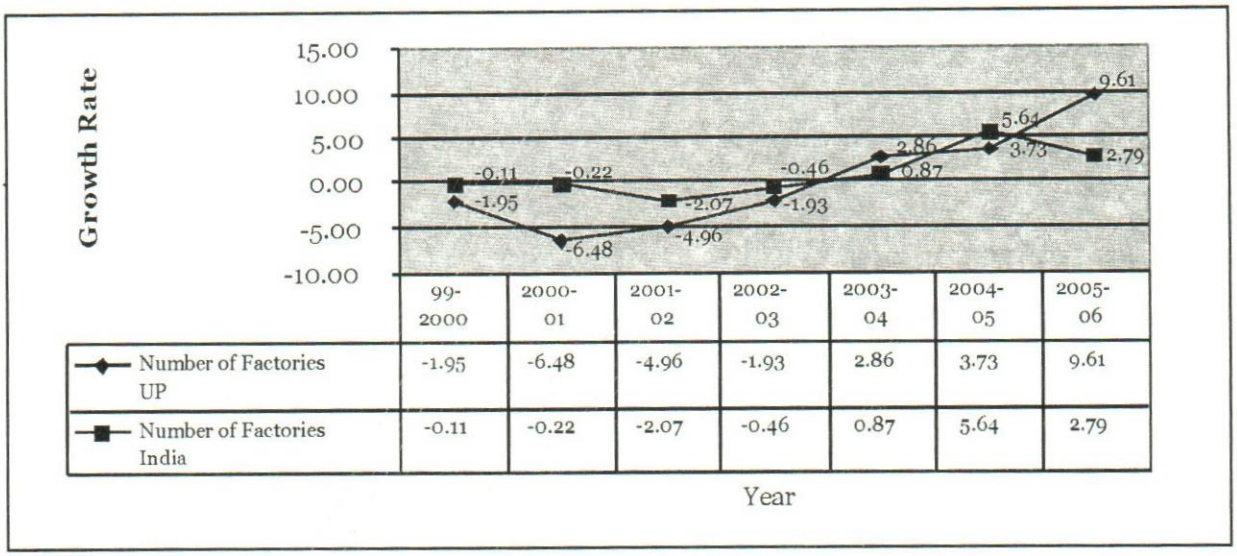


Fig. 3. Rate of Industrialisation

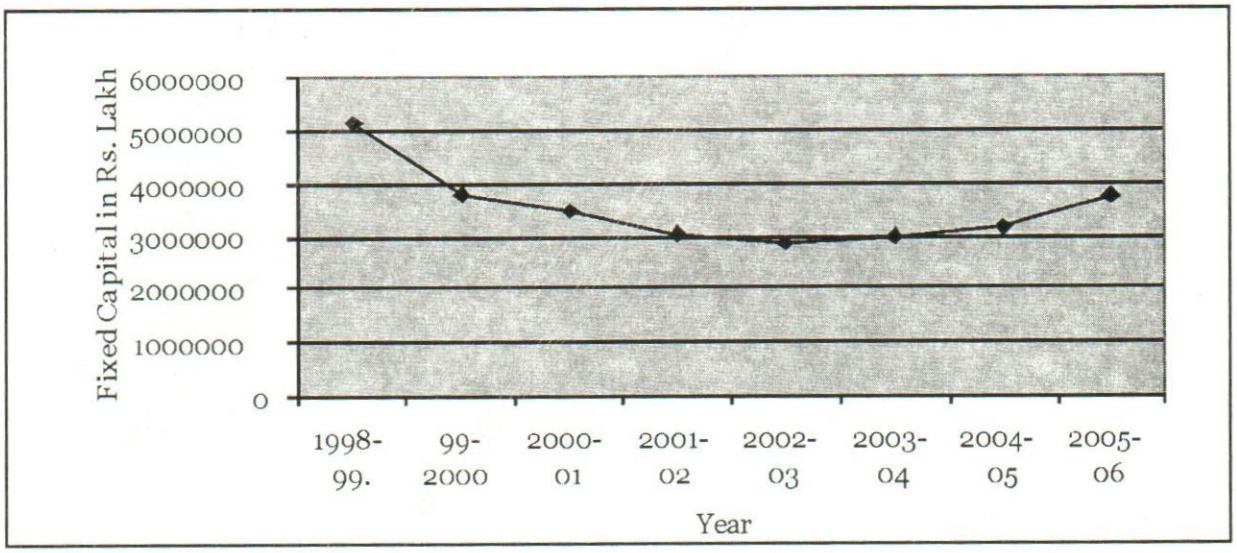


Fig. 4. Fixed Capital in UP (Rs. Lakh)

Fixed Capital

The study of the term Fixed capital as indicated in Annual Survey of Industries indicates that fixed capital represents depreciated value of the fixed assets owned by the enterprise which also incorporates other fixed assets such as hospitals, schools, etc. which are provided for the betterment of industry personnel besides investment in land, building, plant, and machinery. But to our understanding investment in such assets are going to be meager. At the outset this gives an idea of the size of the firm, because higher the investment of fixed nature will lead to higher employment and higher output. Besides this it is also argued that fixed capital investment is of vital importance for productivity (Pani, 2007).

What is remarkable is that in UP the curve peaked in 1998–99 and thereafter it took a continuous downward trend only to recover after 2003–04, but the curve for all India showed a continuous upward trend only a marginal drop in 2000–01 and then a steady increase over the rest of the period. It can be reiterated that in the period before reforms the fixed capital investment registered a sharp upward trend but in the post reform period the rate of increase is milder.

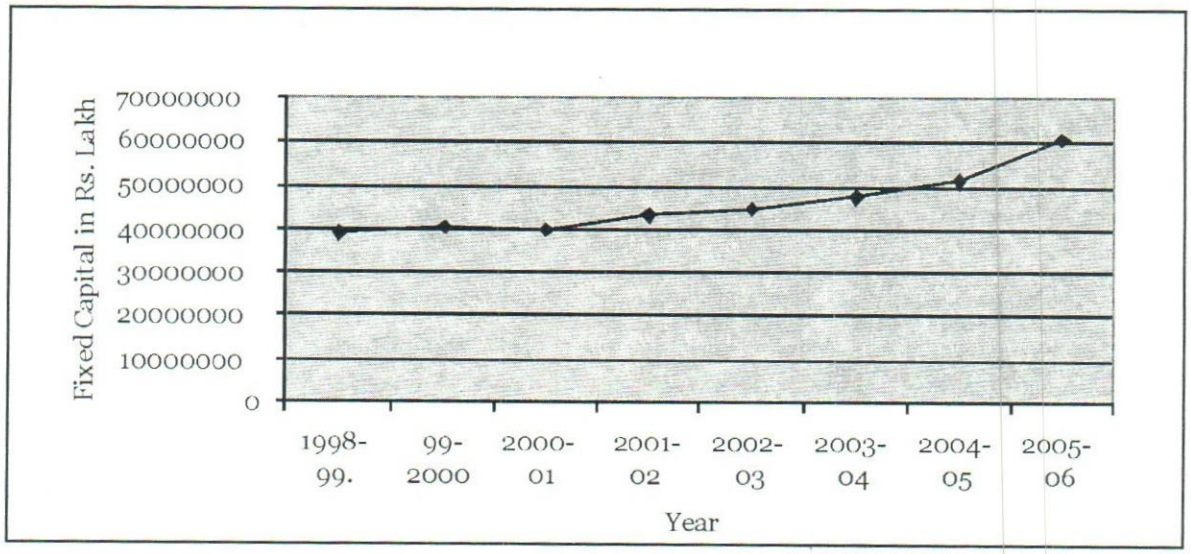


Fig. 5. Fixed Capital in India (Rs. Lakh)

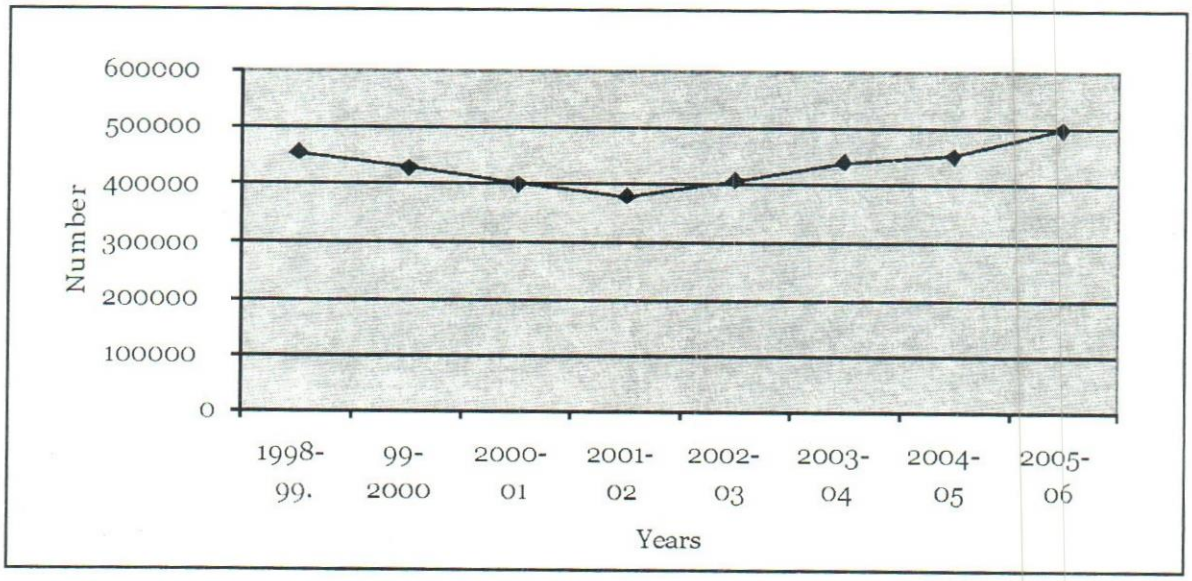


Fig. 6. Number of Workers — UP

Total Number of Workers

The number of workers as defined in ASI states "to include all persons employed directly or through any agency whether for wages or not and engaged in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing process or in any other kind of work incidental to or connected with the manufacturing process or the subject of the manufacturing process."

Comparisons made on this variable imparts the fact that State of UP as well as the national data show that there has been a fall in the rate of growth of workers 1998–99 onwards only to rise after 2001–02. The curve is steep for the national level as compared to the curve of Uttar Pradesh which followed a downward path with a bit of improvement after passing of few years after the implementation of reforms in 1998–99. Growth of workers if compared on percentage point highlights the hard reality in the face of State economy that reforms were not employment generating as proclaimed by the planners and it took time to translate into positive growth after 2002–03.

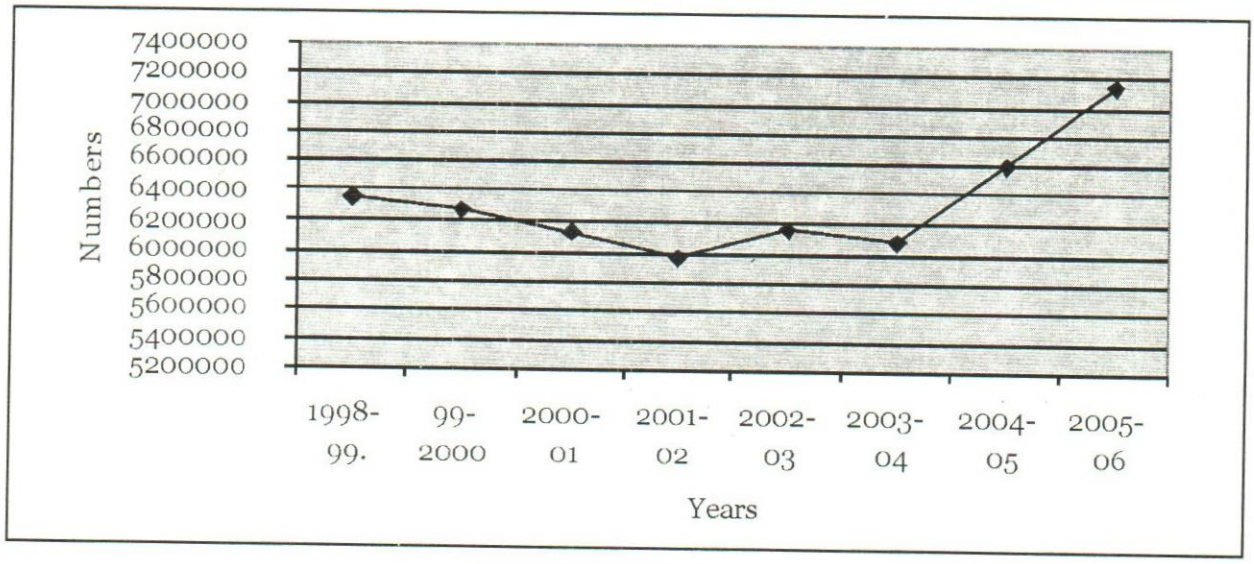


Fig. 7. Number of Workers — India

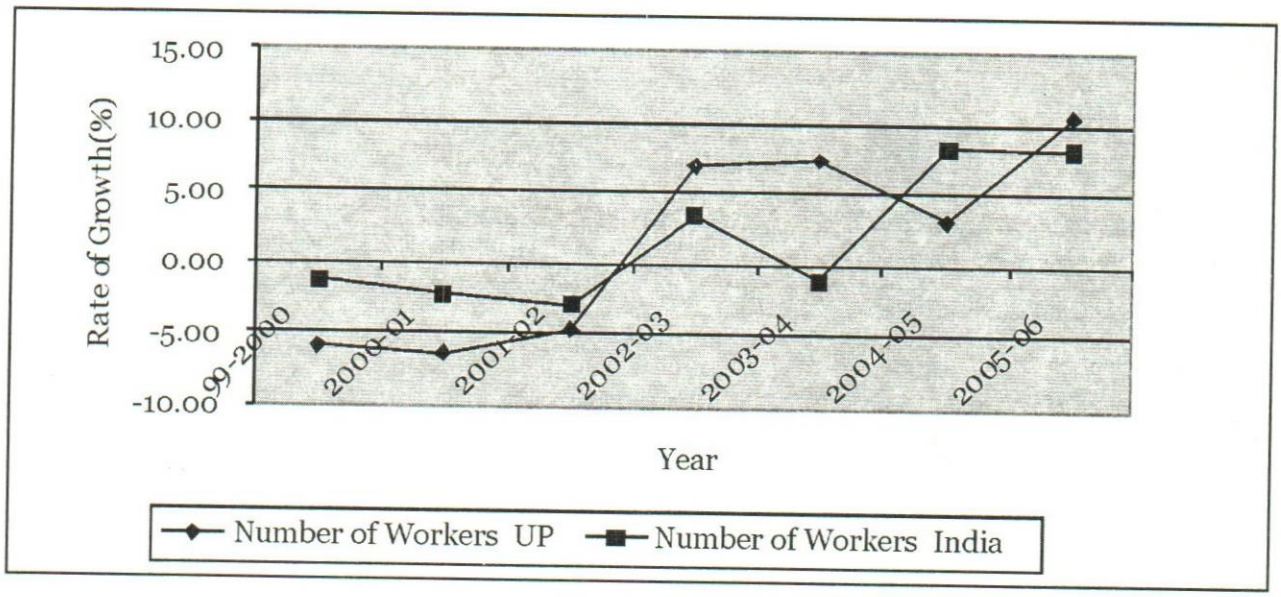


Fig. 8. Growth of Workers

Net Value added

As understood value added in a factory is the difference between the value of output and value of input. It is the sum total of contribution made by the factors of production in the manufacturing process. Depreciation is discounted and net value added is computed. At the macroeconomic level this is the component which makes up the domestic product of an economy (Pani, 2007) and ultimately leads to the stage where we can calculate industrial sectors contribution to the State's domestic product.

In the following figures 9 and 10 the curves very stoutly shows that at the state level few fluctuations could be gauged but after the implementation of reforms steady directional change could be seen and after a transitional phase of four years or so curve is seen picking up. But at the national level steady upward motion of the curve could be observed. So far as the contribution of UP. is concerned we calculated and found that at the beginning of the time period i.e., 1998–99 the state contributed just about 20 percent to the net value added from the factory sector at the national level. There is a fall after that and during the 2003–04 in terms of value added UP contributed once again about 7.05 percent of the national figure. However after that once again UP's contribution fell all time low 5.27 percent of the national figure and when compared to more

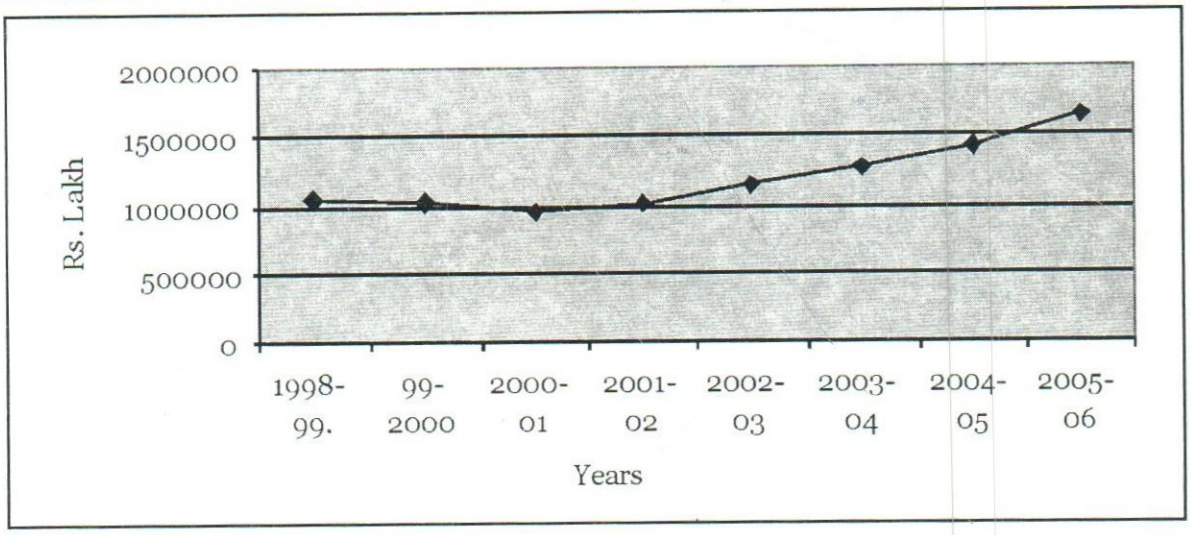


Fig. 9. Net Value Added (Rs. Lakh) UP

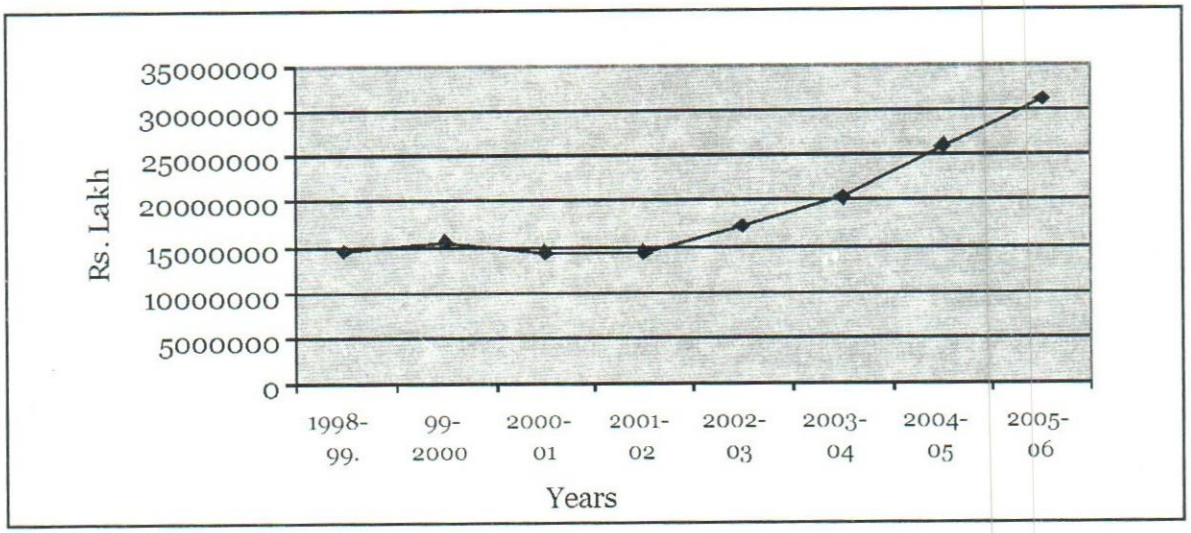


Fig. 10. Net Value Added (Rs. Lakh) India

industrialized states of Maharashtra and Gujarat, UP is way behind these states and show a wide divergence between developed and laggard states of the Indian economy when contribution of the manufacturing sector is undertaken.

Gross Fixed Capital Formation

Following Pani (2007) GFCF has been taken up as GCF is not relevant here for the "simple reason that GCF also includes the stocks which are indicative of demand pressures and potential sales." The new investments in physical assets are termed as GFCF and do not incorporate stocks or inventories. The Figure shows that GFCF in UP follows a downward trend after 1998–99 which leads to the ultimate fall in the organized sector employment as well as value added. Sudden change in policy seems to have pulled down GFCF tremendously down at the state level but later coped up and turned positive once again. But on the other hand the national curves charts upward direction peaking in 2001–02 decline in 2002–03 and shoots up till and picked up later to reach maximum level in 2005–06. In terms of UP's share in the national GFCF is about 7.25 percent (2005–06) which has dropped from 11.80 percent in 1998–99 which registered a record high.

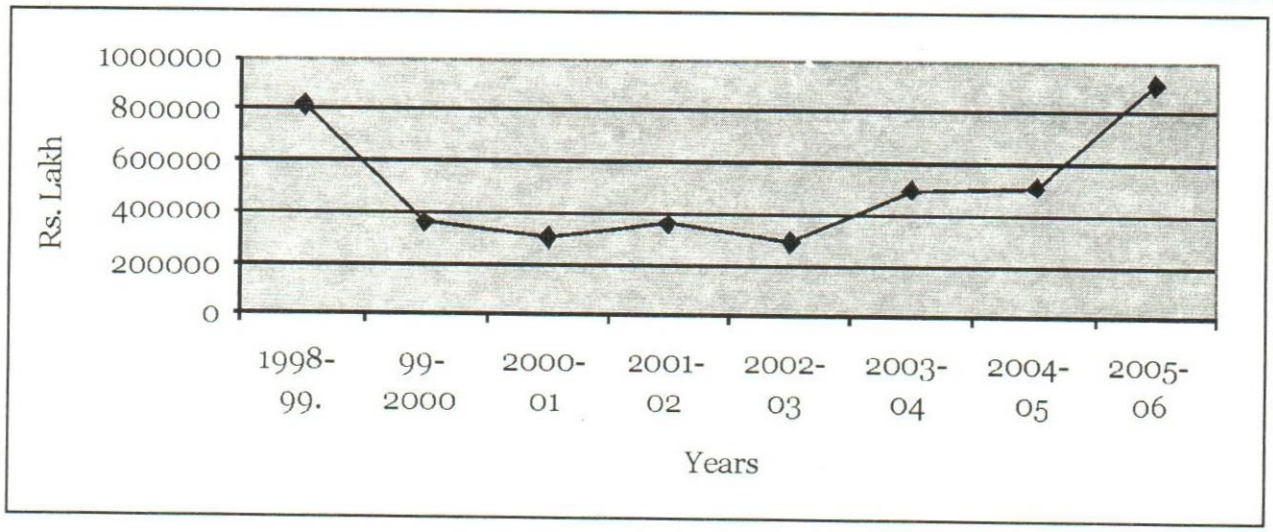


Fig. 11. Gross Fixed Capital Formation (Rs. Lakh) - UP

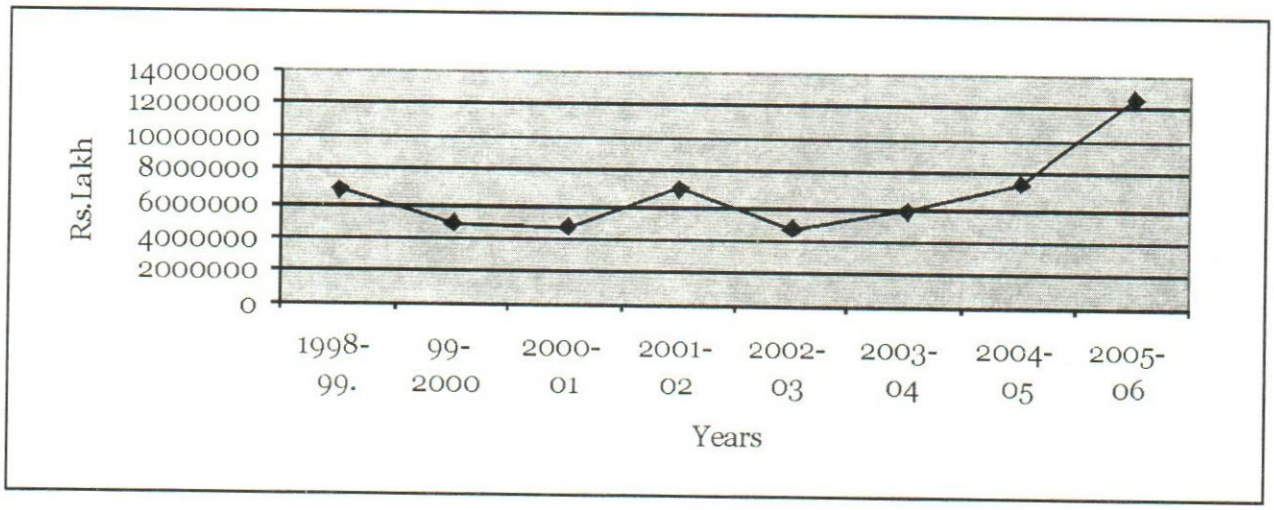


Fig. 12. Gross Fixed Capital Formation (Rs. Lakh) - India

Total Output

All manufacturing and processing is captured into this variable. A continuous upward direction is reflected by the curve at the national level whereas in the state of UP very low level of output is registered in the initial phase of study and it steadily followed upward path with few fluctuations only to pick up all time high in 2005–06. It is remarkable that output rose suddenly after 1997–98 which can be attributed to policy change implemented by the State government. Uttar Pradesh's share of national economy's manufacturing is about 6.23 percent in 2005–06 which has declined from 7.42 percent in 1998–99. This depicts the industrial backwardness of Uttar Pradesh as compared to states like Maharashtra, Gujarat, and Tamilnadu which contributed approximately 19.5 percent, 16 percent, and 10 percent respectively for the same period.

