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Contents

Focus

Small to Medium Enterprises (SMEs)—Lifeline of Indian Economy

S.V. Deshmukh and R.R. Lakhe

The present review presents the state-of-art of certain aspects of the Small to Medium Enterprises (SME) of India highlighting the role of state government policies towards promotion of this sector. The results show great spatial variation in the SMEs across various states and reveal a geographically-concentrated increase of the SME units. Uttar Pradesh shows maximum number of SMEs, while Tamilnadu shows highest growth rate in the new SMEs set-up. This high growth may be attributed to the incentives offered by the respective government. However, some states (Tamilnadu and Uttar Pradesh) show a corresponding high rate of closure of SMEs thus indicating a need to alter the SME-promotional policy to ensure a sustainable development of the sector.

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Today, SMEs are the lifeline of booming economies, with India being no exception. The data published by the Government of India (GoI) shows that presently, 12.84 million SMEs are operational in India with majority of them being un-registered entities. The Indian government in accordance with the provision of Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 has classified the Micro, Small and Medium Enterprises (MSME) in two classes: (i) manufacturing enterprises which are the enterprises engaged in the manufacture or production of goods pertaining to any industry specified in the first schedule to the industries (Development and Regulation) Act, 1951 and (ii) service enterprises which are the enterprises engaged in providing or rendering of services. These enterprises are further classified in terms of the investment in plant and machinery and equipments, respectively (Table 1). In the year 2007, there were about 12.84 million SMEs in India (MSSI, 2007), which gave employment to 31.25 million people. The performance of SMEs shows a positive growth year on year (Figure 1). In view of the SME's high growth potential in terms of output, employment, and exports, the role of the Ministry of Small Scale Industries (MSSI) along with various state governments has devised numerous policies (SIDBI, 2000). This has been done to strengthen this sector thereby enabling it to remain competitive in market-led economy and to generate additional employment. This sector has performed exceedingly well and enabled India to achieve a wide measure of industrial growth and diversification. By its less capital intensive and high labor absorption nature, the SME sector has made significant contributions to employment generation and rural industrialization. This sector is ideally suited to build on the strengths of traditional skills and knowledge, by infusion of technologies, capital, and innovative marketing practices. Furthermore, the sustainable development of this sector demands use

of novel measures to improve the quality of services, manufactured goods, and reduction of waste (Lim et al., 1999), while the other aspect involves strategies revolving around human resource (Pande et al., 2000). It may be said that the growth potential in the SME sector looks very promising, given some safeguards and tools for sustainable development. This expectation is based on an essential feature of the Indian industry and demand structures. The diversity in production systems and demand structures will ensure long term co-existence of many layers of demand for consumer products/ technologies/processes. There will be flourishing and well-grounded markets for the same product/process, differentiated by quality, value added, and sophistication. This characteristic of the Indian economy will allow complementary existence for diverse types of units.

Table 1: Classification of Enterprises

Manufacturing sector	
Enterprises	**Investment in plant & machinery**
Micro enterprises	Does not exceed 25 lakh INR
Small enterprises	> 25 lakh < 5 crore INR
Medium enterprises	> 5 crore < 10 crore INR
Service sector	
Enterprises	**Investment in equipments**
Micro enterprises	< 10 lakh INR
Small enterprises	> 10 lakh < 2 crore INR
Medium enterprises	> 2 crore < 5 crore INR

The promotional and protective policies of the government have ensured the presence of this sector in an amazing range of products, particularly in consumer goods. However, the concern of the sector has been inadequacies in capital, technology, and marketing. The process of liberalization coupled with government support will therefore attract the infusion of just these issues in the sector. Having stated the government's positive role in this sector, it may be imperative that the sustainable development of the sector still remains under the threat from global competition, especially from less developed countries, where labor is very cheap. To counter these threats, different measures are needed to ensure the quality of product/services, which guarantees sustainable growth. In view of this, a detailed analysis of published material has been carried out to understand the complexity of the sector.

Materials and Methods

In the present study, all published material, such as government reports and information available on the Internet as well as magazines, was used to study the state-of-art of the Indian SMEs. The study focuses on the promotional policies of various state governments to support as well as promote the SMEs. The results pertaining to the state-of-art of the sector are analyzed as a function currently practiced as government policies. The collected data was analyzed following statistical tools to gain further insights. The data collection was done for:

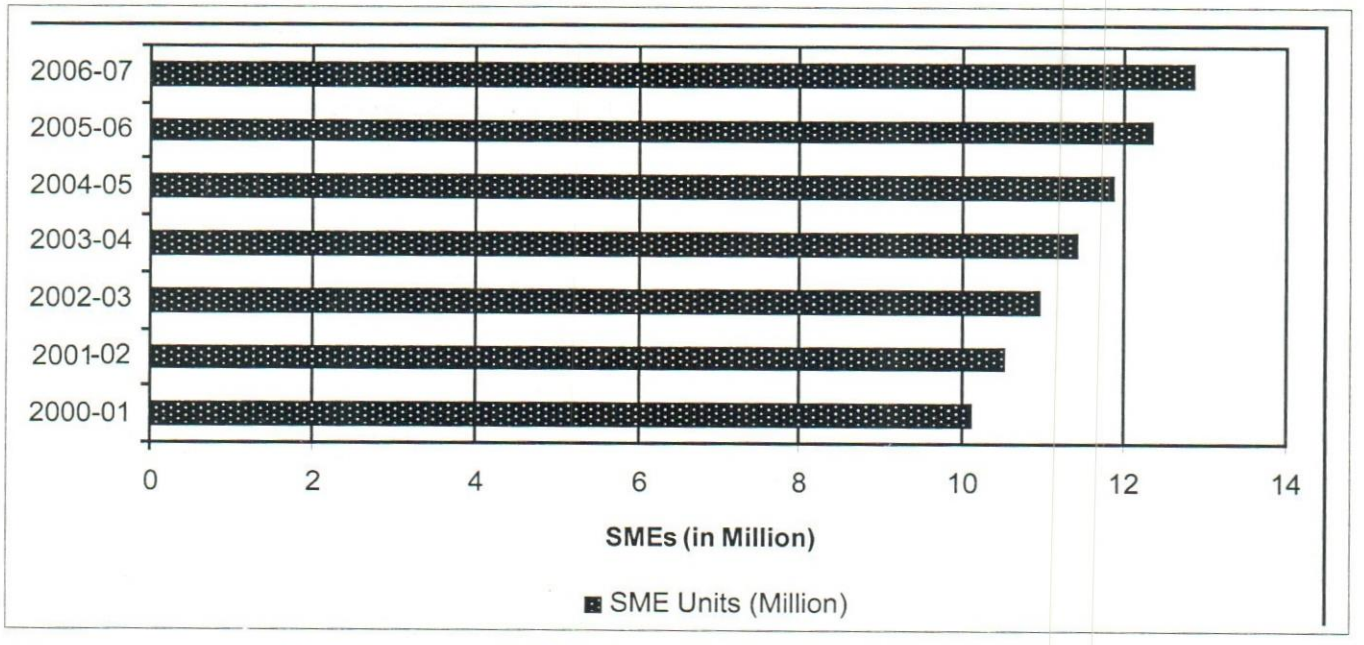

Fig. 1. Performance of SMEs in Terms of the Number of Units Set Up after 2000

1. status of SMEs in top 10 states of India in terms of number of SMEs (geographic distribution),
2. performance of the sector with respect to production ability and employment generation,
3. SMEs set up in different states (growth rate), and
4. role of incentives offered by states in the growth of the SME sector.

Results and Discussion

The performance of the SME sector in India can be understood from economic indicators such as:

Production

The SME sector plays a vital role in the economic growth of India by contributing almost 40% of the gross industrial value added each year. It has been estimated that investment in fixed assets in the SME sector produces 4.62 million worth of goods or services with an approximate value addition of 10 percentage points. The small-scale sector has grown rapidly over the years and the growth rates during various plan periods have been very impressive. The number of small-scale units has increased from an estimated 0.87 million units in the year 1980–81 to over 12.84 million units in the year 2006–07. When the performance of this sector is viewed against the growth in manufacturing and industry sector as a whole, it instills confidence in the resilience of the SME sector.

Employment

The SME sector in India creates largest employment opportunities for the Indian populace, next only to agriculture (Figure 2). It has been estimated that an investment of Rs 0.1 million in fixed assets in the small-scale sector generates employment for four persons. The food products industry has ranked first in generating employment, providing employment to 0.48 million persons (13.1%). The next two industry groups are non-metallic mineral products with employment of 0.45 million persons (12.2%) and metal products with 0.37 million persons (10.2%). Per unit employment is highest (20) in units engaged in beverages, tobacco, and tobacco products mainly due to the high employment potential of this industry, particularly in Maharashtra, Andhra Pradesh, Rajasthan, Assam, and Tamilnadu.

Evolution and Development of SME Policy

Since independence, government policies have been inclined towards protecting the interests of the SME sector and facilitating its rapid development. The government, in pursuance of its policies, initiated various support measures from time to time which include:

- Policy of reservation
- Revision of investment ceilings
- Modernization
- Technological upgradation

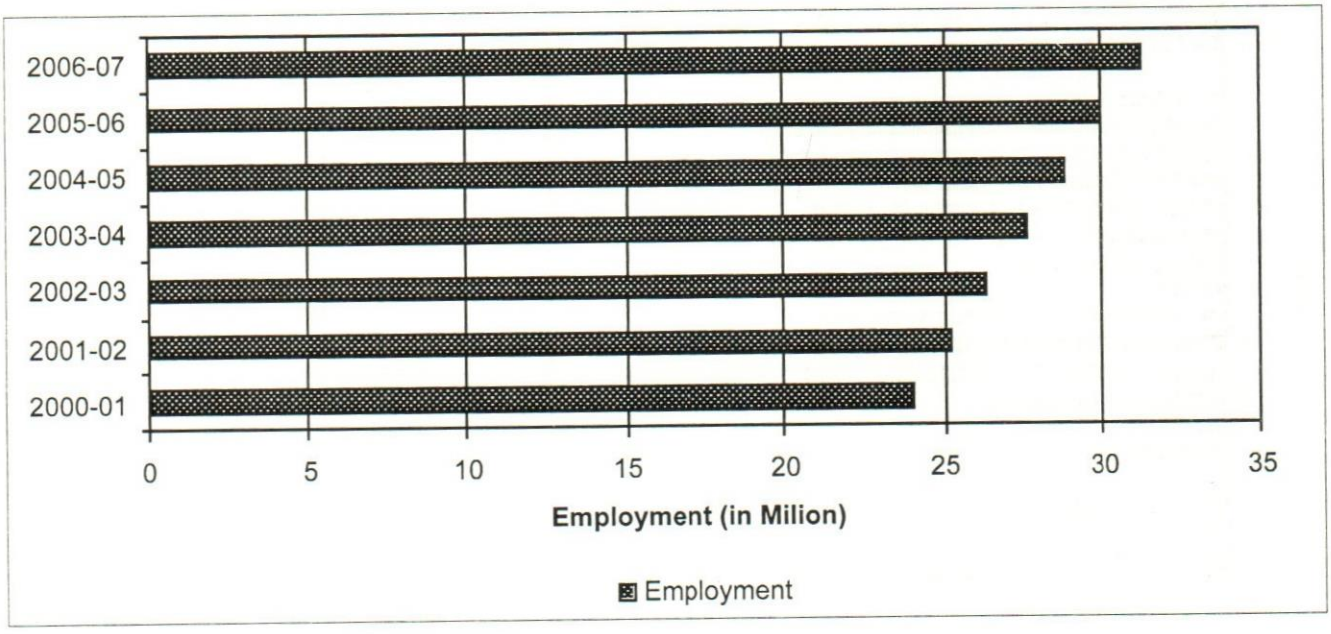

Fig. 2. Performance of SMEs in Terms of Employment Generation since the Year 2000

- Marketing assistance
- Fiscal incentives, etc.

In order to protect, support, and promote small enterprises, as also to help them become self-supporting, a number of protective and promotional measures have been undertaken by the government. Some such measures are:

- Promotional measures cover
- Industrial extension services
- Institutional support in respect of credit facilities
- Provision of developed sites for construction of sheds
- Provision of training facilities
- Supply of machinery on hire–purchase terms
- Assistance for domestic marketing as well as exports
- Special incentive for setting up enterprises in backward areas, etc.
- Technical consultancy and financial assistance for technological upgradation

While most institutional support services and some incentives are provided by the central government, others are offered by the state governments in varying degrees to attract investments and promote small industries with a view to enhance industrial production and generate employment in their respective states.

Set up of SMEs

The set up of SMEs is primarily governed by the economy of different states; availability of capital, energy (power), and skilled workforce are some of the aspects. Besides these, goods transportation and government policies are also responsible for the setting up of new SMEs. The set up of SMEs in any state shows the extent of contribution of the respective state in the overall economy of India. The data up to the year 2006 shows a marked difference amongst the number of SMEs set up in Uttar Pradesh (> 2 million) and Andhra Pradesh with more than a million SMEs (Figure 3).

With respect to the number of operational SMEs, the data for years 2003 to 2006 show an increase in the number of SMEs in many states of India (Figure 4).

Based on the data from Figure 4, Uttar Pradesh and Tamilnadu were found to have more SMEs than other states. The addition of SME units in successive years presents a clearer picture of the macro economy of different states. Although the data indicated an increase in SME number in majority (70%) of the states, the increase was significant ($P<0.05$) in only Uttar Pradesh and Tamilnadu. In order to

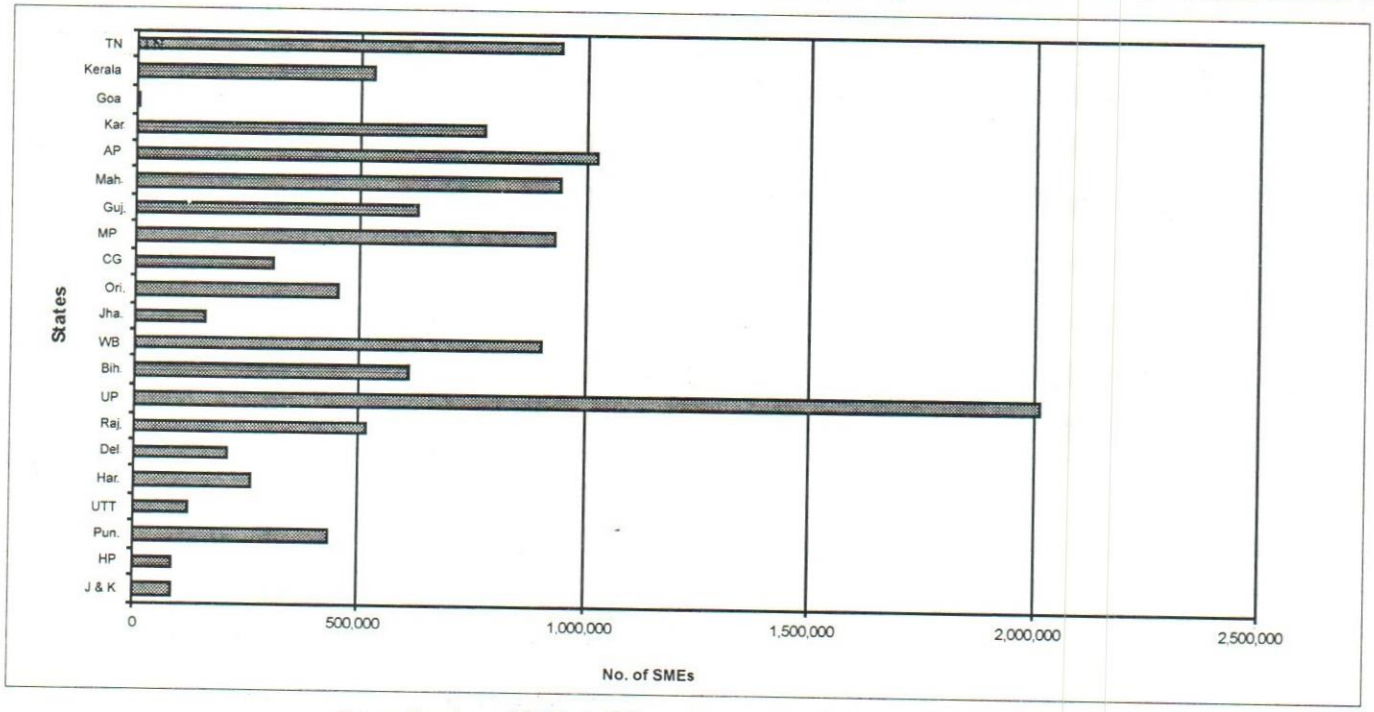

Fig. 3. Number of SMEs in Different States of India (as on March 2006)

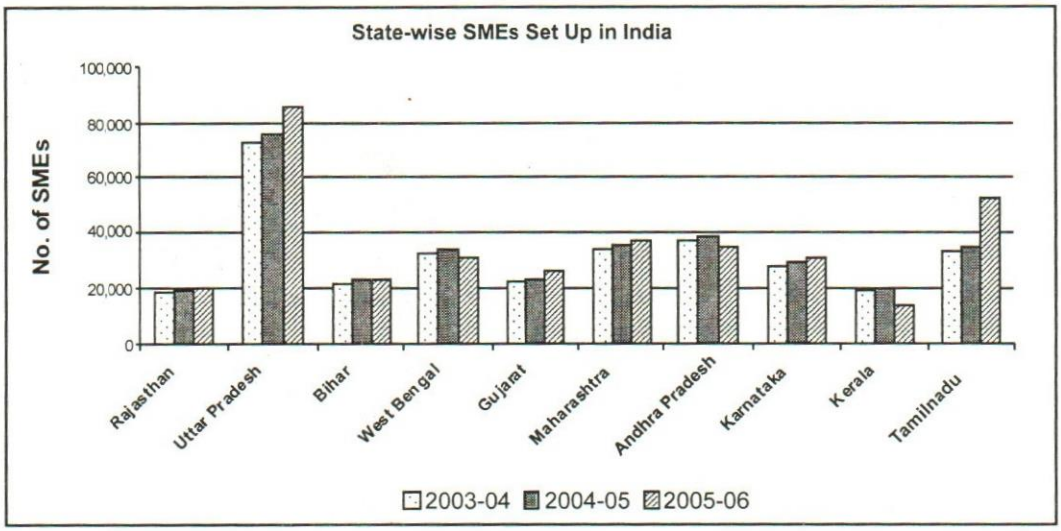

Fig. 4. State-wise SME Set Up

achieve sustainable growth rate, a consistent increase in the number of SMEs is expected, which can be accomplished by favorable government policies and support. The growth rate (obtained from the data of years 2003 to 2006) of number of SMEs set up reveals that Tamilnadu attained a maximum growth rate of 27.4%, followed by Uttar Pradesh and Gujarat with 8.9% (Figure 5).

State-wise SME Set Up and Promotional Schemes and Incentives

To meet the challenges of international competition and to promote export of SME products, the following promotional schemes are being implemented. These include:

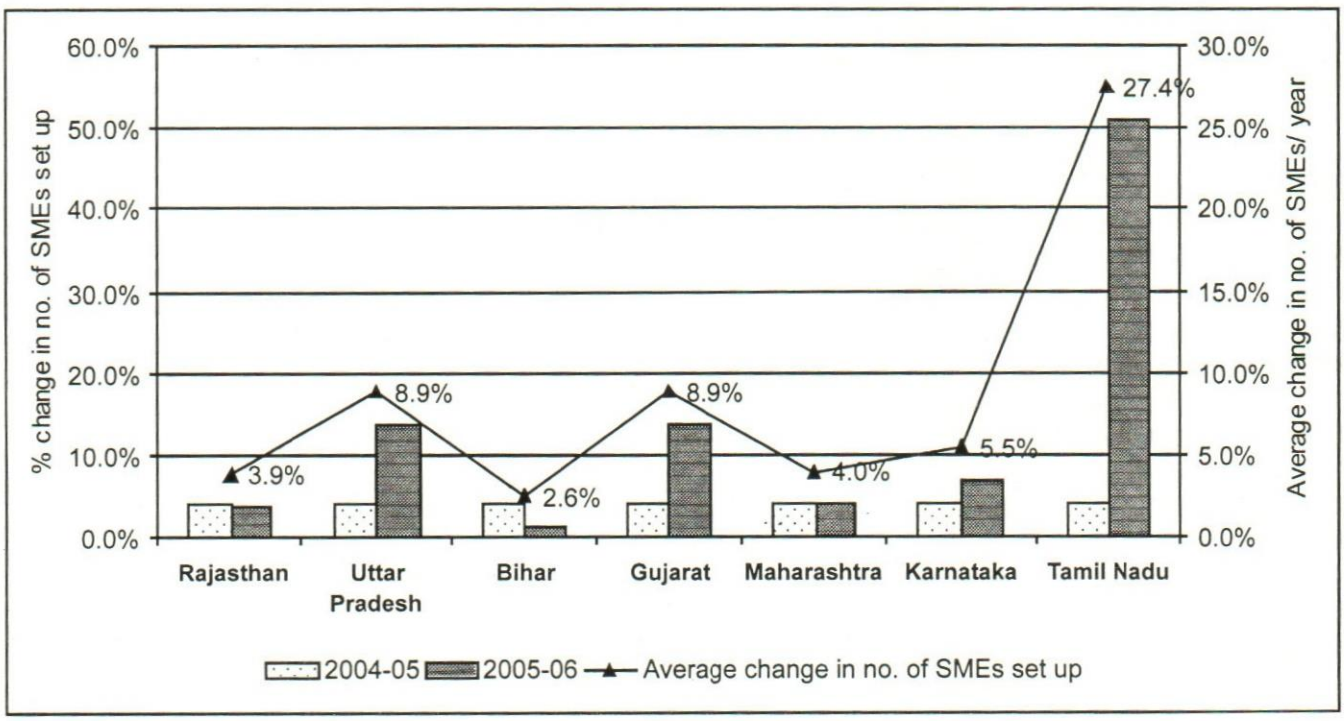

Fig. 5. SMEs Set Up Growth Rate

***Technology Development and Modernization Fund Scheme*:**

Small Industries Development Bank of India (SIDBI) has been implementing a scheme of technology development and modernization of SME units with effect from April 1995. Under this scheme assistance is available for meeting the expenditure on purchase of capital equipment, acquisition of technical know-how, upgradation of process technology, and products with thrust on quality improvement, improvement of packaging, and cost of TQM and acquisition of ISO-9000 series certification. The scheme now covers not only export-oriented units but also non-exporting units since September 1997.

***Quality Awareness Scheme*:**

Small Industries Service Institutes organize workshops related to ISO-9000 certification and awareness about quality. Under the scheme of promoting ISO-9000 certification, SMEs are given financial support by way of reimbursing 75% of their expenditure to obtain ISO-9000 certification subject to a maximum of Rs 75,000. Other schemes for technology improvement include, Tool Rooms (which provide tools, dies, moulds, and fixtures to SMEs at a very low price), Process-cum-Product Development Centers, and Small Industry Cluster Development Program. The Small Industry Cluster Development Program aims at a diagnostic study of the clusters, identification of technological needs, technological intervention, and wider dissemination of information and technology within the clusters.

***Incentives by States*:**

All states of India provide incentives in some form or the other for promoting the SME sector in their respective states. These incentives primarily include, subsidy on fixed capital investment, sales tax relief on fixed capital investment, power subsidy, and infrastructure support. The current incentives offered by various state governments are presented in Table 2.

Table 2: State-wise Key Incentives for SMEs in India

States	Subsidy on fixed capital investment	Sales tax relief on fixed capital investment	Power subsidy	Infrastructure/ technical support
Andhra Pradesh	@ 20% up to a maximum of Rs 2 million	Exemption @ 135% for 14 years	Max. up to Rs 3 million for 3 years	Single window clearance for SSI units
Bihar	New units: @15% till date of production, varies according to the place of operation	New units: Based on the location @ 175% or 10 years (whichever is earlier)	Subsidy @ Rs 0.15 paise per unit	Allotment of land and sheds: 30 year lease
Gujarat	Small units: Category 1 —@ 20%, Rs 1 million; Category 2—@ 25%, Rs 1.5 million	Exemption: Category 1—@ 110% 7 yrs; Category 2—@ 90%, 5 yrs, 60%, 5 yrs	Nil	Nil
Karnataka	Zone I: 25% or Rs 1.1 million max Zone II: 30% up to Rs1.2 million	Small units: @ 100% up to 4(6) yrs, 6(8) yrs, and 7(8) yrs	Units using captive power generation exempt from electricity tax up to 5 years	Allotment of land/ sheds: @ 20%, up to Rs 2 million for cooperative sector
Maharashtra	Group A: NA; B: @ 15%, Rs 0.70 million; C: @ 20%, Rs 1 million; D: @ 25%, Rs 1.5 million; D+: @ 80%, Rs 2 million	Exemption for Group A: NA; B: @ 100%, 6 yrs; C: @ 110%, 8 yrs; D: @ 120%, 10 yrs; D+: @ 130%, 12 yrs	Units in A/B/C Groups: refund of electricity duty in the form of a grant for 5 yrs; D/D+: grant period is 7 and 10 yrs respectively	Preparation of feasibility study: implementation agency to contribute 75% towards cost of study
Tamilnadu	@ 15% subject to a maximum of Rs 1.5 million in backward blocks; 20% limited to Rs 2 million in most backward blocks; 30% for SSIs to set up effluent treatment plants limited to Rs 0.2 million	Waiver @ 100%, 5 years or deferal; @ 100%, 9 years for new units	@ 40% (1st year), 30% (2nd year), 20% (3rd year) on low tension power	Speedy acquisition & transfer of land to projects and provision of external infrastructure
Uttar Pradesh	—	New units @ 100% for 4 years, 75% for next 2 years, and 25% for another 3 years limited to 250%	Bulk power supply at a rebate; third party sale of surplus captive power allowed	Transport subsidy for hill areas @ 75% (GoI); additional 25% in hill districts by state government
West Bengal	@ 20%, Rs 2 million in Group C area for SSIs set up after April 1, 1999	For new units: deferment 110%, 175% for 11 years, and 15 years for B and C area categories	Waiver of electricity duty on electricity consumed for 5 years	—

Source: SIDBI 2000

The Effect of Various Promotional Schemes

The data for the number of sick industries in different states for the years 2001 to 2003 depicts the effectiveness of various promotional schemes in different states (Figure 6) (www.indiastat.com). Although many states show a decreasing trend in the number of sick SMEs, in case of West Bengal, the number of the same has been found to reduce by 50% year on year. However, the trend is reverse in case of states such as Tamilnadu, Uttar Pradesh, and Bihar. Surprisingly, Tamilnadu shows maximum growth rate in terms of the number of SMEs set up (refer to Figure 5). After careful evaluation (that made in Table 2), it can be seen that the state government of Tamilnadu offers generous help for SME set up and does achieve a higher growth rate of the same. However, the data also shows that this rate is exorbitant, especially when compared to other states, and somewhat less sustainable, as can be seen from the number of sick units.

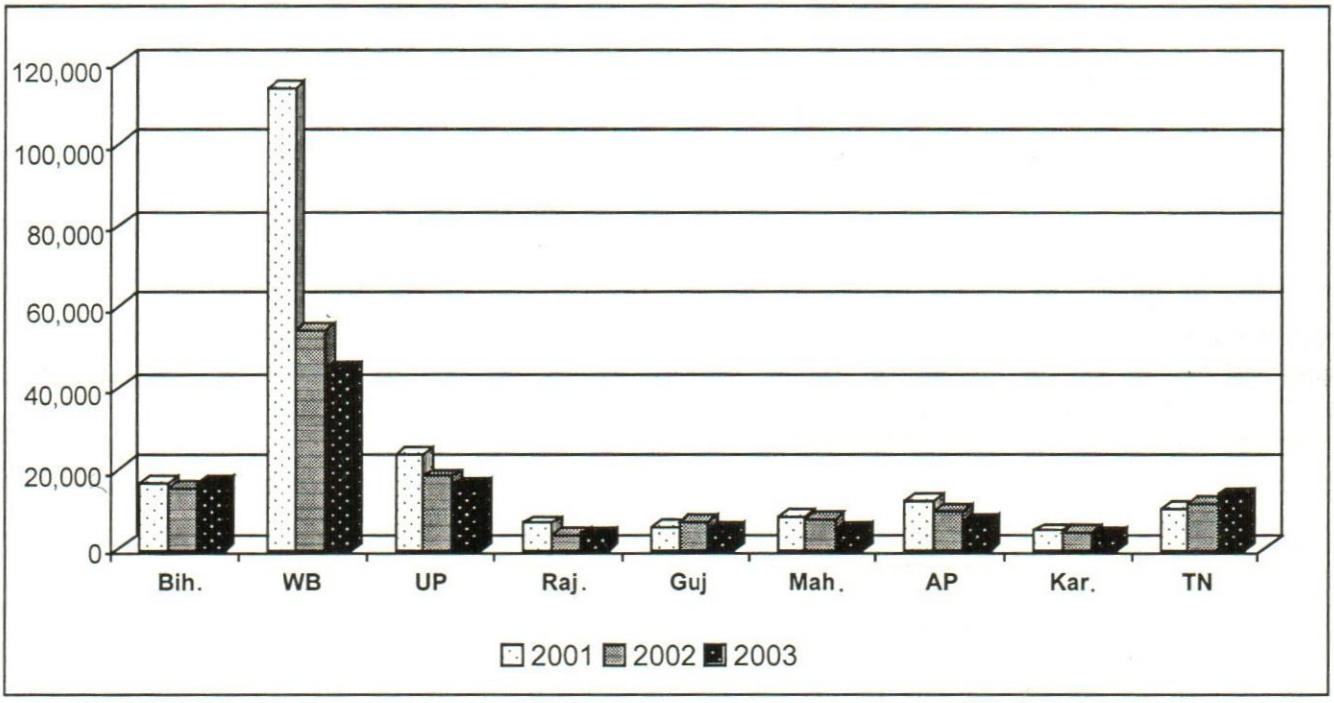

Fig. 6. Number of Sick SMEs in Selected States of India

Concluding Remarks

Since different states provide different types of incentives with a single aim to promote the growth of SMEs sector, it becomes imperative to define the scope for improvement through policy initiatives. The major change apart from policy initiatives thus demands something more, such as introduction of the approach such as "six sigma," which has potential to cater various demands of SMEs, including improving quality of product or service, customer satisfaction, waste reduction, time management, skill development, etc. Practically, data pertaining to the use of such analysis approach (that is, six sigma) is very limited, and in some sectors virtually non-existent. Thus, the present situation warrants promotion of this time-tested method for achieving quality obligations pertaining to different products and services. So far the broad reasons for sickness of SMEs include the following: lack of demand; shortage of working capital; non-availability of raw material; power shortage; labor problems; marketing problems; equipment problems; and management problems to name a few. Potentially, all these reasons of sickness can be addressed using the methodology of six sigma (the DMAIC) model. The Define, Measure, Analyze, Improve and Control or DMAIC strategy demands heavy investment in training and human resource development. Thus, the reward for quality achievement has to be supported with promotional activities to achieve the desired quality.

The Managerial/Policy Implications of the Study

The present review shows the state-of-art of the SMEs sector. SMEs are the backbone of Indian economy, and

the major driving force for sustainable development of macro economy. During the last few years, approximately 37% to 40% SMEs faced closure due to varied reasons. Since the closure percentage of existing SMEs is high and gestational period required for the new SMEs is more, the situation presents stressful times for larger companies, which are mostly dependent on the products or services from SMEs. The review thus shows that the existing policies have to be altered in order to achieve high growth rates in the SMEs sector and to provide better understanding of the sector. This then can be used by the policy maker as well as managers to improve the micro economy (of individual SME) that will ensure stable economic benefits for and from the SME sector. Given today's global nature of business, supply chains, etc., it is important for managers to understand this aspect fully along with its benefits.

Acknowledgements

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Try not to become a man of success but rather try to become a man of value.

— Albert Einstein

Focus

Indian Steel Industry in Global Prospective

Mritunjay Kumar Pandey

The iron and steel sector incorporates the characteristic of leading industry on the country's economy and in the process of industrialization. When the progress in iron–steel industry and the relation between the country's development periods are observed, it could be seen that forward and backward linkages play an important role on the development of sub-sectors related to iron and steel. The importance of the sector originates from providing input to all kind of industries of the nation. Indian steel industry registered a strong growth in steel consumption driven by strong growth in all steel consuming sectors, viz., automotive (13.6%), capital goods (18.3%), construction (10.7%), consumer non-durables (10.5%), consumer durables (9.1%), etc. During the fiscal year 2006–07, India's apparent steel consumption grew by 11.7% to 43.8 million tons. The flat products and long products consumption grew by 11.5% and 12.3%, respectively. Domestic steel consumption grew by 11.1% to 49.4 million tons. Steel exports grew by 6.1% to 4.7 million tons and steel imports increased by 6.4% to 4.1 million tons. The Indian steel industry was internationally cost-competitive till the end of the seventies. But since then and even today they are suffering from high cost, especially the labor cost. Thus, it is thought pertinent to have a comprehensive study over it. We have to turn raw materials to finished products in accordance with standardized international demand. For this, the government should also assist them technologically, economically, and lawfully with the help of excise, custom, and new steps in this regard. From this picture we can say that due to availability of raw materials and low cost manpower, this industry is in its growth stage and this trend will remain the same in the next 20 years.

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Steel is indispensable to modern civilization in peace and war. It is the backbone of all industrial and commercial activities. The iron and steel sector incorporates the characteristic of leading industry on the country's economy and in the process of industrialization. When the progress in iron–steel industry and the relation between the country's development periods are observed, it could be seen that forward and backward linkages play an important role on the development of sub-sectors related to iron and steel. The importance of the sector originates from providing input to all kinds of industries of the nation.

Iron is most widely found in the crust of the earth, in form of various minerals. In historic times, a prosperous iron industry developed in many countries, based on local supplies of ore and proximity of forests to supply charcoal for fuel. Steel-making was largely a development of the 19th century, with the invention of melting processes.

Today, steel production is an index of national prosperity and the basis of mass production in many other industries such as ship-building, automobiles, construction, machinery, tools, and industrial and domestic equipments. The development of transport, in particular by sea, has made the international exchange of raw materials required (iron ores, coal, fuel oil, scrap, and additives) economical and profitable. Therefore, the countries possessing iron ore deposits near costal fields are no longer privileged, and large smelting plants and steelworks have been built in coastal regions of major industrialized countries which are supplied with raw materials from exporting countries thereby enabling them to meet the present-day requirements for high-grade materials.

The history of steel-making in India can be traced back to 400 BC when the Greek emperors recruited Indian archers for their army who used arrows tipped with steel. Many more evidences show India's perfect knowledge of steel-making long before the advent of Christ. Archaeological findings in Mesopotamia and Egypt testify to the fact that use of iron and steel was known to mankind

for more than six thousand years and that some of the best products were made in India.

Significance of the Study

Steel forms the backbone of the economy of any industrial nation. Due to its strong backward and forward linkages, it is also dispensable for the growth and development of the economy. The efficiency with which resources of the iron and steel industry are managed affects the national economy in a complex way.

Objectives of the Study

1. To analyze Indian steel industries in global prospective.
2. To evaluate the future dimension of steel in Indian industries.

Research Methodology

The study is based on secondary sources of information. Secondary data has been collected from the published reports, annual statements, and departmental records of ministry. The information so collected will be supplemented by the published information collected from libraries and websites of International Iron Steel Institute, Brussels.

Indian Prospective

The foregoing discussion as regards the state of Indian steel industry with global prospective does not give a clear picture about the prospective future of Indian steel industry. With a change in production attitude between developed and developing nations of the world, the total demand for steel has been increasing over time and total future requirement will fall short of the total world production towards the end of the century. Now the question that arises is should India invest in new steel projects to match the demand for steel with a view to attain self sufficiency along with a margin of availability for export or should it utilize utilized capacities of the units and also modernize the same to have higher utilization for overcoming the said future threats? The probable factors it should consider first are the cost and competitiveness of Indian steel products. The Indian steel industry was internationally cost-competitive till the end of the seventies. But since then and even today they are suffering from high cost, especially the labor cost.

However, the steps taken by TISCO to modernize its plant resulted in availability of additional capacities, which will ensure energy optimization, improvement of material yield, and environmental pollution in the country. Thus, the products will be more cost effective along with additional supplies from green field plants. The question of choice of scale, technology, location, and product mix should be carefully examined for investment in green field plants with a view to the objective of supply steel at the least resource cost of the nation. However, the rejuvenation on the part of Indian steel industry is that when Word Steel Dynamics (WSD) ranked TISCO as No. 1 in the field of 22 world's best steel companies. In the words of Peter F. Marcus, Managing Partner of WSD, the steel industry Bible: "TISCO is India's only world class steel maker and one of few steel making companies in the world with such a standing." This only reiterates the fact that Indian steel industry has to go miles.

Indian Steel Industry in the Global Scenario

A glimpse of world crude steel production from 1970 to 2006 is presented in Table 2 which shows that it has recorded continuous growth year after year barring little exception. However, the average growth rate has varied during the said period as depicted through Table 3. It is further observed that the growth rate which was 0.5% in 1990–95 went up to 2.3% (1995–2000) and further to 6.1% and finally to 9% (2005–06).

The domestic steel market of developed countries has been contracting steel capacity and the process of modernization has been undertaken in the western world. There has also been a geographical redistribution of the global pattern of steel production with most of incremental productive capacity coming up in the developing countries. There has been import substitution fueled growth in the steel industry under national control in most of the semi-industrial countries such as India and Brazil. Brazil has, however, oriented its growth of steel output in a major way towards export during the eighties. During this period, South Korea and Taiwan also geared their growth in export of steel and other steel-based industrial products under the aegis of state leadership.

From just a level of 25 MT in 1973, China was able to achieve a production of 181.6 MT in 2002 and 422.7 MT in 2006 and occupied first position in the world map.followed by Japan (2nd), USA (3rd), and Russia (4th). It is interesting to note that India and China were in the same rank in steel producing during early fifties. But China undertook India somewhere in early sixties and then emerged as the largest producer of the world leaving us at 7th position (44 MT). It can be further observed that over the decade steel production in the world has been deelining except in China.

Table 1: Rank of World Steel Companies

2006		2005			2006		2005		
Rank	mMT	Rank	mMT	Company	Rank	mMT	Rank	mMT	Company
1	117.2		n/a	Arcelor Mittal[1]	41	7.0	38	7.0	Mariupol (Ilyich)
2	32.7	3	32.0	Nippon Steel	42	6.8	39	6.8	BlueScope
3	32.0	5	29.9	JFE	43	6.8	42	6.2	Panzhihua
4	30.1	4	30.5	POSCO	44	6.6	48	5.7	Jiuquan
5	22.5	6	22.7	Baosteel	45	6.5	41	6.4	voestalpine
6	21.2	7	19.3	U.S. Steel	46	6.4	46	5.8	Handan
7	20.3	8	18.4	Nucor	47	6.4	59	4.4	Tata
8	19.1	12	16.1	Tangshan	48	6.3	43	6.2	Metalloinvest
9	18.3	9	18.2	Corus Group	49	6.3	51	5.4	Taiyuan
10	18.2	10	17.5	Riva Group	50	6.0	54	5.0	Jianlong
11	17.5	13	15.2	Severstal	51	6.0	44	5.9	Chelyabinsk (Mechel)
12	16.8	11	16.5	ThyssenKrupp[2]	52	5.7	49	5.6	AK Steel
13	16.1	14	13.9	Evraz Group	53	5.4	56	4.6	Liuzhou
14	15.6	15	13.7	Gerdau	54	5.2	55	4.6	Beitei
15	15.3	20	11.9	Anshan	55	5.2	57	4.5	Tangshan Guofeng Steel
16	14.6	22	10.5	Jiangsu Shagang Group	56	5.1	66	4.0	Xinyu
17	13.8	18	13.0	Wuhan	57	5.0	53	5.2	Erdemir Group
18	13.6	16	13.5	Sumitomo	58	4.9	61	4.4	Nangang
19	13.5	17	13.4	SAIL	59	4.8	69	3.8	Kunming
20	12.8	19	12.6	Techint	60	4.8	50	5.5	HKM[4]
21	12.5	21	11.4	Magnitogorsk	61	4.5	65	4.2	EZDK
22	11.2	24	10.4	Jinan	62	4.4	85	2.9	Tonghua
23	10.9	27	9.6	Magang Group	63	4.4	60	4.4	Zaporizhstahl
24	10.8	25	10.3	Laiwu	64	4.3	70	3.5	Shaoguan
25	10.7	26	10.3	China Steel	65	4.3	78	3.3	Steel Dynamics
26	10.5	23	10.4	Shougang	66	4.2	86	2.9	Global Steel Holdings
27	9.9	32	8.5	Valin Steel Group	67	4.1	62	4.2	SIDOR
28	9.8	28	9.4	Imidro	68	4.0	76	3.4	Pingxiang Steel
29	9.5	30	8.6	IUD	69	4.0	63	4.2	Hadeed
30	9.1	31	8.5	Novolipetsk	70	3.9	75	3.4	Hebei Jinxi
31	8.9	33	8.2	Hyundai	71	3.8	68	3.9	Nisshin Steel
32	8.8	29	8.7	Sistema Usiminas	72	3.8	58	4.5	Stelco
33	8.7	34	8.2	Metinvest	73	3.7	67	4.0	SSAB
34	7.7	35	7.7	Kobe Steel	74	3.6	87	2.8	Xinjiang Bayi
35	7.6	40	6.5	Benxi	75	3.5	52	5.2	CSN
36	7.5	37	7.0	Baotou	76	3.5	72	3.4	Tianjin Tiantie
37	7.4	36	7.1	Salzgitter[3]	77	3.5	80	3.2	IPSCO
38	7.2	45	5.8	Celsa	78	3.4	73	3.4	Vizag Steel
39	7.2	79	3.3	Duferco Group	79	3.4	77	3.3	AHMSA
40	7.0	47	5.8	Anyang	80	3.4	90	2.7	Lion Group

Notes: 1. 2005 tonnages—Mittal Steel 63.0. Arcelor
2. 50% of HKM included in Thyssen Krupp
3. includes part of HKM
4. total production

Source: IISI, Brussels

Table 2: World Crude Steel Production, 1970 to 2006

Year	Production
1970	595
1975	644
1980	717
1985	721
1990	775
1995	756
1996	755
1997	799
1998	777
1999	789
2000	848
2001	850
2002	904
2003	970
2004	1,069
2005	1,142
2006	1,244

Note: All figures are in Million Metric Tons
Source: IISI, Brussels

Table 3: Average Growth Rates of World Crude Steel Production

Year	Growth
1970-75	1.6%
1975-80	2.2%
1980-85	0.1%
1985-90	1.5%
1990-95	-0.5%
1995-00	2.3%
2000-05	6.1%
2005-06	9.0%

Production

The world's crude steel production has reached its peak at 1244 MT in 2006, (Table 1) recording about 6.58 times increase in the production just within a period of half century.

The average annual growth in production during the fifties and sixties was around 6%, which reduced to 1.6% and 0.1% during seventies and eighties, respectively. The average annual growth rate during 1995 was reversed and stood at -0.5%. However, this fall has again been set off during 1995–2000 and 2005–06 by the increasing trend of 2.3 and 9%, respectively.

TISCO, India's largest private sector steel enterprise, reached 6th position among the largest steel producing companies of the world in 2006–07 from 54 during the last year. The top slots have been occupied by established steel-makers of developed world like Arcelor, LML group, Nippon Steel, Posco, etc. This figure reflects the redistribution of global pattern of steel production in 2006.

Consumption

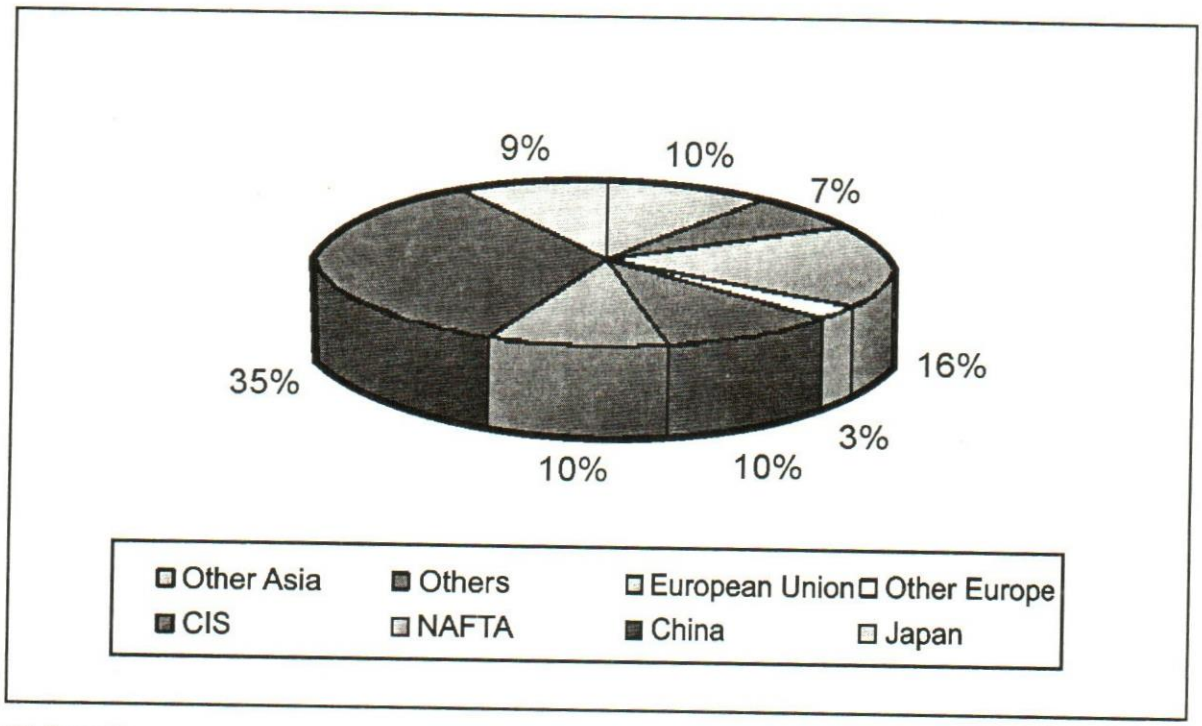
In the modern world consumption of steel has been reckoned as a basic indicator for development. It has been noticed that over the years, consumption of crude steel has registered a downward trend in industrialized nations where the developing countries have accelerated their consumption. The total finished consumption in the year was 756.6 in 2000 and it has registered almost an increasing trend to reach 113.2 during 2006.

As regards India, steel consumption has grown steadily since the advent of industrialization. The consumption of finished steel in India from 1950–51 to 2005–06 reflects that during this period steel consumption has gone up. But it is disheartening to note that there is a step rise in the absolute consumption of steel in India in comparison to the world.

There has also been a geographical redistribution of global pattern of steel. Figures 1, 2, 3, and 4 reflect the shift in global production and consumption pattern of steel between 2002 and 2006. The figure reveals that the apparent steel consumption has declined in the world except in China.