Contribution figures would indicate that UP's share is way below what may be considered as reasonable, if the proportion of population is anything to go by. Even after taking the performance in agriculture into consideration, it will still fall much below the proportionate level of contribution. Of particular concern is the steady downward trend in contribution witnessed on number of factories, fixed capital, net value added, gross fixed capital formation. This would suggest that not only there had been limited investments, growth also is shrinking year on year probably due to relative low productivity and resultant erosion of capital.

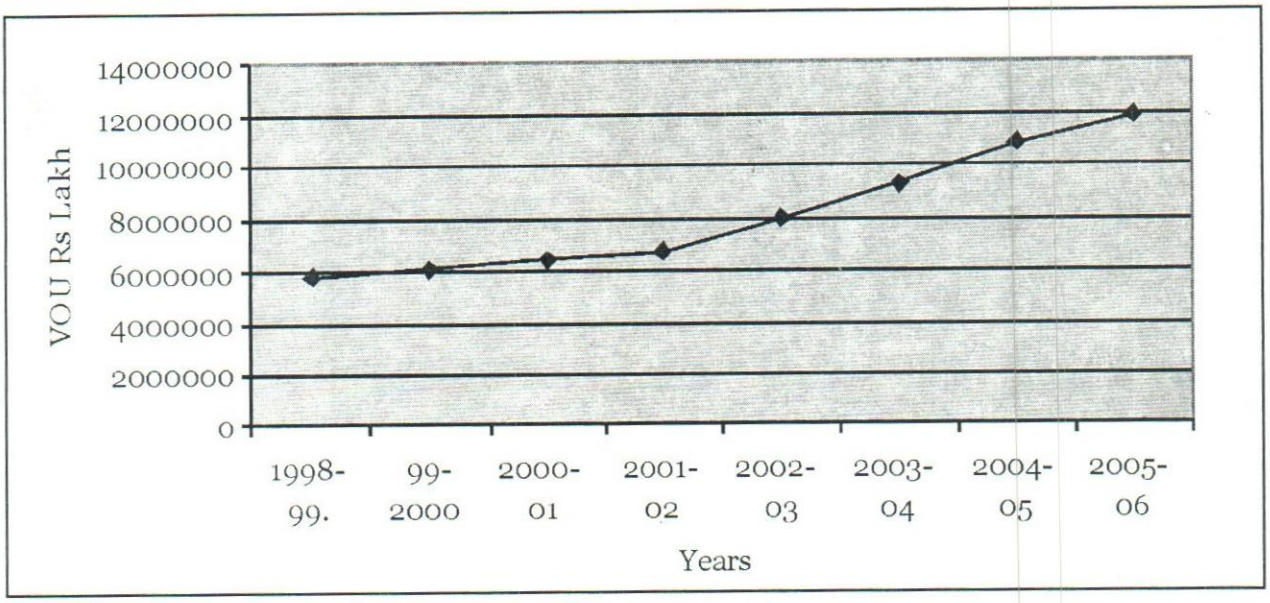


Fig. 13. Value of Output (Rs. Lakh) - UP

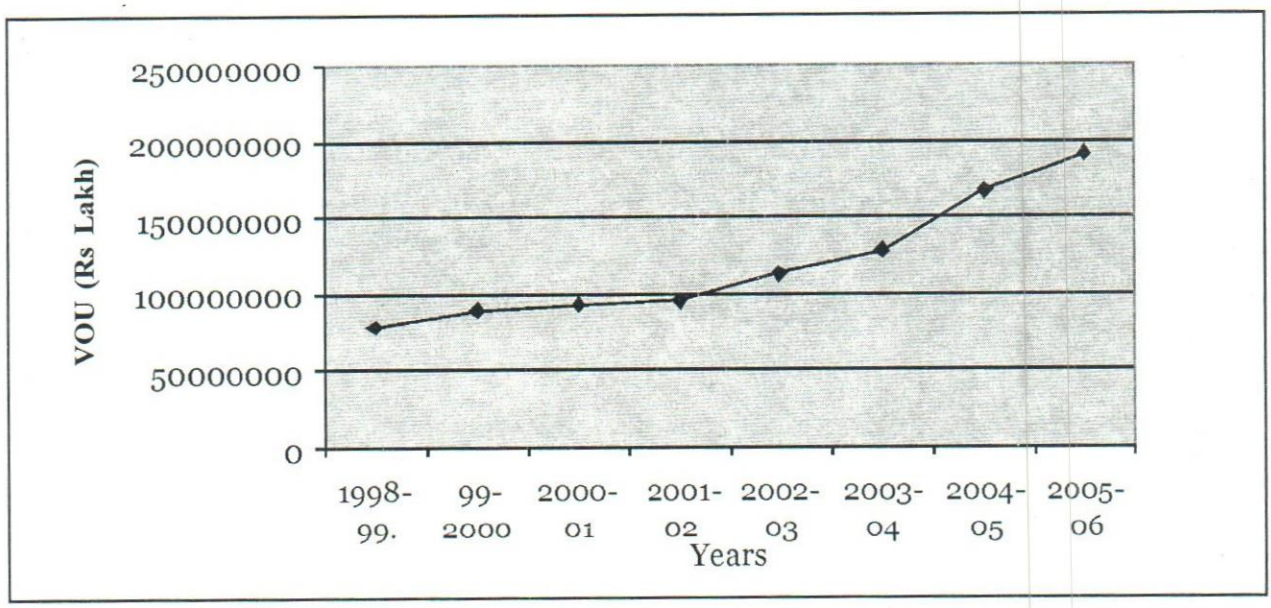


Fig. 14. Value of Output (Rs. Lakh) - India

Structural Ratios and Technical Coefficients

It is an established understanding that the real test of industrial sector performance could be gauged by putting the structural ratios and technical coefficients of the sector on a comparative plane with that of others. In this context, we are also dwelling upon certain key structural ratios for comparative analysis, such as number of workers per factory, fixed capital per factory, fixed capital per worker, gross output per worker, and net value added per worker.

The information thrown up by each class of ratios is interpreted on the basis of an average or typical factory. On the technical coefficient front, this study examines coefficients such as fixed capital to gross output and net value added to gross output.

Fixed Capital Per Factory

Fixed capital per factory is indicative of average size of factory, but in investment terms. On this ratio the story of

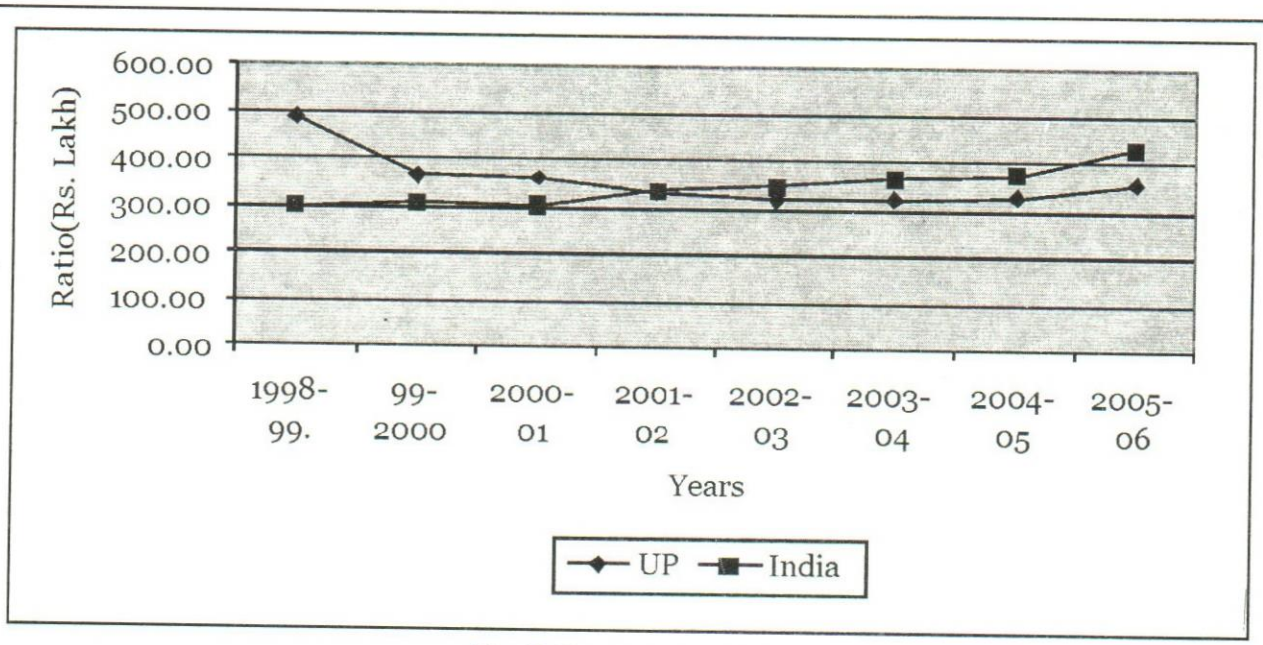


Fig. 15. Fixed Capital per Factory

UP is somewhat different. Till 2000–01 UP could garner relatively higher investment (13.55 percent) compared to all India average, but fell behind thereafter. Though there is some increase in recent years, the gap between UP and national average is gradually widening which is alarming and a matter of concern for the policy makers to embark upon the reasons for its fall in the changing policy framework.

Output Per Worker

One of the important measure to gauge the productivity of the industrial sector is gross output per worker as it is a partial measure of efficiency or partial factor productivity. As we know that various factors of production combines in various proportions and labor is not the only input that is used in the production process. Though we know that relative effect of labor on productivity cannot be captured by just deriving output per worker but it still gives some tentative reflections on production capability of workers in a given production set up. Though productivity may be affected by many factors such as superior machinery or equipment, skill of workers, composition of the workforce, etc., yet a comparison with national average can give a

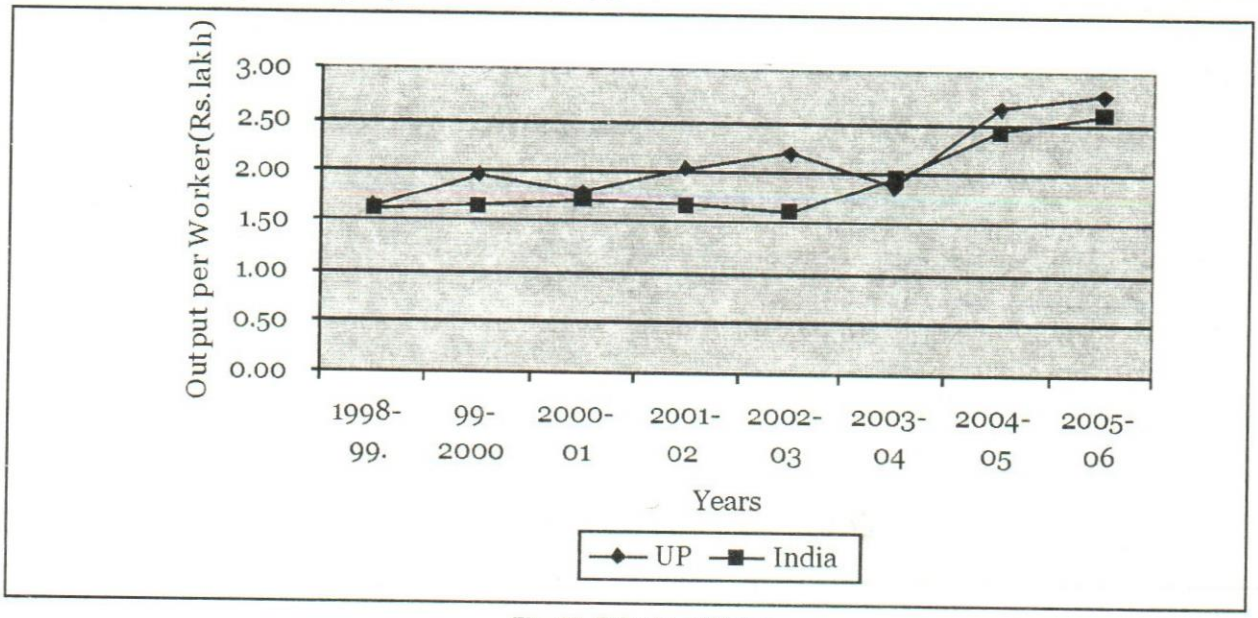


Fig. 16. Output per Worker

feel of the nature and extent of difference. As is evident from Figure 16, gross output per worker was way above the national average during the initial years of our study period. However, like performance on certain other indicators, on this one too, UP is showing signs of decline indicating fall in productivity. Lower productivity, in a way, is suggestive of lower competitive strength.

However, the above comparisons clearly show that the gulf between the performance of UP and that of the country as whole are widening on certain key ratios like, fixed capital per factory, fixed capital per worker, and gross output per worker. This would suggest that UP has been less successful in attracting investments and is probably losing out to other better performing states. In today's world, where the concern is economic development, every state is trying to attract investors in its fold. This provides the investor with a choice and puts the state to a position of investment seeker. It may therefore be of relevance to compare at places the performance of UP with couple of better performing states in order to have a feel how far behind UP is.

Capital Intensity

To delve deep into the matter we have derived the ratio between fixed capital per worker which is showing a sharper fall in comparison to fixed capital per factory. This could be suggestive of the fact that the average number of workers in a factory may be more than what is required and hence it could also mean investment made per factory is lower than what is required to be able to maintain productive performance. Whatever may be the cause this should also leave us to ponder about as it is reflective of mechanization of production process which impinges on productivity.

Capital intensity as revealed by fixed capital per worker can be an approximate measure to know labor productivity which much depends on mechanization of the production process. Figure 17 shows that capital intensity (fixed capital per worker) has been steadily increasing at the all India level but a continuous and steep fall could be seen in the manufacturing sector of the state of Uttar Pradesh. It is striking to find that capital intensity of the state was once much above the all India level but slumped below the national average after 2002–03 and needs further probing to know pros and cons of this behavior.

Value Added Per Worker

Though in terms of net value added per worker, UP is lately falling below the all India performance level, it is important to note that UP had been maintaining a rising trend in comparison to its own performance year on year for the entire period under consideration (1998–99 to 2005–06). Secondly, even during the latest period the gap does not appear to be all that high to call performance of UP to be way below the all India level. Hence, it may be said all may not be lost for UP, despite poor showing in some of the structural ratios.

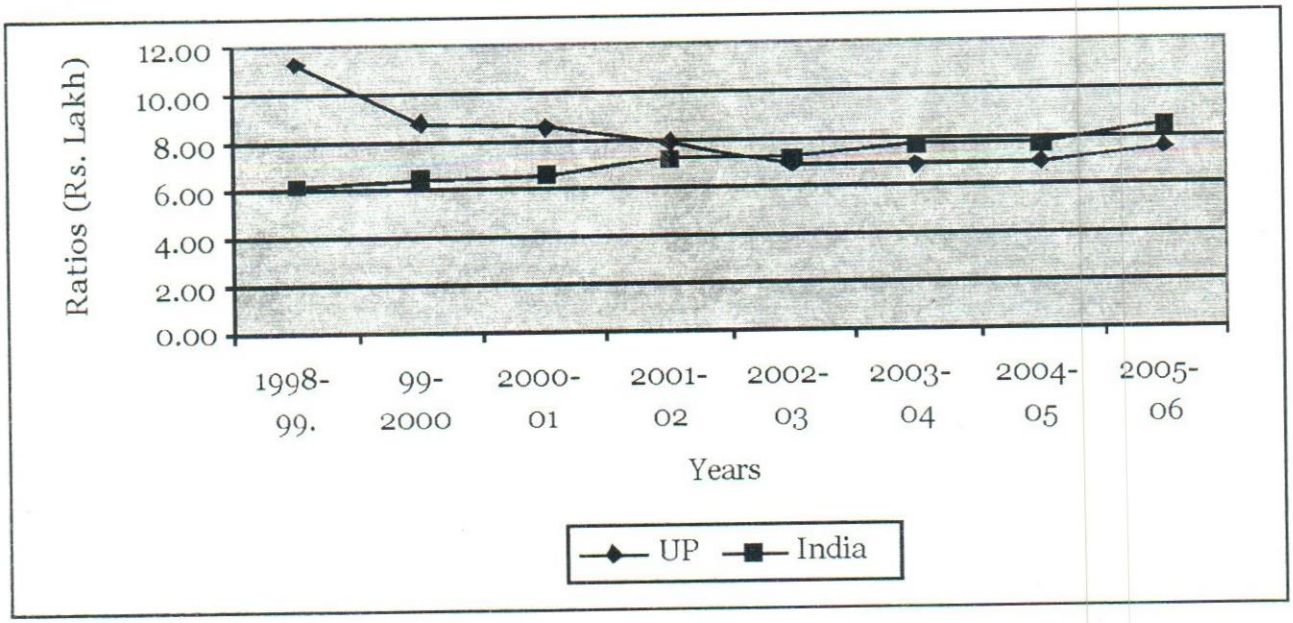


Fig. 17. Capital Intensity

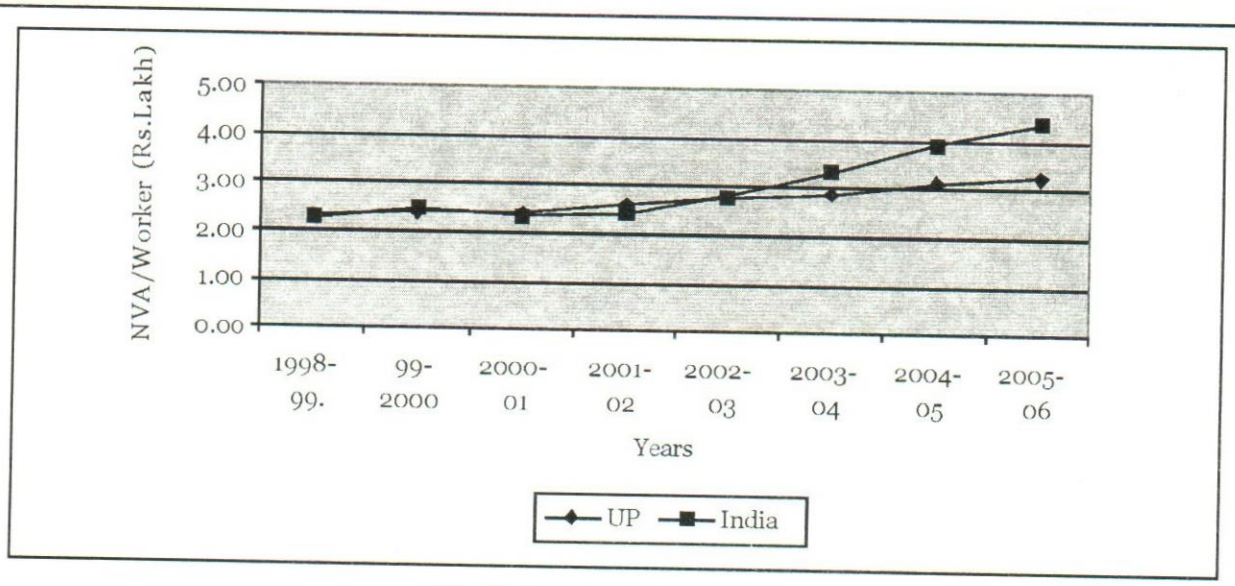


Fig. 18. Net Value Added per Worker

Value Added to Output

It is one of the significant technical coefficients which shed light on the type of economic organization that exists within the industry. Higher the vertical integration in the sector, more production takes place in house or within the firm (Pani, 2007). Value added to output is derived to highlight this phenomenon existing in the industry. Figure 19 depicts this ratio (value added to output) at the national level has been steady since 2001–02 after declining continuously after 1999–2000. At the state level this coefficient has declined continuously since 1998–99 only to rise once again in 2003–04 and follow a downward trend in the last two years under study—thus widening the gap between state and the all India level. Anyways, the curve hovered below the national average is well depicted and suggests that there is increasing share of inputs in the value of output.

Workers Per Factory

Number of workers per factory has a vital bearing on the performance of industrial sector. Apart from reflecting

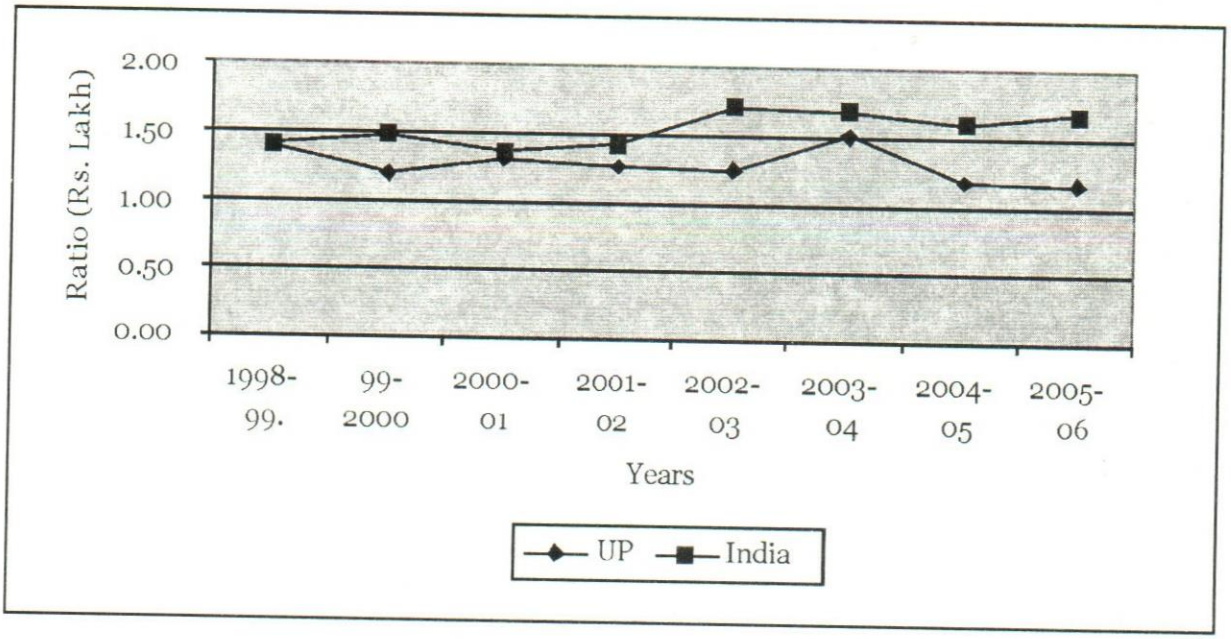


Fig. 19. Value Added per Output

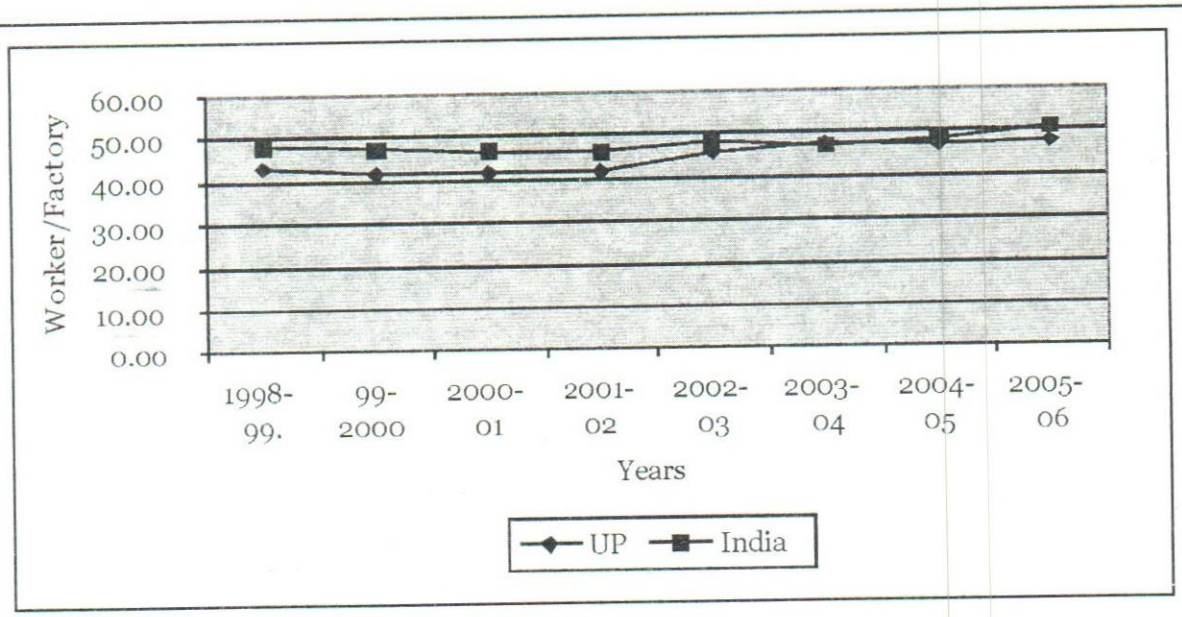


Fig. 20. Workers per Factory

concentration of workers it also impacts productivity. On average factory size, not only the pattern is fairly consistent but UP also compares favourably with the overall factory size of India. Figure 20 shows that average factory size as reflected in the number of workers per factory has remained more or less constant at the national level. On the whole we find a decline in the factory size in terms of employment per factory after the all time high in 2003–04. It has equated with national average in 2003–04 but remained lower than the all India level during the rest of the period under consideration.