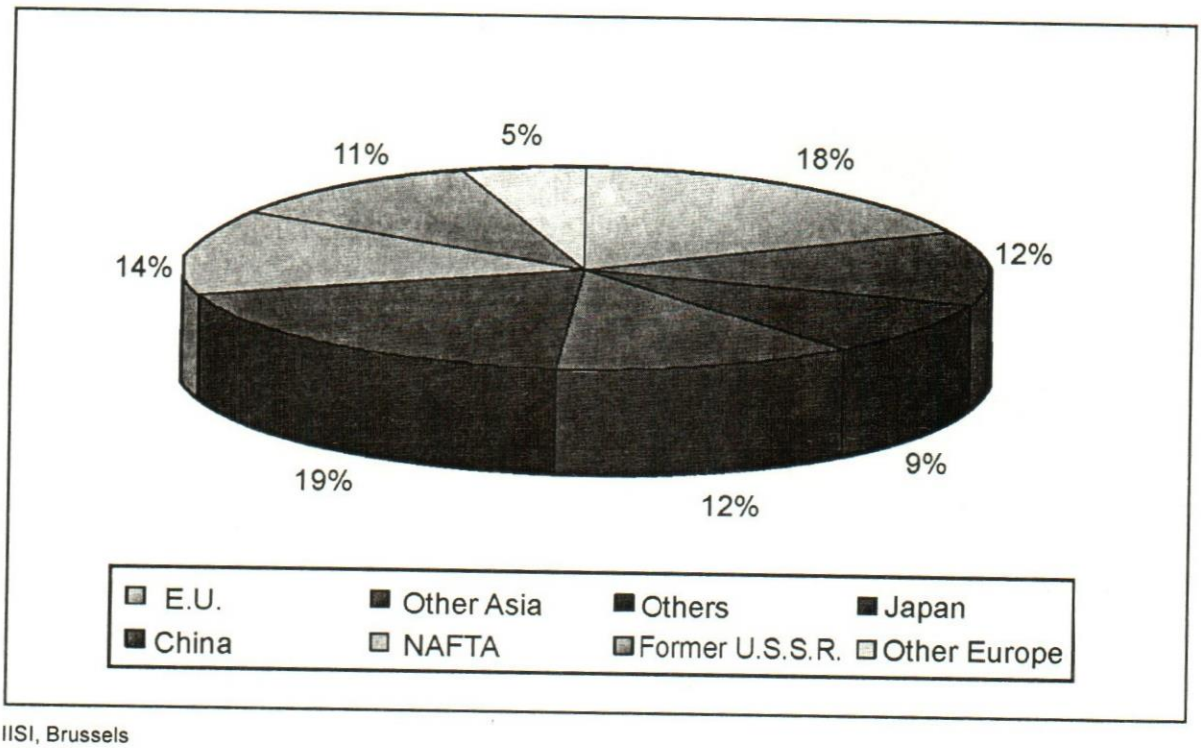
Demand for Steel

Global Steel Industry Overview: Global crude steel output, which closely tracks demand, grew by 89% to 1,244 million tons in 2006 as compared to 1,142 million tons in 2005 mainly driven by strong growth of 18% in China. In 2006, the top two steel producing countries were China (422.7 million tons) and Japan (116.2 million tons) (Table 4). The finished steel consumption grew by 8.5% at 1,113 million tons in 2006 as compared to 1,026 million tons in 2005 (Table 5). China accounted for 33% of global steel consumption and 50% of global demand growth. The Asian region, especially China, witnessed the most remarkable growth over the past 10 years. In 1996, China produced 101 million tons of crude steel. By 2001, crude steel production increased to 151 million tons at a compound annual growth rates (CAGR) of 8% in 2006, China produced 422.7 million tons of crude steel, registering a CAGR of 23% in the last few years. China's share of world crude steel production also increased exponentially. In 1996, China became the largest steel producing country in the world for the first time, accounting for 13.5% of global steel production. In 2006, this share increased around to one-third of total crude steel production.



Source: IISI, Brussels

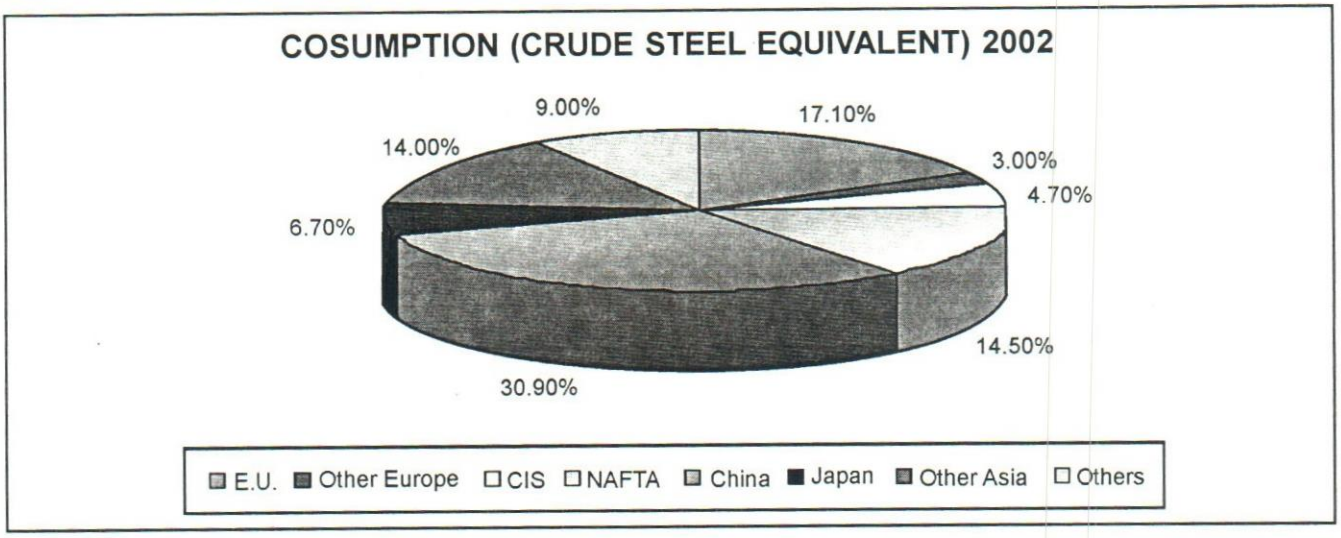
Fig. 1. Steel Production: Geographical Distribution, 2002



Source: IISI, Brussels

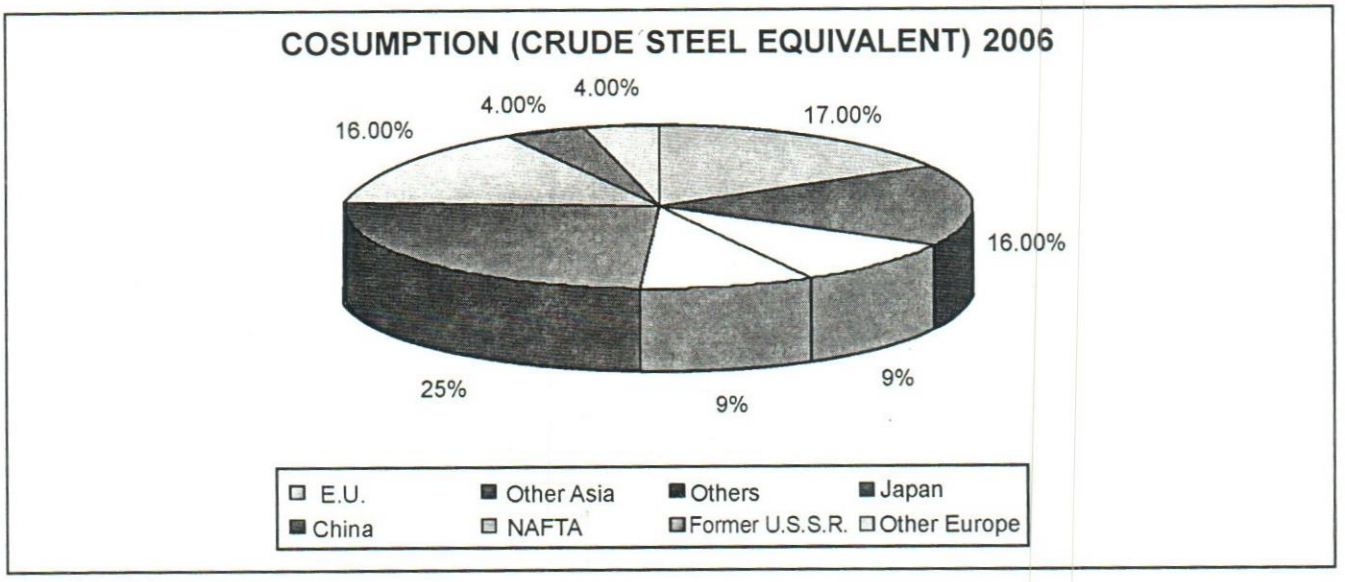
Fig. 2. Steel Production: Geographical Distribution, 2006

Others comprise:	
Africa	1.5%
Central and South America	3.7%
Middle East	1.2%
Australia and New Zealand	0.7%



Source: IISI, Brussels

Fig. 3. Steel Consumption: Geographical Distribution, 2002



Source: IISI, Brussels

Fig. 4. Steel Consumption: Geographical Distribution, 2006

Others comprise:	
Africa	1.8%
Central and South America	3.4%
Middle East	2.2%
Australia and New Zealand	0.7%

Table 4: Major Steel-producing Countries, 2005 and 2006

Year	2006		2005	
	Rank	mmt	Rank	mmt
China	1	422.7	1	355.8
Japan	2	116.2	2	112.5
United States	3	98.6	3	94.9
Russia	4	70.8	4	66.1
South Korea	5	48.5	5	47.8
Germany	6	47.2	6	44.5
India	7	44.0	7	40.9
Ukraine	8	40.9	8	38.6
Italy	9	31.6	10	29.3
Brazil	10	30.9	9	31.6
Turkey	11	23.3	11	21.0
Taiwan, China	12	20.2	13	18.9
France	13	19.9	12	19.5
Spain	14	18.4	14	17.8
Mexico	15	16.3	15	16.2
Canada	16	15.4	16	15.3
United Kingdom	17	13.9	17	13.2
Belgium	18	11.6	18	10.4
Poland	19	10.0	21	8.3
Iran	20	9.8	20	9.4
South Africa	21	9.7	19	9.5
Australia	22	7.9	22	7.8
Austria	23	7.1	23	7.0
Czech Republic	24	6.9	26	6.2
Netherlands	25	6.4	24	6.9
Romania	26	6.3	25	6.3
Egypt (e)	27	6.0	28	5.6
Argentina	28	5.5	29	5.4
Sweden	29	5.5	27	5.7
Malaysia (e)	30	5.5	30	5.3
Thailand (e)	31	5.4	31	5.2
Slovakia	32	5.1	34	4.5
Finland	33	5.1	33	4.7
Venezuela	34	4.9	32	4.9
Kazakhstan	35	4.2	35	4.5
Saudi Arabia	36	4.0	36	4.2
Indonesia (e)	37	3.8	37	3.7
Luxembourg	38	2.8	39	2.2
Greece	39	2.4	38	2.3
Byelorussia	40	2.3	40	2.0
Bulgaria	41	2.1	41	2.0
Hungary	42	2.1	42	2.0
Others		23.3		21.9
World		**1,244.2**		**1,141.9**

Note: mmt is Million Metric Tons Crude Steel Production
Source: IISI, Brussels

Table 5: Apparent Steel Use, 2000 to 2006 (Million Metric Tons Finished Steel Products)

	2000	2001	2002	2003	2004	2005	2006
Austria	2.9	3.0	3.1	3.1	3.3	3.5	4.3
Belgium-Luxembourg	5.7	5.4	4.5	4.0	4.8	4.2	4.6
France	19.4	17.3	16.4	15.7	16.8	15.0	16.4
Germany	37.0	35.6	34.3	34.3	36.4	36.1	38.4
Italy	30.5	30.4	30.2	31.8	33.2	31.6	36.0
Netherlands	4.7	4.7	4.0	3.4	3.5	3.6	3.9
Spain	17.4	18.9	19.7	21.0	21.1	20.9	23.4
Sweden	3.6	3.1	3.3	3.6	4.0	4.1	4.4
United Kingdom	13.5	13.5	12.6	12.3	13.2	11.4	12.9
Other EU (15)	11.3	10.9	11.8	10.9	11.2	11.4	12.0
European Union (15)	**146.0**	**142.8**	**139.8**	**140.1**	**147.5**	**141.8**	**156.3**
Czech Republic	3.9	4.0	4.2	4.4	5.2	5.2	5.9
Poland	7.6	7.1	7.1	7.7	8.5	8.4	10.6
Other new EU (10)	5.1	5.3	5.3	5.6	6.0	5.9	6.6
New EU (10)	**16.6**	**16.4**	**16.5**	**17.7**	**19.7**	**19.6**	**23.0**
European Union (25)	**162.6**	**159.3**	**156.3**	**157.8**	**167.2**	**161.4**	**179.3**
Romania	2.6	2.7	2.8	3.1	3.3	3.3	3.9
Turkey	12.7	11.0	12.3	14.6	16.6	18.5	21.9
Others	5.8	6.5	6.4	6.7	7.4	7.2	7.6
Other Europe	**21.1**	**20.3**	**21.5**	**24.3**	**27.3**	**29.1**	**33.3**
Russia	24.4	26.9	24.9	28.5	29.2	30.5	36.0
Ukraine	4.9	5.8	5.5	6.6	7.2	7.2	7.1
Other CIS	4.9	4.3	4.0	4.0	4.0	4.0	4.0
CIS	**34.1**	**37.9**	**35.4**	**40.2**	**41.5**	**42.9**	**48.4**
Canada	17.8	15.2	15.9	15.5	17.4	16.2	17.3
Mexico	14.1	13.1	14.3	14.9	16.0	16.1	18.0
United States	114.7	103.8	102.7	100.4	115.6	107.1	119.6
NAFTA	**146.6**	**132.1**	**132.9**	**130.8**	**149.0**	**139.4**	**154.9**
Argentina	3.0	2.6	1.7	2.8	3.6	3.7	4.5
Brazil	15.8	16.7	16.5	16.0	18.3	16.8	18.5
Venezuela	1.7	2.3	1.6	1.5	2.3	2.4	3.2
Others	7.6	7.4	7.8	7.7	8.5	9.3	9.8
Central and South America	**28.1**	**28.9**	**27.7**	**28.0**	**32.6**	**32.3**	**36.0**
Egypt	4.0	4.2	4.0	4.2	4.0	4.9	4.7
South Africa	4.0	4.2	4.9	4.1	4.9	4.7	6.0
Other Africa	6.5	7.2	6.9	8.5	9.2	10.1	10.9
Africa	**14.5**	**15.6**	**15.8**	**16.8**	**18.1**	**19.7**	**21.6**
Iran	9.6	10.6	11.3	14.7	14.5	16.1	17.9
Other Middle East	10.2	12.5	14.0	14.8	16.7	17.3	19.0
Other Middle East	10.2	12.5	14.0	14.8	16.7	17.3	19.0
Middle East	**19.7**	**23.1**	**25.3**	**29.5**	**31.2**	**33.4**	**36.8**
China	124.3	153.6	186.3	247.0	272.0	326.8	356.2
India	26.3	27.4	28.9	31.2	34.3	39.2	43.1
Japan	76.1	73.2	71.7	73.4	76.8	78.0	79.0
South Korea	38.5	38.3	43.7	45.4	47.2	47.1	49.3
Taiwan, China	21.1	17.4	20.4	19.9	22.1	19.9	19.8
Other Asia	36.8	41.2	41.6	42.9	47.1	49.0	47.6
Asia	**323.0**	**351.1**	**392.7**	**459.8**	**499.4**	**560.0**	**595.0**
Australia and New Zealand	6.7	6.3	7.2	7.5	8.0	7.9	7.9
World	**756.6**	**774.5**	**814.7**	**894.8**	**974.3**	**1,026.0**	**1,113.2**

The global steel consumption increased both in developing and developed countries in 2006, with double-digit growth in Europe, CIS, NAFTA, and South and Central America. In Europe, the increase in demand was accompanied by a substantial increase in steel imports primarily from China, which emerged as a significant net exporter in steel in 2006. Construction was the key over-demand across the European Union (EU) in 2006, notably in Germany, which recovered very strongly.

The demand for raw material, viz., iron ore, coal, scrap, energy, etc., have increased significantly due to robust growth in global crude steel production led by China. The shortage of raw materials or constraints of logistics, led to increase in raw materials and constraints of logistics, led to shortage of raw materials. Iron ore prices increased over last five years consecutively. Iron ore fines prices increased by 19% in 2006, 71.5% in 2005, 18.6% in 2004, and 9% in 2003. There is a further increase in contracted prices of iron ore fines by 9.5% by 2007. China's crude steel production increased by 18% or 63 million tons in 2006 and to support this production, iron ore imports into China increased by 19%. In order to respond to the tightening supply–demand balance, major iron ore and coal producers are investing in new mines to increase production capacity.

Indian steel industry registered a strong growth in steel consumption driven by strong growth in all steel consuming sectors, viz., automotive (13.6%), capital goods (18.3%), construction (10.7%), consumer non-durables (10.5%), consumer durables (9.1%), etc., during the fiscal year 2006–07. India's apparent steel consumption grew by 11.7% to 43.8 million tons. The flat products and long products consumption grew by 11.5% and 12.3%, respectively. Domestic steel consumption grew by 11.1% to 49.4 million tons. Steel exports grew by 6.1% to 4.7 million tons and steel imports increased by 6.4% to 4.1 million tons.

Driven by continued growth in developing and emerging economies, global growth is likely to remain robust. World GDP is expected to grow by 3.4% in 2007. China and India are expected to continue its march towards high growth, though controlling inflationary pressures may be a challenge for the Indian government.

The International Iron and Steel Institute (IISI) forecasted global steel consumption to grow by 5.9% in 2007 and 6.1% in 2008, driven by strong demand from Asia, Africa, and South America. The apparent steel demand is likely to increase by 65 million tons in 2007 and 72 million in 2008. China is expected to remain the market with steel demand likely to increase by 13% (46 million tons) in 2007, which represents 71% of global steel consumption growth in 2007.

The Indian steel industry is now believed to be at an inflexion point. It is poised of a demand growth of 10% in FY 2007–08. Demand for flat products and a long product is expected to grow by 12% and 9%, respectively.

Rise in personal disposable incomes and easy access to funds from bank has led to new housing projects in last 3–5 years. The automotive sector also grew at a significant rate of over 15% due to easy availability of consumer finance, excise duty reduction, and higher disposable income with households. Recent increase in interest rates is likely to dampen this sentiment somewhat, but the growth rate is likely to remain robust.

The company infrastructure in India constituted under the chairmanship of the Prime Minister in August 2004 planned for an expenditure of approximately Rs 1,450,000 crores (USD 320 billion) in the XI Five Year Plan (2007–12) on irrigation, urban infrastructure, power, roads, railways, ports, airports, telecom projects, etc. This may lead to increased steel consumption in foreseeable future. India's steel consumption is expected to increase to 65 million tons by FY 2009–10 and over 125 million tons by FY 2014–15.

Conclusions and Suggestions

From this discussion we see that there is a growth trend in steel industries. The consumption per capita in LPG has gone upto 38 kg in 2006. Our export has also gone up and this is a sign for the health of any nation. The need is to develop the several resources present in our country accordingly. We have to turn raw materials to finished products in accordance with standardized international demand. For this, the government should also assist them technologically, economically, lawfully with the help of excise, custom, and new steps in this regard. From this picture we can say that due to availability of raw materials and low cost manpower, this industry is in its growth stage and this trend will remain same in the next 20 years.

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Action is the real measure of intelligence.

— Napoleon Hill

Focus

Growth and Productivity Analysis of Basic Metal Products Industry in Punjab

Gulshan Kumar and Avtar Singh

In the globalized environment, growth and productivity are the two prominent factors that justify competitiveness and survival of an industry. The basic metal products industry of Punjab finds itself able to withstand the challenges posed during pre-liberalization and liberalization periods.

The present study is an endeavor to investigate growth pattern and productivity trends of small scale basic metal products industry of Punjab. The growth of industry has been measured in terms of four variables, namely: number of units, fixed investment, employment, and production. Yearly growth rates have been computed to mirror year-to-year fluctuations in growth and compound annual growth rates (CAGRs) that have been worked out to find the impact of policies of liberalized regime on growth of this industry. Productivity trends have been sketched in terms of capital intensity, capital–output ratio, and partial factor productivities. In order to comprehend the strengths and weaknesses of this industry, strengths, weaknesses, opportunities, and threats (SWOT) analysis has been conducted. The study observed that policies of the liberalization era have promoted capital investment and factor productivities, boosted technological upgradation, but at the cost of employment.

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The basic metal products industry in Punjab has managed to retain its position of importance, despite the fact that the state has no mineral resources of its own. Thanks to the dynamic entrepreneurship of the people of Punjab, the ever-increasing income, expenditure of its population, and the existence of fairly organized infrastructure, the industry was able to withstand the onslaught of political and socioeconomic upheavals. These include having unfriendly neighbor, militancy, and the most important, policies of liberalization under the WTO regime which the state encountered during its development history. The new policy of liberalization marked the beginning of the end of protective measures for industry, promotion of industrial competitiveness by addressing the basic concerns, namely, technology, finance, and marketing. Moreover, the process of removal of quantitative and non-quantitative restrictions led to free movement of goods between regions and, as a result, business turnover and competition grew to a large extent. The basic idea behind all such reforms was to lift government controls and regulations on production, trade, and investment to build a more competitive environment, improvement in efficiency, and, hence, growth.

Punjab, which holds a satisfactory picture on the industrial map of India, has made significant growth in its small scale industrial sector. Basic metal products industry is one of the prominent industries of Punjab. As per the Annual Sample Survey (ASS) classification, basic metal products include the manufacture of basic iron and steel, basic precious non-ferrous metals, and casting of iron and steel as well as non-ferrous metals. The industry's product list includes a wide range of products carved out of raw ferrous and non-ferrous metals which serve as raw material for producer and consumer goods industries like light engineering, auto parts, tools and implements, pipe fittings, etc. Thus, the industry

occupies a pivotal position on the industrial landscape of the state because of its strong forward linkage effect.

In absolute terms, the basic metal products industry in the small scale sector of Punjab has made many strides, both in the pre-liberalization and liberalization period. The basic metal products producing units in the small scale sector were only 2,232 [5.5% of the total small scale industrial (SSI) units registered with the Directorate of Industries, Punjab] in the year 1980–81 which swelled to 4,325 (2.6% of the total registered SSI units) in 1991–92, and further grew to the level of 5,202 (2.5% of the total registered SSI units) in 2004–05. As regards employment, the industry provided direct employment to 19,588 persons (7.39% of the total employment in registered SSI sector of Punjab) in 1980–81, which surged to 33,042 persons (5.06% of the total employment in registered SSI sector) in 1991–92, and further climbed to the level of 56,625 persons (6.05% of total registered SSI employment) in 2004–05. In the area of fixed capital investment, it was only Rs 44.52 crores (13.4% of total fixed investment in the registered SSI sector of Punjab) in 1980–81 which jumped to Rs 136.72 crores (9.12% of the total registered fixed investment) in 1991–92, and further advanced to the level of Rs 300.60 crores (5.56% of the total registered fixed investment) in 2004–05. Similarly, the level of production of small scale basic metal products industry of Punjab, which was only worth Rs 122.87 crores (11.52% of total value of production of registered SSI sector) in 1980–81, pushed to the level of Rs 569.58 crores (12.83% of total value of production of registered SSI sector) in 1991–92, and further enhanced to Rs 2722.98 crores (10.27% of total value of production in 2004–05).[1]

A number of researchers like Ahluwalia (1991), B. Golder (2004), B.N. Golder (1986), Balakrishnan and Suresh (2003), Bawa and Kainth (1980), Beri (1962), Brahmanada (1982), Golder and Kumari (2003), Gupta (1990, 1985), Gupta and Kumar (2006), Krishan and Mehta (1968), Krishnaji (1980), Mehta and Madani (1973), Veermani and Golder (2005), and Venkataramaiah and Burange (2003) have estimated the growth trends and productivity in Indian manufacturing sector at aggregate and disaggregate levels by using compound growth rates, partial and total factor productivity indices. In this paper, an attempt has been made to study the growth behavior in a number of units: fixed investment, direct employment, production, partial productivities of labor and capital, capital–output ratio, and capital intensity of basic metal products industry of Punjab to make policy makers aware and to have a more realistic understanding of this industry.

Objectives of the Study

Academicians, planners, and policy makers have stressed the need to comprehend the analysis of growth performance and productivity to frame a sound industrial development strategy. This paper also attempts to make policy makers aware about the basic metal products industry in Punjab.

The specific objectives of the study are as follows:

1. To compute partial productivity of labor, capital, capital–output ratio (average), and capital intensity, and also to examine their prevailing trends.
2. To analyze comparative picture of growth performance of number of units, fixed investment, direct employment, and production during pre-liberalization and liberalization periods.
3. To carry out analysis of SWOT of basic metal products industry of Punjab.

Database and Analytical Framework

The present study is based on secondary data for a period of 25 years ranging from 1980–81 to 2004–05. The data for registered manufacturing small scale units (SIDO) relating to number of units, direct employment, fixed capital, and production of basic metal products industry at aggregate level for this period was culled from Directorate of Industries, Punjab. (Data for the next years is still under computation as the Directorate of Industries, Punjab manually calculates the figures.) Since the figures regarding fixed capital and production were at current prices, these were converted into constant prices by deflating them with index number of the wholesale prices of manufactured products' total, taking 1993–94 as the base year. Yearly growth rates for all these four variables were computed to ascertain year-to-year fluctuations in growth.

[1]All percent shares in this section have been calculated by the author on the basis of data supplied by Directorate of Industries, Punjab.

Partial productivities of labor and capital were obtained as O/L and O/K. For making an assessment of the extent of amount of units of capital needed to produce a certain level of output and capital intensity, K/O and K/L ratios were also computed. CAGRs were worked out for the overall period (1980–81 to 2004–05) and two sub-periods, namely, pre-liberalization (1980–81 to 1991–92) and liberalization periods (1991–92 to 2004–05). CAGRs for all the eight variables were estimated by fitting an exponential function of the following form:

$$Y_t = \beta_0 \beta_1^t e^{Ut} \quad (1)$$

where Y_t is a dependent variable, β_0 and β_1 are the unknown parameters, and U_t is the disturbance term. Equation (1) could be written in the logarithmic form as:

$$\log Y_t = \log\beta_0 + t \log\beta_1 + U_t \quad (2)$$

Equation (2) was estimated by applying the Ordinary Least Square Method and the compound rate of growth (gr_c) was obtained by taking the antilog of estimated regression coefficient, subtracting 1 from it, and multiplying the difference by 100:

$$gr_c = (A.L.\ \hat{\beta}_1 - 1) \times 100 \quad (3)$$

where $\hat{\beta}_1$ is an estimate for $\hat{\beta}_1$. The significance of growth rates was tested by applying t-test:

$$t = \frac{\hat{\beta}_1}{s\,(\hat{\beta}_1)} \sim t(n-2)\ d.f. \quad (4)$$

where $\hat{\beta}_1$ is the regression estimate and s $(\hat{\beta}_1)$ the respective standard error. All statistically non-significant growth rates are treated as almost zero growth rates.

Research Findings

This section presents the results and discussion of the study. The first subsection ("Growth Performance") is devoted to the analysis of CAGRs of the number of units, employment, fixed capital, and production. Moreover, yearly growth rates were also calculated to ascertain the year-to-year fluctuations. The second subsection ("Profile of Productivity and Related Variables") is devoted to the profile of capital intensity, capital–output ratio, and partial productivities of labor and capital in basic metal products industry. The third subsection ("SWOT Analysis of Basic Metal Products Industry") deals with SWOT analysis of basic metal products industry.

Growth Performance

Measuring growth has been one of the most extensively researched areas. The growth rate analysis helps in evaluating growth performance. A positive growth rate reveals an increase in related aspect by its magnitude per annum, whereas it is the opposite in case of negative growth rate. All statistically insignificant growth rates indicate no growth rate. The year-to-year growth rates CAGR of the number of units, fixed investment, employment, and value of production of basic metal industry are shown in Table 1. The results are discussed in brief under the following four subheads.

Number of units: Column-wise investigation of Table 1 reflects that the year-to-year growth rates for number of units remained quiet steady till 1991–92 and hovered within a narrow band of 3.88% in 1987–88 to 5.85% in 1991–92 with an exception of two years (1983–84 and 1990–91) when it climbed to 9.05% and 8.04%, respectively. 1991–92 onwards, the year-to-year growth rates started a downhill journey, almost consistently till 2004–05, with an exception of 1995-96, when it clocked an annual growth rate of 5.97%. However, a steep fall of -10.08% was witnessed in 2002–03 followed by a pull-back (0.31%) in 2003–04, and finally to 0.79% in 2004–05.

Further perusal of Column 2 of Table 1 reveals that the pre-liberalization period showed an annual growth rate of 6.12% which was way ahead of its counterpart, 1.53% belonging to the liberalization period. However, a compound growth rate of 3.94% was observed for entire period of the study.

Fixed investment: Column 3 of Table 1 shows extreme volatility in year-to-year growth rates of fixed investment, with the highest figure of 18.79% recorded in 1982–83 and the lowest figure of the order of -12.75% recorded in 2003–04. Further study of the data reveals that the variable started with a negative year-to-year growth rate of 9.61% in 1981–82 followed by a sharp rise to 18.79% in 1982–83. However, the growth figure fell sharply in following two years and settled at the level of 2.61% in 1984–85. Then started the ugly phase of negative year-to-year growth rates which lasted till 1992–93, with an exception of the year 1986–87, when

Table 1: Year-to-Year and Componud Annual Growth Rates (in percent)

Year	Number of Units	Fixed Investment (in Rs cr.)	Direct Employment (in No.)	Production (in Rs cr.)
1981–82	5.82	-9.61	4.59	-9.59
1982–83	5.67	18.79	5.02	5.12
1983–84	9.05	1.64	7.85	1.10
1984–85	7.49	2.61	4.91	0.62
1985–86	5.98	-5.03	6.40	0.60
1986–87	4.77	15.28	5.98	21.14
1987–88	3.88	-2.02	3.18	3.79
1988–89	6.84	-5.13	5.14	0.12
1989–90	4.88	-2.50	5.83	5.82
1990–91	8.04	-0.02	6.11	14.95
1991–92	5.85	0.82	7.73	8.25
1992–93	3.31	-1.72	-6.40	20.11
1993–94	3.56	3.42	19.43	14.89
1994–95	3.87	6.51	5.06	25.43
1995–96	5.97	4.16	6.58	-1.34
1996–97	2.63	9.70	4.85	13.30
1997–98	2.33	14.96	4.51	16.54
1998–99	2.11	17.43	5.04	6.09
1999–2000	1.94	13.79	4.94	25.21
2000–01	1.67	8.76	3.94	7.50
2001–02	1.08	6.09	2.24	12.41
2002–03	-10.08	-5.83	-5.08	-3.45
2003–04	0.31	-12.75	1.53	-7.3
2004–05	0.79	1.52	3.75	25.58
CAGRs:				
Pre-liberalization period	6.12*	1.38*	5.59*	5.02*
Liberalization period	1.53*	7.76*	0.87**	10.94*
Overall period	3.94*	3.84*	5.0*	9.73*

Notes:

* Significant at 5% level of significance

** Insignificant at 5% level of significance

Fixed investment and production figures are taken on 1993–94 constant prices to compute various growth rates.

Source: Calculated from the data supplied by Directorate of Industries, Punjab.

it registered a sharp rate of growth of 15.28%. From 1992–93 till 1998–99, the annual growth rates started their upward march and scaled the peak of 17.43% in 1998–99. However, the following period failed to maintain the momentum as the growth figure touched its lowest ebb (-12.75%) in 2003–04. Column 3 also highlights that during the pre-liberalization period CAGR of fixed capital investment was only 1.38%, which went up to 7.76% during the liberalization period. However, the entire study period recorded a CAGR of 3.84%.

Direct employment: Column 4 of Table 1 demonstrates that the year-to-year growth rates of employment have shown a fair amount of stability during the entire study period. The growth figure remained within the positive territory throughout except on two occasions, that is, for the years 1992–93 (-6.40%) and 2002–03 (-5.08%). The year 1993–94 remained an excellent year for direct employment when the year-to-year growth figure reached 19.43%. The column further envisages that the pre-liberalization period recorded a much higher CAGR (5.59%) than the liberalization period (0.87%). However, the entire study period witnessed a CAGR of the order of 5.0%.

Production: An investigative scan of year-to-year growth rates of production as compiled in Column 5 of Table 1 presents massive fluctuations with phases of low, moderate, and high growth rates. Starting from a negative growth figure of 9.59% in 1981–82, it turned into a positive growth figure of 5.12% in the year 1982–83. Then started a phase of low growth rates for seven years, spanning till 1989–90, with an exception of 1986–87, when it touched a peak of 21.14%. 1989–90 onwards the variable has shown moderate to high annual growth rates with an exception of three years (1995–96, 2002–03, and 2003–04) when it clocked negative growth rates of 1.34%, 3.45%, and 7.3%, respectively. The period mirrors three very exceptional years too—1994–95, 1999–00, and 2004–05—when it registered an impressive growth rate of 25.43%, 25.21%, and 25.58%, respectively.

Further, this column delineates that the year-to-year compound rate of growth of production was detected more than double in the liberalization period (10.94%) compared to pre-liberalization period (5.02%). This upbeat growth in the liberalization period resulted in CAGR of 9.73% in the overall period of the study.

The conclusion from the entire discussion is that the CAGR for fixed investment and production improved significantly during the liberalization period, while it decelerated substantially for the number of units and direct employment in the same period. Liberalization has boosted capital investment and technological upgradation in basic metal industry in Punjab.

Profile of Productivity and Related Variables

Productivity is the relationship between economic output and inputs such as labor and capital used in production of that output. It is evident that the capacity of the economy to produce goods and services mainly depends on productivity of these factors. Productivity can be increased through better utilization of resources. It is widely agreed that increasing productivity is a barometer of good health of businesses which allows them to produce output at lower average cost and makes them competitive both in short as well as long run. Table 2 depicts the profile of capital intensity, capital–output ratio, and partial productivities of labor and capital of the basic metal products industry of Punjab. This table also highlights the compound growth rates of capital intensity, capital–output ratio and partial productivities of labor and capital for pre-liberalization and liberalization periods. The detailed column-wise explanation of the Table 2 is discussed further.

Labor productivity (AOLR): The figures of annual growth rates of labor productivity as complied in Column 2 of the table shows a fluctuating behavior. But, despite fluctuations, there is an evident improvement especially after 1990–91, ultimately reaching the level of Rs 0.0481 crore in 2004–05. This clearly mirrors an improvement in labor productivity in the liberalization period over the pre-liberalization period: the CAGR of 6.62% as observed in the liberalization period is way ahead of its counterpart at -0.53%. However, for the overall period of the study a CAGR of 4.51% was observed.

Capital intensity (DOM): Perusal of Column 3 of Table 2 reveals capital intensity, which was at the highest level of Rs 0.0073 crore in 1980–81, has shown fluctuations throughout the study period but with a negative bias. Capital intensity reached the lowest level of Rs 0.0040 crores in 1995–96. Thereafter, it improved consistently till 2001–02 and finally settled at Rs 0.0053 crores in 2004–05.

This column further exhibits that capital intensity has decelerated in the pre-liberalization period as revealed by the negative CAGR of 3.94%. However, in the liberalization period, an improvement was noticed

Table 2: Profile of Capital Intensity, Capital–Output Ratio and Partial Productivity of Capital and Labor

Year	AOLR(in Rs cr.)	DOM(in Rs cr.)	COR	AOCR
1980–81	0.0212	0.0073	0.35	2.89
1981–82	0.0183	0.0063	0.35	2.90
1982–83	0.0184	0.0072	0.39	2.56
1983–84	0.0172	0.0068	0.39	2.55
1984–85	0.0165	0.0066	0.40	2.50
1985–86	0.0156	0.0059	0.38	2.65
1986–87	0.0178	0.0064	0.36	2.78
1987–88	0.0179	0.0061	0.34	2.95
1988–89	0.0171	0.0055	0.32	3.11
1989–90	0.0171	0.0051	0.30	3.37
1990–91	0.0185	0.0048	0.26	3.88
1991–92	0.0186	0.0045	0.24	4.17
1992–93	0.0239	0.0047	0.20	5.09
1993–94	0.0230	0.0041	0.18	5.66
1994–95	0.0274	0.0041	0.15	6.66
1995–96	0.0254	0.0040	0.16	6.31
1996–97	0.0274	0.0042	0.15	6.52
1997–98	0.0306	0.0046	0.15	6.61
1998–99	0.0309	0.0052	10.17	5.97
1999–00	0.0368	0.0056	0.15	6.57
2000–01	0.0381	0.0059	0.15	6.49
2001–02	0.0419	0.0061	0.15	6.88
2002–03	0.0426	0.0060	0.14	7.05
2003–04	0.0389	0.0052	0.13	7.49
2004–05	0.0481	0.0053	0.11	9.07
CAGRs:				
Pre-liberalisation period	-0.53**	-3.94*	-3.5*	3.6*
Liberalisation period	6.62*	2.76*	-3.74*	3.72*
Overall period	4.51*	-1.14*	-5.45*	5.70*

Notes: * significant at 5% level of significance.
** insignificant at 5% level of significance.

Terms used:

a) DOM: Degree of Mechanization (Capital Intensity): It is fixed capital at constant prices per employee(K/L)

b) COR: Capital–Output Ratio: It is ratio of total fixed capital to total production (both deflated).(K/O)

c) AOCR: Average Output Capital Ratio (Capital Productivity): It is ratio of total production to total fixed capital (both deflated).(O/K)

d) AOLR: Average Output Labor Ratio (Labor Productivity): It is total production at constant prices per employee.(O/L)

Source: Calculated from the data supplied by Directorate of Industries, Punjab.

with CAGR of 2.76%. However, the overall period of the study witnessed a CAGR of -1.14%.

Capital–output ratio: A glance at the Column 4 of the table shows that the capital–output ratio, which was 0.35% in 1980–81, climbed to 0.40% in the year 1984–85 and thereafter declined almost consistently to reach at the lowest level of 0.11% in 2004–05.

The column further delineates that capital–output ratio witnessed a declining trend both in the pre-liberalization and liberalization period underlining a healthy sign for the industry. During the pre-liberalization period, CAGR was worked out to be -3.5% while it was -3.74% in the liberalization period. In the overall study period, CAGR was found to be -5.45%.

Capital productivity: It is quite evident from Column 5 of Table 2 that capital productivity, which remained sluggish during the initial years of the study till 1986–87, picked up momentum thereafter and showed steady growth for the remaining period of the study, and finally reached 9.07% in 2004–05. It also shows an improvement of CAGR for the liberlization period (3.72%) over the CAGR of the pre-liberalization period (3.6%). However, the CAGR for the entire period of the study remained at 5.70%.

On the basis of this discussion, it can be concluded that the liberalization has given a boost to the mechanization and technological improvement in basic metal product industry in Punjab. The policies of the liberalized regime have resulted in lower capital–output ratio and enhancement of factor productivities, but at the cost of employment generation.

SWOT Analysis of Basic Metal Products Industry

A SWOT analysis is a written exercise that helps clarify and focus on the specifics that make up the four areas (strengths, weaknesses, opportunities, and threats) that most affect basic metal products industry. The purpose of SWOT analysis is to help policy makers build on strengths, help them identify ways to minimize and correct the effect of weaknesses in the basic metal products industry, and to take the greatest possible advantage of potential opportunities while formulating a plan to deal with potential threats.

Strengths: Strengths are those factors that make any business stronger. In strength analysis, one examines the advantages the basic metal products industry has over its counterparts. The following points highlight the strengths of the basic metal products industry in Punjab:

- Easy availability of cheap migrant labor
- Flourishing domestic market
- Small scale units with benefits of simpler management structures
- Greater locational flexibility
- Dynamic entrepreneurial abilities of the people of Punjab
- Existence of fairly efficient infrastructure
- Conducive and investor friendly environment in the state

Weaknesses: Weaknesses, the anti-theses of strengths, are those areas in which the existing basic metal product industry does not perform well. The following points highlight the weaknesses of the basic metal product industry in Punjab:

- No mineral base in the state leading to dependence on external sources
- Instability in the prices of raw material
- Lack of standardization and quality control
- Irregular and erratic power supply
- Non-sophisticated marketing sense
- Absence of research and development (R&D) culture
- Unskilled labor
- Lack of synergies between government support institutions and practical market

Opportunities: Opportunities are those factors that have the potential to make the business stronger, more enduring, and profitable. The following points highlight the opportunities available to the basic metal products industry in Punjab:

- Sunrise areas like IT-enabled services, software, etc., can be tapped to enhance efficiency
- Punjab, being a part of the national freight corridor scheme, can help the industry expand its business

- R&D and reverse engineering
- Improvement in relations with its neighbor, Pakistan, can open new vistas of growth

Threats: Threats are those factors that have the potential to adversely affect the basic metal products industry of Punjab. The following points highlight the threats to the basic metal product industry in Punjab:

- Increased competition owing to dismantling of quantitative restrictions under WTO
- Vulnerability to fast changes in technologies from large business houses
- Changing consumer trends

Conclusion and Findings of the Study

The upshot of the entire discussion is that, despite the problem of militancy in the pre-liberalization period, significant growth rate was observed in all the four variables, namely, number of units, employment, fixed investment, and production. But the policies of the liberalized regime resulted in qualitative growth in the basic metal products industry in Punjab. Highly significant growth was envisaged in fixed investment and production, a relatively low significant growth was observed in number of units, and insignificant growth was witnessed in direct employment during the liberalization period. However, in overall period of the study, significant growth rate was registered in case of all these four variables. Thus, it can safely be inferred from the analysis that the liberalization has resulted in jobless growth because along with an acceleration in the growth of production, the rate of growth of employment has gone down drastically.

The profile of labor and capital productivity indicates that in absolute terms, partial productivities of labor and capital have gone up significantly, whereas the capital–output ratio has fallen miserably and capital intensity has depicted marginal decline during the overall period of the study. The comparative profile of pre-liberalization and liberalization periods revealed that during the liberalization period, productivities of labor and capital and capital intensity have improved significantly, whereas the capital–output ratio has decelerated.

Even the SWOT analysis of the basic metal products industry of Punjab highlights immense challenges as well as opportunities for the industry. The need of the hour is that our policy makers adopt a cohesive and integrated approach to nurture and strengthen the crucial basic metal products industry. Punjab, where agricultural growth has saturated and an army of technically-trained graduates is joining the job market, industrial development is the only alternative which can provide gainful employment to the educated unemployed youth. In this context, the basic metal products industry needs a focused attention because of its strong forward linkage effects.

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The distance between insanity and genius is measured only by success.

— Bruce Feirstein

Decision-making Model for Economical Wastepaper Collection

Rupesh Kumar Pati, Prem Vrat, and Pradeep Kumar

Conservation of earth's resources is crucial to a sustainable future for humanity. Since 1980 recycling and reuse (major component of reverse logistics) have been key issues around the globe. Reverse logistics refers to all the logistic activities to collect and process used products and or parts in order to ensure ecofriendly recovery. This paper proposes a decision-making model which acts as a framework for economical collection of the wastepaper from the initial stage, that is, customer (also named as vendor customer) by the dealer stage. Use of this model also improves the quality of the wastepaper being recycled. This improves the overall productivity of recycling paper.

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Conservation of earth's resources is crucial to a sustainable future for humanity. Many of waste materials generated from human activities may be recycled and thus, become a resource for industrial production or energy generation. These recyclable wastes were previously discarded, as they were considered useless. The prevalent method of disposing solid wastes like paper, glass, plastics, etc., is curbside collection followed by land disposal. But, in the recent years, there has been a surge of interest in waste recovery and recycling in both the developing and developed world. The goal of conserving and protecting natural resources has shifted the central concern of waste management from disposal towards waste prevention and recycling.

Factors such as political pressure and public opposition to disposal sites, economic pressure of the high cost of waste disposal due to land shortage (increasing the cost of landfills), and stringent regulatory standards of waste disposal are forcing many industrialized countries towards recycling (Cointreau and de Kant, 1991; Hooper and Nielsen, 1991). This trend towards increased material and energy efficiencies and increased recycling are similar across various industries.

The pulp and paper sector presents one of the energy incentives and highly polluting sectors within the Indian economy and is, therefore, of particular interest in the context of both local and global environmental discussions. Increase in productivity through the adoption of more efficient and cleaner technologies in the manufacturing sector will be most effective in merging economic, environmental, and social development objectives. Paper recycling is one such technique of producing paper.

Indian Paper Industry

Paper industry is one of the key industrial sectors in Indian economy. The pulp and paper industry in India has a tremendous growth potential, which is currently estimated at 8% per annum. The per capita paper consumption figure in India was 3.6 kg (in 1995), which is very low as compared to the world average of 45.6 kg (in 1995). The consumption levels are estimated to reach 6 kg in 2005/06 (IPMA, 1996, p. 59). Although per capita consumption of paper in India is very low compared to other countries, the paper industry holds a considerable share in manufacturing/production sector. Today, more than 380 small and big paper mills produce a variety of different paper, paperboard as well as newsprint products. Cultural paper constitutes the biggest share in production with 41% (in 1991), followed by Kraft paper with 27% share, paperboard with 17%, newsprint with 12%, and specialty paper at 3% (Sharma et al., 1998).

Demand for paper and paper products has continuously been increasing over time. Consumption of paper and paperboard equaled 1.2 million tonnes in 1980–81 and increased to 2.6 million tonnes in 1994–95. Imports of paper and paperboard accounted for about 7% of consumption in 1980–81. This figure increased to over 10% in 1994–95. On an average, about 0.2 million tonnes of newsprint (about 40% of consumption) had to be imported in the last few years (Schumacher and Sathaye, 1999). It has been projected, that with the existing resources, there would be shortfall of paper 5.1 million tonnes between the demand and supply of paper by 2015–16 (Sharda et al., 2000). Paper recycling is an effective way to fill this gap between supply and demand as well as benefit the ecosystem.

The comparative analysis of the furnish structure in global, China, and Indian subcontinent's paper industry is depicted in Figure 1 (Panwar et al., 2001). It can clearly be seen that the percentage of wastepaper utilized in India for the production process (29.1%) is considerably less compared to what most of the countries accounted for. The global recovered paper consumption grew from 49.9 million tons between 1990 and 1998 to 135 million tons in 1998. In 2005, it is forecasted that 174 million tons of recovered paper will be used globally. From 1998–2005, rate of increase of recovered paper is 3.6% annually (Gnanasekaran et al., 2001).

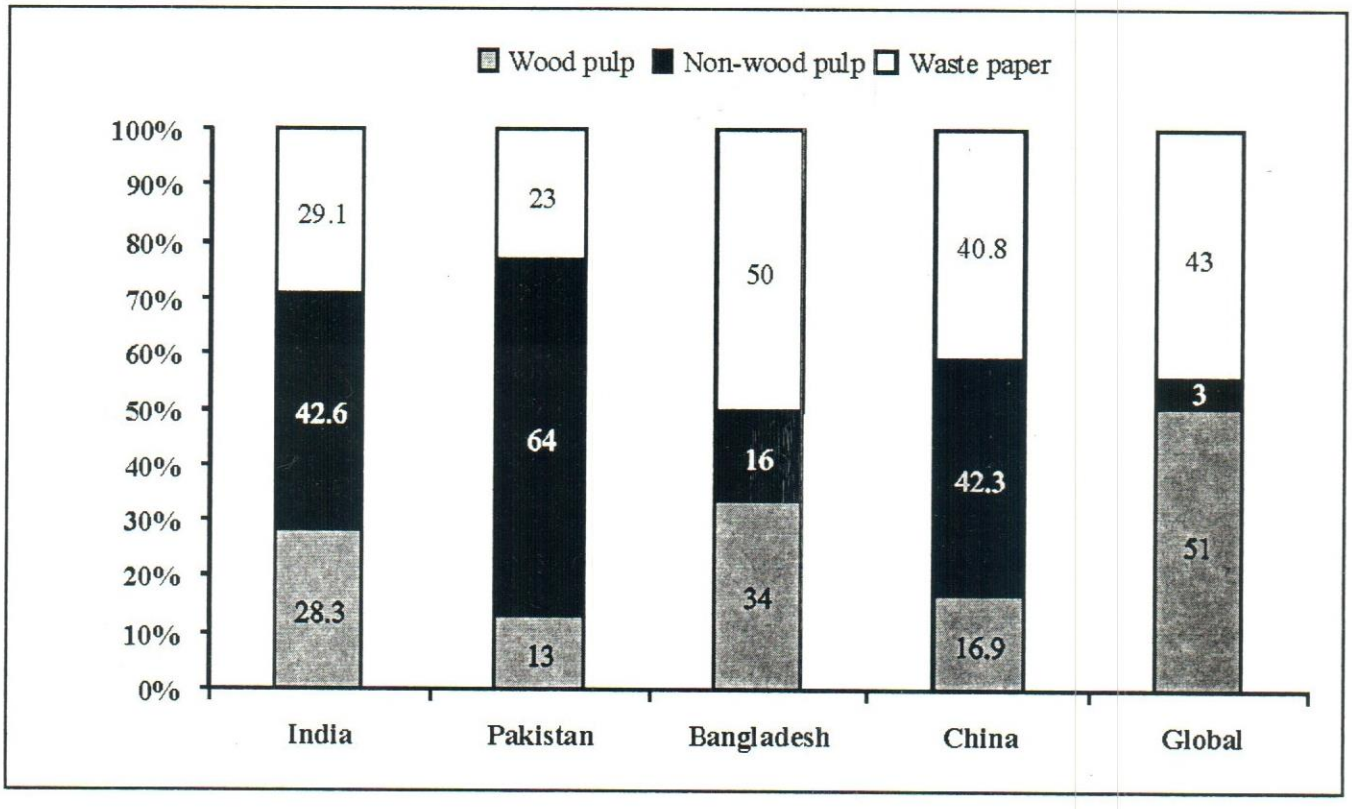

Fig. 1. Structure Comparing Global, China, and Indian Subcontinent Paper Industry

Table 1: Effect of Burning and Land Filling of Wastepaper on the Ecosystem

	Burning of Waste-paper (1000 kg)	Landfill of Waste-paper (1000 kg)
Output	Quantity (kg)	Quantity (kg)
Solid waste	55.87609	55.87609
CO_2	939.624	142.35658
CO	1.39999	0.00062645
VOC	0.299334	0.299334
NO_x	1.500028	0.00156613
SO_2	1.300009	1.300009
CH_4	–	51.767331
HC	–	0.00031323
Particles	–	0.0012592
Organic matter	–	751.22513

Paper is a major component of the overall municipal solid waste stream. The ill effect of the burning and land filling of wastepaper on the ecosystem in India has been studied previously and is illustrated in Table 1 (Beukering et al., 1996). Thus, wastepaper recycling is seen as one important waste management strategy to prevent the ecosystem from degradation. Recycling of the wastepaper reduces the need for the disposal capacity, which in turns leads to lower emissions from landfills. The present scenario of the Indian paper industry leads us to the situation of:

- shortage of forest based fibrous raw material,
- problems in the processing of the agro residues,
- increasing environmental pressure, and
- stringent discharge norms and high cost of inputs for the treatment of the effluent.