Capital Output Ratios

Capital output ratio is the best coefficient that explains the growth in value of output along with an increase in productive efficiency. This technical ratio's changes justify the investment in fixed capital. We know that investment in fixed capital is carried out with the intension of build capacity for higher growth, capital intensive innovations, and diversification, with the intension to bring about change in composition of output. Figure 21 demarcate a steady decline in Uttar Pradesh's share in capital output ratio as compared to national average. In 1998–99 it can be seen

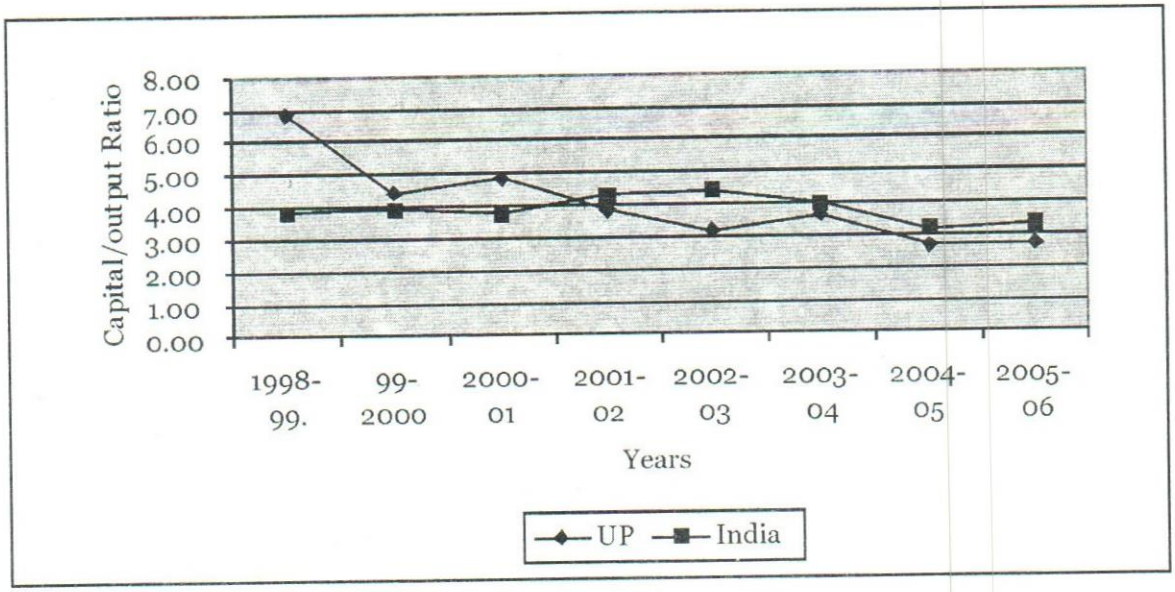


Fig. 21. Capital Output Ratio

that Uttar Pradesh's average was well above the national average but fell below all India average in 2001–02 and continues to deplete thereafter.

Small Scale Industries in Uttar Pradesh: Overview of Structure and Performance

Data on small-scale industries in Uttar Pradesh were available till now only in respect to registered units but steps were taken to provide some information on unregistered units in the Third Census on sample basis. Effective policy formulation and implementation pertaining to the promotion and development of this sector, requires a sound database. The Office of the Development Commissioner (Small Scale Industries) conducted two censuses of registered SSI units prior to the Third Census. The First Census was conducted in 1973–74 in respect of 2.58 lakh SSI units registered in the country, out of which 25669 units were of UP. During this Census, only 1.4 lakh units were found working including 12851 units of UP. The Second Census was conducted during 1990–91 in respect of 9.87 lakh SSI units registered in the country including 95285 units of UP up to 31-3-1988. During this Census, only 5.82 lakh units were found working which included 53282 units of UP. The data generated by the Census with the passage of time had lost its relevance and required immediate updation to achieve its purpose. Accordingly, the Third all-India Census was conducted during 2002–03 for the possible proximate reference year, i.e., 2001–02.

All the Small Scale Industrial undertakings (SSIs) and Small Scale Service and Business (industry related) Enterprises (SSSBEs) operating on the date of survey were under the coverage of Third Census. Among these, those that were permanently registered as SSIs, ancillary units and SSSBEs till 31-3-2001 were treated as the registered SSI sector, although the criteria for registration and the definitions have been varying over time. The registered SSI sector comprising units permanently registered till 31-3-2001, for which list of names and addresses of the units were available, was covered on complete enumeration basis. The rest of the SSIs and SSSBEs were treated as the unregistered SSI sector and these were covered through a sample survey.

In the third Census, the units permanently registered up to 31-3-2001 were covered on complete enumeration basis. A total of 2,85,220 units were surveyed. Out of these, 1,62,938 units were found to be working and the

Table 2: Comparison of the Third Census With Second Census (Registered SSI Sector)

S.N.	Indicator		2nd Census (1987-88)	3nd Census (2001-02)
1.	Percentage of Working Units		55.91	56.84
2.	Percentage of Working Units in rural areas		38.22	46.95
3.	Percentage of Working Units that are	SSIs	98.27	60.90
		Ancillaries	0.70	2.86
		SSSBEs	1.37	39.11
4.	Percentage of Proprietorship Working Units		80.14	90.85
5.	Percentage of Proprietorship Working Units engaged in Manufacturing/Assembly/Processing		76.46	53.88
6.	Percentage of Working Units that are owned/Managed by		4.71	1.25
		SCs STs	0.55	8.08
		Women	4.53	3.19
7.	Per Working Unit Fixed Investment (Rs. lakhs)		1.84	4.62
8.	Per Working Unit Investment (Original) in P & M (Rs. lakhs)		0.93	1.30
9.	Per Working Unit production (Rs. Lakhs)		6.99	10.30
10.	Per Working Unit Employment (No.)		7.00	3.57
11.	Employment per rupee one lakh of investment in Fixed Assets		3.55	0.77
12.	Production/Employment(Rs. lakhs)		1.06	2.88

Source: Second Census (1987-88) & Third Census (2001-02).

remaining 1,22,282 units were found closed. Thus, the number of working units works out to be 57 percent and those of closed 43 percent.

First census of SSIs was carried out long back in 1973–74. Hence, we put attention on the relatively recent census results of this sector. Table 2 makes comparison among two census reports of SSIs on the basis of some selected indicators. The table reveals that the proportion of working units has increased somewhat in the third period. Per unit fixed investment has substantially risen from Rs 1.84 lakhs to Rs 4.62 lakhs while per unit employment has gone down from 7.00 to 3.57. This adverse effect on employment can be regarded as a sequel to modernization. Per working unit production has increased from 6.99 lakhs to 10.30 lakhs, which reveals that the small scale sector has become more efficient with regard to overall use of factors in the working units. On the other hand, by investment in plant and machinery increased from 0.93 to 1.30 lakh respectively according to two census reports. This means that capital productivity has registered increase. But labor productivity has continuously increased over the considered period. Besides, the employment-fixed asset ratio shows that the small scale sector is now using capital intensive method of production relative to the past. This indicates that the objective of employment creation has been relatively relegated to the background. This is rather alarming and is largely the upshot of the upcoming modern small scale industries increasingly using higher doses of sophisticated machinery and equipment relative to labor.

What Causes Performance Hinderance?

A World Bank Study for Uttar Pradesh has attributed three key factors which undermine growth and productivity:

- Inadequate infrastructure
- Decline in quality of governance and
- Lack of growth of quality human stock

To this Planning Commission added

- Low competitiveness
- Lack of proper incentives
- Poor location of industries and
- Lack of infrastructure

To this we added a few more i.e.,

- Stability of policies
- Law and order
- Labor laws
- Trade tax differentials
- Incentives
- Effectiveness of support agencies; and
- Industrial clusters to provide facilities required for industries to develop.

But despite the proliferation of industrial clusters and booming production coupled with export sector largely have its roots into emerging modern small scale industry; there is ample evidence to give pangs of concern and discontent. A great number of SSI are traditional, existing in rural or semi-urban areas and largely are dependent on local raw material, skill, and labor intensive technology. These SSI suffer from myriad of problems that include information gap, lack adequate skill, etc. As a result of liberalization the opportunities for the development of industries has increased many folds during recent years but the state has had to face competition from neighboring states. All the bottlenecks in the industrial development can be summarized and enlisted as follows:

1. Being land locked state deprived of harbor facilities.
2. Lack of standard infrastructure facilities.
3. Increasing gap between demand and supply in power sector.
4. Regional imbalances.
5. Package of special incentives to Uttaranchal by Government of India.
6. Possible adverse impact of WTO.
7. Complexities of labor laws.
8. Lack of resources for investment.
9. Low C:D deposit ratio in the State.
10. Sickness in SSI units.
11. Problems of marketing of SSI products.

This gradually hampers their growth rate and eventually has an adverse bearing on employment generation and other dependant objectives of the State policy.

Conclusion

It can been reiterated that in today's scenario, a state needs the investors more than the investors needing the state and more so after knowing the fact the industry's

are fleeing to Uttaranchal in pursuit of better incentives in that state. In such a situation it becomes essential to actively pursue a set of agenda items. Some of these are:

- Making the state easy to do business with
- Solving problems of entrepreneurs, not selling procedures to them
- Using measurements for improving, not mere accounting
- Being a facilitator, not a controller
- Treating investors and entrepreneurs as customers

The heart of working in the above mode is how the three elements-purpose, process and people-link together. It is important to understand these links for better execution of things, which had been sorely lacking in the state of Uttar Pradesh. Hence, it is of vital importance to master three individual processes—the strategy process, the operations process, and the people process—and also the way they work together as a whole. They are the foundation for effective execution, and are at the centre of conceiving and executing any strategy. It is these that differentiate between a leading state and a laggard state (Chakroborty, 2008).

As we know that everything ultimately boils down to governance, which involves interplay of three elements, each representing a specific set of deliberate arrangements—institutions, the delivery mechanism and the supportive and subordinate framework of legislations, rules and procedures. Managing this interplay becomes crucial for growth, including industrial growth, and therefore needs attention at the highest level in the state, on a continuous and ongoing basis.

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"Setting goals is the first step in turning the invisible into the visible."

—Tony Robbins

Focus

Design of Automation of Specific Gravity Seed Gradation Process

S. K. Patil

Millions of tones of seed are processed in India every year for qualitative and quantitative improvements. Quality seed alone can enhance 15 to 20 percent of productivity. It is estimated that quality seed under optimum management may contribute to the tune of 45% of total crop production. Looking toward need to achieve higher efficiency in seed gradation, improved quality output, and high degree of reliability in performance the author designed state of art automation for specific gravity seed gradation machine. The achievements observed due to implemented improved method are higher efficiency, improved quality, and high degree of reliability. This paper discusses the design of automation in specific gravity seed grader, achieved by applying various sophisticated mechanical and electronic systems.

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Introduction

Presently manually controlled specific gravity seed gradation machines are used in India for gradation of seeds and grains of various types on the basis of their specific weight. Manually controlled gravity machines have their own problems and limitations such as improper setting of parameter, excessive setting time, more grading cost and dependency on operator. Worldwide millions of tones of grains and seeds are processed every year for quantitative and qualitative improvement. Grains are graded to provide good quality food grain for daily consumption, while seeds are graded to provide good quality seed to the farmers for sowing in the field. Good quality seeds have high percentage of germination. Value addition depends on quality of gradation. Quality seed is the basic requirement for sustainable agriculture.

Post harvest management has a great importance in seed industry. At present Indian seed processing industry is based on traditional, time consuming, and laborious process. This is a seasonal and time bound activity to fulfill the market demand. The term-specific gravity seed gradation machine refers to the machine used for gradation of seeds or grains on the principle of weight difference (sp. gravity) of seeds. Traditional manually controlled specific gravity seed gradation machines have their own problem and limitations, such as improper setting, more setting time, bottle necking, seed damage and amongst all, less productivity. Existing specific gravity seed gradation machines have a manual setting facility for the change in every type and size of seed. Thus quality of gradation is completely depended on skill of operator and every chance of mismanagement led to deterioration of quality as well as reduction in quantity of processed seed.

Worldwide seed and grain processing industry is multi billion dollar business where a billion tons of seeds/

grains have been processed every year. Grains are graded to provide good quality food grain for daily consumption, while seeds are graded to provide good quality seed to the farmers for sowing in the field. Quality seeds fetches 25 to 40 percent more price in market as it gives more yield because of higher germination and vigor due to automatically controlled specific gravity seed gradation machine and also helps to improve brand image in market. Implementation of mechatronics to automate specific gravity seed gradation machine for qualitative and quantitative improvement with reduction in processing cost and time is primary need of seed business. Liberalization of trade policies and internationally competitive market forced Indian seed industries in keeping abreast with technological advances to stay competitive in the global market system. To meet increasing demand and competition, Indian seed processing industry are trying to modernize and update grading systems.

To tackle this problem systematically, the mechatronic concept was implemented for automation of specific gravity seed gradation machine. The automation helps to maintain consistency in regards of yield and quality with reduction in processing time and cost. The article also emphasizes redesigning of mechanisms responsible for easy adjustment of various setting parameters.

The use of electromechanical, pneumatic, pneumo-hydraulic and electronic systems are required for auto adjustment and control of process parameters. The use of sensors, transducers, and programmable logic controller made it possible to operate the machine from the single operator's desk. The feedback system provided takes care of the process and safety interlocks to avoid bottlenecking and breakdown in the machineries.

Working Principle of Machine

Specific Gravity seed gradation machine is used for grading of seed or grain on the principal of specific gravity difference in seeds. It separates grains or seeds of similar in size and shape, but having different specific gravity. The grains are fed to the deck through the storage hopper. Deck is the rectangular top with wire mesh surface supported by M.S. structure and seeds are fed through the storage hopper. The wire mesh surface allows the formation of air cushioning on the deck surface. The bottom side of deck is provided with blowers for generating air in desired quantity and pressure. There is a provision for deck oscillation and adjustment of longitudinal and transverse slope.

Materials and Methods

Present conventional method of gravity machine setting consist of manual adjustment of the important four parameters responsible for efficient grading of seeds/grain. These four parameters are

1. Longitudinal slope adjustment of deck.
2. Transverse slope adjustment of deck.
3. Oscillation speed adjustment of deck.
4. Adjustment of damper position of blowers

The desired changes in the mechanism of manually controlled specific gravity seed gradation machine were made and incorporated pneumatic, electromechanical, and pneumo-hydraulic systems for operating various mechanisms for automation of specific gravity seed gradation machine. This system is easily adoptable for automation. The provision of sensors and electronic control panel with programmable logic controller made it possible to control all parameters precisely.

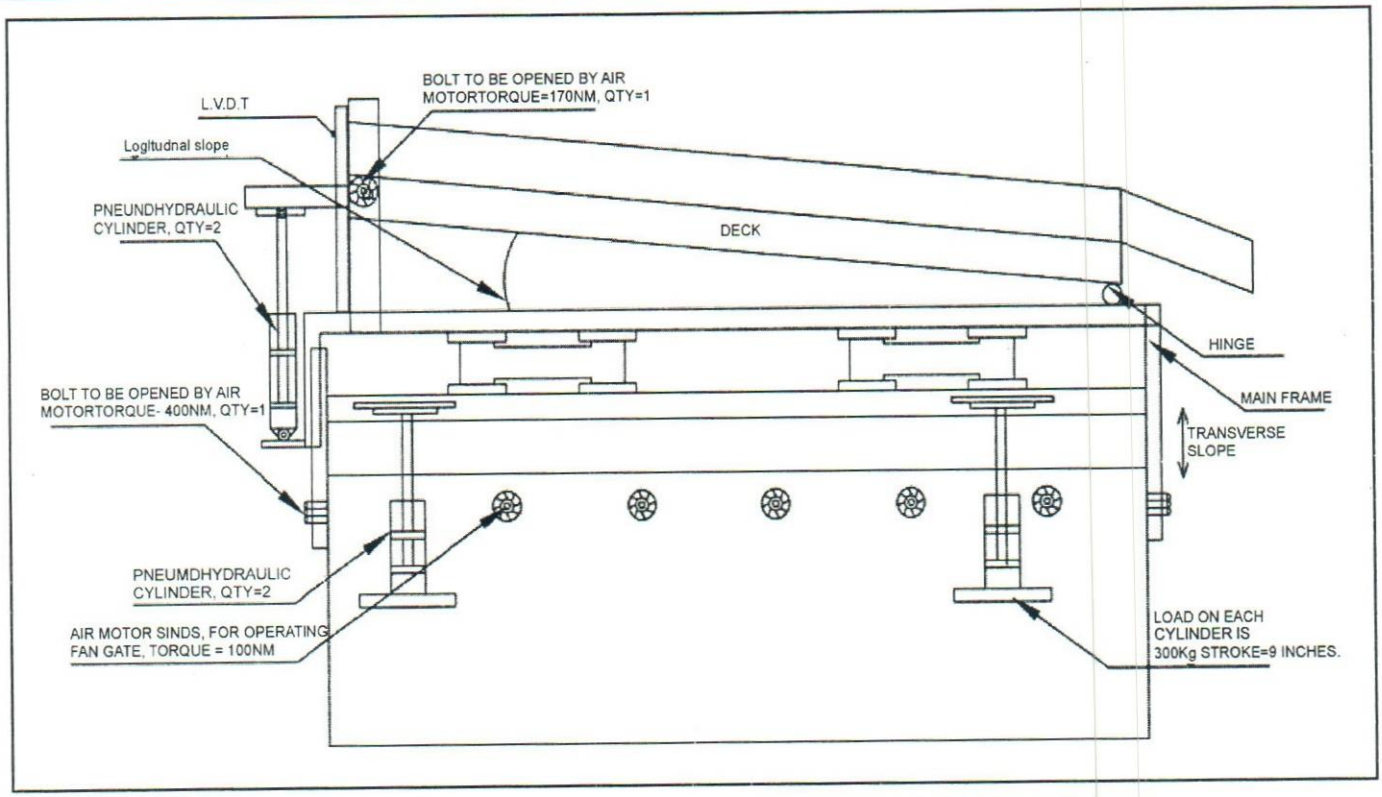
Application of Mechatronic concept

The system designed for governing various adjustments for efficient grading is as follows:

1. System for longitudinal slope adjustment of deck– The pneumo hydraulic cylinder was given for adjustment of slope (Figure 1). The cylinders of the same capacity were provided at both ends of the deck base swiveling frame which helps to lift the deck. The synchronized pneumatic circuit was designed and provided to ensure motion of both the cylinders uniformly at same speed (Figure 3). This avoids twisting in deck. It is necessary to open locking nut before lifting the frame by rotating air motor provided therein.

   After achieving the desired deck slope, the lock nuts are to be tighten by reverse rotation of pneumatic motor (Figure 2). Details about the lifting force required and torque requirement are depicted in Table 1.

2. System for transverse slope adjustment of deck– The higher capacity cylinder and air motor was provided to sustain the increased load, however the working mechanism is same as above. The details of lifting force required and torque requirement are presented in Table 1 and the working is shown in Figure 2.



Fig, 1. Provision of air motor and pneumo-hydraulic cylinder for longitudinal slope adjustment

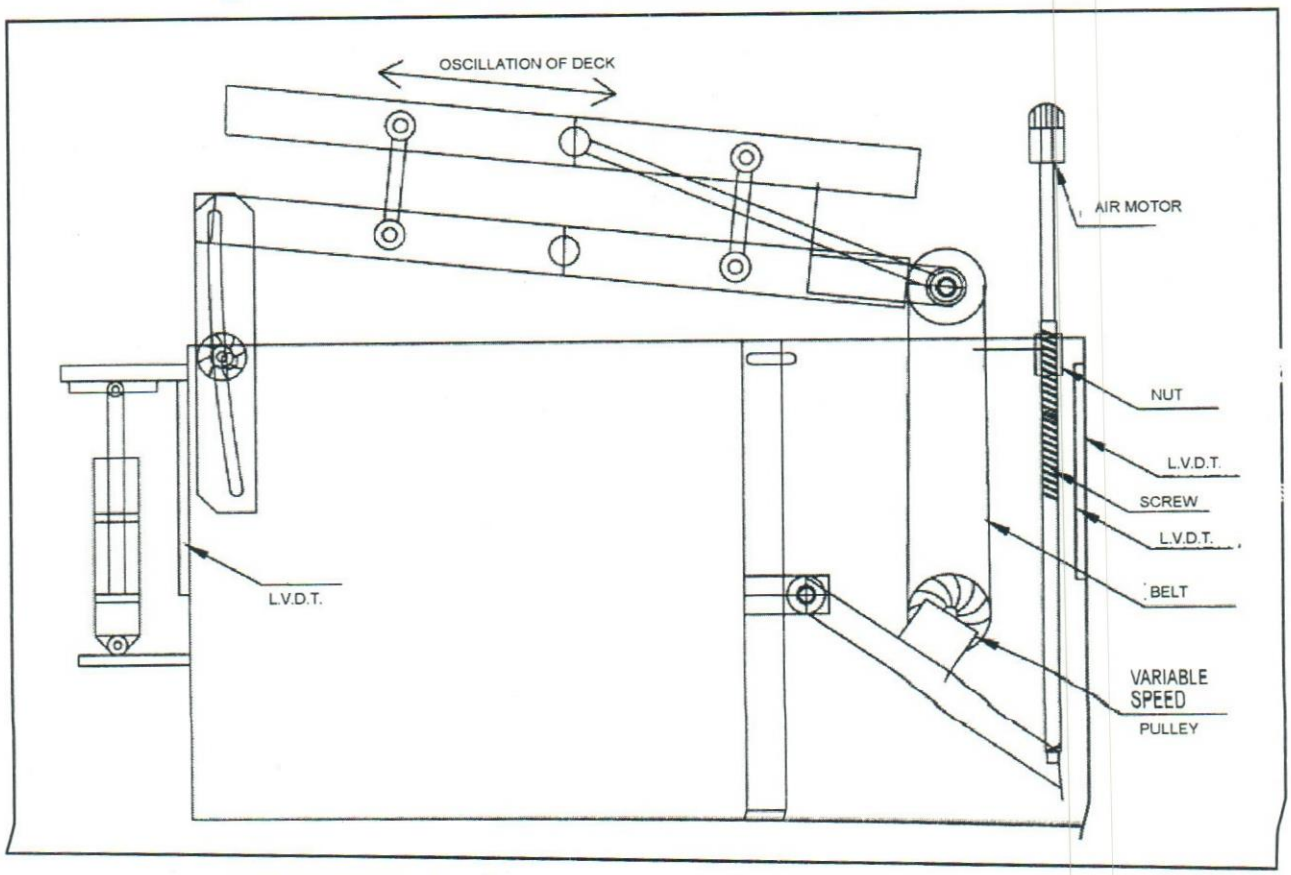


Fig. 2. Provision for adjustment of transverse deck slope and oscillation speed.

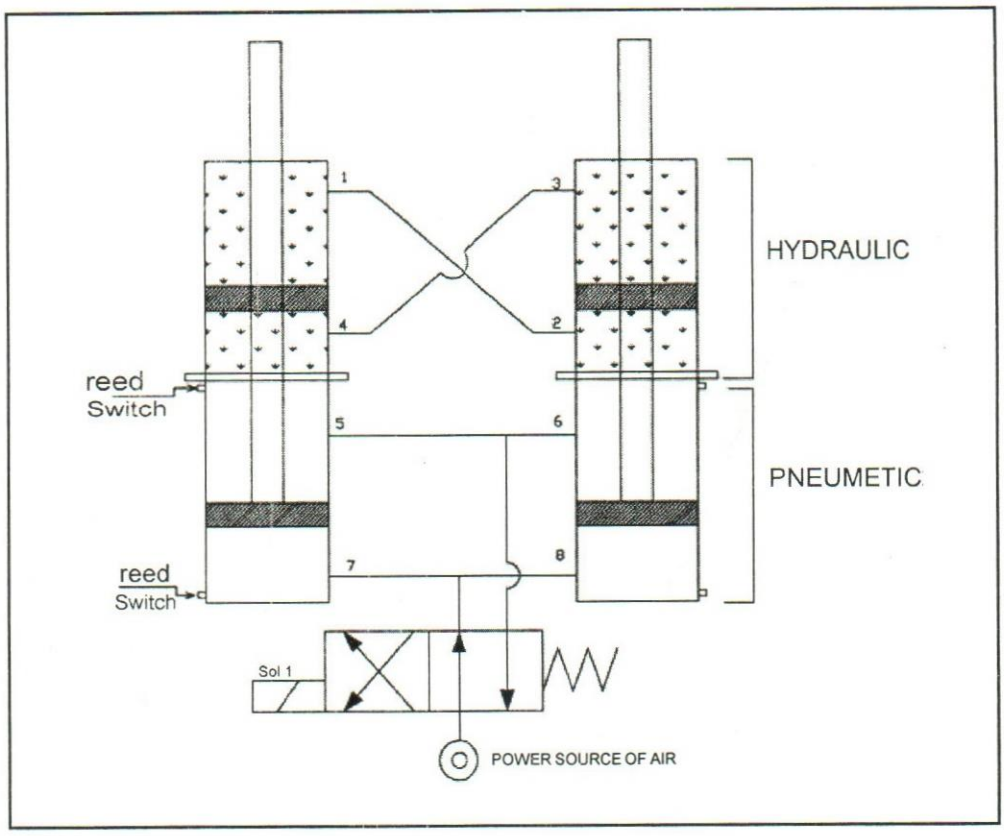


Fig. 3. Syncronising circuit for two cylinder to adjust slope of deck

Table 1. Torque and force Requirement for various adjustment

Type of setting		Force required	Torque required
Longitudinal slope adjustment	Bolt loosening torque		130N-m
	Deck lifting force longitudinally	230 kg	
Transverse slope adjustment	Bolt loosening torque		224N-m
	Deck lifting in transverse direction	442 kg	
Damper position adjustment	Torque Required		70N-m
Oscillation speed adjustment	Torque Required		70N-m

3. Adjustment of blower damper–The blower damper adjustment was done by separate air motors provided for each damper. The air motor torque required to operate damper is given in Table 1. The working is shown in Figure 4 and 5.