The major advantages associated with the increasing use of recycled fiber by the paper industry are its sustained availability and ecofriendly uses, low cost, high fiber yield, less capital investment, and lower water, energy, and chemical consumption compared to the integrated mills based on wood or agro residues.

The mills based on wastepaper prefer to use imported wastepaper because of its better quality in terms of fiber strength and also due to inadequate domestic supply owing to the unorganized collection of waste paper within the country. The yield from each tonne of imported waste paper can be as high as 0.9 tonne, which is considerably higher compared to the yield for agro-pulp (0.4 tonne) and wood-pulp (0.5 tonne) based paper. Also, using wastepaper consumes only 40% of the energy required for the process based on other raw materials (Gupta et al., 1998).

The wastepaper percentage is going to be much higher in future as paper consumption increases due to increase in population and literacy rate. However, to keep pace with demand, one would need to recover and recycle paper considering the likely shortage of paper. But, the recovered paper collection and sorting are highly labor-intensive processes. The characteristics of the collection system are decided by the population density, number of households covered by the program, and the waste stream characteristics (Jaher, 1995). There are possibilities for efficient collections by creative route planning and vehicle development. Hence, this paper proposes a framework of a decision-making model for an economic collection of the wastepaper from the initial source, that is, vendor customer by planning the route creatively for vehicular movement. This model can further be extended for collection of wastepaper between other pair of entities (stages) in the reverse supply chain.

Indian Paper Recycling System

Indian paper recycling system consists of five entities or participants in the recycle collection chain to carry out reverse logistics activities involving collection of wastepaper/used paper from the customer/industries to the manufacturer. The members of this reverse supply chain include the dealer, which collects unsegregated wastepaper from customers/industrial houses through waste pickers and itinerant buyers. The supplier finally sends the segregated recyclable paper to the manufacturer for production of new paper. The supplier then collects the desired segregated waste from the godown owner (where segregation is done).

The forward supply chain completes the entire paper recycling system. The forward supply chain takes care of the logistic activities concerning movement of finished paper after production till it reaches the desired final customer.

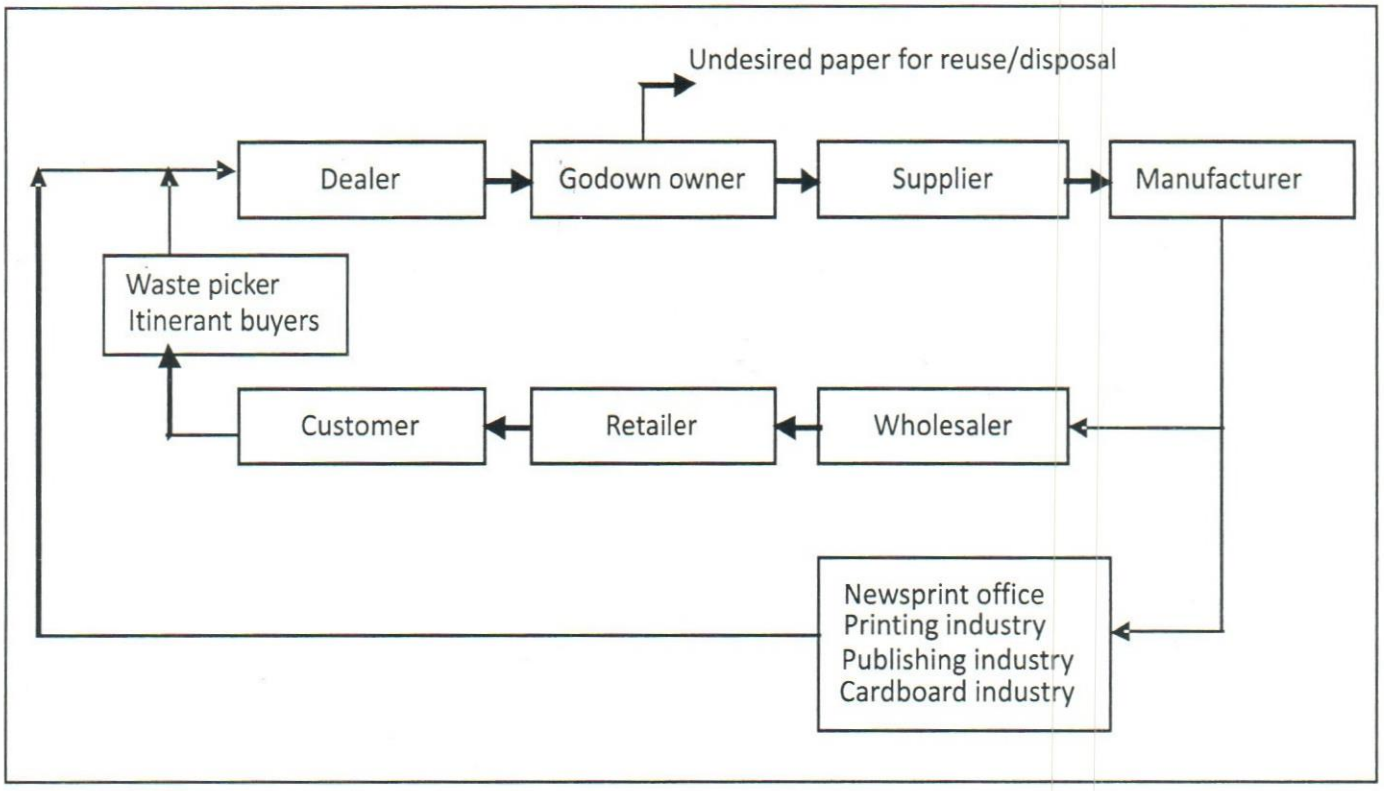

Fig. 2. Participants/Entities of Paper Recycling System

The members of the forward supply chain are the wholesaler, retailer, and the final customer (with industrial houses as exception, as they may fulfill their need directly from the manufacturer). The representation of the paper recycling system can be pictorially depicted in Figure 2.

Majority of the waste pickers are unskilled migrants, who roam the streets and dumpsites to collect any type of material they can sell to the dealer. The itinerant buyers are also mobile, but instead of picking waste from bins and dumpsites, they go from door to door on a bicycle to buy waste from households or shops. The materials collected by itinerant buyers are not been mixed with disposable wastes; the quality is much higher than the wastepaper gathered by waste pickers (Beukering et al., 1996). In order to improve the quality of recyclable paper and reduce the collection cost, the dealer should device an effective collection strategy. In this strategy the dealer should collect wastepaper directly from the customer eliminating the waste picker/itinerant buyer stage. The elimination of the intermediate stage also reduces travel time for the collected wastepaper to move from the source to the recycling unit. When the customer is involved directly with the dealer he can be renamed as vendor customer, that is, VC (as he is the final customer of finished paper as well as the initial vendor for the recyclable paper).

Wastepaper Collection Decision-making Model

For the purpose of collecting wastepaper, the ultimate consumer/vendor customer can be divided in to three categories: single-family house, residential apartments, and industrial/institutional sectors. The quantity of wastepaper generated in a specific period increases as one moves from single-family houses to industry/ institutes. For the purpose of efficient collection, the dealer should facilitate a collection point in some particular groups of single-family houses, apartments and industry/institute. These categories and collection points are formed on the basis of the amount of waste generated by these categories in a specified period of time. These collection points can be termed as vendor customer collection points or simply VC.

The proposed decision-making model for an economic collection of wastepaper from the initial source, that is, vendor customer by the dealer is shown in

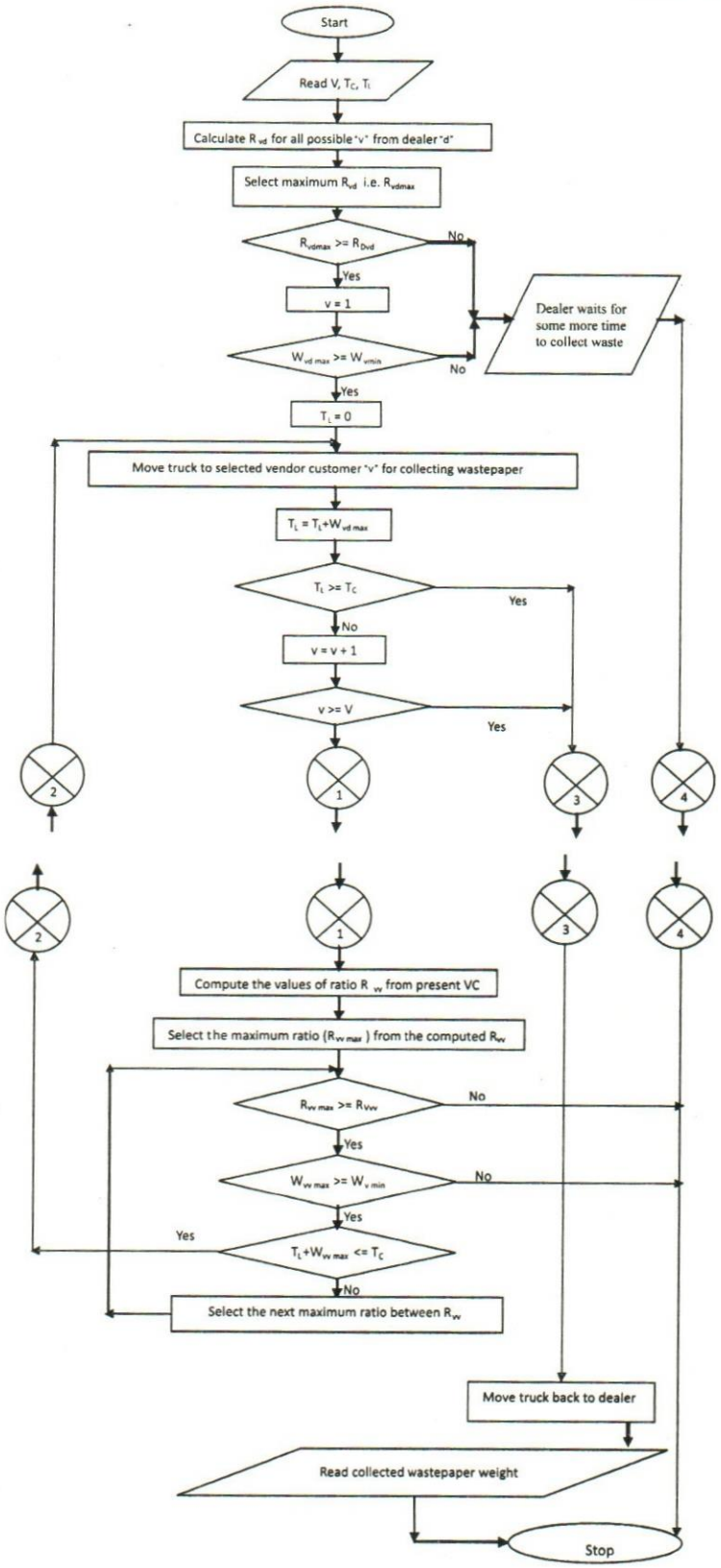

Fig. 3. Wastepaper Collection Decision-making Model

Figure 3. The purpose of the proposed model is to guide the dealer to make and implement decision on the wastepaper collection route from the set available vendor customers. The model runs on a pair of assumptions. At first, the distance between various entities and sub-entities needs to be known. Second, the data relating to the average wastepaper collection at the vendor customer during a particular period are required before the decision model is utilized.

The model (Figure 3) depicts several key steps in the form of flowchart to help the dealer in collection through proper vehicular movement. This model also guides the dealer in proper manpower planning for the collection purpose. The decision for cost efficient and effective vehicular collection of wastepaper depends on the decision taken on two separate stages combined together.

The first stage of the model determines time and direction of the movement of the collecting vehicle (for example, truck) from a predetermined dealer. The parameters that affect decision-making in the first stage are ratios of weight of wastepaper to be collected from the vendor customer "v" by the dealer "d" to the distance moved between them (R_{vd}); weight of wastepaper ($W_{v\,d\,max}$) at the vendor customer "v" for maximum R_{vd}. Whereas, the second stage determines the time and direction of vehicular movement from the vendor customer (VC) selected in the previous stage. The second stage includes the decision on whether the collecting vehicle should move to another vendor customer or return to the origin. The decision of the second stage depends on capacity of the truck (T_C), present load carried by vehicle (T_L), ratio of the weight of wastepaper in uncovered vendor customer to traversing distance from present vendor customer (R_{vv}), and finally, weight of wastepaper ($W_{v\,v\,max}$) at the vendor customer "v" with maximum R_{vv}. The total number of vendor customers (V) available for collection of the wastepaper also affects the second stage decision.

The other notations used in Figure 3 are as follows:

$R_{vd\,max}$ = Maximum of all the R_{vd} Values,

R_{Dvd} = Minimum desired R_{vdmax} for truck to be moved from dealer "d" to VC "v",

$W_{v\,min}$ = Desired minimum weight of wastepaper to be collected from vendor customer.

$R_{vv\,max}$ = Maximum of all the R_{vv} computed for a particular vendor customer as reference,

R_{Vvv} = Minimum desired ratios of R_{vv} for the truck to travel/move between two VC's to collect wastepaper.

Conclusion

The new concept of reverse logistics is slowly but steadily entering all prime industrial sectors of the Indian economy. This concept moves a long way in improving energy, raw material and thus the total productivity of any firm/industry. For the paper industry to sustain in the fiercely-competitive global market, growing wastepaper stock must be utilized to displace some of the virgin raw material, that is, wood pulp used in the production process. The reverse logistics process used in the paper industry also helps in improving the ecosystem, which is constantly being deprived of its precious forest cover. But the major problem in recycling of paper is the difficulty and uneconomical collection of used paper from vendor customers. The proposed decision model provides the dealer of the recycled paper industry with a framework for economic collection of wastepaper from the specified set of vendor customer collection points. Use of this model also ensures an improved quality of wastepaper available for recycling, as they are not mixed with other wastes in the dumpsites. All this has direct impact on the improved productivity in the paper recycling. This model can further be extended to other layers of the reverse supply chain, e.g., collection of wastepaper by godown owner from the specified set of dealers.

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Small opportunities are often the beginning of great enterprises.

— Demosthenes

Focus

Wage-productivity Analysis: Lead and Zinc Industry

Juin Choudhury

The wage-productivity relationship is very important in order to identify the nature of relationship between important economic variables. This type of research paper is needed especially in the non-coal sector where much remains to be done for improving the operational efficiency of this industry. This paper has been carried out to analyze the efficiency of the wage–productivity relationship in lead and zinc industry. The main objective of the analysis is to find out whether there exists a positive relationship between wage and productivity.

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Lead and zinc occurrences in India are localized mainly in the Precambrian formation of the peninsular shield and to smaller extent in lesser Himalayas. The name of this ore is also called galena and sphlerid. About 90% of the total resources of lead and zinc in the country are located in Rajasthan and Gujarat of the western region (Statistics of Mines in India).

Wages in Lead and Zinc Industry

Wages (Concept and Theory)

The term wages may be used to describe one of the several concepts including that which is rated straight time, average hourly earnings, weekly take-home pay,and annual earnings. Money paid to a worker is considered as his wages. He gets other types of benefits as well such as pension, welfare funds, social security, vacations, and holidays which are regarded as fringe benefits. These are paid in addition to the wages and form part of total costs (Chakraborti, 1996, p. 31).

Money Wages and Real Wages

Wages earned by employees are normally expressed in terms of money. There are two aspects of wages. One is expressed by the term money wage while the other by real wage. Money wage given to workers commands over the goods and services, whereas real wages depend on the level of production.

Consumer Price Index Number

Consumer price index is a mechanism which helps measure the rise or fall in consumer price. The consumer price index is used for various purposes, namely, income adjustment, real wage calculation, price adjustment in business and industrial contracts, deflation of income value series in national accounts, and price analysis.

Wage Structure

Wage structure is the complex of rate within firms differentiated by occupation of employees and the complex of interfirm rate structure (Choudhury and Chakrabarti, 2004, p. 38).

Basic Wage

The term basic wage is ordinarily understood to mean that part of the price of labor which the employer must pay to all workmen belonging to all categories (Choudhury **and Chakrabarti, 2004, p. 38).**

Dearness Allowance

It is an additional payment made by the employer to his employees to compensate them to certain extent for the rise in the cost of living (Choudhury and Chakrabarti, 2000, p. 281).

Over-time Payment

The payment of overtime allowance to the factory and workshop employees is guaranteed by law.

Bonus

Bonus is a unique component of India's industrial composition system. Bonus is regarded as an incentive for regular attendance as an encouragement for good work.

Fringe Benefits

In addition to the wages, employees also receive certain supplementary benefits and services known as fringe benefits which have been discussed earlier.

Incentive System

The term incentive is used to signify inducements offered to the employees to put forth best in order (Choudhury and Chakrabarti, 2000, p. 282).

Analysis

From Table 1, in the first sub-period, 1973–78, the production increased at the rate of 19.62% per year. But in the second sub-period the production increased at the rate of 5.12% per year. In 1986–92 the production increased at the rate of 2.12%, and in the fourth sub-period the production remained almost constant. On the whole period, that is, 1973–2007, the production increased at the rate of 6.08% per year.

Table 1: Rate of Change of Average Production of Lead and Zinc Industry

Sub-period	Average production (in %)
1973–1978	19.62
1979–1985	5.12
1986–1992	2.12
1993–2000	0.20
2001–2007	-3.06
1973–2007	**6.08**

Source: Director General of Mine Safety

From the first sub-period (1973–78) to the fourth (1993–2000), though we see that production was positive in every sub-period, there was a downfall of production. In the 1993–2000 sub-period, production was much lower than the previous three periods. Shortage of water and a major accident in a mine led to such a steep fall of the production in this sub-period. Again from 2001–07 production started decreasing at the rate of 3.06% per year.

Table 2 shows the growth rate of employment of underground mines above the ground and overall mines. In the first sub-period, employment of underground mines, those above the ground, and in overall mines increased at the rate of 10.40%, 14.07%, and 12.15%, respectively. In the second sub-period, employment of underground mines increased at the rate of 6.95%, whereas employment of above ground mines increased at the rate of 12.19%, and in case of overall mines, it increased at the rate of 8.79%. In the third sub-period, in case of underground mines and those above the ground, employment remained constant but in case of overall employment it increased at the rate of 3.11% per year.

Table 2: Growth Rate of Average Daily Employment

Sub-period	Underground mines (in %)	Above ground mines (%)	Overall (in %)
1973–1978	10.40	14.07	12.15
1979–1985	6.95	12.19	8.79
1986–1992	0.57	0.57	3.11
1993–2000	-3.97	-3.98	-2.86
2001–2007	-0.45	2.6	-8.38
1973–2007	**1.78**	**4.15**	**2.70**

Source: Director General of Mine Safety

In the fourth sub-period the employment of underground and above ground decreased at the rate of 3.98% and 2.86% for overall mines. In the last or fifth sub-period, employment of underground and overall mines

decreased at the rate of 0.45% and 8.38% but employment in above ground was in an increasing trend at the rate of 2.6%.

On the whole period, that is, 1973–2007, employment increased at the rate of 1.78% for underground mines, 4.15% for above ground mines, and overall at the rate of 2.70% .

From the first sub-period (1973–78) to 1993–2000, employment was continuously in a declining trend. This is due to the introduction of sophisticated equipment and for effective management system adopted for optimizing production economically. If we see the above ground category it is found that the employment increased at a higher rate than the other categories, except in the period 1993–2000 when it had a negative trend. This is because the above ground category consists of mainly clerical and supervisory staff which is one of the prime requirements for efficient running of an organization.

Table 3 shows that in the first sub-period, average productivity increased at the rate of 6.95% for overall and 8.54% for underground mines. During this period, the average production increased at the rate of 19.62% whereas

Table 3: Growth rate of Average Productivity of Underground and Overall

Sub-period	Underground (in%)	Overall (in %)
1973–1978	8.54	6.95
1979–1985	-2.28	-3.20
1986–1992	1.83	-0.78
1993–2000	4.11	2.92
2001–2007	0.57	-9.00
1973–2007	8.82	2.34

Source: Director General of Mine Safety

employment increased at the rate of 12.15% per year. In the second sub-period, average productivity decreased at the rate of 2.28% per year because in this period, production increased at the rate of 5.12% and at 8.79%. In the third sub-period, the average productivity decreased at the rate of 0.78% for overall but increased at the rate of 1.83% in underground mines. However in this period production increased at the rate of 2.12% and employment at the rate of 3.11%.

In the fourth sub-period, productivity of overall mines increased at the rate of 2.92% where productivity of underground mines increased at the rate of 4.11%. In this period production was almost constant but employment decreased at the rate of 2.84%. On the whole period, that is, 1973–2007, productivity of overall mines increased at the rate of 2.34% where productivity of underground mines increased at the rate of 8.82% per year. During this period, production of overall increased at the rate of 6.08% per year and employment increased at the rate of 2.70% per year.

If we go through Table 4 that accounts the rate of change in money wage for different sub-periods, we find a continuous growth rate starting from 1973–2007. From this

Table 4: Growth Rate of Money Wage

Sub-period	Underground (in %)	Above ground (%)	Overall (%)
1973–1978	11.69	6.47	5.03
1979–1985	13.92	7.78	14.15
1986–1992	13.27	10.28	11.56
1993–2000	15.49	10.29	13.51
2001–2007	00.04	00.07	0.34
1973–2007	12.34	10.32	11.96

Source: Director General of Mine Safety

table we see that after first sub-period (1973–78), money wage increased at a faster rate. From the period 1979–85, the growth rate of money wage steeply increased due to introduction of productivity linked bonus, including casual labor with temporary status. On the whole the rate of change in money wage comes out to be 12.34%, 10.32%, and 11.96% for underground mines, above ground mines, and for overall mines, respectively.

Referring to Table 5, if we calculate the rate of change in real wage for the entire period category wise, it can be seen that the real wage of underground increased at the rate of 6.05% however above ground and overall remain almost constant. In the second sub-period, that is, 1979–85 in case of overall and underground mines, it increased at the rate of 3.51% and 3.70%, whereas in mines above the ground, real wage decreased at the rate of 1.71%.

Table 5: Growth Rate of Real Wage

Sub-period	Underground mines	Above ground mines	Overall
1973–1978	6.05	0.83	6.05
1979–1985	3.51	-1.71	3.70
1986–1992	7.36	22.37	5.52
1993–2000	8.40	14.16	6.35
2001–2007	-0.29	1.50	-0.31
1973–2007	**4.56**	**3.14**	**4.86**

Source: Director General of Mine Safety

In third-sub period (1986–92), real wage of underground and overall mines increased at the rate of 7.36% and 5.52%, respectively, however real wage of mines above ground steeply increased by 22.37% compared to other categories.

In case of the fourth sub (1993–2000), real wage increased at the rate of 8.40%, 14.16%, and 6.35% for mines underground, above ground, and overall mines. In case of underground mines in the fifth sub-period (2001–07), real wage decreased slightly at the rate of 0.29% but in case of mines above ground, it increased at the rate of 1.50%; for overall mines, real wages decreased at the rate of 0.31%.

On the whole period, that is, 1973–2007, real wage increased at the rate of 4.56% whereas in mines above ground and overall mines, real wage increased at the rate of 3.14% and 4.86%, respectively. In sub-periods 1986–92 and 1993–2000, we can see that money wage increased at higher rate with 13.51% and 11.93% for overall mines.

As we see there was not any uniform increase or decrease of real wage. This is because even if we see the consumer price index number, the change is not uniform since consumer price index number is the determining factor of real wage so real wage has increased sometimes and decreased sometimes.