4. System for adjustment of deck oscillation speed–

Provision of variable speed pulley was given for online adjustment of speed of oscillation. The speed of oscillation can also be adjusted while the machine is in an operating state. The speed pulley is mounted on oscillating frame move up or down with the help of screw rod (Figure 4). The clockwise/anticlockwise

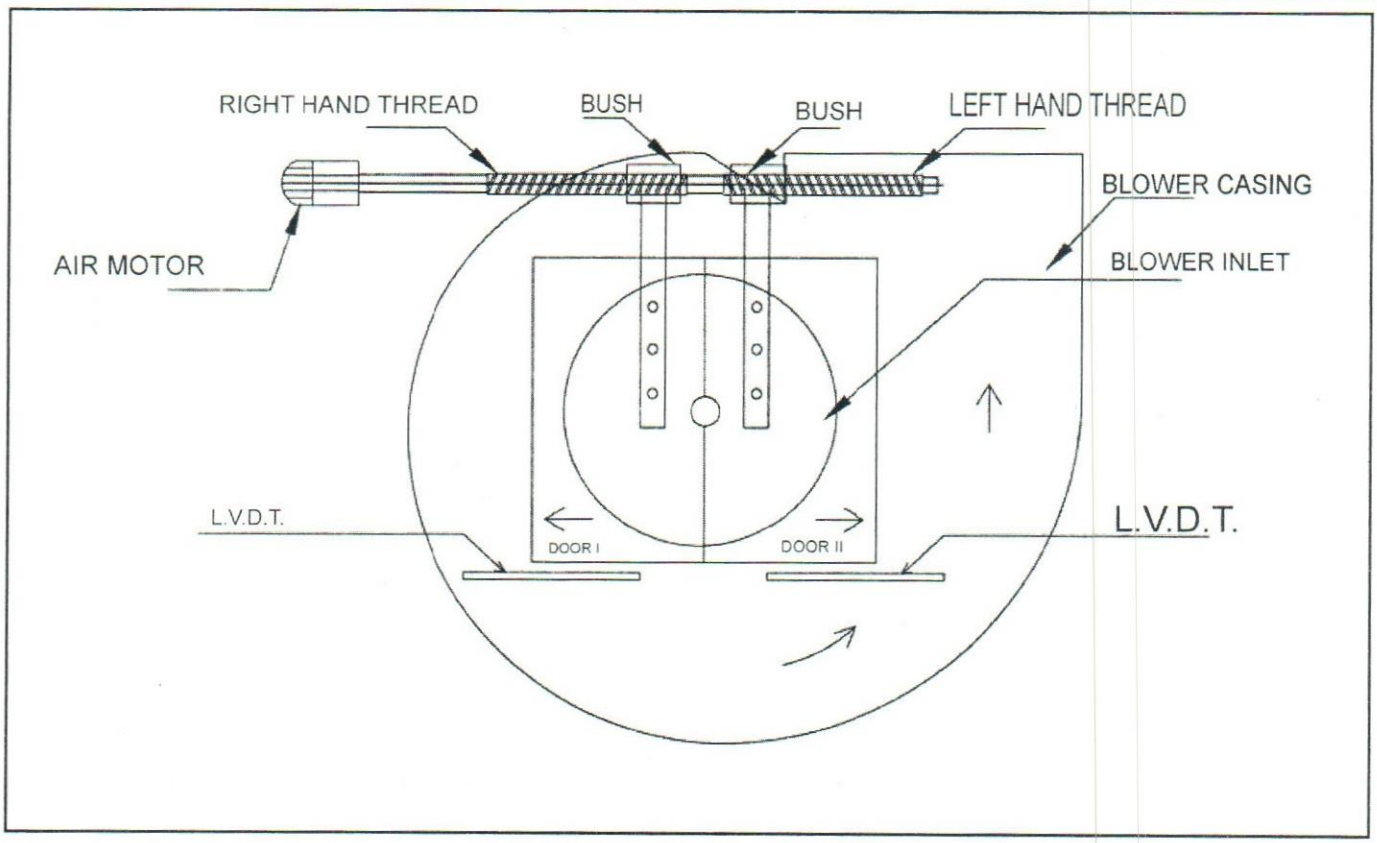


Fig. 4. Adjustment of blower air damper

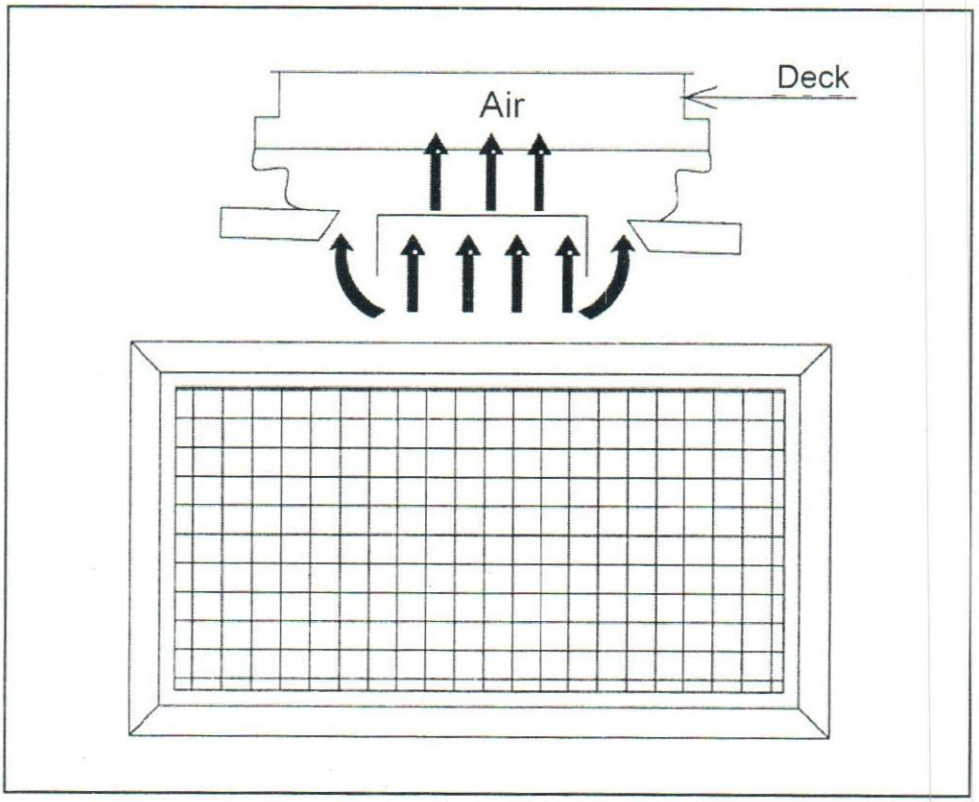


Fig. 5. Air flow in deck

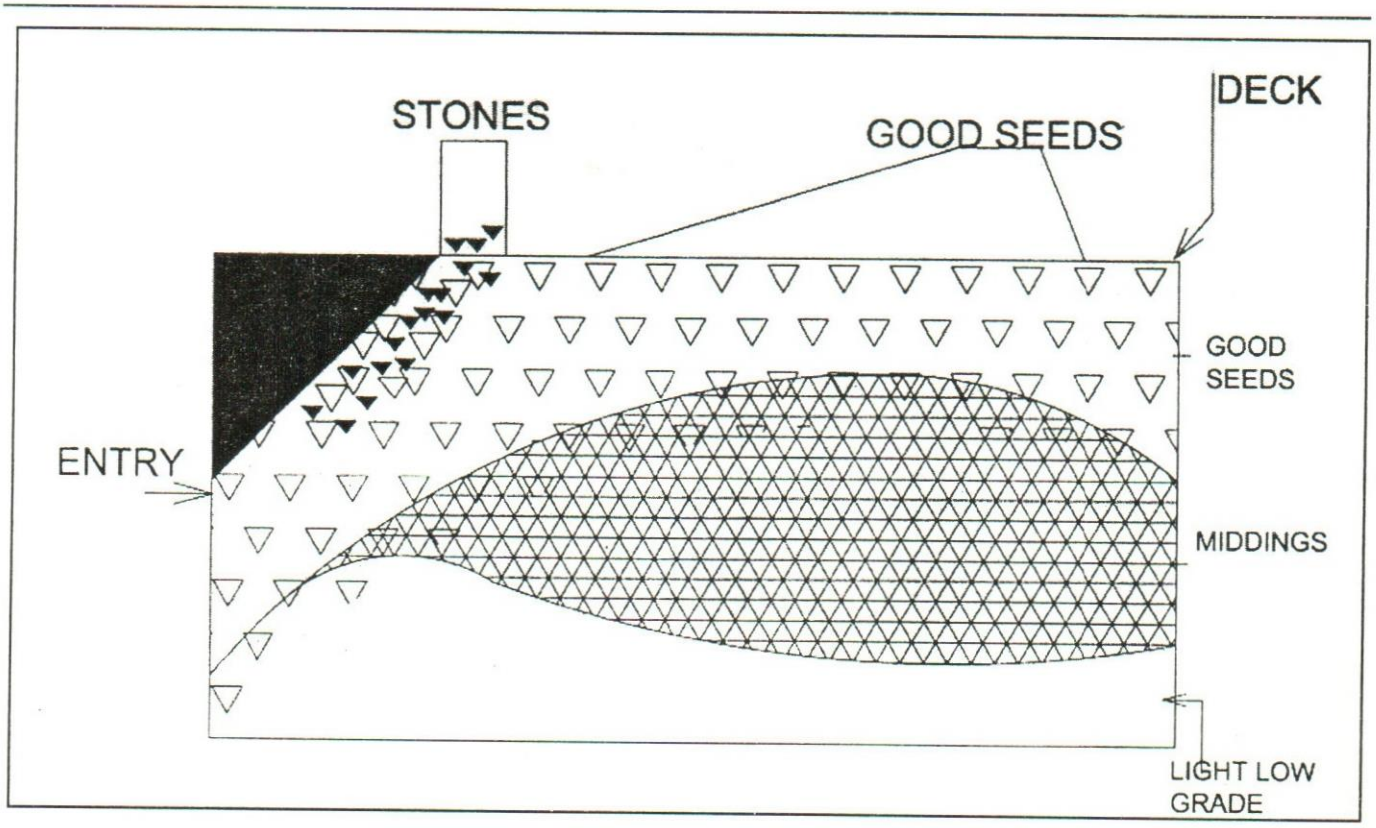


Fig. 6. Flow Pattern of seeds

rotation of screw changes speed of oscillation (Figure 4).

5. Control panel–Two modes are provided for operation, that is,

a) Auto Mode b) Semi Auto

Auto Mode–The setting data for adjusting various parameters is stored in the data memory of programmable logic controller for various types and varieties of grains/ seeds. Operator has to select type of seed from chart and press button "Enter" of the P.C. Automatically all the setting slope of deck in longitudinal and transverse direction, speed of oscillation and adjustment of air dampers for different blowers is done. If the operator needs some marginal changes in the setting, there is a provision of the button: "SET" is given on the control panel. The operator has to press button "SET" then change the slopes, speed of oscillation, blower damper setting by the push buttons provided on panel. Once he gets satisfied with the results, he will again press button "SET". The latest setting will now be stored in the data for that particular grain and the old one will go in the history sheet provided in the P.C. Position Sensors are provided for getting the exact feedback of deck slope position, air damper position. Transducer is used to get the exact feedback speed of oscillation of deck. Safety interlocks are incorporated in the program to ensure safer operation. Even in semi auto mode these interlocks are operational.

Semi auto mode–In this mode, the operator can control operations from operator's console by changing detent type knob from auto to semi auto mode. The push buttons are provided for performing various operations. Worldwide the specific gravity seed gradation machine with grading capacity 2 ton/hrs (2TPH) is popularly used. Hence 2 ton /hr capacity model is taken for performing work.

Result and Discussion

The comparative data of manually operated and automatically controlled specific gravity seed gradation machine presented in chart no.1 and 2 revealed that the power cost saving is 39%, labor cost reduced up to 20%, saving in setting cost of machine is 100% by auto controlled specific gravity seed gradation machine. The total reduction in processing cost due to automation was up to 56.52% reduction over manually operated specific gravity seed gradation machine.

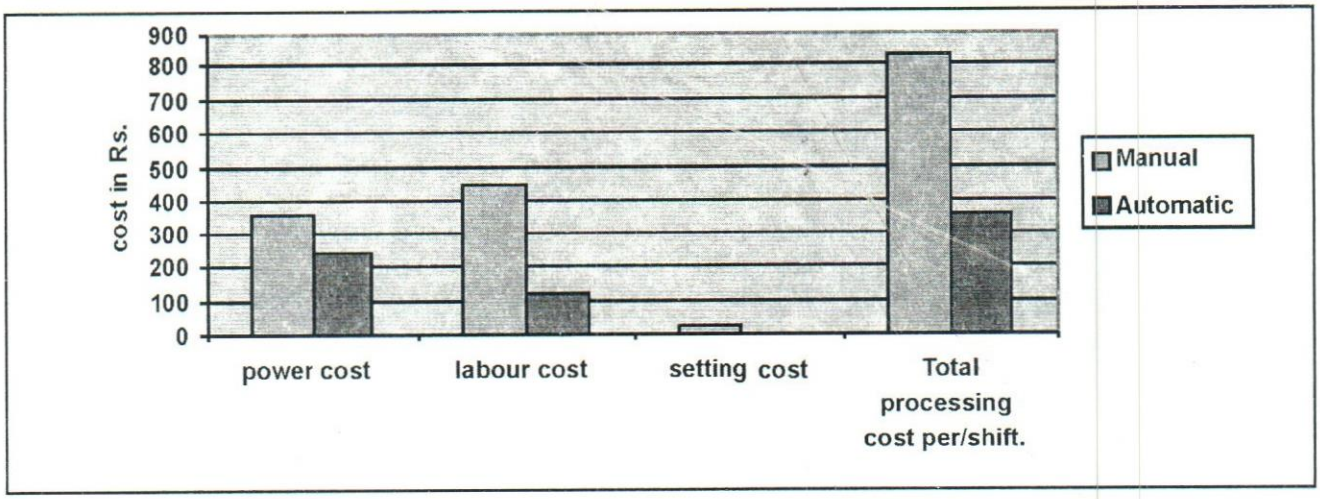


Chart No. 1. Comparison of processing cost per shift between Manual Vs. Auto sp. gravity machine of 2 ton/hr capacity

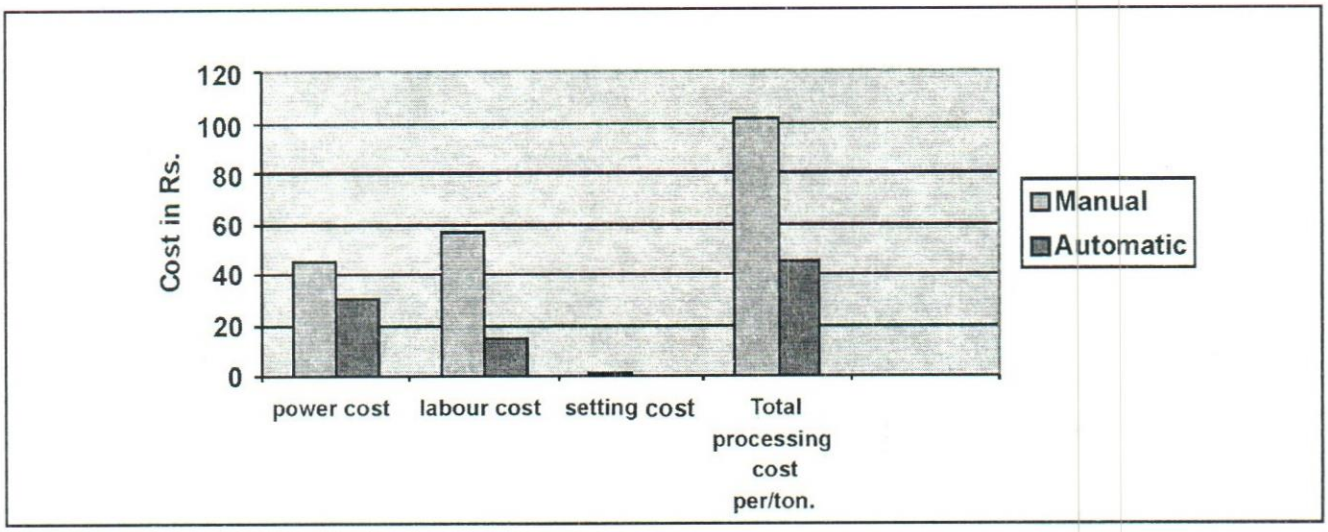


Chart No. 2. Comparison of processing cost per ton between Manual Vs. Auto sp. gravity machine of 2 ton/hr processing capacity

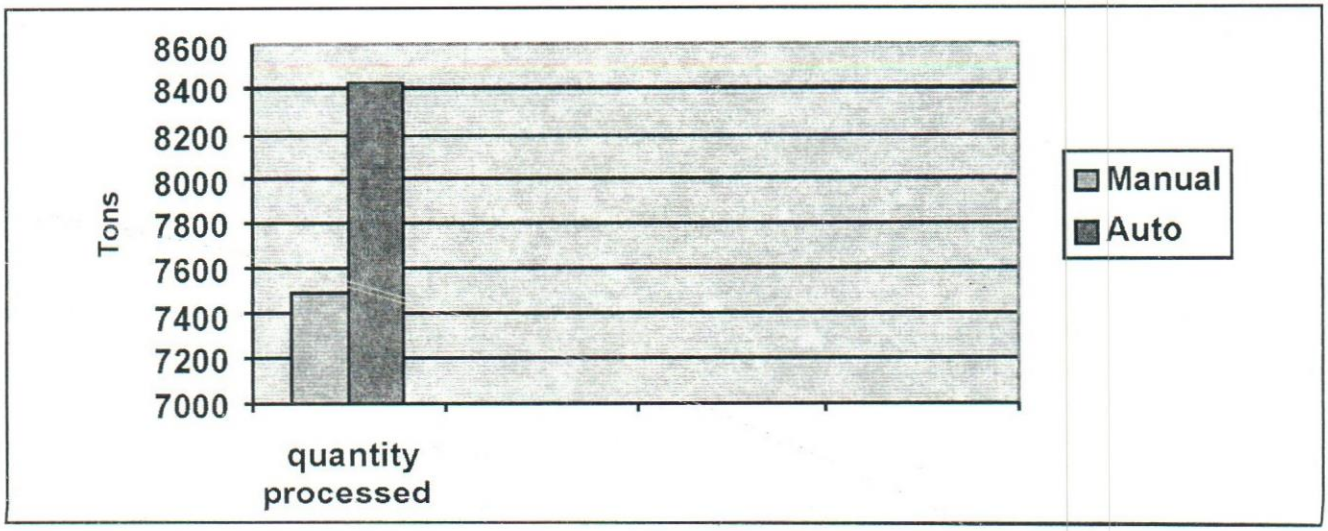


Chart No. 3. Quantity of seed processed per season of 8 months (considering 26 working days a month)

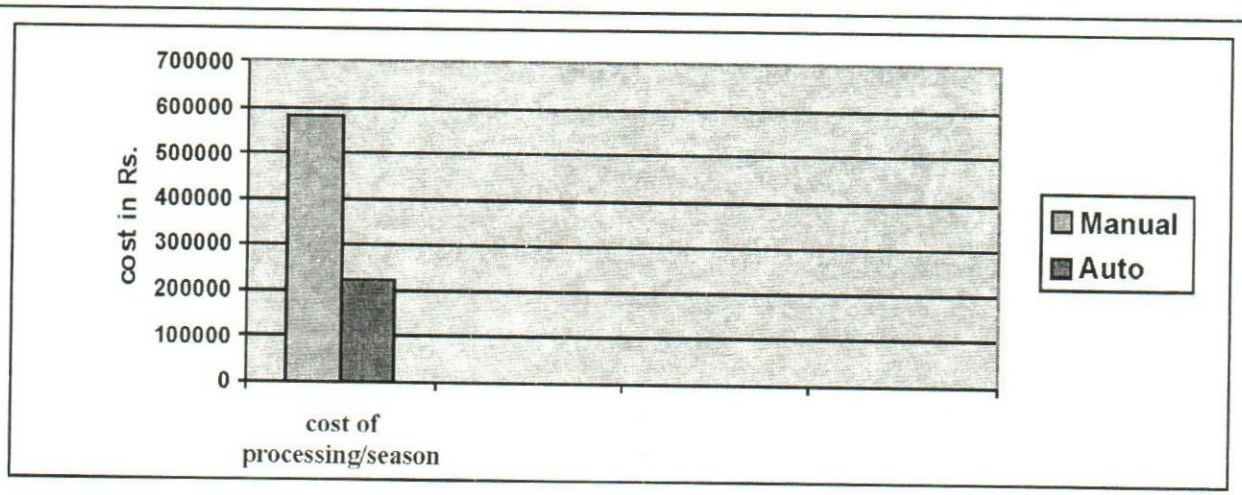


Chart No. 4. Comparison between the processing cost if auto and manual controlled machine processes equal qty. (i.e. maximum qty. that can be processed by auto m/c per season)

Table 2. Other Benefits of Auto sp. Gravity

Particular	manually control m/c	Automatic machine	Benefits
Production increase	12.0 ton/shift	13.5 Ton/shift	1/5 Ton/shift
Valve addition	Say Rs. X/- per ton	Rs. (1.25 to 1.4)* X per ton	25% - 40% value addition
Export market to final produce	Limited potential for export	Potential of export market due to uniform quality	Good export potential
Export market to Gravity machine	No export market	Its unique feature generates export market for gravity	Good export potential to auto gravity machine itself
Labour requirement	Skilled operator needed	Skill do not require for setting.	auto setting facility

Refer chart no.3 and 4, it is estimated that by considering 8 months season of seed processing total 8000-8400 tons seed/grain could be processed by automation of specific Gravity seed gradation machine which is reflected to be 13 to 15% higher than manually controlled machine resulting in the saving of Rs.3 lakh to 4 lakh per season per machine.

Automation of specific gravity seed gradation machine (table no.2) it was found to be 25% to 40 % value addition due to quality output from machinery. The automation of specific gravity seed gradation machine mainly consist of auto adjustment of deck slope, oscillation speed and air flow by using electro mechanical, pneumatic, pneumo hydraulic and electronic systems to control activity from operators control desk. As per table no.1, the force required for longitudinal slope adjustment & Transverse slope adjustment due to automation is 230 & 442 kg and torque required for loosening of bolts for slope adjustment are 130Nm. &224Nm, respectively. For blower damper & oscillation speed adjustments required torque are 70Nm each. In manually operated machine the adjustment of slope & speed of machine is totally dependable on the skill & energy of operator however, due to seed type & specific gravity wise control data fed to the controller of auto machine controller, the exact adjustments increased quality & quantity output of specific gravity seed gradation machine.

Conclusion

A country like India having an agro-based economy is concentrating on improving quality of agro-produce. Value addition in agro-produce is the key area where the

government of India is focusing. The export of Agro produce can generate revenue. An automatic specific gravity seed gradation machine not only provides a quality output at less processing cost but also gives other benefits like export grade output, increase production rate, value addition in agro-produce, etc. Compared to these advantages, the cost incurred in automation of machine, i.e., Rs 4.00 lakh to Rs 6 lakh is negligible and can be recovered only in one season by saving in processing cost. Good quality seed will increase yield of farmers in the field. Value addition in agro-produce can only help farmers to increase their economical standard. It is the need of the hour to provide the advantages of technology to the biggest farmer community. There is a wide scope to work in this field. Engineers and Technocrats should come forward to develop new machines and processes which will help farmers to relive from their stressful work and help in increasing the value of their produce.

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"The value of an idea lies in the using of it."

— Thomas A. Edison

Feature

A Survey on Work Culture and Ethical Behavior: A Case Study of HP Police Force

Shyam L. Kaushal

Work culture refers to the basic pattern of shared assumptions, values, and beliefs ruling the way employees think about and act on the problems and opportunities within an organization. An ethical work culture of an organization manifests a place characterized by respect, trust, caring, justice, co-operation, team cohesiveness, integrity, moral awareness and consequently a high performance. However, these values are being replaced by disvalues such as short cuts, avoidance, speed, dissatisfaction, frustration, failure, stress, discrimination, anger, jealousy, and corruption that are hampering performance. This in turn affects efficiency and tarnishes the image of an organization, whether manufacturing or services, e.g. police administration. The present study on police administration in general and Himachal Pradesh in particular gains importance in view to analyze their work culture and functioning style. Therefore, the present survey was undertaken on a random sample of 100 employees to study the ethical work culture in HP Police, to examine the designation, experience, salary slab, and department wise relationship with their ethical conduct. Opinions of employees have been gathered through a 24 item questionnaire on a five point scale containing six dimensions of ethical work culture suggested by Patric and Quinn (1994) as social darwinism, machiavellianism, popular conformity, allegiance to authority, democratic participation and organizational integrity. The collected data has been analyzed with the help of statistical techniques like mean, standard deviation and t- values.

To conclude findings of the survey on ethical work culture amongst HP Police force indicated high morals and integrity in their conduct. The IPS officers opined democratic participation, HPS and HP police cadre employees identified principled integrity as the dominating dimension of ethical work culture. The salarywise analysis indicated that middle-income group people are having more ethical tendencies as compared to others. However, all three groups favored principled integrity as their major instinct. The new entrants were found to be having tendencies of greater ethical conduct in comparison to senior and older employees. The investigation department was observed to be higher on ethical work culture followed by intelligence department. It can be said that in almost all departments and groups, employee signify respect to authority, rules and norms, loyalty, justice friendly, caring attitude, and discipline that constitute a rich work culture. However, on the basis of the gaps and differences in their opinion on ethical conduct, scope has been felt for improvement.

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Introduction

Work culture refers to the basic pattern of shared assumptions, values, and beliefs ruling the way employees think about and act on the problems and opportunities within an organization (Schein, 1991). It basically, involves work related activities and the meanings attached to such activities in the framework of norms and values regarding work (Sinha, 1990). It is well established that prevalent culture shapes behavior, attitudes, and perceptions of members, in both domestic and work life. Rollins & Roberts (1998) observed that an organization's work culture determines its performance and success. Carroll and Gannon (1997) emphasized that performance and the organization's culture are interrelated and significantly manifest ethical conduct of employees. Davidson (1998) suggested that good leaders can develop a culture with considerable effort and persistence that supports ethical conduct.

According to Petric and Lindsay (1998) ethical work culture of an organization manifests a place characterized by respect, trust, caring, justice, co-operation, team cohesiveness, integrity, moral awareness and a consequent high performance. Moreover, a culture that emphasizes ethical conduct adopts six core values: honesty, integrity, respect, trust, responsibility, and citizenship. In nutshell, this represents a rich work culture. However, these values are fast being replaced by disvalues such as short cuts, avoidance, speed, dissatisfaction, frustration, failure, stress, discrimination, anger, jealousy, and corruption that are hampering performance. This in turn affects efficiency and tarnishes the image of an organization, whether manufacturing or services. For example, police administration. Basically, the police force is responsible for law and order situation. The strength of a democratic society and the quality of life enjoyed by the citizens are determined in a large measure by the ability of the police to discharge their duties efficiently. So many times police become focus of criticism due to limitations of practices like random patrol, rapid response, follow-up of criminal investigations, and police excesses, mishandling of cases that breed suspicion and mistrust in society. The Telgi stamp paper scam, police scuffle with workers of Hero Honda-Gurgaon, and abusing and killing of dozens of children at Nithari-Noida speaks volumes of administrative failure, excesses and politicalization of police. The instances of police lathicharge on agitating groups even peaceful, involvement in robberies, thefts, collecting money unlawfully, aligning with goons, mafias, and the underworld, acting as tools in the hands of ruling political party are few among many reports in media and newspapers that dilutes the impression about the police administration. The worst feeling about police in masses is that they are tyrants. Guruprasad (2009) felt that public perceives police to be rude, unfriendly, lazy, and corrupt. As Daruwala (2007) mentioned that abusive, violent, discriminatory, and corrupt policing contribute to many ills of the society. Karnik (2005) observed that a society with low tolerance levels and old attitudes will face difficulties to work successfully in global environment.