From Table 6 it is clear that the growth rate of wage bill had an increasing trend. In 1973–78 the wage bill increased at the rate of 17.85%. In this period, employment increased by 12.15% whereas money wage increased at the rate of 5.03% per year. In the second sub-period, wage bill increased at the rate of 23.73%

Table 6: Rate of Change of Wage Bill

Sub-period	Wage bill (in %)
1973–1978	17.85
1979–1985	23.73
1986–1992	15.24
1993–2000	10.07
2001–2007	5.32
1973–2007	**14.76**

Source: Director General of Mine Safety

per year and employment increased at 8.79%, whereas money wage also increased at the rate of 14.15%.

In the third sub-period (1986–92) the wage bill increased at the rate of 15.24% whereas employment increased only at 3.11% per year and money wage increased at the rate of 11.56%.

In the fourth sub-period, it increased at the rate of 10.07% in this period though money wage increased at the rate of 13.51% per year. But employment decreased at the rate of 2.86%. In this period employment was 2.69% whereas money wage increased at the rate of 11.92%.

On the whole period (1973–2007), the wage bill increased at the rate of 14.76%, whereas money wage increased at the rate of 11.96% and employment increased at the rate of 2.70%.

In the second sub-period (1979–85), the wage bill increased at a higher rate in comparison to other sub-periods. The reason was that in this period both employment and money wage increased at higher rates due to the introduction of productivity linked bonus, including casual labor with temporary status.

In Table 7 the first sub-period covers the year 1973–78 when wage share increased at the rate of 1.89%. In the periods of 1979–85 and 1986–92, the wage share decreased at the rate of 5.57% and 5.05%, respectively. But in fourth and fifth sub-periods, that is, 1993–2000 and 2001–07, it increased at the rate of 1.53% and 1.98%,

Table 7: Growth Rate of Wage Share

Sub-period	Wage share (in %)
1973–1978	1.86
1979–1985	-5.57
1986–1992	-5.05
1993–2000	1.53
2001–2007	1.98
1973–2007	**1.32**

Source: Director General of Mine Safety

respectively. On the whole, that is, 1973–2007, the wage share increased at the rate of 1.32% per year.

The aim is to study the relationship of average productivity with money wage, and real wage in lead and zinc industry. This study covers the period of 1973–2007; while determining this relationship we will consider the rate of change in four sub-periods.

From Table 8, it can be seen that the rate of change of money wage is always greater than average productivity except in the year 1973–78. In the first sub-period, that is,

Table 8: Average Labor Productivity and Real Wage

Sub-period	Rate of change of average productivity (%)	Rate of change of real wage (%)
1973–1978	8.54	0.23
1979–1985	-2.28	3.70
1986–1992	1.83	5.52
1993–2000	4.11	6.35
2001–2007	0.57	-0.31
1973–2007	**8.84**	**3.95**

Source: Director General of Mine Safety

1973–78, the average productivity increased at the rate of 8.54% and money wage increased at the rate of 5.03%.

During this period the rate of increase in average productivity as well as employment increased at the rate of 19.62% and 12.15%, respectively, per year. In case of the second sub-period, the average productivity decreased at the rate of 2.28%, whereas money wage increased at the rate of 14.15% per year. During this period production increased at the rate of 5.12% whereas employment increased at the rate of 8.79%.

In case of third sub-period the average productivity increased at the rate of 1.83% and money wage at the rate of 11.56%. Also, in this period, production increased at the rate of 2.12% whereas employment increased at the rate of 3.11% per year.

On the whole, that is, 1973–2007, the productivity increased at the rate of 8.84% whereas money wage increased at the rate of 11.96% per year.

In this whole period the production increased at the rate of 5.08% whereas employment increased at the rate of 2.69% per year. The relationship between average productivity and money wage is almost positive.

From Table 9, it can be seen that in case of first sub-period, that is, 1973–78, the average productivity increased at the rate of 8.54%, whereas real wage

Table 9: Average Labor Productivity and Money Wage

Sub-period	Rate of change of average productivity (in %)	Rate of change of money wage (in %)
1973–1978	8.54	5.03
1979–1985	-2.28	14.15
1986–1992	1.83	11.56
1993–2000	4.11	13.51
2001–2007	0.57	0.34
1973–2007	**8.82**	**11.93**

Source: Director General of Mine Safety

remained almost constant. In this period money wage and consumer price index number remained almost the same.

In the second sub-period, productivity decreased at the rate of 2.28% whereas real wage increased at the rate of 3.70% per year. In this period money wage increased at faster rate by 14.15% whereas consumer price was 9.86%.

In the third sub-period (1986–92), the average productivity increased at the rate of 1.83% and real wage increased at the rate of 5.52%. At this time, money wage increased at the rate of 11.56%, but consumer price index increased only at the rate of 5.93%.

In the fourth sub-period (1993–2000), the average productivity increased the rate of 4.11% and real wage

increased at the rate 6.35% whereas money wage increased at the rate of 13.51% and consumer price remained 6.53%.

In the last sub-period (2001–07), the average productivity increased the rate of 0.57% but real wage decreased at the rate of 0.31%, whereas money wage increased at the rate of 0.34% and consumer price remained at 6.53%.

On the whole sub period, that is, 1973–2007, the average productivity increased at the rate of 8.82% and real wage increased only at the rate of 3.95% per year. In this whole period money wage increased at the rate of 11.93% and consumer price was at 7.57%.

Thus, it can be seen that except in some case the relationship between productivity and real wage had a positive relationship.

Formation of Econometric Model represents the Impact of Wage on Productivity

We take two variables—productivity and wage—that is, money wage as well as real wage, by which we can develop the econometric model, and by this statistical method we can know its validity (Chakraborty, 1996).

There is a linear relationship between productivity and wage:

$$b = \sum \log x . \sum Y - N \sum Y \log x / (\sum \log x)^2 - N \sum (\log x)^2 \ldots . \quad \text{(i)}$$

$$a = \sum Y - b \sum \log x / N \ldots . \quad \text{(ii)}$$

To clarify the impact of wage on productivity, we take overall productivity of money and real wage.

Overall average productivity on money wage and real wage from Equations (i) and (ii), we get:

b = 5.83(money wage), **b = 6.66**(real wage)

but the standard error of estimation and $t_{statistic}$ do not follow the $t_{distribution,}$ and there is no positive relationship between average productivity on money wage and real wage.

Conclusion

Finally, from the stated behavior of the different economic variables of lead and zinc industry, it can be observed that there does not exist any relationship between productivity and wage (both money wage and real wage) during the period of 1973–2007. The value of "b" between the years 1973 and 2007 becomes 5.83 and 6.66, respectively. However, the values of standard errors were not satisfactory. So, "b" values were not statistically accepted during the whole period of 1973–2007.

Higher productivity depends upon the attitude of management and workers, which rests on psychological climate favorable to productivity. The economic security is most important psychological factor required to generate higher productivity.

Acknowledgement

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You cannot dream yourself into a character; you must hammer and forge yourself one.

— James A. Froude

Focus

Cycle Time Reduction through "Scare" Analysis: A Kaizen Process

Dipak Ranjan Jana, Anjani Kumar, and Amresh Kumar

Manufacturing excellence may be achieved through quality improvement and cost reduction of their products. Cycle time reduction is also an important parameter in the manufacturing process. In the present analysis, the role of SCARE analysis, a Kiazen process, has been discussed in reducing the cycle time. The reduction in production cycle time also decreased the rate of customer demand time. Further, the customer was satisfied through reduction in the delivery time or with the increase in the efficiency of TACT TIME (Available production time/Rate of customer demand). Empirical study was conducted on CNC machine tool in machining two plummer blocks (an automotive component) of different sizes, both small and big. If the machining operation was being carried out on the two automotive components separately, the total time taken in the machining process was (6.5+5) minutes = 11.5 minutes. Later, both smaller and bigger components were loaded on the CNC machine tool at the same time, with the help of properly designed jigs and fixtures, and the machining operation was carried out simultaneously on both components. One combined CNC program has been developed in the machine interface for this purpose. The total elapsed operation time was observed to be 8.5 minutes. As a result, an effective total cycle time was reduced to (11.5-8.5) minutes = 3 minutes. It has been observed through experimental analysis that SCARE analysis has reduced the cycle time in face milling and drilling operations of small and big size plummer blocks which gives a percentage reduction of 26% in the cycle time.

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Kaizen recognizes the problem associated with any organization by approaching solution through gradual continuous improvements for achieving higher standards. It is known as "Step by Step" improvement philosophy. It is the starting point and driver for all lean initiatives. Behind many accomplishments which have made Japanese companies world leaders is the philosophy of continuous improvement or Kaizen (Ashmore, 2001, p. 211). Kaizen is meant to be blended into the normal day-to-day activities with the focus on eliminating waste, creating standardization, and having a clean, organized workplace. Kaizen has often been associated with quality improvement. As companies proceed along a path of continuous improvement, they generally adopt a kind of *pareto* analysis to determine where their attention should be paid. Some of the common benefits associated with Kaizen include enhancement of attention and total employee involvement in work, ad hoc correction of incidents in routine work (elimination of trivial many issues) and making everyone familiar with performance measure metrics, and allowing extension beyond standard benchmark. There have been various instances of kaizen implementation in manufacturing industries in scholarly literature. Erlandson et al. (1998, p. 269) studied the application of kaizen philosophy and poka-yoke techniques to create job opportunities and improve productivity of individuals with cognitive disability. They conducted their study on a fuel clamp assembly and a re-designed assembly fixture. Shin (1997) defined a new paradigm called K-Reengineering where "k" stands for *kaizenizing* which is a harmonious blending of two philosophies: kaizen and business process reengineering (BPR). Rowlands and Richards (2002, p. 1,364) investigated the issues relating to quality and quality strategy, thereby outlining a framework for

quality system using a modeling method based on IDEFO and its corresponding case study of a semiconductor manufacturing process. This paper presents cycle time reduction in a manufacturing process through SCARE analysis, a Kaizen process and its method of implementation. The steps that have been followed for implementing Kaizen in process improvement are:

- Design and drawing study
- Sequence study with respect to machining process
- Developing and defining the methods with respect to machine for different operations
- Planning of jig, fixture, and tools for production process
- Planning for process improvement with respect to quality management process

Kaizen recognizes and admits that any organization may have problems. It approaches solution by establishing a corporate culture through which everyone can candidly admit their problems. Kaizen advocated a process-oriented way of thinking. Figure 1 shows the process improvement steps for the implementation of Kaizen, gradual continuous improvements for achieving higher standards.

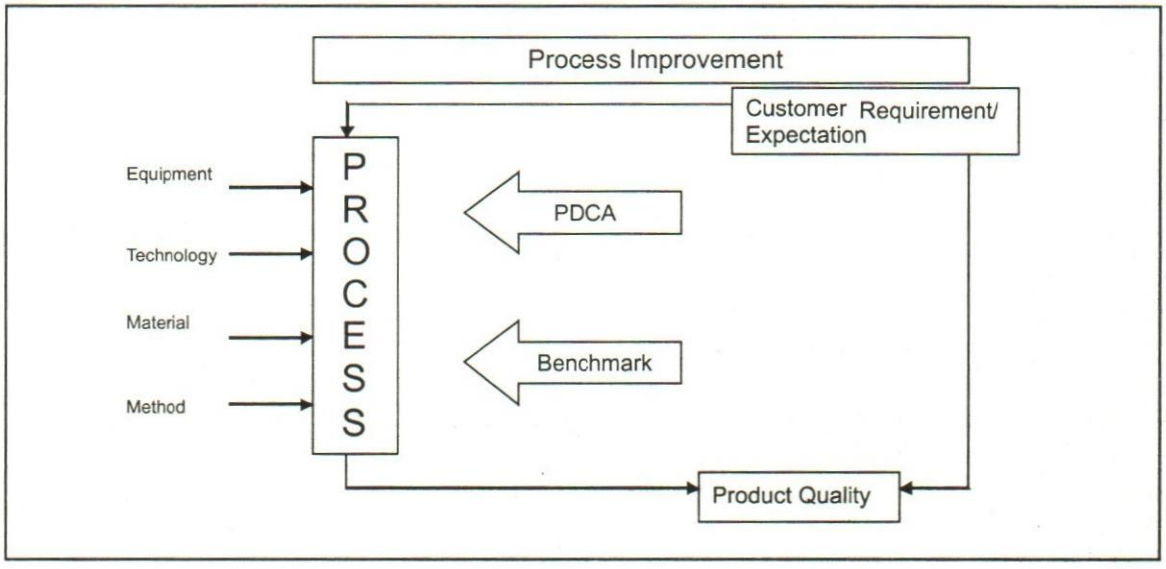

Fig. 1. Process Improvement

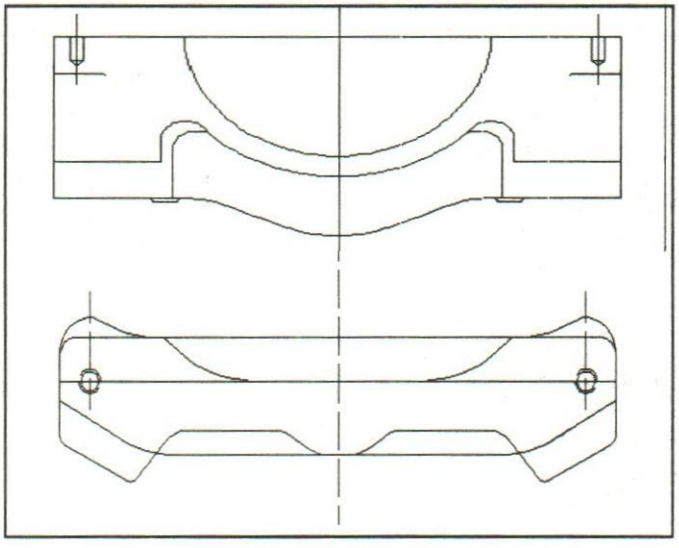

Fig. 2. Smaller Plummer Block

Total Cycle Time for Face Milling and Drilling Operation before Scare Analysis

The line diagram of plummer block is shown in Figure 2. Face milling and drilling operations on plummer blocks of two different sizes (one small and the other big) have to be performed on CNC machine tool (LMV-Junior).

Face Milling and Drilling Operations Performed on Small and Big Plummer Blocks Separately

It was an earlier practice to perform the operations, face milling first and then drilling, on both the plummer blocks separately, and one by one. The operation consists of two steps: face milling and drilling.

Operation performed on small plummer block: The detail of the time taken in different operations and the required cycle time for the said operation for smaller plummer block is given as follows.

- **Face milling:** 80mm inserted carbide cutter (sandvick make) was used for face milling operation. The face milling operation was performed at the speed of 1200 rpm with a feed of 600 mm. The above operation took 2 minutes.
- **Drilling:** Drilling operation was performed for Φ 6 Z 9 (-40, -62) drilled hole. At first, a 15 mm deep dowel hole was made using carbide drill (sandvick make) for carrying out the drilling operation on both sides of the plummer block at a speed of 3200 rpm with feed of 750 mm. The total time taken for the said operation was 1 minute. For loading and unloading of the job, the time taken was 2 minutes. Thus, the total cycle time for the complete operation, that is, face milling and drilling, for the small plummer block was 5 minutes. The CNC program for the same operation is given in Appendix 1.

Operation performed on big plummer block: The detail of the time taken in different operations and the required cycle time for the said operation for big plummer block is given as follows.

- **Face milling:** 80mm inserted carbide cutter (sandvik make) was used for face milling operation. The face milling operation was performed at the speed of 1200 rpm with a feed of 450 mm in first cut and 700 mm in second cut. This operation took 3.25 minutes.
- **Drilling:** Drilling operation was performed for Φ 10 Z 9 (-10, -62) drilled hole. The carbide tool with chamfering (sandvik make) was used for the purpose. The time taken for drilling operation was 1.25 minutes and the time taken for loading and unloading the jobs was 2 minutes. Thus, the total cycle time for complete operation, that is, face milling and drilling, for the big plummer block was 6.5 minutes. The CNC program for this operation is given in Appendix 2.

Observation: The total cycle time for complete operation, face milling, and drilling operation, for small plummer block was 5 minutes and that of big plummer block was 6.5 minutes. Therefore, the total cycle time for complete operation, face milling, and drilling operation, for both small and big plummer block comes out to be (5+6.5) minutes = 11.5 minutes.

Total Cycle Time for Face Milling and Drilling operation after SCARE Analysis

SCARE analysis was then conducted for the process simplification and cycle time reduction for productivity improvement.

Process Simplification

Process Simplification is the reduction of complexity of any process. Complexity of the process was reduced through simplifying the process and reducing the number of operations through scare analysis. Simplification and standardization of the operations was done through the following processes to cut down the cycle time in manufacturing process:

- ***Designing the single jig and fixture for both the jobs:*** Single jig and fixture was designed for both small and big size plummer block, so that face milling and drilling operation can be performed on both small and big plummer block simultaneously.
- ***Using better grade of inserts:*** A better grade of inserts, GC 4230 grade inserts (Insert Code: R390-180612M-PM), was used in place of earlier used GC 4020 grade of inserts Sandvik make, to reduce the cycle time.

Master CAM/DELCAM & CNC programming live "Fanuc control" of ISO hidden-hine, a CAD/CAM solution software, was used for the complex shape of job in the manufacturing process.

SCARE Analysis

The SCARE Analysis is nothing but Simplifying, Combining, Adding, Re-arranging, and eliminating some of the processes to reduce the cycle time. These have been discussed as follows:

Simplifying: Simplification of the process is done by designing a single jig and fixture for both small and big plummer block. Further, it facilitates the following:

1. Loading both the jobs at the same time.
2. First, the facing operation is carried out for both small and big plummer blocks.
3. Then drilling operation is carried out simultaneously on both small and big plummer blocks.

Combining: The face mills and drilling operations for both small and big plummer blocks, are carried out simultaneously by developing a CNC code as a single programming (Appendix 3).

Adding: Adding jigs and fixtures in the same machine bed at a time for both small and big plummer blocks. It is an economic arrangement with regard to machines.

Rearranging: Economic arrangement has been done for tool changing mechanism in the magazine box as per the operations.

Eliminating: The following operations could be eliminated by process simplification.

1. Eliminates the loading and unloading of the jobs from twice to once.
2. Eliminates excessive fatigue of operators and reduces man hour.
3. Eliminates the frequency of tool changing through the study of SMED (Single Minute Exchange of Die).
4. Eliminates the expenses on tooling.
5. Eliminates human error due to all the above factors.

Thus, new processes will be developed with regard to the principles of process simplification and process improvement. Both the jobs will be loaded in the machines at the same time and both the operations will be carried out simultaneously.

Operation Carried Out on Both Small and Big Plummer Blocks Simultaneously

A single jig and fixture were designed for both the jobs as discussed earlier. Then, both the plummer blocks were mounted on the work table at the same time. In first step, the face milling operation was done simultaneously on both the plummer blocks. In the second step, the drilling operation was done simultaneously on them. This could be possible with the help of a single CNC code programming (Appendix 3). The details of the time taken for different operations are given as as follows:

Face milling: Face milling operation was carried out simultaneously on small plummer block followed by a big one with the help of Φ 80 mm cutter (sandvick make) at an rpm of 1200 with the depth of the cut being 1.5 mm. The time taken in face milling operation for both the plummer blocks was 3.25 minutes.

Drilling: Time taken in drilling operation was 1 minute for the small plummer block, drilled to Φ 6 Z 9; and the time taken in drilling operation for big plummer block was 1.25 minutes drilled to Φ 10Z9. Again, both these operations were done simultaneously. The loading and unloading time in this operation is 3 minutes.

Observation

The total cycle time taken for both the plummer blocks, for both the facing and drilling operations, when they were carried out simultaneously after the SCARE analysis was (3.25+1+1.25+3) minutes = 8.5 minutes. Therefore, the total reduction in cycle time comes out to be (11.5-8.5) = 3 minutes.

Conclusions

The following conclusions have been drawn from the analysis made earlier:

1. Process has been simplified.
2. The face milling and drilling operations for both small and big plummer blocks have been combined and carried out simultaneously.
3. The concepts of single jigs and fixtures for small and big plummer blocks have been added.
4. Re-arrangement has been done for tool changing mechanism in the magazine box.
5. Different operations have been eliminated.

6. Improvement in productivity has been achieved through elimination of different processes, wastage of man hours, operator's fatigue, and cycle time reduction.
7. Cycle time has been reduced through SCARE analysis and it is an effective way to increase the productivity.
8. The percentage reduction in cycle time has been observed as 26%.

Appendix 1	Appendix 2	Appendix 3
T1.1 M6]\ (DW Cutter 98) (UA0, 1) M3 S1200 GZ100 G90 GX18 Y-225 Z30 M8 Z0 E26 = 6 "1" G1Y-120 FE26 G1Y-113 FE26 GY-79 G1Y-26 FE26 G1Y39 GZ10 "Z" USB = 0 GX18 Y-225 G1 Z0 (EPP, 1, 2) GZ100 M9 T2.2 M6 (DIS "DRILL 6") (UA, 1) M3 S3200 G Z150 GXY GZ50 GZ30 M8 G81 R5 Z-15 F750 XY G91 XY-168 G80 G90 GZ10 M9 GZ250 Y100 M30	T1.5 M6 (DIS "cutter" dia 80) (UA, 2) M3 S1200 G90 GZ100 GX18 Y-300 GZ30 M8 GZ0.5 "1" G1 Y-220 F450 G1 Y-120 GY-75 G1 Y-26 G1 Y39 GZ10 "2" USB=1 GX18 Y-300 GZ0 (EPP, 1, 2) GZ30 M9 GZ100 T4.4 M6 (DIS "drill" dia 10) (UA, 2) M3 S1800 GZ150 GXY GZ50 GZ30 M8 G81 R5 Z-15 F650 XY G91 XY-232 G90 G80 Z10 M9 GZ250 Y125 M30	T1.1 M6 (DIS "cutter" dia 80) (UAO, 1) M3 S1200 G90 GZ100 GX1 PY-225 GZ30 M8 GZ0 E26=650 "1" G1Y-120 FE26 G1Y-113 FE26 GY-79 G1Y-26 FE26 GY+39 GZ10 M9 "Z" GZ100 T1.5 M6 (DIS "cutter" dia 80) (UA, 2) M3 S1200 G90 GZ100 GX18 Y-300 GZ30 M8 GZ0.5 E26=450 "1" G1Y-220 FE26 G1Y-120 FE26 G1Y-75 G1Y-26 G1Y39 GZ10 "Z" USB=1

Appendix 3		
GX18 Y-300	GZ30 M8	M3 S1800
G70 E26=700	G81 R57-IS F750	GZ150
(EPP, 1, 2)	XY	GXY
GZ30 M9	G91 XY-168	GZ50
GZ150	G80 Z10	GZ30 M8
T2.2 M6	G90	G81 R5 Z-15 F650
(DIS "drill" dia 6)	GZ250 Y100	XY
(UA, 1)	T4.4 M6	G91 XY-232
M3 S3200	(DIS "drill" dia 10)	G80 GZ10 M9
GZ50	(UA, 2)	G90 GZ250 Y100
GZ50		M30

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The reward for work well done is the opportunity to do more.

— Jonas Salk

Focus

Reduction of Cycle Time through Quality Circles: An Empirical Study

Shopharani H. and B. Mahadevappa

The fledging quality circle movement in India is fast catching up as more and more enterprises in both public and private sectors have been introducing this concept. The aim of this study is to examine the reduction of cycle time through quality circles in public and private sector organizations. Cycle time reduction provides a real time, continuous, positive, internal sense of urgency, without adding the feeling of crisis. Cycle time reduction transcends into a competitive advantage for the company through improved profits, reduced lead time, improved delivery dependability, improved quality, and increased productivity. It is seen that quality circle is a movement which does not make a distinction between different types of management or types of work being carried out. Certainly, it is easier to carry out quality circle activities in a workshop environment. Quality circles know no boundaries and can be practiced effectively anywhere and in any situation where groups of people are working. Needless to say, the contribution of quality circles goes beyond cycle time reduction.

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In a world of increasing global competition with increasing customer requirements, reduction of business cycle time has become the focal point in a wide variety of industries. The fast pace of technological changes and the need to respond to international competition attaches prime importance to company's ability to respond quickly to customer demands. Cycle time is important to the development of new products as well as their production and marketing. These include launching new products, filling an order from shelf risk, assembling to customer requirement, and engineering to order. Shorter product development time, improve delivery speed, and improve customer satisfaction seem to be the catch phrase of the day.