With improved awareness and education, globalization of standards and patterns of lifestyle it is inevitable to change the attitudes, style and approach of police from just problem oriented policing and an agency enforcing the criminal law to community policing. Thus, dire need of the hour is a humane police. Bedi (2007) mentioned that the Supreme Court in its judgment of January 11, 2007 directed to set up a State Security Commission to check political interference and to ensure police administration as per the laws of the land. It will certainly help good and fair policing. Sen (2007) highlighted the need for police reforms in order to check criminals in uniform and suggested streamlining recruitments in general and allocation of assignments in particular. Banerjee (2007) emphasized the need for the accountability clause in Police Act in order to penalize the erring cops. Sen (2009) lauded the approach of policing to change the environment instead of changing people. In fact, the key issue with the police administration is to make police accountable to law and creating a system and policy for operational responsibility of employees for ensuring the safety and security of the population at large. Schwab (2008) felt a strong need to identify the fundamental problems of policing and making corrections in the system accordingly, to be successful. All this requires multi pronged efforts to make it a reality in a democratic society in which complex social problems will always place heavy demand on the police not only to be effective but also to be humane and civil. Therefore, the present study on police administration in general and Himachal Pradesh police, in particular, gains importance with a view to analyze their attitudes and perceptions about the ethical dimensions of work culture and its correlates.

HP Police: A Brief View

Himachal Pradesh is a hill state having geographical area of 55673 sq. km and difficult topology and climatic conditions with population of 6077248 persons (2001 census). The main stay of people is horticulture and agriculture besides government jobs as major source of earning. It is one of the leading states in literacy (77.13%),

a role model hill state in economic development, politically stable and now giving more impetus on industrial development. To trace history, Himachal Pradesh as political entity came into existence on April 15, 1948. It was constituted by integrating the princely States and finally got statehood on January 25, 1971. Similarly, the government created police department to maintain law and order in the state.

HP Police department has grown over the years and has been given teeth as per needs from time to time. There are 87 police stations, 125 police posts, and 11 check posts located in the 12 Districts of the State. The strength of Himachal Pradesh police includes 72 IPS officers, 134 State Police services officers, 4578 NGOs, and 12914 other ranks. It has been noticed that HP police is servicing good without much exceptions. Though the crime rate, scams, frauds, and social unrest in the State is quite low as compared to many parts of the country, it cannot be termed as evil free. However, the registered cases of different crimes: murder, robbery, rape, kidnapping, cruelty to women, molestation, rioting, accidents, burglary, theft, etc. in the State, however shows an almost upward trend indicating the need for better and improved administration. Moreover, increasing urbanization, development, and industrialization are changing the nature and complexities of offences and misdeeds in the State in addition to the limitations of policing in remote areas. Further, with the emergence of internet, IT revolution, increasing population, education spread, high unemployment rate, price rise, disintegration of joint families, modernization, and westernization menace in India, including Himachal Pradesh, are contributing also to moral erosion leading to many ills in society thus posing challenges to police administration. These are making the role of the police very sensitive and critical where people look at the police with greater integrity and higher morals. Therefore, the present survey is an attempt to assess the ethical work culture perceived by police force in Himachal Pradesh.

Methodology

The survey was undertaken to study the ethical work culture in the HP police force, to examine the relationship between cadre, length of service, salary slab, and department of respondents with their ethical behavior.

Sample

The sample comprised of 100 personnel, i.e., IPS = 9, HPS =16 and HPP = 75, in Himachal Pradesh selected on random basis.

Tool

Opinion have been gathered through a 24 item questionnaire on a five point scale containing six dimensions of ethical work culture suggested by Patric and Quinn (1994) as social darwinism, machiavellianism, popular conformity, allegiance to authority, democratic participation and organizational integrity. The opinions of the employees may be briefly described as follows:

Darwinism: Fear of disappearance and the pressure of final survival dictate moral conduct. The direct use of force is the accepted norm and an atmosphere of fear pervades. This is the lowest stage in the ethical ladder.

Machiavellianism: Successfully attaining goals justifies the use of any effective means, including dishonesty. An atmosphere of distrust pervades.

Popular Conformity: There is a tradition of standard operating procedures. Peer pressure to adhere to social norms dictates what is right or wrong behavior.

Allegiance to Authority: Directions from legitimate authority, inside and outside the firm, determine organizational moral standards. Right and wrong are based on decisions that rest with the legal and hierarchical power.

Democratic Participation: Egalitarian participation in decision-making and reliance on majority rule become organizational moral standards.

Organizational Integrity: Here, justice, utility, caring, dignity, freedom, service, and accountability become guiding principles. Sustained enhancement of these relationships forms organizational character. Conscious, daily integration of the guiding principles in all systems and processes overrides other value, culture stages and creates an atmosphere of trust and commitment.

Statistical Technique

The collected data has been analyzed with the help of statistical techniques like mean and standard deviation.

Results and Analysis:

The gathered opinion on ethical work culture of HP Police force with regard to designation, salary slab, length of service, and department wise has been tabulated and analyzed as under:

Table 1 presents cadre/level wise analysis of perceived work culture in HP police. It has been revealed that IPS cadre opined democratic participation (M=2.00), HPS cadre identified principled integrity (M= 3.24) and HP police exhibited principled integrity (M=18.32) as the

Table 1. Designation wise Response Analysis of Work Culture in HP Police

Designation	IPS (N=9)		HPS (N1=I6)		HPP (N2=75)	
	Mean	SD	Mean	SD	Mean	SD
Social Darwinism	-	-	0.33	1.85	-	.34
Machiavellianism	-	-	0.33	.54	0.52	.34
Popular conformity	0.01	-	-	-	0.33	1.92
Allegiance to authority	0.01	0.1	0.33	2.1	2.00	3.73
Democratic participation	2.00	2.0	0.33	1.32	6.43	4.71
Principled integrity	0.33	4.1	3.24	4.3	18.32	29.3
Total	2.36	6.9	4.56	6.1	32.16	38.3

Table 1.a. Significance of Mean Differences among (IPS, HPS, HPP) Groups (Value of t-test)

Groups/ Factors	Social Darwinism	Machia-vellianism	Popular conformity	Allegiance to authority	Democratic participation	Integrity	Total
1st vs 2nd	-	-	-	.41	.23	-	.33
2nd vs 3rd	.18	03	-	.20	.63	2.10*	.06
3rd vs 1st	-	-	-	.22	.6	3	.14

Note: (IPS =1st Group, HPS =2nd Group, HPP=3rd Group), (=Significant at 0.5 level)*

Table 2. Salary Group wise Response Analysis of Work Culture in HP Police

Income Group/Factor	Rs. 5,000-10,000 (N=14)		Rs. 10,000-20,000 (N=73)		Above 20,000 (N=13)	
	Mean	SD	Mean	SD	Mean	SD
Social Darwinism	.16	.68	.66	1.35	-	-
Machiavellianism	-	-	.33	.67	-	-
Popular conformity	.16	.33	.17	.33	.17	.68
Allegiance to authority	.50	0.2	1.33	2.7	.33	.68
Democratic participation	.16	1.0	1.5	3.1	1	2.01
Principled integrity	1.33	2.7	4.83	10.2	1.17	2.38
Total	2.31	4.9	8.82	13.4	2.67	5.75

dominating ethical work culture stages. It means these are the peoples guided by principles of justice, utility caring, dignity, service, and accountability. Thus highlighted high morals, ethics and sincerity of HP police may be attributed for peace and a better law and order situation in HP.

However, IPS officers and HP police (t=3.00), and HPS officers and HP police (t=2.10) observed to be differing significantly on principled integrity. Thus, group comparisons indicate differences in the degree of justice and accountability of HPS and HPP.

From table 2 it is clear that middle-income group, i.e., Rs 10–20 thousands respondents (M=12.15) indicate more ethical work culture intentions as compared to lowest income group (M=2.31) and highest income group (M=2.67) of HP police. However, all three groups favored principled integrity (M=1.33), (M=4.83), and (M=1.17) respectively. It may be said that least earners may opt for easy money whereas high salaried employees indicate chances of abusing power in the absence of peer pressure, though all respondents highlighted character and integrity as their major values possessed at work.

Table 2.a exhibits significance of differences among different experienced groups. The salary groups Rs 5,000–10,000 vs. Rs 10,000–20,000 (t=4.48) and Rs 10,000–

Table 2.a. Significance of differences among Salary (5–10, 10–20, and above 20) Groups (value of t-test)

Groups/ Factors	Social Darwinism	Machia-vellianism	Popular conformity	Allegiance to authority	Democratic participation	Integrity	Total
1st vs 2nd	.21	-	.007	.55	.71	4.48**	1.50
2nd vs 3rd	-	-	.007	.70	.36	4.69**	1.52
3rd vs 1st	-	-	.007	.28	.96	.43	.11

*Note: (5-10=1st Group , 10-20=2nd Group, and above 20=3rd Group) (**=Significant at .01 level)*

Table 3. Length of Service wise Response Analysis of Perceived Work Culture in HP Police

Length of Service	Up to 10 years (N=52)		10–20 Years (N=22)		More than 20 years (N=26)	
	Mean	SD	Mean	SD	Mean	SD
Social Darwinism	0.33	0.12	0.016	-	-	0.73
Machiavellianism	2.37	0.12	0.016	-	0.016	0.34
Popular conformity	3.49	-	-	-	0.52	1.34
Allegiance to authority	4.23	0.12	2.37	3.66	1.0	1.01
Democratic Participation	6.43	1.04	3.24	1.16	4.23	1.34
Principled integrity	4.23	0.12	3.24	2.34	3.24	5.74
Total	21.08	1.52	8.882	8.38	9.006	10.84

Rs 20,000 vs. above Rs 20,000 (t= 4.69) were found significantly differing on the principled integrity. Thus, specify the symptoms of unethical intentions prevalent among the police force.

The table 3 shows that up to 10 years experience group respondents (M=21.08) are more inclined to ethical work culture as compared to 10–20 years age (M=8.88) and above 25 years (M=9.00). Thus, newly entrants found to have ethical conduct in comparison to relatively senior and older employees. The reasons can be the honesty, sincerity, and enthusiasm of new employees towards their work. The entrants observed to be stronger on the democratic participation (M=6.43), medium experienced respondents noticed to be having inclination to integrity (M=3.24), and the senior most respondents also show democratic participation (M=4.23) as major stages of their ethical work culture in police. Therefore, it is inferred that new entrants and the oldest employees prefer to do what others do whereas average experienced employee keep independence and high morals.

Table 3.a presents that 10–20 and above 20 years experienced groups observed to be differing significantly on the stage of integrity (t=3.51) as well the new entrants and the oldest respondents differ significantly on principled integrity (t=2.17). Thus, it is concluded that experience wise different police force groups point toward differences in their ethical behavior.

Table 3.a. Significance of Differences among different Length of Service (up to 10, 10–20, and above 20 years) Groups (Value of t-test)

Groups/ Factors	House of manipulation	House of compliance	House of integrity	Total
1st vs 2nd	-	.20	1.69	1.29
2nd vs 3rd	-	.13	3.51**	.63
3rd vs 1st	-	.094	2.17*	1.04

Note: (up to 10=1st Group, 10–20=2nd Group, and above 20 years=3rd Group) (*=Significant at 0.5 level), (**=Significant at .01 level)

Table 4 exhibits department wise ethical work culture perceived by HP police force. The investigation department found to be higher on ethical considerations (M=10.88) followed by personnel department (M=8.29). The stage wise analysis revealed that investigation department observe principled integrity and democratic participation (M=6.43), the intelligence department point out principled integrity (M=4.23) and personnel department indicated principled integrity (M=3.49). It is concluded that in almost all departments the respondents ventilated respect to authority, rules and views, loyalty, justice friendly, caring attitude, and discipline. It can be attributed to cordial relations between the superior and subordinates and manifests moral excellence in HP police force.

Table 4. Department wise Response Analysis of Perceived Work Culture in HP Police

Department	HR / Personnel (N=26)		Intelligence (N1=30)		Investigation (N2=37)		Prosecution (N3=7)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Social Darwinism	0.02	1.3	0.02	.73	-	-	0.02	.73
Machiavellianism	0.02	.34	0.02	.34	-	-	0.02	.34
Popular conformity	0.52	.23	1.0	1.34	-	-	0.02	1.34
Allegiance to authority	1.0	1.04	3.24	.34	2.93	3.66	0.02	.34
Democratic Participation	3.24	1.04	2.37	0.34	6.43	1.16	0.02	0.34
Principled integrity	3.49	6.16	4.23	0.74	6.43	2.34	0.33	0.74
Total	8.29	10.1	10.88	2.84	15.79	8.38	0.41	2.84

Table 4.a. Significance of mean differences among different Department HP Police (Value of t-test)

Groups/ Factors	Social Darwinism	Machia-vellianism	Popular conformity	Allegiance to authority	Democratic participation	Integrity Total	Total
1st vs 2nd	.16	-	-	.22	.14	1.12	1.03
2nd vs 3rd	.02	-	-	.18	1.12	1.02	.54
3rd vs 1st	.13	-	.04	.17	.31	.33	.45
1st vs 3rd	.12	-	.03	.12	.12	.32	.32
1st vs 4th	.1	.2	.05	.16	2.3*	.32	.89
2nd vs 4th	.23	-	.12	.10	1.2	.23	.12
3rd vs 4th	.11	.1	.97	1.32	1.34	2.32*	.56

Note:(HR / Personnel= 1 Group , Intelligence = 2 Group, Investigation = 3 Group, Prosecution = 4 Group) (*=Significant at 0.5 level)

However, the personnel and prosecution department noted to be differing significantly on democratic participation (t=2.3) and investigation and prosecution department found to be differing significantly on principled integrity (t=2.32). Thus, it can be a pointer to the need of streamlining recruitment and promotions by giving due attention to the character and integrity of individuals for improved follow-up of investigations of cases and speedy and effective prosecution of culprits.

Observations and Conclusions

To conclude findings of the survey on ethical work culture amongst HP Police force have revealed high morals and integrity in their conduct. The IPS officers opined democratic participation, HPS and HP police cadre identified principled integrity as the dominating ethical work culture stages. It means that police administration in Himachal Pradesh is guided by principles of justice, caring, dignity, service, and accountability. It may be attributed for peace and good law and order situation in the State by and large.

The groupwise salary analysis indicated medium-income group employees showing more ethical tendencies as compared to other low and high paid groups of HP police. The symptoms in relative terms could be attributed that least earners for having more needs may pull them for unethical practices, whereas high salaried personnel may abuse power. However, all three groups favored principled integrity as their major instinct. The new entrants found to be having tendencies of better and ethical conduct in comparison to senior and older employees. However, the entrants and the senior most employees revealed inclination to democratic participation means following the rule of majority in their conduct. The investigation department found to be higher on ethical considerations

followed by intelligence department. However, personnel and prosecution department relatively need to give more attention to ethics in order to improve image of the police.

It is observed that in almost all employee groups and departments the respect to authority, rules, loyalty, justice, caring attitude, discipline and integrity characterize the work culture in the police force. However, the gaps and differences in their opinion are a pointer towards a scope of improvement in their conduct. It is suggested for good and fair policing that whistle blowers and honest employee should be appreciated in public and any guilty must be punished in public. To fix individual responsibility for any misconduct will check police behavior. In fact, character and integrity should be made as major considerations for recruitment and promotion decisions. Further, high morals and positive work culture should be highlighted during pre placement training and retraining activities. It is suggested that police force be paid adequately, monitor their performance scientifically, appreciate the performers and punish the guilty. It will not only make public – police interface better but also change their image.

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"Great acts are made up of small deeds."

— Lao Tzu

Feature

Status of Entrepreneurship and Associated Environment: A Study from Durgapur

Suchismita Mondal Sarkar and Soumyendra Kishore Datta

The study intends to provide an insight into the entrepreneurial environment of the industrial town of Durgapur, in Burdwan district of West Bengal. A sample of 175 small/medium enterprises from different markets of this region was surveyed using sampling techniques. The data collected was analysed using descriptive statistics, frequency distribution tables, and regression analysis. The results reveal that though the environment is conducive for entrepreneurial development, the enterprises still faces certain bottlenecks regarding bulk purchase of inputs, power crisis, and threat from globalization. Problems related to production, marketing, and development are identified and policy suggestions are made.

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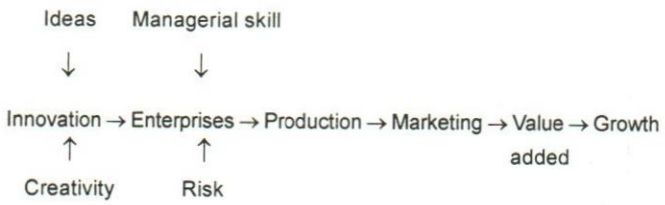
Introduction

Entrepreneurship is widely regarded as an integral player in the business culture and particularly as an engine for job creation and economic growth. Entrepreneurs take prudent risks. They assess costs, market/customer needs, and persuade others to join and help. An entrepreneur is usually a positive thinker and a decision maker. The entrepreneur takes the initial responsibility to make a vision a success. Every successful entrepreneur brings about benefits not only for himself/herself but for the region or country as a whole. Entrepreneurship is a major mechanism leading to economic growth and adaptation in all economics, whether developed or developing. Various nations are emphasizing programs to enhance or promote entrepreneurial activity. Experts stress the need for providing training programs for creating entrepreneurial attitudes in the young minds. Various NGOs like NEN (National Entrepreneurship Network), AWAKE (Association of Women Entrepreneurs of Karnataka), SEWA of Ahmedabad, etc. are shouldering these responsibilities by creating awareness to youth for taking up different enterprises.

Entrepreneurship is defined as a force that mobilizes resources to meet unmet market demand, the ability to create and build something from practically nothing, the process of creating value by pulling together any package of resources to exploit an opportunity. Hansra, et al. (2002) defined an entrepreneur as a person who either creates new combinations of production factors such as new methods of production, new products, new markets, fund new sources of supply, and new organizational forms; or as a person who is willing to take risks; or a person who by exploiting market opportunities eliminates disequilibria between aggregate supply and aggregate demand; or one who owns and operate business.

According to Cole (1959), "Entrepreneurship is the purposeful activity of an individual or a group of individuals, undertaken to initiate, maintain or aggrandize profit by production or distribution of economic goods and services." International comparison reveals that small and medium enterprises (SMEs) create the majority of jobs. A concerted effort to fully develop the potential of agribusiness could generate millions of additional jobs (Anonymous, 2004). Manimala et al. (2002) developed a conceptual model that emphasizes the role of entrepreneurship in the creation and growth of new firms, in turn leading to national economic growth. Thus entrepreneurship plays a premium role in industrial development.

Process of Entrepreneurship Development



An entrepreneur's initiative to start a unit is triggered by many factors, both internal and external. Entrepreneurship involves the drive to achieve certain desired objectives with some degree of risk based on which it can blossom. Creative development leads to new ways of producing and delivering services in a cost efficient manner and thus the rate of change imbibed in the process results in value added and growth of the economy.

In the business history of India, Tata, Birla, Modi, Dalmia and others are well known names of successful entrepreneurs in the country who started their business enterprises with small investments and made great fortunes. In West Bengal, the entrepreneurial development has already started, not only in Kolkata but also in other districts like Hoogly, Howrah, Burdwan, etc.

In this study, Durgapur, being the main industrial region in West Bengal, is purposively selected as the study area to assess the overall entrepreneurial environment there. Some new major industries are in the offering (IT sector) and big investments are also coming from new entrepreneurs. Durgapur being only 150 kms away from Kolkata enjoys the facilities of international marketing for its products. Presently, the enterprises of Durgapur, particularly the entrepreneurs in the manufacturing and business sectors are confronting various problems.

Objectives and Methodology:

The specific objectives of the study are:

- To examine the broad universe (causes and motivators) of entrepreneurship at Durgapur.
- To study the operation of small enterprises in terms of their profit, sales, and payment and to examine the role-played by these petty enterprises in promotion and attribution to the entrepreneurial world.
- To delineate the factors attributed by the entrepreneurs as responsible for thwarting the process of sustainable management of their enterprises.

A sample of 175 enterprises was chosen from the study area for analysis. We intended to examine the infrastructural facility, reception of threat from globalization, willingness of the entrepreneurs to compete with international brands and over all the profitability of the firms in different trading, retailing and manufacturing units. Accordingly the questionnaire was designed. Primary data was collected directly from the field of enquiry. Survey was carried out in four regions of Durgapur. The names of the markets that were visited are Benachity, Muchipara, Bhiringi and Station Bazaar. The markets were chosen, based on the type of enterprise situated there. The enterprises were classified in three broad categories—Manufacturing, Business, and Others. Muchipara was chosen for manufacturing enterprises, Benachity and Bhiringi for business enterprises, and Station Bazaar for others. The enterprises surveyed under manufacturing sector includes Grill making, Motor vehicle, Sweet making, Furniture, Tailoring, etc, under Business sector includes Readymade Garments, Dry food, Electronic good, Footwear, Grocery, Bookstall, etc. and under the other sectors include Cycle repairing, Mobile repairing, Flourmill, etc. The motivating factors that drive them to the selection of their respective business were also examined. The collected information was analysed and inference about the different aspects of analysis was made employing statistical tools such as frequency distribution tables and Regression Analysis.

Results of Segregated Analysis

Factors motivating towards entrepreneurship: Urge to find out a source of livelihood is found to be one of the important reasons for starting up a new enterprise. Regarding starting a business, we found that Bengalees are risk averse and they are only motivated towards entrepreneurship only if they inherit it. Besides necessity-based entrepreneurs,

Table 1: Profile of Entrepreneurs and Their Enterprises

Character	No. of respondents	Types of Enterprise	No. of units
Bengalee	130	Manufacturing	48
Non-Bengalee	45	Business	71
		Others	56
Caste			
General	144	Registered units	120
SC/ST	31	Unregistered units	55
Educational Background		**Motivating Factors**	**No of respondents**
Engineer/M.B.A./M.Sc./M.A	14	Inherited from Family	86
Non-Technical graduates	54	Influenced by Friends	16
Under Graduates	50	Risk taking attitude	23
Non-Matric	57	Joblessness	43
		Others	7

Source: Field Survey, 2008

opportunity-based entrepreneurs were also found. However, influence of successful entrepreneurs and family inheritance and of course, the availability of required raw materials for the enterprises have emerged as other major motivators of entrepreneurship at Durgapur (Table 1). Further it is evident from the table that most of the entrepreneurs emerge from non-technical and poor academic background thereby tacitly implying that they hardly feel the urge to undertake innovative ventures requiring skill and aptitude.

Quality of Support Services:

Data in Table 2 reveal that entrepreneurs who hold Government registration can avail good support service which includes credit facility, local government support, local social pressure group, training scope, marketing scope, communication facility and labor relation. It is also observed that, literate entrepreneurs can acquire the training facility easily and can avail bank loans with less hazards. They are able to maintain good relationship with local government bodies and hence can easily get license. They can take the opportunity of good marketing scope with much ease. But illiterate people face difficulties in availing such facilities.

Table 2: Quality of Support Services

Category of Support Service	Quality (percent of respondents)		
	Good	Medium	Bad
Credit facility	36.0	41.7	22.3
Local government support	41.1	36.0	22.9
Local social pressure group	38.3	42.3	19.4
Training scope	19.4	41.2	39.4
Marketing scope	56.6	37.1	6.3
Communication facility	85.1	10.9	4.0
Labor relations	78.3	17.1	4.6
Marketing scope	36.0	41.7	22.3

Source: Field Survey

It is found that 69 percent of total enterprises were registered and the remaining 31 percent non-registered. Again out of the total, 51 percent entrepreneurs were found to perceive good support service; 32 percent think that support service is medium and for the rest 17 percent support service is viewed as bad. Hence clubbing the first two categories, it may be said that altogether 83 percent of total entrepreneurs considered support service to be more or less congenial to their functioning. It is found that registered entrepreneurs are getting good support service because of their sound legal status. For example, those entrepreneurs who have the valid license to run their enterprises can get bank loans easily for expansion of their business. But the training scope for the new entrepreneurs especially for manufacturing sector is insufficient at Durgapur. Only 21 percent of total entrepreneurs think that it is good but the rest 79 percent consider it extremely inadequate for further flourishing of entrepreneurial spirit.

Perception about availability of Infrastructural facilities

Infrastructure plays an important role in determining entrepreneurship development in a region. The major

components of infrastructure are physical, social, and financial. In this study infrastructure includes electricity, presence of workshop, nearby input market, product marketing facility, advertising, communication facility. Each component is discussed separately.

Electricity: Availability of electricity is the most important infrastructural facility especially for the manufacturing sector. According to 53 percent of total entrepreneurs, power supply at Durgapur is good, according to 34 percent, power supply is slightly disrupted and the rest 13 percent think that it is bad. Therefore, we can see that, power supply at Durgapur is not so good. This is because of the fact that power supply hasn't increased with the increase in demand. Durgapur as a town is growing day by day. At the same time, sectors like manufacturing, business are also growing. Therefore, power consumption has increased a lot compared to previous years. However, the supply remained constant over the years causing the entrepreneurs of Durgapur to face the problem of power cut.

Presence of workshop: In case of manufacturing sector the presence of workshop is an absolute must. Out of 175 enterprises, 35 technical enterprises (27 percent) were found, most of them having the workshop facility.

Nearby input market: About 64 percent of total entrepreneurs have get their required inputs from the nearby market, which is not more than 5 kilometer away. Entrepreneurs from manufacturing sector get their inputs from nearby markets since Durgapur is a town based upon its manufacturing sector, but most entrepreneurs from business have generally get their inputs from Kolkata. Communication facility is very good at Durgapur. Proximity to Kolkata is probably another reason for this.

Product marketing facility: Some entrepreneurs, particularly the owners of manufacturing enterprises, use a third party (marketing agencies) to sell their product which increased their sales. But the small entrepreneurs generally sell their products directly in the market. This is especially true for the business sector. Good marketing can increase the demand of the product to a large extent and to increase the demand, advertising is very important, i.e., advertisement through hoarding, local news paper, and local cable channel serves in conveying information about new product lines or new varieties to the consumers. In this way the demand of the product may be increased.