An approach of this kind obviously takes us to quality circles. Quality Circle is a simple, economical, and optimum technique for bringing incremental improvement in the organizations. Quality circle refers to a small group of people who meet together regularly and voluntarily to identify and solve problems pertaining to quality, performance, and enrichment of their work life. It arrived in India about two decades back by the Bharat Heavy Electrical Ltd (BHEL)—Ramachandrapuram unit in Hyderabad—and has still not lost its relevance in industries (Rajkumar and Dixit Garg, 2002). Now this movement has spread over almost all industries, both in public and private sectors.

As quality circle has stood the test of time in India, it is pertinent to evaluate their performance. The existing literature provides only a partial answer to the research question on how to evaluate the performance of a quality circle. C. Krishnamurthy (1992) reviewed the functioning of quality circles in large organizations: this is only an overall assessment of their functioning. A study conducted by M.N. Agarwal (1994) has focused on the impact of quality circle as an intervention, on improving the quality

of work life and productivity. These studies have not focused on effectiveness of quality circles per se.

This paper however, tries to measure contribution of quality circles to the organizations through the reduction of cycle time by quality circles.

Objective of the Study

The aim of this study is to examine the reduction in cycle time through quality circles in public and private sector organizations. It also aims at comparison of cycle time before implementation of improvement project and the cycle time after implementation of improvement project by quality circle. The study also determines the factors responsible for reduction of cycle time through the quality circles.

Hypothesis

The hypothesis formulated in this study is:

- H_0: There is no significant reduction in cycle time after implementation of quality circle recommendations
- H_1: There is a significant reduction in cycle time after implementation of quality circle recommendations

Sample, Data Collection, and Analysis

The sample for the study consists of 85 quality circles selected randomly from the Directory of Quality Circle Forum of India (QCFI), a non-profit organization established for promoting quality circles in India (Table 1). These were stratified into public and private sector quality circles.

Table 1: Sample of Quality Circle

Type	N	%
Public sector	34	40
Private sector	51	60
Total	**85**	**100**

Primary data was collected from interviews of steering committee members, facilitators, leaders, and members of quality circles. Secondary data was collected from the proceedings of the Annual Quality Circle Convention organized by Quality Circle of India. These proceedings consist of presentations made by quality circles about their successful implementation of improvement projects.

Simple descriptive statistics such as mean, standard deviation, and correlation were calculated by using Statistical Package for Social Science (SPSS) for analysis and interpretation of data.

Cycle Time

A firm's business cycle time is measured from the time a customer's order is taken, to the manufacture of the item ordered to exact customer specification, to exact customer specification, to the shipment of the item, and finally, to the receipt of payment from the customer for the finished product.

From the survey it was observed that the total business cycle time includes one or more of the following sub cycles:

- Book/bill cycle: It is the total time taken to transform a customer order into delivery time. This includes sales and marketing and physical distribution. This cycle represents a discrepancy between the times the customer would prefer to have the order to when the customer actually gets the order. Consequently, book/bill cycle time is a major competitive factor. This includes order time, delivery time, etc.
- Design/develop cycle: It is the total time taken to design and develop a new product or improve an existing product. These include market analysis, market product definition, product design, prototype development, functional verification, model development, performance evaluation, field testing, process planning, and process verification. This also includes turning time and fitting time.
- Spec/source cycle: This is the total time taken to develop and approve specifications of new materials and quality suppliers. The major elements of this cycle are the supplier and process engineering. This includes welding time and process time.
- Purchase/produce cycle: It is the total time taken from ordering and releasing a raw material needed until it is a part of a finished product. The major elements of this cycle are the factory, physical distribution, and the supplier. This includes loading, unloading and packing time, etc.

Cycle Time Reduction in Sample Units

The data pertaining to cycle time reduction through quality circles is given in Table 2 as follows.

Table 2: Cycle Time Reduction before and after Implementation of Quality Circle

Reduction of Cycle Time related to	No. of Quality Circles	Cycle Time		% of Reduction
		Before (Minutes)	After (Minutes)	
Waiting time	12	18,024.95	6,085.40	66
Rework time	11	32,275.32	19,898.57	38
Delivery time	7	6,529.50	1,227.00	81
Overtime	7	39,126.00	23,115.75	41
Assembly time	7	4,227.22	1,807.33	57
Process time	6	3,840.68	940.57	76
Welding time	6	45,333.50	37,228.58	18
Down time	6	1,773.52	283.33	84
Fitting time	5	10,347.60	40.33	99
Break valve machine cell time	4	8,160.00	1,605.00	80
Mould change time	3	160.02	30.70	81
Turning time	2	284.00	174.00	39
Idle time	2	226.00	95.00	58
Painting time	2	2,803.00	1,440.17	49
Packing time	2	3,405.00	1,212.00	64
Loading time	2	990.00	100.00	90
Letting time	1	160.00	40.00	75
Total	**85**	**177,666.30**	**95,323.73**	**46**

As seen from Table 2, of the 85 projects, 12 belong to waiting time, 11 to rework time, and seven each belong to delivery time, overtime, and assembly time. It is important to note that six projects have reduced 84% and five projects have reduced 99% of cycle time after implementation of quality circle recommendations. Overall, there was 46% reduction of cycle time after implementation of quality circle recommendation.

Cycle Time Reduction in Public Sector

The data as shown in Table 2 was further segregated into public sector and private sector to depict the comparative situation. Table 3 presents data related to cycle time reduction in public sector.

From the data given in Table 3, it is observed that quality circles play a vital role in reduction of cycle time in public sector undertaking. Out of 34 quality circles, seven circles focused on reduction of rework time and over time, four focused on delivery time, and two concentrated on assembly time. However, the extent of reduction of cycle time varies from 38% to 99%, the average percentage of reduction being 54%. It is noteworthy that the average reduction in public sector is greater than the overall average.

Table 3: Cycle Time Reduction before and after Implementation of Quality Circle Project in Public Sector Undertakings

Reduction of Cycle Time related to	No. of Quality Circles	Cycle Time		% of Reduction
		Before (Minutes)	After (Minutes)	
Rework time	7	31,732.32	19,548.77	38
Overtime	7	39,126.00	23,115.75	41
Delivery time	5	4,660.50	471.00	90
Process time	4	1,920.68	300.57	84
Painting time	2	2,803.00	1,440.17	49
Packing time	2	3,405.00	1,212.00	64
Waiting time	2	62.00	33.00	47
Loading time	2	830.00	60.00	93
Assembly time	2	1,219.80	324.00	73
Welding time	1	18.67	1.58	99
Total	**34**	**85,777.97**	**46,506.84**	**54**

Testing of Hypothesis

H_0 : There is no significant reduction in cycle time after implementation of quality circle improvement project in public sector undertakings.

H_1 : There is a significant reduction in cycle time after implementation of quality circle improvement project in public sector undertakings.

The results of t-test reject the null hypothesis and accept research hypothesis as the *p* value is < 0.001. It shows that there is a significant reduction in the cycle time after implementation of quality circle project compared to before implementation in the sample of public sector undertakings.

The major factors contributing to reduction in cycle time in public sector were as follows: effective problem solving by quality circles; enhancement of job interest; active participation of members; and continuous encouragement and support by the management.

Training of quality circle practitioners before commencing operation is stressed because solutions to any problem are not arrived at in an ad hoc manner. However, quality circles, after systematic prioritizing and analysis, help members develop their capability to resolve problems in a convincing manner, acceptable to all concerned. As research findings indicate, more positive attitudinal changes are an important spin-off benefit of the operation of quality circles. By encouraging employees at grassroots and other levels of management, and at different departments to achieve the common organizational goal, quality circles help to resolve work related problems like reduction of cycle time.

Table 4: t test results for reduction in the cycle time of public sector undertakings

QC project Implementation	N	Mean	SD	Mean	SD difference	t value	*p* value
Before	34	2,521	7,691	1,153	872	2.292	< 0.001
After	34	1,368	4,819				

Table 5: Cycle Time Reduction before and after Implementation of Quality Circle improvement Project in Private Sector Undertakings

Reduction of Cycle Time related to	No. of Quality Circles	Cycle Time		% of Reduction
		Before (Minutes)	After (Minutes)	
Waiting time	10	17,962.95	6,052.4	66
Down time	6	17,73.52	283.33	84
Assembly time	5	3,007.42	1,483.33	51
Fitting time	5	10,347.6	40.33	99
Welding time	5	45,314.83	37,227.00	18
Rework time	4	543.00	349.80	36
Beak Valve Machine Cell Time	4	8,160.00	1,605.00	80
Mould Change Time	3	160.02	30.7	81
Turning time	2	284.00	174.00	39
Delivery time	2	1,869.00	756.00	60
Process time	2	1,920.00	640.00	67
Idle time	2	226.00	95.00	58
Loading time	1	160.00	40.00	75
Total	**51**	**91,728.34**	**48,776.89**	**47**

Cycle Time Reduction in Private Sector

The data in the Table 5 clearly shows that while 10 circles focus on waiting time, six belong to cost reduction through down time, and five belong to assembly time and welding time. One circle through the reduction of fitting and finishing time has achieved 99% reduction of cycle time followed by 84% reduction through down time. Overall, there is 47% reduction of cycle time after implementation of quality circle recommendations.

Testing of Hypothesis

The testing of hypothesis is done similar to that of public sector and the details are given in Table 6.

The results of t-test rejects the null hypothesis, that is, there is no significant reduction in cycle time after implementation of quality circle improvement project in public sector undertakings and accepts the research hypothesis. That is, there is a significant reduction in cycle time after implementation of quality circle improvement project in public sector undertakings as the *p* value is < 0.001. It shows that there is a significant reduction in the cycle time after implementation of quality circle project compared to before implementation.

The major factors that contributed for reduction in cycle time in private sector were promotion of participative

Table 6: t-test Results for Reduction in the Cycle Time of Private Sector Undertakings

QC project Implementation	N	Mean	Standard deviation	Mean difference	SD deviation	t value	*p* value
Before	51	1,905	6,058	955	852	3.258	< 0.001
After	51	950	5,166				

culture, support by the management, more effective team work, enhancement of job interest, and enhancing problem solving capability. The feeling of cooperation and trust and the lack of alienation among employees are attributable to the benefit of organization. Moreover, encouraging quality circle members to represent workers in company board or plant councils also encouraged employees to involve themselves in quality circle activities,

Conclusion

Cycle time reduction provides a real time, continuous, positive, internal sense of urgency, without adding the feeling of crisis. Cycle time reduction transcends into a competitive advantage for the company through improved profits, reduced lead time, improved delivery dependability, improved quality, and increased productivity. It is established through the present study that there is significant reduction in cycle time both in public and private sectors. It is, therefore, recommended that all the organizations should try to establish quality circles and get the obvious benefit. It is seen that quality circle is a movement which does not make a distinction between different types of management or types of work being carried out. Certainly, it is easier to carry out quality circle activities in a workshop environment. Quality circles know no boundaries and can be practiced effectively anywhere and in any situation where groups of people are working. Needless to say, the contribution of quality circles goes beyond cycle time reduction.

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Shallow men believe in luck. Strong men believe in cause and effect.

— Ralph Waldo Emerson

Focus

Small Scale Industries in a Global Perspective

Anchal Singh

Small Scale Industries (SSIs) have emerged as an engine of growth in several developed and developing countries of the world including India and has acquired a prominent place in our socio-economic development since independence through their ever-increasing contribution to national income.

However, with the advent of economic reforms in 1991, SSIs in India had to face stiff competition from globalization and economic liberalization as it has allowed companies to increase their base of operations, expand their workplace with minimal investments, and has facilitated consumers to enjoy a wide array of goods and services.

The paper attempts to probe the peculiar issues in an increasingly globalized scenario and its effect on the SSIs by analyzing its growth performance with regard to units, employment, output, exports, and concludes by recommending appropriate credit availability measures for ensuring their sustenance along with competitive growth.

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SSIs act as a catalyst in the socio-economic development of India as it facilitates tapping of resources for judicious use with low capital investment in reducing regional disparities, generating employment opportunities, and increasing exports by fostering entrepreneurship.

The study is based on the following objectives:

- To examine performance of SSIs during pre- and post-liberalization.
- To evaluate the performance in terms of its contribution to the overall growth of the Indian economy.
- To investigate into various problems faced by SSI units for availing of financial assistance.

Methodology

The present study is analytical and descriptive in nature, hence, keeping in view the objectives of the study's secondary data has been collected from publication of RBI, viz., RBI Bulletin, Statistical tables relating to banks of India, reports on trends and progress, and reports of the Banking Commission. After collection of data, it has been analyzed through statistical tools like percentage and hence growth trend has been depicted.

Review of Literature

SSIs have been accorded a vital place in the national economy by the national decision makers for increasing the supply of manufactured goods, promoting capital formation. The SSI has achieved an evangelical peak along with industrialization and economic growth in India. Presently, it constitutes as a core industry facilitating balanced regional development and decentralization of economic power. Even after the development of industrialization, Britishers were really scared of Indian

textiles and tried to impose ban on their imports (Gupta and Sharma, 1996).

During the pre-economic liberalization period numerous incentives, concessions, and institutional facilities were being provided for the development of SSIs (Nyati, 1988). However, during 1990s with the advent of economic liberalization the forum was shifted from protection to competitive promotion (Raja and Rajashekar, 2002).

The Indian SSI has emerged as a vibrant and dynamic segment for mobilizing resources in the economy. The strategy of economic development which the government lays down for generating large scale employment, education and training, capital formation, balanced economic growth, expanding trade, transport and equitable distribution of national income with active involvement and participation of every citizens for accomplishing the goal, cannot ignore the relevance of SSI.

Indian economy is undergoing a transition phase over the decades and is witnessing the challenges of liberal and market-oriented environment which is posing a big threat before the SSI for its survival and warrants for technology development and to strengthen the financial infrastructure for boosting them.

The SSI sector in India has been making remarkable progress since independence and has facilitated in achieving the socio-economic objectives of achieving growth led equity. On July 1991, the government initiated economic reforms for liberalizing the Indian economy in terms of investment regime, trade policies, the financial sector, taxation, and public enterprises. For promoting and enhancing the competitiveness and productivity of small, tiny and village enterprises the Indian government has propounded a slew of measures which is popularly known as New Small Enterprise Policy on August 6, 1991. The advent of New Policy has literally changed the very philosophy of dealing with small scale sector whereby since independence they were insulated by the government but now they are exposed to the competitive business environment where only the fittest will survive and the obsolete will be wiped out.

SSI in India has been facing an intense competitive environment due to the onset of economic reforms, liberalization of investment regime, foreign direct investment (FDI) at the international level, and the evolution of the World Trade in 1995. However, its performance can be studied by analyzing the performance portfolios of SSIs.

Performance and Contribution of SSI

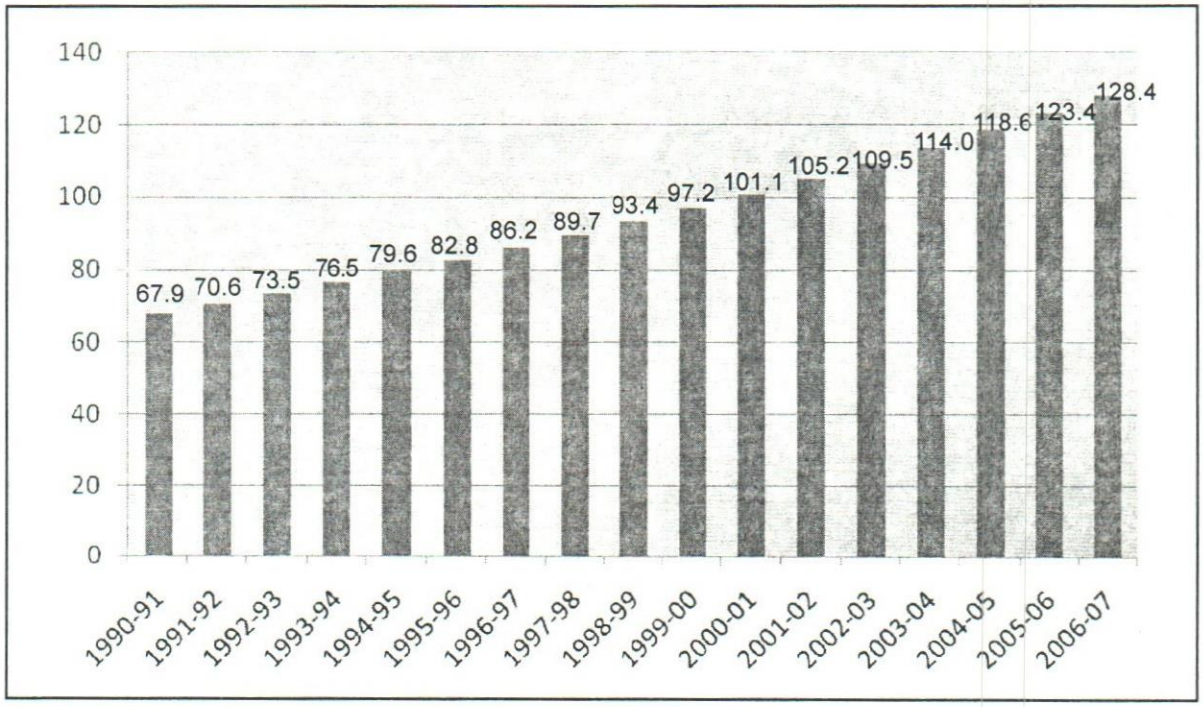
During 2006–07 the number of SSI units was 128.4 lakhs with a production of Rs 587,196 crores employing 312.5 lakh people accounting for more than 40% of gross value of output in the manufacturing sector.

The performance of SSIs in the pre- and post-liberalization periods has been indicated in Table 1. The table reveals that the number of SSI units increased to 67.9 lakhs in 1990–91, 118.6 lakhs in 2004–05, and is estimated to increase to 128.4 lakhs in 2006–07 at an average annual growth rate of 5.51%. Further, it also exhibits that number of SSIs increased by 34.73% from 13.53 lakhs to 18.23 lakhs during the quinguennium period starting from 1985–86 to 1989–90. This decelerating trend continued further and though the number of small scale units increased from 82.8 lakhs in1995–96 to 97.2 lakhs in 1999–2000 but in terms of actual growth rate in percentage it further decreased to 17.39%.

The number of small scale units increased from 101.1 lakhs during the year 2000–01 to 118.6 lakhs during 2004–05 registering a decreasing trend in the growth rate in actual term to 17.30%.The data reveals that though the number of small scale units has been increasing as also in terms of percentage, we witness a slightly upward trend starting from the period 1990–91 to 1994–95 (17.23%) and 1995–96 to 1999–2000 (17.39%). However, during 2000–01 to 2004–05 a mild decline has been registered as compared to 1990s which amounts to 17.30%. This may be due to the globalization which has created an intense competitive environment and is posing a threat for small units.

Employment Generation

Indian SSI sector absorbs a major chunk of population and provides livelihood next only to agriculture. According to the third census, it has been estimated that out of 100,000 rupees of investment in fixed assets, the small scale sector will generate employment for four persons. Table 1 shows that the employment generated by small industrial units in India increased from 39.70 lakh persons in 1973–74 to 287.6 lakh persons during 2004–05. Table 1 also reveals that the number of persons employed in small scale units increased by 24.58%, from 96.00 lakh to 119.60 lakh during the five years starting from 1985–86 to 1989–90.The employment provided in small scale sector increased by



Small Scale Industries Portfolios

Chart 1: Number of SSI Units (in lakhs)

20.90% from 158.3 lakh persons to 191.4 lakh persons in the quinquennium period from 1990–91 to 1994–95, thereby revealing a downfall in terms of actual growth rate during this period; whereas the employment in small scale units increased by 15.76% from 197.9 lakh persons to 229.1 lakh persons in the quinquennium period starting from 1995–96 to 1999–2000. This further shows a declining trend in employment generation. During the year 2000–01, the numbers of people engaged in it were 240.9 lakh persons which increased to 287.9 lakh persons in 2004–05 and stood at 19.38% with an increase of 3.78% as compared to the previous year. During the year 2006–07, nearly 312.5 lakh persons were employed in this sector. Through this analysis, we can conclude that though in terms of number the small scale units are increasing, in actual terms there is a declining trend in employment generation which may be due to the waves of globalization which has liberally opened up our economy.

According to the third census regarding SSIs two industry groups manufacturing non-metallic mineral products and metal products created employment potential of 0.45 million persons (12.2%) 0.37 million persons (10.2%), respectively and was next only to food products industry and has ranked first in absorbing almost 0.48 million persons (13.1%). On the contrary, the only 5% was contributed by the rest of the industries.

Thus, it can be concluded that on the employment front, the performance of small scale industries is found to be very satisfactory during the liberalization process. The values of the targets set for employment during the X Plan Period have been revised on the basis of the third All India Census keeping the 4.4 million additional jobs proposed for the X Plan Period fixed.

Production

The SSI sector plays an indispensable role in term of accelerating the country's growth contributing to nearly 40% of the gross industrial value added in the Indian economy. Table 1 reveals that the production of SSI has increased tremendously during 1973–74 and 1989–90. It was Rs 7,200 crores and increased to Rs 429,796 during 2004–05 and reached to Rs 587,196 crores during 2006–07. Further, it reveals that the production of SSIs in India increased by 116.17% from Rs 61,200 crores to Rs 132,300 crores during the quinquennium period from 1985–86 to 1989–90. The production of small scale units increased by 55.01% from Rs 78,802 crores to Rs 122,154 crores during the quinquennium period from 1995–96 to

Table 1: Performance of Small Scale Industries in Pre- and Post-liberalization Periods in India

Year	Date of Industrial Policy Resolution	Investment limit (in lakhs)	Number of Units (in lakhs)	Production (Rs. crore)	Employment (in lakh)	Exports (Rs. crore)
1950–51	6.4.1948	5	0.16	615	7.0	40
1960–61	30.41956	5	0.37	1,280	14.0	15
1966–67		7.5	1.31	2,850	30.0	210
1973–74		7.5	4.2	7,200	39.7	400
1974–75		10	5.0	9,200	40.4	500
1975–76		10	5.5	11,000	45.9	500
1976–77		10	5.9	12,400	49.8	800
1977–78	23 .12.1977	10	6.7	14,300	54.0	800
1978–79		10	7.3	15,800	63.8	1,100
1979–80		10	8.1	21,600	67.0	1,200
1980–81	23.7.1980	20	8.7	28,100	71.0	1,600
1981–82		20	9.6	32,600	75.0	2,100
1982–83		20	10.6	35,000	79.0	2,000
1983–84		20	11.6	41,600	84.2	2,200
1984–85		20	12.4	50,500	90.0	2,500
1985–86		35	13.5	61,200	96.0	2,800
1986–87		35	14.6	72,300	101.4	3,600
1987–88		35	15.8	87,300	107.0	4,400
1988–89		35	17.1	106,400	113.0	5,500
1989–90		35	18.2	132,300	119.6	7,600
1990–91	1990	60	67.9	78,802	158.3	9,664
1991–92	6.8. 1991	60	70.6	80,615	166	13,883
1992–93		60	73.5	84,413	174.8	17,784
1993–94		60	76.5	98,796	182.6	25,307
1994–95		60	79.6	122,154	191.4	29,068
1995–96		60	82.8	147,712	197.9	36,470
1996–97		60	86.2	167,805	205.9	39,248
1997–98		300	89.7	187,217	213.2	44,442
1998–99		300	93.4	210,454	220.6	48,979
1999–00		100	97.2	233,760	229.1	54,200
2000–01	30.8 2000	100	101.1	261,297	240.9	69,797
2001–02		100	105.2	282,270	252.3	71,244
2002–03		100	109.5	314,850	263.7	86,013
2003–04		100	114.0	364,547	275.3	97,644
2004–05		100	118.6	429,796	287.6	124,417
2005–06		100	123.4	497,842	299.9	150,242
2006–07		500	128.4	587,196	312.5	–

Source: Handbook of Statistics of Indian Economy, RBI, Mumbai.

1999–2000 while sluggish trend is seen in terms of actual growth. The production of SSIs increased by 64.48% from Rs 261,297 to Rs 429,796 crores in the quinquennium period from 2000–01 to 2004–05, thus exhibiting an increasing trend in terms of actual growth rate in percentage implying that globalization has created an unfavorable impact of the growth rate of SSI producing goods and services.

Contribution to Exports

An upward trend can be seen in the exports made by SSI units contributing towards 45.50% of the Indian exports. The SSI sector contributes nearly 35% directly and 15% indirectly towards the exports by way of merchant exporters, trading houses, and export houses.