Advertising: Advertising seems to be very costly at Durgapur. About 45 percent of the total entrepreneurs think that this facility is not for the small-scale entrepreneurs. Some of them feel that increasing the price of their product may enable them to avail advertisement facility but in that case it will be difficult for them to compete with the multinational companies.

Table 3: Availability of Infrastructural Facilities

Category of Infrastructural Facilities	Quality (percent of respondents)		
	Good	Medium	Bad
Electricity	53	34	13
Presence of workshop	35	11	54
Nearby input market	64	15	21
Product marketing facility	56	40	04
Advertising	38	17	45
Communication facility	92	06	02

Source: Field Survey, 2008

Communication facility: Communication facility, which is most important for all the sectors, is good due to the NH-2 high way and also because of the Railway service that is very frequent in Durgapur. The above results are summarized in the Table 3.

About 54 percent of total entrepreneurs have chosen their location of enterprise because of good marketing scope, 29 percent due to the presence of nearby input market, and 17 percent due to some other reasons.

Regression Analysis

The postulated model considered in the study hypothesizes that profit is highly influenced by the number of years of experience and sales to payments holds true in the following way:

Amount of Profit = f (Years of Experience, Sales to Payment)

Profit is regressed on Years of Experience and on the ratio of Sales to Payments separately for manufacturing sector, business sector and the others. Simple regression done to study the relative efficacy of the explanatory variables (years of experience & sales to payments) on profit shows that years of experience do not have a role to make profit. This is examined with the help of the slope coefficients of years of experience and sales to payments. New entrepreneurs are coming with new techniques and ideas to run their business and are competing out the old

Table 4: Results of Log Linear Regression Analysis

Sector	Variable	Coefficient	SE	t-value	R^2	F
Manufacturing	Constant	7.007 (.000)	1.039	6.744	.408	14:124 (.000)
	YEAR_EXP	.206 (.549)	.342	.604		
	SALE_PAY	1.354 (.000)	.261	5.184		
Business	Constant	7.092 (.000)	.573	12.388	.205	6.190 (.004)
	YRS_EXP	.570 (.001)	.167	3.411		
	SALE_PAY	1.355 (.257)	1.182	1.146		
Others	Constant	3.812 (.000)	.482	7.906	.841	92.329 (.000)
	YRS_EXP	1.473 (.000)	.109	13.563		
	SALE_PAY	4.000 (.137)	2.631	1.520		

Note: Figures in parentheses indicate level of significance
YEAR_EXP means years of experience and SALE_PAY means sales to payments
Source: Field Survey, 2008

units in the adjoining area. By using new techniques, a new entrepreneur can produce quality products in a cost efficient manner and thereby he can outrun the existing enterprises with backdated technologies. In order to focus on the responsiveness of profit to years of experience and sales to payments ratio we calculate the elasticity of profit with respect to the aforesaid explanatory variables by employing log linear regression. The results are summarized in Table 4.

Manufacturing sector: Thus in the manufacturing sector we can see that the elasticity of profit with respect to years of experience is 0.206, i.e., less than one (inelastic). Therefore, elasticity is positive but less than one. It means if years of experience increases then profit will also increase but at a lesser rate than the increase in years of experience. However, the elasticity of profit with respect to sales to payments is 1.354 (i.e., elastic). Therefore, the elasticity is positive and greater than one. It means if sales to payments increases then profit will increase more than in proportion to sales to payments. This helps us to measure the relative responsiveness of profit to years of experience and sales to payments.

Business sector: In the business sector, though years of experience are expected to turn up to be a major factor in increasing profit, the elasticity of profit with respect to years of experience is 0.570 (i.e., inelastic) and the elasticity of profit with respect to sales to payments is 1.355 (i.e., elastic), same as in the case of manufacturing sector.

Other sectors: In this sector, the elasticity of profit with respect to years of experience is 1.473 (i.e., elastic). That means, if years of experience in these sectors increases then profit will increase more than proportion. In addition, the elasticity of profit with respect to sales to payments is 4 (i.e., elastic). That means, here also profit will rise more than in proportion to sales to payments. But if we want to consider the relative efficacy of years of experience and sales to payments then we can see that the effectiveness of sales to payments is nearly 3 times than that of years of experience to increase profit. Although it is rather difficult or even not so important for cycle repairing, mobile repairing shops, etc. to incur costs for advertisement for promoting their sales, they hardly need to undertake great wage payments for generating their services. These enterprises are mostly run by one individual or two, their input costs are almost nil since they are mostly service providers so, probably their profits increase proportionally at a much higher rate with respect to sales-payment ratio.

Impact of Globalization on the Entrepreneurial Environment

Globalization has thrown challenges of competition, price pressures, quality expectations, efficiency of management, cost effective solutions to small enterprises. While large industries have risen up to these challenges, small enterprises are facing crisis. In the manufacturing sector companies like POSCO from South Korea is perceived to be a threat for the Steel town of West Bengal. In the business sector we found that the companies like

Pantaloons, Wall Mart are proving their strong presence. The tagline for Pantaloons is "isse sasta aur achha kahin nahin" and the tagline for Wall Mart is "Save Money, Live better" are quite attractive for consumers. Pantaloons have been successful in making a good market in West Bengal. In January 2008 during their three day special offer the sales volume of 'Big Bazaar' at Durgapur was 96 lakhs (32 lakhs per day on an average), while it was 46 lakhs in Burdwan and 48 lakhs at Haldia. The figures reveals to what extent the domestic entrepreneurs are receiving the threat. That is why almost 68 percent of total entrepreneurs think globalization is a threat for them. But the rest 32 percent thinks that it cannot reduce their sales because of their goodwill in the market.

Table 5: Problems Faced by different enterprises

Problems	Reasons
Problem of low profitability	• Competition from multinational companies. • Increasing input costs
Problems related to production	• Disruption of electricity affects production. • Absence of workshop.
Problems of marketing	• Lack of sufficient orders. • Lack of linkage with marketing agencies. • Lack of adequate sale promotion measures. • Lack of permanent market for the product of small-scale enterprises. • Absence of proper brand name. • Unattractive packaging system. • Poor quality of products due to the application traditional technology, resulting in poor market.
Problems related with raw materials	• Lack of benefits from large-scale purchase like discount, credit facilities, etc. • Ignorance about the major raw material suppliers and their terms and conditions, all these causes high cost of raw materials.
Inadequate training facility	• Lack of adequate training facilities required in the specific areas of product selection, quality of the products, production techniques, packaging and other technical knowledge, etc, in order to compete with the multinational brands.
Inadequate financial assistance	• Financial assistance provided to them by the agencies concerned is not adequate to meet their actual requirements.

Very interestingly, it is noted that in the question of competing with international brands 83 percent of the entrepreneurs are in favor of expanding their business by increasing their efficiency, standard, quality of the product, etc. Globalization has goaded them to reconcile with management, research, development, technology production, and marketing. Regarding the way of expansion, they would prefer to use the steps like introducing new product, increasing the scale of operation and area of operation, etc. That means the entrepreneurs of Durgapur have the confidence of competing globally, which is a positive sign for entrepreneurship development at Durgapur. However, 12 percent of the entrepreneurs want to shift to some other occupation. According to some, in order to switch to other occupation, they require some new training, new skill, and most importantly a huge amount of initial investment that becomes a constraint. Particularly the entrepreneurs from business sector want to switch to other occupation. According to them the condition of the business sector was really good before 20 to 25 years. But now the presence of the shopping malls at city centre has reduced their sales badly and moreover the increasing cost of living has made it more unsustainable. They fear young generation being fond of shopping malls; the situation of the business sector may even worsen. Thus there is no possibility of upswing; rather this downswing is going to be a long-term phenomenon. Therefore, it is the right time for the entrepreneurs particularly those having a low profitability in business sector, to shift to other occupations. Thus we see though the entrepreneurial environment is congenial, the entrepreneurs are facing various problems as summarized in Table 5.

Concluding Observation and Policy Prescription

For realizing the development potential of the enterprises in this region, a number of specific programs for improving the productivity, product mix, working conditions, technological level, access to plentiful and superior inputs, etc. are necessary. The state should act as a facilitating agency in this regard so that the benefits spell out to the intended beneficiaries. However with the undeniable, hard reality for some of the extremely unsuccessful entrepreneurs, is surely the time to shift to alternative livelihood options.

Given the specific problems of low profitability, lack of infrastructural facility, competition with Multinational Corporations, etc. faced by different enterprises, they

have both the desire and potential to compete with these situations. Therefore, it is necessary for the authorities concerned to utilize the unutilized potential of these people through proper policies. The following suggestions are recommended:

- First of all, in order to compete with the MNCs, the firm should improve the quality of the product. For this, the firm may introduce the concept of flexible specialization thereby employing multi-skilled worker and multipurpose machinery and thus engendering the efficiency of the worker.
- Secondly, the concept of cluster of firms can be introduced. There may be networks of small and medium size firms or even small and large firms coexisting together based on bound by some organic relationship developed among themselves. These firms work closely together even with firms which sometimes compete with them in local networks producing similar or complementary products. Product is the key component of competitive strategy. The entire production system has to be flexible in order to accommodate fast changes in the market. The entrepreneurs in an industrial cluster bound by an organic relationship are required to exercise cooperation among themselves, mutually trust and help each other both informally and through consortia for marketing, design, loan, guarantees, raw material procurement and maintenance of machines, etc. encouraged by local and regional governments. This helps them to achieve economies of scale and the necessary flexibility and information to compete in distant fast changing and fragmented markets.
- Thirdly, besides this, the subcontracting model of flexible specialization, widely practiced in Japan and South Korea, holds out great prospects for development of small and medium industries alongside the large industries in these regions. There had been a large percentage of small and medium firms undertaking subcontracting work in Japan in textile, general and electric machinery, iron and steel and non-ferrous metals, etc. But subcontracting is feasible in industries where production involves divisible production process and the final product is constituted of a number of parts or subassemblies. Hence the vertically integrated firms should be dismantled in order to reap the advantages of subcontracting involved in reduced cost, quality products, better timing, and market flexibility. In Durgapur, there are a number of big firms engaged in divergent industrial production, where subcontracting seems to be eminently suitable, such as A.B.L. (Acc. Babcock Ltd) already undertakes practice of subcontracting (Datta,1999).
- Again, a number of public sector units in Durgapur like D.S.P, MAMC, HFC, etc. have undergone golden handshake policy, introduced voluntary retirement scheme on a wide scale and shed off a number of workers (supposed to be redundant) from their fold. These workers are mostly literate or having technical qualifications or acquired technical skill on the shop floor. Given institutional support and guidance through a regional or local industrial policy, it can be expected that many of these workers, having earned a huge sum at a single slot through voluntary retirement, may venture forward to launch individual or joint enterprises on the model of flexible specialization to produce competitive and accessory products requiring technical expertise earned during their erstwhile employment.
- Finally, the problem of power cut is reported to be the major infrastructural bottleneck especially for the manufacturing sector. Govt. should give priority to meet the growing demand for electricity.

However, Government has already planned different projects for the improvement of infrastructure and to implement some of the different development projects in a public private partnership. The local authority assured that the problem of power crisis is likely to be over by 2010 with the establishment of a power plant by Damodar Valley Corporation (DVC) at Andal. DVC will generate more than 9000 MW of power by the end of 2011. Durgapur Steel Plant (DSP) is also trying to improve the local infrastructure including communication facility. All these steps, if implemented properly, may help the entrepreneurs to counter different problems for developing their enterprise in coming future.

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"Absorb what is useful, reject what is useless, add what is specifically your own."

— Bruce Lee

Feature

A Study on Certified Seed Production of Wheat and Paddy in Punjab

Sangeeta Verma and M. S. Sidhu

The seed growers are generally large farmers in Punjab. The study showed that the average size of operational holding of the selected seed growers was 41.53 acres. The average area per seed farm under wheat and paddy was 23.66 acres and 23.21 acres respectively while per seed farm area under non-seed wheat and paddy crop was 11.13 acres and 21.41 acres respectively. The area allotted by the PSSC per seed grower was 19.71 acres for wheat, out of which 98 percent was sown. During field inspection, the PSSCA approved 97.88 percent of the sown area. For paddy, the area allocated per seed grower was 11.66 acres. Out of this, about 96 percent area was sown. During field inspections, 95.54 percent of the area was approved.

The gross returns for the grain and seed crops of wheat were about Rs 14063 and Rs 17080 per acre respectively. The returns over operational cost were about Rs 8952 per acre for grain crop and Rs 11084 per acre for the seed crop. Thus, the additional returns from the seed crop worked out of about Rs 2133 per acre. This was mainly because of high yield of seed crop (19.98 quintals per acre) in comparison to grain crop (18.94 quintals per acre). For paddy, the operational cost for grain and seed crops was about Rs 6741 and Rs 7623 per acre respectively. For paddy, gross returns for grain crop were about Rs 15713 per acre whereas the returns from seed crop were Rs 19281 per acre. The higher returns from seed crop were due to high yield (29 quintals per acre) as compared to yield of about 28 quintals for grain crop. The returns over operational cost were about Rs 8972 and Rs 11659 per acre for grain and seed crops of paddy respectively. Thus, the additional returns for seed crop were Rs 2686 per acre as compared to the grain crop.

The study indicated that about 71 percent of the selected seed growers delivered their wheat seed to the PSSC whereas this figure was about 55 percent for paddy seed. The quantity of wheat seed delivered was about 83 percent of its production. On the other hand, this figure was about 71 percent in case of paddy. Among the major reasons for not delivering the seed to the PSSC were risk of rejection of seeds, late payment, laboratory tests, cumbersome procedure and high transportation and labour cost involved in the process. Overall, the certified seed production of wheat and paddy was profitable to the seed growers of Punjab.

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Introduction

The seed program is successful if it can make available sufficient quantity of high quality seed at the appropriate time, at reasonable price and at the place where it is required while extremely rigorous and rigid quality measures can achieve the highest quality, they can make the seed cost high. It may be mentioned that a certified seed is the ultimate output of seed production chain. It is used by farmers for raising crops. Certified seed production is undertaken by the public and private sector seed organizations/agencies. Seed multiplication system is a three tier phenomenon viz. breeder-foundation-certified seed production system. Breeder's seed is the seed of a variety produced by the plant breeder or of the institution or the company with which the plant breeder is associated. The breeder seed is further used for producing foundation seed which is further multiplied at seed growers' level to produce certified seeds.

Coming first to procurement of seeds, the Punjab State Seeds Corporation (PSSC) procure foundation seeds from organizations like Punjab Agricultural University (PAU). The PSSC mainly organized production of certified seeds on the fields of contract seed growers as well as shareholder growers. The seed production can also be organized on the State Government farms. The foundation seed was given to the growers by the PSSC on payment basis. The growers had also to pay certain other charges like inspection fee, registration charges. The growers in non-project area could also produce seed for the PSSC depending upon the suitability of the area. The main criteria for allocating seed programs was that a farmer must be seed minded, field should be approachable for inspection and in a compact block, and land should be suitable for seed production.

The seed growers in Punjab are mostly large farmers. The small and medium farmers generally avoid the long process of certified seed production. It demands considerable financial strength on part of the grower (Government of India, 1975). He must have extra funds to pay for the higher cost of current inputs needed on seed production; he must be capable of risking a loss if his crop is rejected; and he must be able to wait for several weeks after harvest for payment.

Wheat and paddy are two principal crops of the state. About 75 percent of the total cropped area of Punjab is under these two crops. Punjab produces about 20 percent of wheat and about 11 percent of rice of the country. The state is also a major contributor towards the central pool of food grains. Punjab contributed about 75 percent of wheat and about 32 percent of rice towards the central pool in 2005–06. Further increase in agricultural production in Punjab mainly depends on the increase in productivity. In this regard, the use of quality seeds will play an important role. The PSSC produced about 91 thousand quintals of certified seeds during the year 2005–06. Out of this, about 97 percent of the certified seed produced was of wheat and paddy crops alone. Therefore, the present study has been undertaken to examine the certified seed production of wheat and paddy in Punjab.

Database

This paper is based mainly on the Ph.D thesis of the first author (Verma, 2008). The term growers/ seed growers in the study means contract seed growers. Separate lists of registered seed growers for wheat and paddy crops were taken from the Punjab State Seeds Corporation for the year 2004–05. A sample of 35 and 25 registered seed growers for wheat and paddy crops respectively without replacement were randomly selected from the lists obtained from the PSSC. It may be mentioned that seed growers in Punjab were generally large farmers. This is due to certain reasons like additional costs involved in seed production, late payments, risk of rejection of seed crop, lengthy and cumbersome procedure of certification, etc. The same is the position at national level.

It may be mentioned that some selected seed growers were growing other seed crop also. The detail is given in Table 1. Thus, the ultimate sample of growers consisted of 49 seed growers for wheat and 29 growers for paddy.

Table 1: Number of Seed Growers in the Sample, 2004–05

Crop	No. of selected growers	Other seed crops raised by the growers	
		Paddy	Wheat
Wheat	35	4	–
Paddy	25	–	14
Total	60	4	14

The data from the selected seed growers relating to their size of operational holdings, cropping pattern, source of draft power and irrigation, educational level, experience as seed grower, varietal position of non-seed crops, area, production and yield of seed and non-seed crops, production of certified seeds, quantum of seeds actually

delivered to the PSSC, price and premium received, storage of seeds, disposal of undersized and rejected seeds and problems faced by them in seed production and marketing were collected. The data about operational cost of seed and grain crops were collected from the sample seed growers and comparative economics was worked out.

Results and Discussion

Phases of Seed Certification

Production and certification of seed is divided broadly into following phases:

1. Verification of seed source

The seed producing agencies supplied lists of growers of seed crops to the certification authority. However, the grower had to retain documentary evidence like seed bag, certification tag, and copy of bill and it had to be submitted to the Punjab State Seed Certification Agency (PSSCA), if demanded.

2. Field inspection

Field inspection of the seed crop was done by the PSSCA. The PSSC also had its own technical staff who visited the seed growers' field to guide them at various stages.

3. Procurement

Seed grower was to deliver the produce, as per yield estimation at processing plant designated by seed producing agency. Seed growers were supplied gunny bags by the PSSC to bring their produce. The produce was checked for its physical appearance, disease infestation and any varietal mixture before acceptance at the plant. After procurement, seed growers were paid advance payment as per policy of the PSSC.

4. Processing

Seed processing helps to improve seed quality. It is a vital link between production and distribution. Seed processing was carried out in the presence of representative of PSSCA.

5.Seed Testing

Under the Seeds Act, every seed lot must meet the minimum seed standards supported by the seed report of seed testing laboratory. In case, seed lots met the prescribed laboratory standards, then the certification authority fixed its tag on each seed bag and sealed them as certified seed.

The seed growers act as vital link in the chain of certified seed production by the public seed agencies. As PSSC does not have its own farm, it arranges its seed production program through seed growers.

A brief profile of the selected seed growers in the study is as under:

Age Group

The study brought out that the maximum number of seed growers, that is, 40 percent were in the age group of 40 to 50 years followed by those between 50 and 60 years (about 28 percent), 30 and 40 years (about 17 percent) and 60 years and above (about 12 percent). Only about three percent of the seed growers were below 30 years of age.

Educational Level

The study brought out that about 97 percent of the seed growers were educated and only about three percent were uneducated. The percentage of growers having education up to matric, plus two and graduation were about 47, 22 and 23 percent respectively. Five percent of the selected growers were post graduates also.

Size of Operational Holdings

The study showed that the average size of operational holding of the selected seed growers was 41.53 acres during the year 2004–05. It may be mentioned here that the average size of operational holding in Punjab state is 9.96 acres which is much lesser than the average size of the operational holding of the selected seed growers. Therefore, we can say that only large farmers take the seed production program of the PSSC.

During *rabi* season, about 47 percent of the operated area was under wheat seed crop and about 27 percent under non-seed wheat crop. The rest of the area was under other crops like sugarcane, sunflower, mango, poplar, vegetables, and fruit crops. During *kharif* season, about 27 percent of the operated area was under the paddy seed crop while this figure was about 52 percent for non-seed paddy crop. The remaining area was under crops like sunflower, poplar, vegetables, and fodder crops.

Source of Draft Power

About 77 percent of the selected seed growers had their own tractors and the remaining about 23 percent were

dependent on custom hiring of tractors for different farm operations.

Source of Irrigation

The study revealed that 69 percent of the selected seed growers had tubewell as a source of irrigation and 31 percent had both canal as well as tubewell irrigation.

Number of Share Holder Growers

The study showed that of the selected contract seed growers, only five percent were share holders of the PSSC during the year 2004–05.

Motivation for Seed Production Program

The study brought out that a vast majority of the selected seed growers (70 percent) had taken this program at their own initiative while about 27 percent were motivated by fellow farmers and their relatives. The remaining three percent of the growers were motivated by the field staff of the PSSC.

Experience of Growers in Seed Production

The PSSC was established in the year 1976. The seed growers of the PSSC at the time of its establishment were also having experience in seed growing from other public institutions established before PSSC like NSC.

The study revealed that for both wheat and paddy, 65 percent of the seed growers had started contract seed production after the year 2000. On the other hand about three percent of the seed growers had opted for this program between 1980 and 1985, five percent started taking this program between 1985 and 1990, about seven percent between 1990 and 1995 and about 15 percent between 1995 and 2000. It may be stated that about five percent of the selected seed growers had been taking this program even before 1980.The seed growers with long experience in seed production were mainly shareholders of the PSSC.

The study further revealed that about 57 percent of the respondents were regular seed growers for the PSSC and the remaining about 43 percent were not regular in this program. The non-regular seed production program of the PSSC was mostly by the seed growers of paddy. About 30 percent and 13 percent of the selected paddy and wheat seed growers respectively were not regular. This happened mainly due to moisture problem in paddy because the PSSC did not accept the paddy seed with excess moisture.

Position of selected seed crops on the sample seed farms

The public seeds agencies allocated the seed production programs of different crops to the seed growers keeping in view the demand of seed for various varieties. The seed production programs of only those varieties which were recommended by PAU was taken up in Punjab. The crop wise detail for 2004–05 is as follows:

Wheat

The average area per seed farm under wheat was 23.66 acres. The variety wise allocation of wheat seed area for the selected respondents indicated the dominance of two varieties. The PBW 343 was the principal variety which covered about 89 percent of the area. Another variety PBW 502 had about 11 percent of the area.

Paddy

The study revealed that area under paddy per seed farm was 23.21 acres. The selected seed growers grew five varieties of paddy. The Pusa 44 was the most dominant variety with about 72 percent of the area. The varieties next in importance were PR 118, PR 113 and PR 114 occupying about 15, about 10 and about two percent of the paddy area respectively.

Position of selected non-seed crops on the sample seed farms

The crop wise detail for 2004–05 is as follows:

Wheat

The study brought out that per seed farm area under non-seed wheat crop was 11.13 acres. The PBW 343 variety alone had about 70 percent of the area while PBW 502, WH 542 and *Sahib* occupied about 18, 11 and two percent of the area respectively. The per farm production of non-seed wheat crop was 210.80 quintals and the yield was 18.94 quintals per acre.

Paddy

For non-seed paddy crop, the average area per seed farm was 21.41 acres. Pusa 44 alone occupied about 91 percent of the area followed by Basmati and Sharbati which occupied about six and three percent of area respectively. The per farm paddy production was about 597 quintals and yield 27.87 quintals per acre.

Table 2: Field Standards prescribed for certification of different crops in India

(Certified seed)

Crop	Isolation distance in meters	Remarks	Maximum permissible levels			
			Off type	Inseparable other crop plants	Objectionable weed plants	Plants affected by seed borne disease
Wheat	3	150 metre for 0.50 loose smut in wheat excess of 0.50	0.20	0.050 *	-	0.50
Paddy	3	-	0.20	-	0.020	-

Note: (i) * –Barley, oats, gram, and triticale
(ii) –Maximum permissible levels are given in percentages unless otherwise indicated.
Source: Central Seed Certification Board, Ministry of Agriculture, Government of India, New Delhi.

Table 3: Per farm area under different wheat and paddy seed crops with the sample growers, 2004–05

(Area in acres)

Seed crop	Area allotted	Area sown	%age of the area sown to area allotted	Area rejected due to				Total area rejected	Area approved
				Isolation	Disease affected	Harvesting before inspection	Area not up to minimum standard		
Wheat	19.71	19.32	98.00	0.03 (0.15)	0.23 (1.19)	-	0.15 (0.78)	0.41 (2.12)	18.91 (97.88)
Paddy	11.66	11.22	96.25	0.04 (0.36)	0.32 (2.85)	- -	0.14 (1.25)	0.50 (4.46)	10.72 (95.54)

Note: Figures in parentheses indicate percentages to area sown

Certification of the crops at field level

Seed certification aims at maintaining and making available to the farmers high quality seeds of notified varieties so as to ensure genetic identity and purity. Inspection of the standing seed crops is an essential step in verifying the conformity of seed crops to the prescribed certification standards. Field standards prescribed for certification of wheat and paddy seed crops is shown in Table 2. The main objectives of field inspection are (a) to verify seed origin (seed source) and identity of the variety; (b) to collect information on cropping history of the field, that is, to verify whether the seed field meets the prescribed land requirements; (c) to check crop and cultivation conditions; (d) to check isolation distance; (e) to check freedom from impurities viz., other crop plants and weed plants; (f) to check freedom from other cultivars and off-types; and (g) to check freedom from seed borne diseases. The field inspections were carried out by technical staff of the PSSCA in Punjab and the minimum number of field inspections was three each for wheat and paddy.

The crop wise area allocated, area rejected during field inspections and area approved of the selected seed growers is shown in Table 3.

Wheat

The area allotted by the PSSC per seed grower was 19.71 acres for wheat, out of which 98 percent was sown. The area sown was less than area allotted because the selected seed growers sold some quantity of the foundation seeds to their fellow farmers/relatives. During field inspection, the PSSCA approved 97.88 percent of the sown area. The area rejected was due to certain reasons like disease affected (1.19 percent); area not conforming to minimum standard (0.78 percent) and isolation distance (0.15 percent).

Paddy

The PSSC allocated 11.66 acres paddy area to each selected paddy seed grower. Out of this, about 96 percent area was sown. As was the case of wheat, the paddy seed was also sold by the selected seed growers to their fellow farmers and relatives. During field inspections, area approved by PSSCA was as much as 95.54 percent and the remaining area so rejected was due to disease affection (2.85 percent), area not up to minimum standards (1.25 percent) and isolation (0.36 percent).

Difference in yield of seed and non-seed crops

As already discussed, the selected seed growers were progressive large farmers and they had high yield for both seed as well as non-seed crops of wheat and paddy. The yield of seed and non seed crops with the selected seed growers is compared in Table 4.

Table 4: Yield differences of seed and non-seed crops with the selected seed growers, 2004–05

(Kgs/acre)

Crop	Seed crop	Non-seed crop	Excess yield of seed crop over non-seed crop	't' value
Wheat	1998	1894	104 (5.49)	2.34**
Paddy	2900	2787	113 (4.05)	1.39*

Note (i) Figures in parentheses indicate the percentage excess yield of seed crop vis-à-vis non-seed crop.

* Significant at 5 percent level of significance

** Significant at 10 percent level of significance

It was found that the yield of wheat and paddy seed crops was higher by 5.49 and 4.05 percent in comparison with the non-seed crops respectively. The differences in yield for both wheat and paddy crops were found to be statistically significant at 10 percent and 5 percent respectively.

Economics of seed vis-à-vis non-seed crops

A study of costs and returns of seed and non-seed crops of wheat and paddy are as under:

Wheat

The various components of operational cost of cultivation for grain and seed crop of wheat are given in Table 5. The data showed that the operational cost of wheat for grain and seed crop was about Rs 5111 and Rs 5996 per acre respectively.

On raising seed crop, the growers incurred additional operational cost on human labor, machine labor, foundation seed, fertilizers, manure, chemicals, irrigation, and rouging which worked out to be about Rs 726 per acre than on the grain crop. Similarly, the seed growers had to spend additional cost on registration/inspection (Rs 159.02) per acre. Thus, the total additional operational cost on seed crop raising was about Rs 885 per acre as compared to the grain crop.

Table 5: Economics of grain and seed crops of wheat with the selected seed growers, 2004–05

(Rs per acre)

Sr. No	Particulars	Operational cost of grain crop	%age to total cost	Operational cost of seed crop	%age to total cost
1	Human labour	1500.39	29.35	1530.61	25.53
2	Machine labour	920.11	18.00	1010.25	16.85
3	Seed	468.59	9.17	730.29	12.18
4	Fertilizers	1000.41	19.57	1199.58	20.01
5	Manure	166.67	3.27	175.51	2.93
6	Insecticides/ pesticides/ weedicides	600.30	11.74	635.32	10.59
7	Irrigation charges	299.88	5.87	303.88	5.07
8	Rouging*	–	–	69.74	1.16
9	Registration/ inspection fee	–	–	159.02	2.65
10	Interest on working capital @ 12.50% p.a. for three months	154.89	3.03	181.69	3.03
11	Total operational cost	5111.24	100.00	5995.89	100.00

*– includes grain loss during rouging

Among the various components of the operational cost, human labour occupied the maximum share for both grain production as well as seed production. The percent share of cost of seed for grain crop was much less than that for seed crop cultivation as foundation seed was costlier than normal seed used for grain crop production.

The economics for grain and seed crop of wheat is shown in Table 6. The gross returns for the grain and seed crops were about Rs 14063 and Rs 17080 per acre respectively. The gross returns from seed crop in case of processed and undersized seeds were Rs 12888.25 and Rs 2144 per acre respectively. The returns over operational cost were about Rs 8952 per acre for grain crop and Rs 11084 per acre for the seed crop.

Table 6: Returns over operational cost of grain and seed crops of wheat with the selected seed growers, 2004–05

Sr. No.	Particulars	Grain crop	Seed crop
1	Yield (Qtls/acre)	18.94	19.98
2	Processed seed (83.21 % of raw seed)	–	16.63
3	Undersized seed (16.79 % of raw seed)	–	3.35
4	Sale proceeds-processed seed (Rs/acre)(16.63 X Rs 775.00)	–	12888.25
5	Sale proceeds- undersized seed (Rs/acre)(3.35 X Rs 640.00)	–	2144.00
6	Sale proceeds- grain crop (Rs/acre) (18.94 X Rs 640.00)	12121.60	–
7	Value of by-product(Rs/acre)	1941.35	2047.95
8	Gross returns (Rs/ acre)	14062.95	17080.20
9	Operational cost (Rs/acre)	5111.24	5995.89
10	Returns over operational cost (Rs/acre)	8951.71	11084.31

Thus, the additional returns from the seed crop worked out of about Rs 2133 per acre. This was mainly because of high yield of seed crop (19.98 quintals per acre) in comparison to grain crop (18.94 quintals per acre). Moreover, the price of processed seed given by the PSSC was also high (Rs 775 per quintal) as compared to grain crop (Rs 640 per quintal). Also, the growers were also found to sell the undersized seed @ Rs 640 per quintal during the lean season.

The study revealed that the net as well as gross returns were higher for the seed crop as compared to the grain crop. Hence, seed growing for wheat came out as a remunerative enterprise for the seed growers during the year 2004–05. Earlier studies have also revealed that seed crops provided higher net return as compared to non-seed/ commercial crops (Sidhu et al., 1997; Radha and Chowdry, 2004; Radha and Chowdry, 2005; and Sharma and Kulshresthe, 2006).

Paddy

The operational cost involved in cultivation of grain and seed crops of paddy with the selected seed growers is shown in Table 7. The data showed that the operational cost for grain and seed crops was about Rs 6741 and Rs 7623 per acre respectively. The additional operational cost for the cultivation of seed crop was incurred on human and machine labor, foundation seed, pesticides, rouging, etc which worked out to be Rs 723.09 per acre. Similarly, for seed crop additional registration or inspection fee accounted for Rs 158.38. Hence, the total additional cost on raising one acre of paddy seed crop was Rs 881.47.

Table 7: Economics of grain and seed crops of paddy with the selected seed growers, 2004–05

(Rs per acre)

Sr.No	Particulars	Operational cost of grain crop	%age to total cost	Operational cost of seed crop	%age to total cost
1	Human labor	2204.64	32.70	2447.48	32.11
2	Machine labor	435.45	6.46	438.28	5.76
3	Seed	117.82	1.75	136.74	1.79
4	Fertilizers	1010.28	14.99	1125.28	14.76
5	Manure	20.23	0.30	20.69	0.28
6	Insecticides/pesticides/ weedicides	800.00	11.87	925.00	12.13
7	Irrigation charges	1948.41	28.90	2053.10	26.93
8	Rouging*	–	–	86.64	1.14
9	Registration/inspection fee	–	–	158.38	2.08
10	Interest on working capital @ 12.50% p.a. for three months	204.28	3.03	230.00	3.02
11	Total operational cost	6741.11	100.00	7622.58	100.00

*–includes grain loss during rouging

In case of paddy also, among the various components of operational cost, human labour accounted for the major share for both grain crop as well as seed crop cultivation. The percent share of operational cost involved for irrigation formed the next most important component of the operational cost as about 24 to 28 irrigations are required for paddy crop cultivation as compared to wheat crop cultivation where about four irrigations are sufficient for crop cultivation.

The economics of grain and seed crop of paddy is shown in Table 8. The gross returns for grain crop were about Rs 15713 per acre while whereas the returns from seed crop were Rs 19281 per acre. The returns over operational cost were about Rs 8972 and Rs 11659 per

Table 8: Returns over operational cost of grain and seed crops of paddy with the selected seed growers, 2004–05

Sr. No.	Particulars	Grain crop	Seed crop
1	Yield (Qtls/acre)	27.87	29.00
2	Drying losses (5 % of raw seed) (Rs/acre);(1.45 qtls X Rs 560.00)	–	812.00
3	Yield after drying (Qtls) (29.00 -1.45)	–	27.55
4	Processed seed (Qtls) (85.60 % of raw seed after drying)	–	23.58
5	Undersized seed (Qtls) (14.40 % of raw seed after drying)	–	3.97
6	Sale proceeds-processed seed (Rs/acre)(23.58 X Rs 728.00)	–	17166.24
7	Sale proceeds- undersized seed (Rs/acre)(3.97XRs 505.00)	–	2004.85
8	Sale proceeds- grain crop (Rs/acre)(27.87XRs 560.00)	15607.20	–
9	Value of by-product (Rs/acre)	106.10	110.00
10	Gross returns (Rs/ acre)	15713.30	19281.09
11	Operational cost (Rs/acre)	6741.11	7622.58
12	Returns over operational cost (Rs/acre)	8972.19	11658.51

acre for grain and seed crops respectively. The gross returns for seed crop from processed seed were about Rs 17166 per acre while that from undersized seed was about Rs 2005 per acre. Thus, the additional net returns for seed crop were Rs 2686 per acre. This was mainly because of high yield of seed crop (29 quintals per acre) as compared to grain crop (27.87 quintals per acre).

Further, the price of processed seed given by the PSSC was also high (Rs 728 per quintal) because of premium provided by the PSSC over the minimum support price (MSP) which was to Rs 560 per quintal for grain crop. Moreover, the growers also disposed the undersized seed @ Rs 505 per quintal during the lean season. Therefore, seed growing of paddy was a profitable enterprise for the contract paddy seed growers during 2004–05.

Procurement system of certified seeds

After harvesting and threshing of seeds crops, the selected seed growers delivered the seed to PSSC. The last date of procurement of seeds was communicated to the growers immediately after harvesting and threshing. The gunny bags were supplied to the growers by the PSSC. The detail regarding procurement system of certified seeds of wheat and paddy is as follows:

Wheat

The graded seed system for the procurement of wheat seed was followed. The following procurement procedure was followed.

The seed did not have moisture more than 12 percent. Raw seed was true to variety, free from weevil infestation and diseases, had good lustre and free from rain damage. Raw seed having cut and undersized grains in excess of 20 percent and inert matter more than 2 percent was not accepted.

i. Grading was carried out in the presence of PSSCA staff. The produce of each seed producer was stacked separately variety wise. Tentative date was communicated to the seed growers by post so that they may attend the grading process. An undertaking was taken from the seed growers that processing would be done at their risk and in case produce did not meet the prescribed standards or the PSSCA refused to tag it, the grower would lift it back within 15 days of issuing the letter failing which the PSSC reserved the right to auction it and to recover the amount given as advance payment, interest charges, store rent, etc. The loading and unloading charges of raw seed were bore by the seed growers.

ii. During the study period, an advance payment to the extent of 80 percent of the procurement price (Rs 640.00 per quintal) was made. Laboratory test of seeds procured was carried out and in case the seed was rejected in the test, it was returned to

Table 9: Per farm seed production and quantity of seed delivered to PSSC by sample growers, 2004–05

(qtls.)

Seed crop	Production	Quantity delivered	Quantity delivered as %age to production	Total number of seed growers	Number of seed growers delivering the seed	%age of seed growers delivering the seed
Wheat	457.61	378.41	82.69	49	35	71.43
Paddy	587.34	414.21	70.52	29	16	55.17

the seed grower after taking the advance payment and processing charges @ Rs 50 per quintal. The final payment was made to the seed grower whose seed was selected only after the receipt of satisfactory laboratory results. The ultimate price given for graded wheat seed was Rs 775.00 per quintal, i.e. Rs. 640.00 (support price) + Rs.135 per quintal as premium.

Paddy

The following procedure was followed for the procurement of seed from the growers:

i. Raw seed having more than 17 percent moisture content and 20 percent of undersized grains was not accepted.

ii. Raw seed was true to variety, free from fungus infestation, had good lustre and free from rain damage.

iii. An undertaking was taken from the seed growers that processing would be done at their risk and in case produce did not meet the prescribed standards or the PSSCA refused to tag it, the grower would lift it back within seven days of issuing the letter failing which the PSSC reserved the right to auction it and to recover the amount given as advance payment and processing charges Rs 50 per quintal. The loading and unloading charges of raw seed were bore by the seed growers.

iv. An advance payment to the extent of 80 percent of the procurement price (Rs 560.00 per quintal) was made. Laboratory test of seeds procured was carried out and in case the seed was rejected in the test, it was returned to the seed grower after taking the advance payment and processing charges @ Rs 50 per quintal. The final payment was made to the seed grower whose seed was selected only after the receipt of satisfactory laboratory results. A premium of 30 percent was given to the seed growers. The ultimate price given for graded seed was Rs 728 per quintal, that is, Rs.560 per quintal support price + 168 per quintal as premium.

Delivery of seed

The quantity of seed delivered to the PSSC by the selected seed growers during 2004–05 is shown in Table 9. The study indicated that about 71 percent of the selected seed growers delivered their wheat seed to the PSSC whereas this figure was about 55 percent for paddy seed. The quantity of wheat seed delivered was about 83 percent of its production. On the other hand, this figure was about 71 percent in case of paddy.

The growers reported various reasons for not delivering the seed to the agency. The major among them were risk of rejection of seeds by the authority, late payment, laboratory tests, cumbersome procedure and high transportation and labour cost involved in the process. Also the processing charges @ Rs 50 per quintal for both wheat and paddy were considered to be high especially in case of unsatisfactory test. Further, some growers preferred to sell seeds to the fellow farmer/relatives.

Disposal of undersized seed

Based on the grading system so followed by the PSSC, the seed meeting prescribed standards only was accepted by the PSSC. The data relating to the quantum of undersized seeds returned to the seed growers by the PSSC is shown in Table 10.

Table 10: Per farm undersized seed returned to the seed growers by PSSC, 2004–05

(qtls.)

Crop	Quantity delivered	Undersized seeds returned*	Undersized seeds as %age of quantity delivered
Wheat	378.41	64.72	17.10
Paddy	414.21	44.54	10.75

* Included inert matter also

It was found that about 17 and 11 percent of the undersized seeds of wheat and paddy respectively were returned to the growers by the PSSC. The study further brought out that about 91 percent of the undersized seed of wheat was sold as grain by the sample growers to millers/traders at prevailing market price. The undersized wheat was also used for making *dalia* by some millers. In case, the price offered was much low due to excessive inert matter in the undersized seeds, it was used up as cattle feed by the selected seed growers.

In case of paddy also, the maximum of the seed, that is, about 97 percent of the undersized seed was sold as grain to traders/ millers at prevailing market price and the rest containing much inert matter was used as cattle feed after processing of paddy.

Conclusion

The seed growers are generally large farmers in Punjab. The study showed that the average size of operational holding of the selected seed growers was 41.53 acres. The average area per seed farm under wheat and paddy was 23.66 acres and 23.21 acres respectively while per seed farm area under non-seed wheat and paddy crop was 11.13 acres and 21.41 acres respectively. The area allotted by the PSSC per seed grower was 19.71 acres for wheat, out of which 98 percent was sown. During field inspection, the PSSCA approved 97.88 percent of the sown area. For paddy, the area allocated per seed grower was 11.66 acres. Out of this, about 96 percent area was sown. During field inspections, 95.54 percent of the area was approved.

The gross returns for the grain and seed crops of wheat were about Rs 14063 and Rs 17080 per acre respectively. The returns over operational cost were about Rs 8952 per acre for grain crop and Rs 11084 per acre for the seed crop. Thus, the additional returns from the seed crop worked out of about Rs 2133 per acre. This was mainly because of high yield of seed crop (19.98 quintals per acre) in comparison to grain crop (18.94 quintals per acre).For paddy, the operational cost for grain and seed crops was about Rs 6741 and Rs 7623 per acre respectively. For paddy, gross returns for grain crop were about Rs 15713 per acre whereas the returns from seed crop were Rs 19281 per acre. The higher returns from seed crop were due to high yield (29 quintals per acre) as compared to yield of about 28 quintals for grain crop. The returns over operational cost were about Rs 8972 and Rs 11659 per acre for grain and seed crops of paddy respectively. Thus, the additional returns for seed crop were Rs 2686 per acre as compared to the grain crop.

The study indicated that about 71 percent of the selected seed growers delivered their wheat seed to the PSSC whereas this figure was about 55 percent for paddy seed. The quantity of wheat seed delivered was about 83 percent of its production. On the other hand, this figure was about 71 percent in case of paddy. Among the major reasons for not delivering the seed to the PSSC were risk of rejection of seeds, late payment, laboratory tests, cumbersome procedure and high transportation and labor cost involved in the process. Overall, the certified seed production of wheat and paddy was profitable to the seed growers of Punjab.

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"It's not knowing what to do, it's doing what you know."

— Tony Robbins

Feature

An Analytical Study of Cost-return Structure and Economic Surplus of Marginal and Small Farmers in Punjab

Mandeep Singh, A.S. Joshi, and A.S. Bhullar

The economic and ecological crisis of Punjab agriculture has resulted in consistent rise in cost of production and dwindling profit margins. This raised the concern of economic sustenance of marginal and small farmers. The present study was undertaken in three districts viz., Ropar, Ludhiana and Bathinda representing three different agro-climatic regions of the state to have an in-depth analysis of economics of farming on marginal and small farms. The study revealed that crop farming generated negative returns on both the categories of farms in all the zones, except small farms in Central Punjab. The returns over cost C_2 from crop production and dairy farming as a whole showed that marginal and small farmers were in deficit in Kandi and Southwestern regions while they were left with some surplus in central region after paying reward to the owned land and family labor. The study further highlighted that marginal farmers in all the zones and even small farmers in the Kandi zone are not economically viable depending only upon crops and dairy farming. Income from off-farm sources is the only factor, which helps them to be viable ones. The main conclusions of the study indicate that the off-farm income and dairy are the major resources, which can promote the viability of marginal and small farmers. Farmers will also have to rationalize their domestic expenditure by exploring more income-generating avenues.

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Introduction

Agriculture continues to hold the place of pride in our economy since time immemorial. In Punjab, out of 11.7 lakh operational holdings during 1990–91, 2.04 lakh holdings (18.3%) were of one to two hectare and 2.96 lakh holdings (26.5%) were of less than one hectare in size. The total holdings declined to 9.97 lakh in 2000–01. As such, the number of small holdings declined to 1.73 lakh (17.4%) and that of marginal holdings to 1.23 lakh (12.3%) respectively (GoP, 2005). The decline in proportion of small and marginal holdings may be due to the operation of reverse tenancy and the small and marginal land owner-farmers leasing out their land to other farm-size groups as the crop raising is becoming less remunerative and there is hardly any scope left for improving their incomes from tiny holdings (Kaur et al., 2001).

It was observed that growth in dairy incomes was more perceptible on marginal and small farms. The growth in income from dairy was 5.68 percent against 0.81 percent from crops on marginal farms and 4.70 percent against 1.67 percent respectively on small farms from 1987–90 to 2000–03 (Sidhu and Bhullar, 2004). It has also been conveyed that optimum combination of dairying along with the existing cereal based production system has the potential to enhance the income of the small farmers (Kaur, 2001). This indicated that there exists a scope to increase the income of small and marginal farmers by organizing their resources optimally. However, before going for policy formulation for the marginal and small farmers it will be desirable to have an analysis of the economics of farming on marginal and small farms. The present study has, thus, been planned with the following specific objectives:

1. To examine the costs and returns structure on crop production and dairy farming on marginal and small farms in Punjab;
2. To evaluate the economic surplus with marginal and small farmers in Punjab; and
3. To suggest some measures to improve the economic condition of marginal and small farmers in Punjab.

Material and Methods

The study was conducted in three districts of Punjab state i.e., Ropar, Ludhiana, and Bathinda representing Zone-I, Zone-II, and Zone-III respectively of the state. Three-stage-stratified-random sampling technique was adopted for the study. The three stages of selection were comprised of development block as the first stage-sampling unit, village as the second stage unit, and the operational holding as the third stage unit respectively. The farmers were categorized into marginal farmers having up to 2.5 acres of operational holding and small farmers having 2.5 to 5.0 acres of operational holding. As much as 120 marginal and an equal number of small farmers were selected for the present investigation. The personal interview method was adopted for the collection of data from the selected respondents on a well-structured pre-tested schedule. The data pertained to the year 2004–05. Tabular analysis was used to estimate the various costs and income levels.

COST CONCEPTS USED

Cost A_1 = All actual expenses in cash and kind incurred in production by the owner operator including interest on working capital.

Cost A_2 = Cost A_1 + rent paid for leased-in-land

Cost B_1 = Cost A_1+interest on value of owned fixed capital

Cost B_2 = Cost B_1+rental value of owned land+rent paid for leased-in-land

Cost C_1 = Cost B_1+Imputed value of family labor

Cost C_2 = Cost B_2+Imputed value of family labor

Results and Discussion

Costs and Returns Structure on Crop Production

Zone-I

A perusal of Table 1 shows that cost A_1 on marginal farms in zone-I came to be Rs 6207.11 per farm while the same was Rs 12472.82 per farm on small farms. The imputed value of family labor was of the order of Rs 3736.67 on marginal farms and Rs 7738.13 on small farms in zone-I which made the cost C_1 at Rs 10025.63 and cost C_2 at Rs 16928.63 on marginal farms while the same were Rs 20499.77 and Rs 36653.76 on small farms.

Gross income from crops came to be Rs 16493.54 on marginal and Rs 33958.06 on small farms in zone-I. If we took the returns over fixed and variable cost i.e., cost A_1, it came to be Rs 10286.43 and Rs 21485.24 on marginal and small farms respectively. The returns declined to Rs 6467.91 and Rs 13458.29 on marginal and small farms respectively in zone-I when imputed value of family labor was added to the cost. However, it turned to be negative over rental value of owned land. Thus, the crop farming on marginal and small farms in zone-I was not viable at cost C_2 level.

Zone-II

The analysis presented in Table 1 further indicates that cost A_1 was Rs 18164.98 on marginal farms and Rs 38718.97 on small farms in zone-II. It increased to Rs 18809.98 and Rs 41588.12 with the addition of interest on fixed capital, which further went up to Rs 21933.68 and Rs 47163.17 when imputed value of family labor was included in the cost. However, the rental value of land is significantly higher in zone-II, it pushed up the cost C_2 to the level of Rs 46742.86 on marginal farms and Rs 93668.52 on small farms in zone-II.

The gross returns from crop production in zone-II came to be Rs 46145.51 and Rs 94830.66 on marginal and small farms respectively. The expenditure made on fixed and working resources fetched Rs 27980.53 and Rs 56111.69 on respective categories of farms in zone-II while the inclusion of family labor in the cost of production resulted to decrease the returns to Rs 24211.83 on marginal and Rs 47667.49 on small farms. The returns turned to be negative on marginal farms with the rental value of owned land while it pushed down to only Rs 1162.14 on small farms in zone-II. Thus the crop production on marginal farms in zone-II was not viable at cost C_2 level.

Zone-III

The cost on fixed and working capital i.e., cost A_1 came to be Rs 15435.18 and Rs 33167.93 on marginal and small farms respectively in zone-III. It increased to Rs 20323.11 and Rs 44114.97 on respective categories of

Table 1: Costs and returns structure on crop production on marginal and small farms in different zones of Punjab

(Rs/farm/annum)

Particulars	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Items of expenditure						
Depreciation on fixed capital	81.85	288.82	645.00	2869.15	137.32	1645.94
Seed	699.03	1388.8	702.18	1436.94	1238.29	2492.19
Fertilizers and FYM	1283.86	3099.49	3050.68	6737.96	2263.97	4585.46
Plant protection measures	148.86	441.03	1733.89	3331.07	4932.97	9970.04
Irrigation charges	794.59	1766.87	2479.3	4377.36	905.72	1959.29
Hired human labor	594.57	1175.58	2403.72	5314.68	1215.66	2882.14
Tractor	2033.73	3269.48	5390.06	10789.33	3936.16	7916.32
Bullock	175.56	244.46	0.00	0.00	0.00	0.00
Combine harvester	0.00	0.00	667.28	1586.47	0.00	0.00
Miscellaneous	103.38	218.1	258.58	568.88	76.62	215.51
Interest on working capital	291.68	580.19	834.28	1707.13	728.47	1501.05
Cost A_1	6207.11	12472.82	18164.98	38718.97	15435.18	33167.93
Rent paid for leased-in-land	0.00	0.00	323.18	1145.35	0.00	0.00
Cost A_2	6207.11	12472.82	18488.16	39864.32	15435.18	33167.93
Interest on fixed capital	81.85	288.82	645.00	2869.15	137.32	1645.94
Cost B_1	6288.96	12761.64	18809.98	41588.12	15572.50	34813.87
Rental value of owned land and rent paid for leased-in-land	6903.00	16153.99	24089.18	46505.35	15738.00	30506.40
Cost B_2	13191.96	28915.63	43619.16	88093.47	31310.50	65320.27
Imputed value of family labor	3736.67	7738.13	3123.70	5575.05	4750.61	9301.10
Cost C_1 (Cost B_1 + Family labor)	10025.63	20499.77	21933.68	47163.17	20323.11	44114.97
Cost C_2 (Cost B_2 + Family labor)	16928.63	36653.76	46742.86	93668.52	36061.11	74621.37
Income						
Gross income	16493.54	33958.06	46145.51	94830.66	36024.60	74444.96
Returns over cost A_1	10286.43	21485.24	27980.53	56111.69	20589.42	41277.03
Returns over cost A_2	10286.43	21485.24	27657.35	54966.34	20589.42	41277.03
Returns over cost B_1	10204.58	21196.42	27335.53	53242.54	20452.10	39631.09
Returns over cost B_2	3301.58	5042.43	2526.35	6737.19	4714.10	9124.69
Returns over cost C_1	6467.91	13458.29	24211.83	47667.49	15701.49	30329.99
Returns over cost C_2	–435.09	–2695.70	–597.35	1162.14	–36.51	–176.41

farms with the addition of interest on fixed capital and imputed value of family labor to the cost of production. The rented value of owned land in zone-III was found to be quite high which pushed up the cost C_2 to the level of Rs 36061.11 on marginal farms and Rs 74621.37 on small farms.

The gross returns from crops came to be Rs 36024.60 and Rs 74444.96 on marginal and small farms respectively in zone-III. An average marginal farmer could fetch Rs 20589.42 on cost A_1 level while an average small farmer could receive Rs 41277.03 at cost A_1 level. With the add-up of interest on capital and

imputed value of family labor to the cost, the returns came down to Rs 15701.49 and Rs 30329.99 on marginal and small farms respectively in zone-III. The returns turned to be negative with the addition of rental value of owned land to the cost of production. Thus, the marginal and small farmers in zone-III could get nothing for owned land.

Zone-wise Comparison

The cost of crop production per farm was the lowest in zone-I and the highest in zone-II due to the low costing maize crop in zone-I and high costing paddy and cotton crops respectively in zone-II and zone-III. Another factor of higher cost of production in zone-II and zone-III was found to be higher rental value of owned land due to its higher productivity as compared to that in zone-I. The proportionate expenditure on fertilizers, irrigation, and tractor use was found to be highest in zone-II followed by zone-III whereas the expenditure on plant protection measures was turned out to be the highest in zone-III followed by zone-II. Moreover, the use of hired human labor was also quite high in zone-II and zone-III as compared to that in zone-I due to some labor intensive operations of paddy and cotton crops such as transplanting, harvesting, threshing, irrigation, picking, and uprooting of sticks.

The gross returns were also the highest in zone-II followed by zone-III and zone-I. It may be attributed to the yield and price variations of maize, paddy, and cotton crops in these zones. The farmers in zone-II were enjoying better returns over cost C_1 as compared to that in zone-III and zone-I. However, the marginal and small farmers in all the zones were non-beneficial at cost C_2 level, except small farmers in zone-II.

Costs and Returns Structure on Dairy Farming

The dairy activity is under taken by the marginal and small farmers as part of their survival strategy as it generate income and employment opportunities for them.

Table 2 presents the costs and returns structure on dairy farming on marginal and small farms in different zones of Punjab.

Zone-I

The cost on fixed as well as working resources came to be Rs 22902.18 and Rs 35722.46 on marginal and small farms respectively in zone-I. Of this, the highest cost of the order of Rs 7145.68 and Rs 11834.32 was incurred on green fodder while the lowest cost was incurred on hired human labor as marginal farmers did not hire any human labor for dairy purpose. Because dairy farming involves huge investments on animals, dairy buildings, machinery, utensils, etc., as compared to the crop production, that is why the interest on fixed capital was as high as Rs 3850.70 on marginal farms and Rs 6456.89 on small farms in zone-I. Including imputed value of family labor in the cost of dairy farming, total cost worked out to be Rs 34709.88 and Rs 51486.85 on marginal and small farms, respectively.

The gross income from dairy farming in zone-I was found to be Rs 29862.18 on marginal and Rs 45129.76 on small farms. If interest on fixed capital and family labor is not accounted for then the returns came to be Rs 6960.00 and Rs 9707.30 on marginal and small farms respectively while interest on fixed capital caused to go down the returns to the level of Rs 3109.30 and Rs 2950.41, on respective categories of farms in zone-I. With the addition of family labor use in the cost, the dairy farming turned to be non-viable as the returns became negative. This shows that marginal and small farms are earning from the dairy farming in zone-I at the cost of family labor i.e., family labor got no rewards from dairy farming in zone-I.

Zone-II

The cost on different purchased inputs including depreciation of fixed capital came to be Rs 44089.60 and Rs 48248.46 on marginal and small farms respectively in zone-II which ranged between as low as Rs 134.90 on hired human labor to as high as Rs 15777.49 on green fodder on marginal farms while the same ranged between Rs 175.64 on hired human labor to Rs 17038.20 on green fodder on small farms. By including the interest on fixed capital, it increased to the level of Rs 52588.90 and Rs 57999.44 on marginal and small farms respectively in zone-II. Family labor was intensively utilized in dairy farming which made an increase of Rs 8979.00 on marginal and Rs 10256.50 on small farms in the cost of dairy farming in zone-II. In this way, total cost i.e. cost C_1 worked out to be Rs 61567.90 and Rs 68255.94 on marginal and small farms respectively which resulted in getting gross returns from dairying of the order of Rs 63900 and Rs 70722 on the respective categories of farms in zone-II. At the level of cost A_1, the returns were found to be Rs 19810.40 and Rs 22473.54 on marginal and small farms respectively which declined to the level of Rs 11311.10 and Rs 12722.56 with the inclusion of interest on fixed

Table 2: Costs and returns structure on dairy farming on marginal and small farms in different zones of Punjab

(Rs/farm/annum)

Particulars	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Cost Items						
Depreciation on fixed capital	2695.49	4519.82	5949.51	6825.69	3491.64	4673.69
Green fodder	7145.68	11834.32	15777.49	17038.20	9138.87	14440.13
Dry fodder	4374.89	7934.66	8658.68	9402.55	5429.16	8082.85
Concentrates	6432.61	7560.46	9163.84	9930.77	6440.94	8257.76
Mineral mixture	92.86	201.48	463.40	582.69	205.13	366.17
Veterinary services	323.68	666.64	474.50	527.21	324.27	413.47
Hired human labor	0.00	168.48	134.90	175.64	0.00	102.78
Interest on working capital	1836.97	2836.60	3467.28	3765.71	2153.84	3166.32
Cost A_1	22902.18	35722.46	44089.60	48248.46	27183.85	39503.17
Interest on fixed capital	3850.70	6456.89	8499.30	9750.98	4988.06	6676.70
Cost B_1	26752.88	42179.35	52588.90	57999.44	32171.91	46179.87
Imputed value of family labor	7957.00	9307.50	8979.00	10256.50	6497.00	8760.00
Cost C_1	34709.88	51486.85	61567.90	68255.94	38668.91	54939.87
Income						
Gross income	29862.18	45129.76	63900.00	70722.00	38504.01	51839.26
Returns over cost A_1	6960.00	9407.30	19810.40	22473.54	11320.16	12336.09
Returns over cost B_1	3109.30	2950.41	11311.10	12722.56	6332.10	5659.39
Returns over cost C_1	–4847.70	–6357.09	2332.10	2466.06	–164.90	–3100.61

capital to the cost of dairy farming on respective categories of farms. When imputed value of family labor was added to the cost, the returns remained only to the tune of Rs 2332.10 on marginal and Rs 2466.06 on small farms in zone-II. Thus, dairy farming was found to be beneficial only at the cost of family labor in zone-II.

Zone-III

In zone-III, the cost of fixed capital and purchased inputs i.e. cost A_1 came to be Rs 27183.85 and Rs 39503.17 on marginal and small farms respectively, which ranged between Rs Nil on hired human labor followed by Rs 205.13 on mineral mixture to Rs 9138.87 on green fodder followed by Rs 6440.94 on concentrates on marginal farms. On small farms, it ranged between Rs 102.78 on hired human labor followed by Rs 366.17 on mineral mixture to Rs 14440.13 on green fodder followed by Rs 8257.76 on concentrates. The interest on fixed capital was of the order of Rs 4988.06 and Rs 6676.70 on marginal and small farms respectively while the imputed value of family labor was computed to be Rs 6497.00 and Rs 8760.00 on respective categories of farms in zone-III. In this way, total cost including owned and fixed resources came to be Rs 38668.91 on marginal and Rs 54939.87 on small farms. This much cost fetched the gross returns of Rs 38504.01 and Rs 51839.26 from dairy farming on marginal and small farms respectively in zone-III.

The returns over cost A_1 were recorded to be of the order of Rs 11320.16 on marginal and Rs 12336.09 on small farms which came down to the level of Rs 6332.10 and Rs 5659.39 with the subtraction of interest on fixed capital from returns on respective categories of farms. It further turned to be negative at cost C_1 level, indicating no reward to the family labor. Thus, dairy farming in zone-III was practiced at the cost of family labor.

Zone-wise Comparison

It is highlighted by the analysis that on dairy farming hired human labor was used to the lowest extent, even no use of hired human labor was recorded on marginal farms in zone-I and zone-II. Fixed resources were found to be the highest in zone-II and the lowest in zone-I. Concentrates and mineral mixture were also used highest in zone-II. All this resulted in the highest cost of dairy farming at each level i.e. cost A_1, cost B_1 and cost C_1 in zone-II followed by zone-III and zone-I.

Though the herd size also played its role, yet the higher level of milk yield in zone-II led to fetch the highest gross returns in same zone followed by zone-III and zone-I. It is miserable to note that dairy farming is running in the state at the cost of family labor i.e., family labor could not get its due share in the income from dairying. This was very much glaring in zone-I and zone-III where returns over cost C_1 turned to be negative.

Costs and Returns from Crops and Dairy Farming as a Whole

Table 3 shows that in terms of gross returns from crops and dairy the marginal and small farmers in zone-II were relatively better placed as compared to the farmers in zone-I and zone-III. The gross returns from crop production and dairy farming came to be Rs 46355.72 and Rs 79087.82 in zone-I, Rs 110045.51 and Rs 165552.66 in zone-II and Rs 74528.61 and Rs 126284.22 in zone-III on marginal and small farms respectively. In this way, in zone-II, on marginal farms the gross returns were found to be higher by about 1.48 and 2.37 times as compared to that in zone-III and zone-I respectively. Similarly, on small farms in zone-II, the corresponding returns were higher by about 1.37 and 2.09 times as compared to those in zone-III and zone-I respectively. After taking into consideration the various costs involved in the production activities such as all paid-out costs, rent paid for leased-in land, interest on fixed assets, imputed rented value of owned land and imputed value of family labor, the total cost i.e., cost C_2-came to be the order of Rs 51638.51 and Rs 88140.61 in zone-I, Rs 108310.76 and Rs 161924.46 in zone-II and Rs 74730.02 and Rs 129561.24 in zone-III on marginal and small farms respectively. It was observed that the expenditure at each level i.e. cost A_1, cost A_2, cost B_1, cost B_2, cost C_1, and cost C_2 was found to be relatively more in zone-II followed by zone-III and zone-I respectively. As far as returns over respective costs are concerned, these were found to be

Table 3: Costs and returns structure on crops and dairy farming on marginal and small farms in different zones of Punjab

(Rs/farm/annum)

Particulars	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Cost Items						
Cost A_1	29109.29	48195.28	62254.58	86967.43	42619.03	72671.10
Cost A_2	29109.29	48195.28	62577.76	88112.78	42619.03	72671.10
Cost B_1	33041.84	54940.99	71398.88	99587.56	47744.41	80993.74
Cost B_2	39944.84	71094.98	96208.06	146092.91	63482.41	111500.14
Cost C_1	44735.51	71986.62	83501.58	115419.11	58992.02	99054.84
Cost C_2	51638.51	88140.61	108310.76	161924.46	74730.02	129561.24
Gross returns	46355.72	79087.82	110045.51	165552.66	74528.61	126284.22
Returns over Cost A_1	17246.43	30892.54	47790.93	78585.23	31909.58	53613.12
Returns over cost A_2	17246.43	30892.54	47467.75	77439.88	31909.58	53613.12
Returns over cost B_1	13313.88	24146.83	38646.63	65965.10	26784.20	45290.48
Returns over cost B_2	6410.88	7992.84	13837.45	19459.75	11046.20	14784.08
Returns over cost C_1	1620.21	7101.20	26543.93	50133.55	15536.59	27229.38
Returns over cost C_2	–5282.79	–9052.79	1734.75	3628.20	–201.41	–3277.02

positive on both the categories of farms in all the zones up to cost C_1. The returns over cost C_1 were found to be the minimum of Rs 1620.21 per annum on marginal farms in zone-I corresponding to the maximum of Rs 50133.55 per annum on small farms in zone-II. The returns over cost C_2 showed that the marginal and small farmers were in deficit in zone-I and zone-III while they were left some surplus in zone-II after paying reward to the owned land and family labor. Thus, it clearly emerged that generally, the marginal and small farmers are not in a position to meet the crop and dairy expenditure out of the corresponding income from these enterprises.

Gross Farm Family Income

The gross farm family income from different farm and non-farm sources in different zones of Punjab is shown in Table 4. The gross farm family income from all the sources was worked out to be the highest of the order of Rs 126780 on marginal and Rs 186241 on small farms in zone-II followed by Rs 92485 and Rs 136980 in zone-III and Rs 72908 and Rs 106149 in zone-I on marginal and small farms respectively. In this way, it was observed that the gross farm family income on marginal farms in zone-II was 1.37 and 1.74 times the income of marginal farmers in zone-III and zone-I respectively while the gross farm family income on small farms in zone-II also depicted almost the similar trend.

The analysis further revealed that the share of dairying in gross farm income was the highest on marginal farms in all the zones i.e., 50.40, 41.63, and 40.96 percent in zone-II, III, and I respectively while the share of crop production came to be the highest on small farms in zone-III (54.35%) and zone-II (50.92%). In zone-I, again the share of dairying on small farms was found to be the highest of the order of 42.52 percent. This showed that in zone-I, in general and on marginal farms in all the zones, dairy occupied the most significant place in generating farm family income.

The gross farm income from crops and dairying of marginal farmers in zone-II was Rs 110046, which was 47.66 percent and 137.39 percent higher than that of marginal farmers in zone-III and zone-I respectively. Similarly, the gross farm income of small farmers in zone-II was estimated to be Rs 165553, which came to be 31.09 percent and 109.32 percent higher than that of small farmers in zone-III and zone-I respectively. This may be attributed to the higher value productivity of different crops and dairying in zone II as compared to zone-III and zone-I.

However, the income from off-farm sources, such as service, pension, sale, remittances, hiring out of machinery and labor services, etc. was the highest in zone-I which comprised 36.42 and 25.49 percent of the gross farm family income on marginal and small farms respectively while the same was 13.20 and 11.11 percent in zone-II and 19.42 and only 7.81 percent in zone-III. The higher level of off-farm income in zone-I may be due to the remittances and services.

Table 4 : Gross farm family income from different sources of marginal and small farmers in different zones of Punjab

(Rs/farm family /annum)

Sources of Income	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Crops	16493.00 (22.62)	33959.00 (31.99)	46146.00 (36.40)	94830.00 (50.92)	36024.00 (38.95)	74445.00 (54.35)
Dairy	29863.00 (40.96)	45130.00 (42.52)	63900.00 (50.40)	70723.00 (37.97)	38505.00 (41.63)	51839.00 (37.84)
Gross farm income	46356.00 (63.58)	79089.00 (74.51)	110046.00 (86.80)	165553.00 (88.89)	74529.00 (80.58)	126284.00 (92.19)
Off-farm income	26552.00 (36.42)	27060.00 (25.49)	16734.00 (13.20)	20688.00 (11.11)	17956.00 (19.42)	10696.00 (7.81)
Gross farm family income	72908.00 (100.00)	106149.00 (100.00)	126780.00 (100.00)	186241.00 (100.00)	92485.00 (100.00)	136980.00 (100.00)

Note: Figures in parentheses indicate percentage to gross farm family income

Table 5: Disposable income from crops, dairying, and off-farm activities of marginal and small farmers in different zones of Punjab

(Rs/farm family/annum)

Sources of Income	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Farm business income from crops	10286.43 (23.49)	21485.24 (37.07)	27980.53 (43.36)	56111.69 (56.53)	20589.42 (41.29)	41277.03 (64.19)
Farm business income from dairy	6960.00 (15.89)	9407.30 (16.24)	19810.40 (30.71)	22473.54 (22.65)	11320.16 (22.70)	12336.09 (19.18)
Total farm business income	17246.43 (39.38)	30892.54 (53.31)	47790.93 (74.07)	78585.23 (79.18)	31909.58 (63.99)	53613.12 (83.37)
Off-farm income	26552.00 (60.62)	27060.00 (46.69)	16734.00 (25.93)	20688.00 (20.82)	17956.00 (36.01)	10696.00 (16.63)
Total disposable income	43798.43 (100.00)	57952.54 (100.00)	64524.93 (100.00)	99253.23 (100.00)	49865.58 (100.00)	64309.12 (100.00)

Note: Figures in parentheses indicate percentage to total disposable income

Disposable Income

Farmers secure a net income from crops and dairy farming after making fixed and operational expenditure on these enterprises, which is termed as farm business income. Besides these sources of income, they have some earnings from off-farm activities. The total of these three sources of income left with the farmers a disposable income with which they have to manage their household requirements. Table 5 put forth such information on marginal and small farmers of different zones in Punjab during 2003–04. It can be seen from the table that the total disposable income was higher on small farms as compared to the marginal ones in all the zones, obviously due to the variation in farm size.

However, it was found to be the highest in zone-II i.e. to the tune of Rs 64524.93 on marginal farms and Rs 99253.33 on small farms. This zone was followed by zone-III where the marginal and small farmers were recorded to have a disposable income amounting to Rs 49865.58 and Rs 64309.12 respectively. The farmers in zone-I had the lowest level of disposable income to the tune of Rs 43798.43 on marginal and Rs 57952.54 on small farms.

In zone-I, the marginal farmers earned the highest proportion of the total disposable income of the order of 60.62 percent from off-farm activities followed by crops (23.49%) and dairy (15.89%). Similar was the trend in case of small farmers in the same zone. In zone-II, the maximum contribution towards disposable income on marginal and small farms was made by crops followed by dairy and off-farm sources. However, in zone-III, after crops, off-farm activities contributed maximum to the total disposable income on marginal farms whereas it was crops followed by dairy and off-farm sources on small farms in zone-III.

The proportionate share of different sources of income on marginal farms ranged between 15.89 percent from dairy in zone-I to 60.62 percent from off-farm income in the same zone while the same on small farms ranged from 16.24 percent from dairy in zone-I to 64.19 percent from crops in zone-III.

Economic Surplus

The economic surplus was calculated by deducting the domestic expenditure from the disposable income of the farm family. A perusal of table 6 indicated that on the basis of the disposable income from crops and dairy, the marginal farmers could not meet their household requirements. They were experiencing deficit in this manner of the order of Rs 24770.80 in zone-I and Rs 12560.07 in zone-III while they were on the bank of survival in zone-II with a meager surplus of Rs 459.75 per annum. It is the adversity of the situation that even the small farmers in zone-I are living under deficit economic surplus from agriculture to the tune of Rs 22042.42. However, the small farmers in zone-II and

Table 6: Economic surplus from crops and dairying and overall economic surplus by including off-farm income of marginal and small farmers in different zones of Punjab

(Rs/farm/annum)

Particulars	ZONE-I		ZONE-II		ZONE-III	
	Marginal	Small	Marginal	Small	Marginal	Small
Farm business income from crops and dairy	17246.43	30892.54	47790.93	78585.23	31909.58	53613.12
Total domestic expenditure	42017.23	52934.96	47331.18	58665.24	44469.65	47300.46
Economic surplus from crops and dairy over total domestic expenditure	–24770.80	–22042.42	459.75	19919.99	–12560.07	6312.66
Off-farm income	26552.00	27060.00	16734.00	20688.00	17956.00	10696.00
Overall economic surplus	1781.20	5017.58	17193.75	40607.99	5395.93	17008.66

zone-III were seem to be enjoying with a economic surplus of Rs 19919.99 and Rs 6312.66 respectively.

After counting for the off-farm income, an average marginal farmer in zone-I and zone-III became viable with Rs 1781.20 and Rs 5395.93 respectively as economic surplus after meeting the domestic expenditure. The economic surplus of an average marginal farmer in zone II increased to Rs 17193.75. Similarly, the off-farm earnings helped the small farmers in zone-I to sustain with an economic surplus of Rs 5017.58.

Thus, it can be concluded that marginal farmers in all the zones and even the small farmers in zone-I are not economically viable depending only upon crops and dairying. Income from off-farm activities is the only factor, which helps them to be viable farmers.

Conclusions/Policy Implications

1. The contribution of dairying to total farm business income showed increasing trends over the years on smaller farms than that on larger ones (Sidhu and Bhullar, 2004). In the present study the proportionate share of dairying in farm business income was 40.36 percent and 30.45 percent on marginal and small farms respectively in zone I, 41.45 percent and 28.60 percent on the respective categories in zone II and 35.48 percent and 23.01 percent on marginal and small farms respectively in zone III. This highlighted that a considerable proportion ranging between 23 to 41 percent of farm business income on marginal and small farms was constituted by the dairy enterprise. Therefore, it can be concluded that dairy farming has a good potential to improve the health of economic surplus. It should be further expanded to raise the level of economic surplus with the marginal and small farmers.
2. Off-farm income has played a significant role toward economic viability of marginal and small farmers. In future also opportunities of earnings from off-farm sources can certainly play an important role in helping the marginal and small farmers to be viable ones.
3. Domestic expenditure exceeds the disposable income turning the economic surplus to be negative on marginal and small farms. Therefore, in order to meet the domestic expenditure in a rational manner, more income-earning opportunities be explored particularly dairying and off-farm activities.
4. In order to enhance the level of returns from crops and dairy farming, the technical efficiency of these enterprises should be improved.

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"Indecision and delays are the parents of failure."

- George Canning

Book Review

Pay Determination of Government Employees: Case Studies of Kerala & A Few Indications in the Central Government and Southern States by Dr. Sabu Thomas.

Directorate of Public Relations and Publications, Cochin University of Science and Technology, Kochi, Kerala - 682 022, Pages 126, Price. Rs. 295

When wages and salaries are revised, employees eagerly wait and anticipate a quantum job in their salaries which is expected to influence consumption and savings. In the case of government employees there are many factors which influence pay revision, which could be considered as the factors that influence directly and indirectly and certain other factors that need attention but are not considered several times. The influence of the association the employees cannot be sidelined while revising the pay and allowances.

In this context the book titled "Pay Determination of Government Employees" needs close attention for providing valuable insights to the recommendations of the Pay Commissions in the country. Governments have full control over pay fixation of its employees which influence the wage determination of private and public sector employees. Employees associations can influence recommendations of pay commission. Each state has its own rules and methods of fixing pay packages. In South India, Tamil Nadu follows central pattern while other states follow different pattern. In this book the author studies salary fixation of state government employees of Kerala in comparison with the recommendations of Central Pay Commission. The pay fixation of other south Indian states is also discussed in the book. The associations of government employee's influence pay revision through their political affiliation. This necessitates study of role and influence of associations in the determination of salaries. In the introductory section the author gives a brief account of pay revisions made by the Central Government.

Theoretical discussion of principles and various approaches of Pay determination are discussed in the Second Chapter. The pay determination of government employees are not on the basis of any theories, the bargaining power of unions are also very little, hence usefulness of the theoretical discussion is not seen in the analysis. It is noted that the important factors that influence pay determination of government employees are pressure from the associations, sympathetic attitude of government, implications of pay revisions at the centre and the negative impact of pay revisions on state finance. The public unions do not have any direct role in wage negotiations; they can help to argue for better welfare packages. The increase in minimum and maximum ratio to 1:12, running Pay Bands (PB) and Grade pay are some of the new concepts used in the Sixth Central Pay Commission Report. For determining pay bands the rate adopted is not identical for all scales. The approach of Sixth Pay Commission deviates from the existing pay scales simply by implementing pay band system and grade pay to employees is not appropriated in the book. It is noted that if pay bands are implemented to avoid stagnation in the individual scales, why other better options were not resorted to solve this issue. It is argued that the approach of the commission may be without proper studies on socio-economic impact after the pay is implemented. The changes in increment date for all employees eliminate discrimination of opportunity among working class. In the case of Public Sector Enterprises, full autonomy is given to industries for wage negotiations subject to certain conditions. The same method is followed in the case of public sector banks.

The brief discussion of various recommendations of Pay Revision Commissions in Kerala is included in this Chapter. The Pay Revision Committee of (1958) recommended Rs.30/- as the minimum pay and the highest Rs.1300/-. Whereas the Eighth Pay Commission (2006)

has reduced the number of existing pay scales from 27 to 24 by merging six identical scales. All categories have benefited more in the Pay revision of 2006. The increase in pay was from Rs.350/- to Rs. 3990/-. It is argued that the important factors such as demand and supply of labour, special characteristics of the economy need to conduct job evaluation, and method of fixing minimum and maximum pay, etc. were not properly considered and due to this leads and lags are built in the system.

Third Chapter discusses the influence of Service Associations in determining pay of government employees in Kerala. Its influence on pay commission in determination of pay is evident from increasing politicisation of unions and government had to appoint more pay commissions when compared many other states. The Kerala State employees also got improved real wages and other service benefits than other state government employees. Hence, it is stated that the expenditure on salaries and allowances of government employees are increasing with the increase in the number of pay commissions. Service associations influence setting up of pay commissions, however, quantitative measurement of impact is difficult. In this study an attempt is made to measure trade unions impact on the basis of the change in the minimum basic pay of each scale and is found to 6.44 for the State and 6.53 for the Centre. The average salaries in the minimum scale are 63.17 in the case of the State and 225.30 in the case of Centre in the pay revision of 1992 and 1996 respectively. The author has noted that in some revisions the government revised the basic pay recommended by the Pay Commission of all or some categories on account of the pressure from service associations. In 2006 the net impact of Pay Commission in the basic pay percentage growth compared to 1988 pay revision is Rs.50/- to Rs.732/- and the percentage growth of pay ranges from 1.3 to 123. The author argues that though there is no direct influence of service unions, the net increase in salary could lead us to the conclusion that pressure of unions both direct and indirect has also influenced the present pay revision to provide better benefit to employees than the previous pay revisions.

The study further analyses pay revision of central government employees and state government employees of South Indian states. Here, the author makes an attempt to explain the position of the unions and the stand of governments after submission of pay revision reports to the central government and four south Indian states. The analysis of different pay scales existing for central government employees and the revised pay bands recommended by the Pay commission shows changes in the ratio as well as average pay increase. A similar attempt is made for four south Indian states. In many cases it is noted that some changes in pay scale has occurred on account of the representations of the employees associations in all states. This may be either due to the influence of trade unions or for rectifying anomalies. However, these modifications which come in the form of revised government orders need not be considered as a conclusive proof for the influence of employees unions. An interstate comparison could have been attempted in this chapter which would have been more meaningful.

The last chapter is on the implications of recommendations of pay commission on state income. An increase in State Domestic Income is not a sufficient indicator for the growth of per capita income of the State. On the basis of the demand from unions, the growth of per capita national income has also been considered for pay revisions. It is noted that, fiscal crises is more severe and more pronounced in Kerala than in other states. Therefore a modest attempt is also made to examine the relationship between state income and pay and allowances of government employees. It is argued that pay revisions are a drag on the state government and it compelled to provide more financial benefits to the employees due to some influence of unions during and after revision of pay of government employees in Kerala. The author also suggests that the government should consider the possibility of conducting job evaluation whenever pay and allowances are revised.

The study is an attempt to evaluate the implications of award of different Pay commissions in the state and the influence of government employees associations. Even though it is very difficult to measure its impact, it is evident that most of the associations under the patronage of political parties could influence pay determination. The ruling front's sponsored association could influence commissions for better reward. To identify and highlight its impact more qualitative approaches could have been considered so that the analysis will support the quantitative measurement. On the whole the book is written for general

understanding so that anyone who is interested in the implementation of recommendations of pay commission and its implications can understand various aspects of recommendations of pay commissions. This book will be a valuable addition to an area of research, where literature is scanty.

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The path to success is to take massive, determined action."

— Tony Robbins

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