The SSI sector has made a remarkable contribution towards exports with the establishment of a large number of modern small-scale industries during the post independence era. The major export items of this sector embraces non-traditional items, readymade garments, sports goods, finished leather, leather products, woolen garments and knitwear, plastic products, processed food, chemicals and allied products, and a large number engineering Rs 400 crores during 1973–74 to Rs 86,013 crores during the 2002–03. It further reveals that the exports from small scale sector in India was Rs 2,800 crores which increased to Rs 7,600 crores during the quinquennium period starting from 1995–96 to 1999–2000, thereby registering a sharp decline in this period.

The factors responsible for the industrial sickness can be divided into two parts: exogenous and endogenous. There are two sets of factors of non availability of assistance regarding marketing, shortage of basic raw materials and working capital needs from the state government agencies. From Table 2, it can be inferred that the number of sick units and the amount financed by banks during the last 11 years has been increasing in SSI sector.

Reasons for Sickness

The exogenous factors pertaining to factors like government policies in context of production, distribution, and price changes in the investment pattern following new priorities

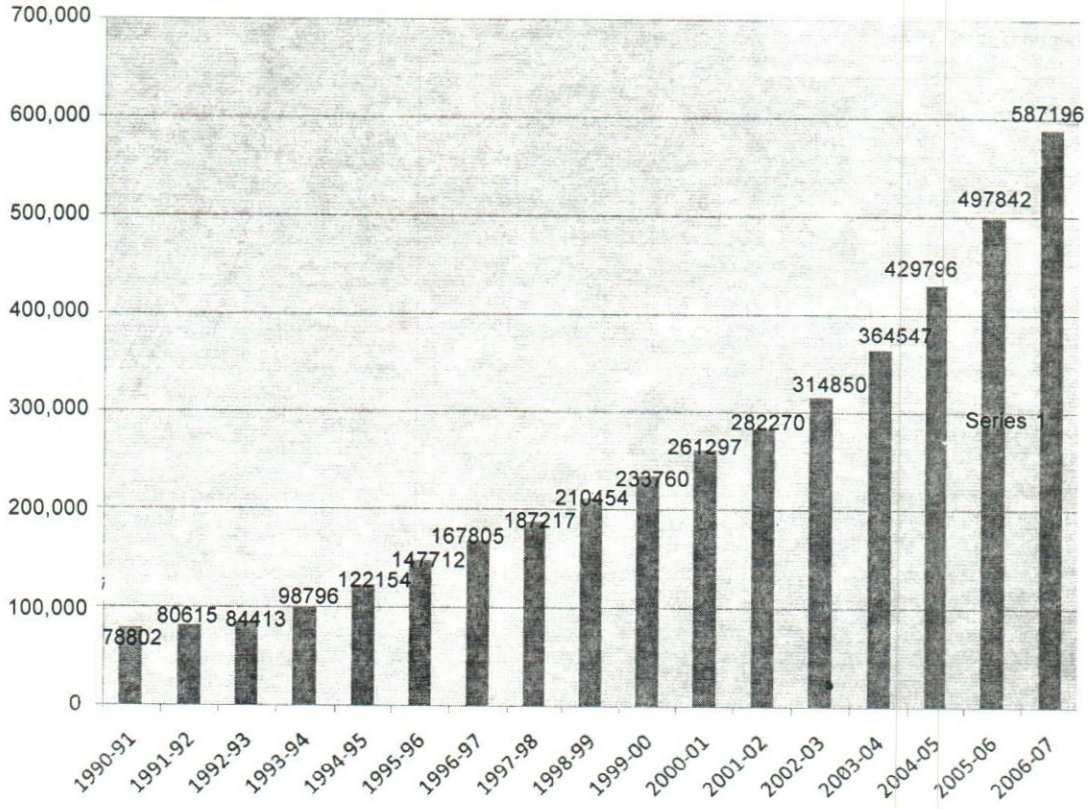


Chart 2: SSI's Production (after 1990s)

Table 2: Sickness of SSI Sector

Year	Total Sick Units		Potentially Viable	
	Number	Amount (crores)	Number	Amount (crores)
1990	218,828	2,426.94	16,451	590.50
1991	221,422	2,792.00	16,140	693.12
1992	245,575	3,100.00	19,210	278.9
1993	238,176	3,442.97	21,649	798.79
1994	256,452	3,690.37	16,580	685.93
1995	268,815	3,547.16	15,539	597.93
1996	262,376	3,721.94	16,424	635.82
1997	235,032	3,909.201	16,220	479.31
1998	221,536	3,856.64	18,686	455.96
1999	306,221	4,313.48	18,692	376.96
2000	304,235	4,608.43	14,373	369.46

Source: SIDBI (2002 Report on SSI Sector 2001, Lucknow)

in the plan, shortage of power transport, raw materials, deteriorating industrial relations affects almost every industry and can ultimately lead in sickness if corrective measures are not taken by the state.

The endogenous factors include mismanagement, diversion of funds, wrong dividend policy, and excessive overhead. It is evident that most of the plants have operated with old technologies and could not keep pace with technological advancements due to various reasons. Inefficient management practices along with diminishing labor productivity and operating efficiency of manufacturing process over the years lowered the profitability of many of the plants. Apart, from that incompetencies of management is also a contributory factor towards the increasing sickness of SSI.

The main contributory factors behind the increasing inefficiency of SSI are as follows:

- Practice of levying duty (excise) at every manufacturing stage
- Corrupt nexus between bureaucrat's ministries
- Inefficient and outdated anti-industry labor laws
- Inadequate knowledge among India's small scale industrialist about international market, international price, and internal products, design, and technology
- Outdated technology
- Labor productivity is low as compared to rival countries
- Insufficient education, technical training, and literacy
- Lack of work culture

Due to the presence of all the aforesaid factors on industry, it has become valuable to face even domestic competition besides international competition.

Suggestions

The problem of growing incidence of industrial sickness is not a sudden phenomenon but a gradual process consuming five to seven years. The Indian government has taken a slew of steps for controlling the increasing sickness in SSIs. Special role has been accorded to SIDBI, SFCs, and commercial banks for providing them financial

assistance. It has been clearly witnessed that the SSIs serve as an important catalyst for fulfilling growth and equity objectives in the developing countries.

- A well thought-out program should be made out for monitoring and fostering entrepreneurship for creating conducive environment for the rapid growth of SSIs in India.
- Credit is the main ingredient for sustained growth of SSI and hence their working capital needs should be fulfilled by commercial banks and also sometimes by cooperative banks and regional rural banks. On the contrary, term loans should be made available by State Financial Corporations (SFCs), Small Industries Development Corporations (SIDCs), National Small Industries Corporation (NSIC), and National Bank for Agriculture and Rural Development (NABARD).
- The IX Plan has witnessed that the SSIs are facing the main problems of inadequate flow of credit, use of obsolete technology, lack of infrastructural facilities, and, hence, the government must provide them with required raw materials, necessary marketing assistance, upgraded technology so as to grab the well-established industrial units to capture the market of SSIs.
- Government should initiate a plethora of measures for boosting exports of products manufactured by small scale sector.
- Marketing also poses a grave threat for small scale enterprises. Market promotion can be done through cooperative/public sector institutions, other specialized/professional marketing agencies and consortia approach for the small scale enterprises.

Conclusion

The small scale sector has performed exceedingly well and hence has facilitated to achieve industrial growth and diversification. It has also contributed substantially towards employment generation and also to rural industrialization.

Under this changing economic scenario, SSI has to face challenges and opportunities. Finance is to industry what blood is to body and, therefore, appropriate financial aid should be made available from institutional sources, because it will facilitate in achieving economic growth with the active participation of entrepreneurs by deploying modern technology and methods of production. So it is a suitable time to invest in the projects of small scale sector and indeed it is a promising sector keeping in view the structure of the Indian economy.

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Those who try to do something and fail are infinitely better than those who try nothing and succeed.

— Lloyd Jones

Focus

SSIs in Indian Economy: A Quantitative Appraisal

Annapurna Dixit and Alok Kumar Pandey

The major thrust of the present paper is to evaluate the performance as well as productivity of labor and capital in the SSIs for the period from 1973 to 2006. In order to estimate performance of production, export, employment, and investment in the SSIs and number of SSI units for the period from 1973 to 2006 and keeping in view the sub-periods like 1973–80, 1981–90, 1991–2000, and 2001–06, we have employed the OLS technique based on dummy variables on time series data. In the present paper an attempt has been made to estimate the marginal productivity of labor and capital employed in SSIs from 1973 to 2006. The findings of the present study are quite interesting. Facts reveal that marginal productivity of labor in case of SSIs is positive and highly significant for the study period.

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Industrialization plays a crucial role in directing the development process of the country for accelerating growth and progress in every sphere. Small-scale industries are considered to be one of the principal driving forces in economic growth for a developing country like India. They not only generate employment opportunities, but also help to diversify economic activities, promote resources for wealth, and make a significant contribution to export and trade. The small-scale industries require small investments so that entrepreneurs can afford to take risks.

The micro and small enterprises (MSEs) constitute an important segment of the Indian economy, contributing around 39% of the country's manufacturing output and 34% of its exports. It provides employment to around 29.5 million people in the rural and urban areas of the country (Economic Survey, 2005–06). The SSI sector has been the second largest employment generator next to agriculture.

In early 1991, the Indian economy faced several economic crises, like fiscal imbalances, mounting inflationary pressures, severe balance of payment crisis, etc. The Congress government, which assumed office at the end of June 1991, responded quickly to these problems. As a rescue measure, a series of new policy measures were announced in July 1991 by Government of India (Ahluwalia, 2002; Jalan, 1992; Joshi and Little, 1996; Nayyar, 1993). These are also known as Structural Adjustment Programmes (SAPs) of 1991 (Bhalla, 2000).

For promoting and strengthening small, tiny, and village enterprises a separate policy was announced by the government on August 6, 1991 for the first time in post-independence period. However, this period cannot be considered favorable for employment generation as the focus was placed on the use of new technologies because in this era of liberalization and globalization, it is very difficult

to rely completely on labor-intensive techniques. To cut down production cost, the need was to enable the SSI sector to minimize its cost so that this sector could compete with cheaper products of large and medium industries and imported ones.

Apart from other factors, it has now been realized that productivity of capital and labor plays a significant role in the process of production. This is the reason that much emphasis has been laid on productivity of capital as well as labor in the process of production by earlier researchers (Ahluwalia, 1991; Bagi and Bagi, 1981; Dhananjayan and Sasikala Devi, 1998; Sadhu and Mahajan, 1982). Industrial productivity, apart from other factors like technology, foreign capital, fiscal as well as monetary policy of the government, highly depends on productivity of primary inputs like capital and labor. Further productivity of these inputs is basically governed by their marginal productivity. Thus, marginal productivity of key factor inputs plays vital role in determining the overall performance of any production process.

The SSI sector has been playing a crucial role not only to industrial and economic development of the country, but also in increasing employment opportunities, equitable distribution of income, foreign exchange earnings, etc. Thus, the role played by SSI sector in the country's development is too vital to escape notice. The present paper has been divided into five sections. Section II outlines the objective of the study. Section III describes the data and methodology. Results of the study have been presented in the Section IV. Findings of the study are given in Section V.

Objective

In the light of the discussion, the major objective of the study is to know the performance of SSIs in Indian economy for the sub periods like 1973–80, 1981–90, 1991–2000, and 2001–06 and also to analyze the performance in terms of average annual growth rate for the period from 1973 to 2006. The study also takes into account the productivity of labor and capital in the SSIs for the periods, 1973–80, 1981–90, 1991–2000, and 2001–06.

Data and Methodology

For the study, time series data (for the period 1973–2006) related to GDP, total output of SSIs, India's total export, export of SSIs, employment in SSI, employment in public sector and private sector, total SSI units (registered and unregistered), fixed investment in the SSIs have been utilized. Data for all these variables has been collected from various issues of *Economic Survey*, *Handbook of Statistics on Indian Economy*, Ist, IInd, and IIIrd Census of SSI.

An attempt has been made to measure the average annual growth rate of SSIs about production, exports, and employment from 1973 to 2006. Trend Growth Rate has been estimated from the regression by fitting semi-log model. The equation is given follows:

$$\ln Y_i = \alpha_0 + \alpha_1 t + u_i \quad \ldots\ldots (1)$$

where, α_0 and α_1 are the coefficients. ν_i is the random disturbance. $\ln Y_i$ is the dependent variable in natural log and t is the time trend from 1973 to 2006. The growth rate is measured by:

$$g_{yx} = \hat{\alpha}_1 * 100 \quad \ldots\ldots (2)$$

For calculating average annual growth rate for sub-periods like 1973–80, 1981–90, 1991–2000, and 2001–06, the technique of slope dummy and intercept dummy has been employed (Gujarati, 2003) in the present study. More specifically, we have adopted the following regression equation:

$$\ln Y_i = \beta_0 + \beta_1 t + \beta_2 D_1 + \beta_3 (D_1 * t) + \beta_4 D_2 + \beta_5 (D_2 * t) + \beta_6 D_3 + \beta_7 (D_3 * t) + \nu_i \quad \ldots\ldots (3)$$

where,

D_1 is the first dummy = 1973 to 1980 = 0; 1981 to 2006 = 1

D_2 is the second dummy = 1973 to 1990 = 0; 1991 to 2006 = 1

D_3 is the third dummy = 1973 to 2000 = 0; 2001 to 2006 = 1

and β_0, β_1,..... are the coefficients. ν_i is the random disturbance. $\ln Y_i$ and t are the same as explain in Equation (1).

In Equation (3), growth for the sub period is measured by:

$$g_{yx}\,1973\text{-}80 = \hat{\beta}_1 * 100 \quad \ldots\ldots (4)$$

$$g_{yx}\,1981\text{-}90 = (\hat{\beta}_1 + \hat{\beta}_3) * 100 \quad \ldots\ldots (5)$$

$$g_{yx}\,1991\text{-}2000 = (\hat{\beta}_1 + \hat{\beta}_3 + \hat{\beta}_5) * 100 \quad \ldots\ldots (6)$$

$$g_{yx}\,2001\text{-}06 = (\hat{\beta}_1 + \hat{\beta}_3 + \hat{\beta}_5 + \hat{\beta}_7) * 100 \quad \ldots\ldots (7)$$

The policy makers and researchers may assume that GDP, SSIs output, export, SSIs contribution in export, total employment, employment in SSIs, total unit (registered and unregistered) have increased over the years. In view of this we may assume that per annum growth in the variables during the period 2001 to 2006 has been higher than during 1991 to 2000, per annum growth during the period 1991 to 2000 has been higher than during 1981 to 1990, and per annum growth during the period 1981 to 1990 has been higher than during 1973 to 1980. The last-mentioned conditions may be stated as:

$$g_{yx}2001\text{–}06 > g_{yx}1991\text{–}2000$$

$$g_{yx}1991\text{–}2000 > g_{yx}1981\text{–}90$$

$$g_{yx}1981\text{–}90 > g_{yx}1973\text{–}80$$

that is,

$$(\hat{\beta}_1 + \hat{\beta}_3 + \hat{\beta}_5 + \hat{\beta}_7) * 100 > (\hat{\beta}_1 + \hat{\beta}_3 + \hat{\beta}_5) * 100$$

$$(\hat{\beta}_1 + \hat{\beta}_3 + \hat{\beta}_5) * 100 > (\hat{\beta}_1 + \hat{\beta}_3) * 100$$

$$(\hat{\beta}_1 + \hat{\beta}_3) * 100 > \hat{\beta}_1 * 100$$

In the present study marginal productivity of capital and labor in SSI has also been estimated by using Cob Douglas production function (1928) and CES production function (1961). For measuring marginal productivity we have employed the production function of Cob Douglas type (Pandey and Gaur, 2004; Sadhu and Mahajan, 1982) and Constant Elasticity Substitution production function (Greene, 2005), which are given as follows:

$$V_i = A\, C^{\alpha}\, L^{\beta} U_i \quad \ldots\ldots (8)$$

where V_i is the output, C stands for capital and L for labor. α stands for the proportion of the capital employed in the process of production. β stands for the proportion of labor employed. And U_i is the random disturbance term.

Marginal productivity of capital and labor is estimated in the double log model, that is:

$$\text{Ln } V = \text{Ln } A + \alpha \text{ Ln } C + \beta \text{ Ln } L \quad \ldots\ldots (9)$$

where α and β denote elasticities of capital and labor in the production function.

Marginal productivity of capital and labor is estimated through the following formula:

MP (Capital) = α (Geometric mean of output/ Geometric mean of Capital)

MP (Labour) = β (Geometric mean of output/ Geometric mean of Labour) .....(10)

CES production function have two characteristics, i.e., it is homogeneous of degree one and it has a constant elasticity of substitution. The Constant Elasticity Substitution production function (Greene, 2005) may be written as:

$$\ln y = \ln \gamma - \frac{\nu}{\rho} \ln[\delta K^{-\rho} + (1-\delta) L^{-\rho}] + \varepsilon \quad \ldots\ldots (11)$$

$$\ln y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon' \quad \ldots\ldots (12)$$

where $X_1 = 1$, $X_2 = 1n\, K$, $= X_3 = 1n\, L$, and $X_4 = -\frac{1}{2} 1n^2 (K/L)$,

The transformations are:

$$\beta_1 = \ln \gamma,\ \beta_2 = \nu\delta,\ \beta_3 = \nu(1-\delta),\ \beta_4 = \rho\nu\delta\ (1-\delta)$$

or

$$\gamma = e^{\beta_1},\ \delta = \frac{\beta_2}{(\beta_2 + \beta_3)},\ \nu = (\beta_2 + \beta_3),\ \rho = \frac{\beta_4(\beta_2 + \beta_3)}{(\beta_2\beta_3)}.$$

The marginal products are:

$$f_K = \delta\gamma^{\rho-1}\left(\frac{Y}{K}\right)^{\rho+1}$$

$$f_L = (1-\delta)\gamma^{\rho-1}\left(\frac{Y}{L}\right)^{\rho+1} \quad \ldots\ldots (13)$$

Performance of SSIs

As regards output, the SSI sector currently contributes over one-third of the country's GDP. Table 1 points out that the industrial production relating to SSI sector increased both absolutely and relatively with an increase over the period of three decades. The production of SSI sector rose from Rs 72 billion in 1973 to Rs 4,716.63 billion by the year 2006. For the same period GDP increased from 616 billion in 1973 to 37,434.72 billion.

Table 1: GDP and Production of SSIs in Indian economy (at current price in Rs billion)

Year	GDP	Production of SSIs	Percentage change in (2)	Percentage change in (3)
1973	616.49	72.00	–	–
1974	725.66	92.00	17.71	27.78
1975	770.71	110.00	6.21	19.57
1976	828.45	124.00	7.49	12.73
1977	945.52	143.00	14.13	15.32
1978	1,016.19	158.00	7.47	10.49
1979	1,108.87	216.00	9.12	36.71
1980	1,325.20	281.00	19.51	30.09
1981	1,551.58	326.00	17.08	16.01
1982	1,733.37	350.00	11.72	7.36
1983	2,027.50	416.00	16.97	18.86
1984	2,276.94	505.00	12.30	21.39
1985	2,544.27	612.00	11.74	21.19
1986	2,836.81	723.00	11.50	18.14
1987	3,215.89	873.00	13.36	20.75
1988	3,837.90	1,064.00	19.34	21.88
1989	4,421.34	1,323.00	15.20	24.34
1990	5,150.32	788.02.	16.49	-40.44
1991	5,941.68	806.15	15.37	2.30
1992	6,815.17	844.13	14.70	4.71
1993	7,921.50	987.96	16.23	17.04
1994	9,252.39	1,221.54	16.80	23.64
1995	10,832.89	1,477.12	17.08	20.92
1996	12,607.10	1,678.05	16.38	13.60
1997	14,019.34	1,872.17	11.20	11.57
1998	16,160.82	2,104.54	15.28	12.41
1999	17,865.26	2,337.60	10.55	11.07
2000	19,254.15	2,612.97	7.77	11.78
2001	21,001.87	2,822.70	9.08	8.03
2002	22,653.04	3,148.50	7.86	11.54
2003	25,494.18	3,645.47	12.54	15.78
2004	28,559.33	4,297.96	12.02	17.90
2005	32,509.32	4,188.84	13.83	-2.54
2006	37,434.72	4,716.63	15.15	12.60
Mean	9,566.35	1,380.54	–	–
SD	1,033,969	134,526.8	–	–

Source: Economic Survey (various issues) from 1975–76 to 2006–07.

The annual growth rate was the highest with 36.71% in 1979. The causal factors behind it this were the various policy measures adopted during the IPR 1977 as the list of items reserved exclusively for the smallscale units increased from 180 to 504 and the concept of tiny sector was introduced within SSIs to give support to very small units. Therefore, this IPR 1977 is regarded as landmark in the development of SSI sector.

The average annual growth rate of total production of SSIs for the entire period 1973–2006 has been recorded at 11.9% (Table 2), while the average annual growth rate of GDP has been 12.9% for the same period. The average annual growth rate of GDP for the sub-periods 1973–80, 1981–90, 1991–2000, and 2001–06 has been 10.0%, 13.0%, 13.3%, and 11.5%, respectively. In the present study, while calculating the average annual growth rate for the sub periods from 1973 to 1980, 1981 to 1990, 1991 to 2000, and 2001 to 2006, we find that the average annual growth rates of the total production of the SSIs varies from one another. It was recorded at 17.8% during 1973–80 (Table 2) but the average annual growth of GDP was recorded at 10%. The average annual growth rate of production of the SSIs for the period 1981–90 was 14.4% (Table 2). For the same period, the percentage change in production of SSIs was lowest with 7.36% in 1982 over the period 1981 (Table 1). A number of measures were announced during the Industrial Policy Statement 1980 to harmonize the production of SSIs with that in large and medium sector and investment limits for tiny, ancillary, and SSIs were raised. But this policy did not succeed in boosting the production of SSIs. The shift in the average annual growth rate during this period was negative at 3.4% over 1973–80 (Table 2). The shift in the average annual growth rate of GDP as well as the total production of SSIs has been recorded negative over 1991–2000. The average annual growth rate during the period 1991 to 2000 has been 13.9% (Table 2). During this period, substantial growth was recorded in the absolute amount of production. The shift in the growth rate was -0.5% over 1981–90. The average annual growth rate for the period 2001–06 was recorded at 10.6% and the shift in growth rate was -3.6% over the period of 1991–2000 (Table 2).

The smallscale sector has displayed its vast capability in the field of exports. Substantial increase in exports was observed in case of readymade garments, canned and processed fish, leather products, hosiery and marine products, etc. The value of exports increased from Rs 400 crore in 1973 to record a high figure of Rs 157,230.30 crore (Table 3) in 2006. A very significant feature of export from the small-scale sector is their share in non-traditional exports. Table 3 depicts that the share of SSI sector in India's total exports also increased steadily from 15.85% in 1973 to 32.92% in 2006. Thus, both in absolute and as well as relative terms, the contribution of SSI sector in the total exports of Indian economy has been remarkable.

During the entire period from 1973 to 2006 the average annual growth rate of exports of SSIs has been 18.9% (Table 2). For the same period the average annual growth rate of total Indian export has been 16.3% and the

Table 2: Average Annual Growth Rate for the Period 1973–2006, 1973–80, 1981–90, 1991–2000, and 2000–06.

Variable	Average Annual growth for 1973-2006	Average Annual growth for 1973-80	Average Annual growth for 1981-90	Shift in growth rate over the period 1973-80	Average Annual growth for 1991-2000	Shift in growth rate over the period 1981-90	Average Annual growth for 2001-06	Shift in growth rate over the period 1991-2000
GDP	12.9	10.0	13.0	3.0	13.3	0.3	11.5	-1.8
Production of SSIs	11.9	17.8	14.4	-3.4	13.9	-0.5	10.6	-3.6
Export of India	16.3	13.3	15.3	2.0	15.8	0.5	19.8	4.0
Export of SSIs	18.9	19.5	17.9	-1.6	16.4	-1.5	16.8	0.4
Employment#	1.0	2.4	1.5	-0.9	0.6	-0.9	-0.9	-1.5
Employment in SSIs	6.3	9.1	7.1	-2.0	4.0	-3.1	4.3	0.3
Total unit SSIs	10.0	10.2	7.8	-2.4	4.5	3.3	2.6	-7.1
Registered Unit	7.2	12.9	10.7	-2.2	2.3	-8.4	7.4	5.1
Unregistered Unit	10.3	7.9	2.9	-5.0	14.8	12.8	2.5	-12.3
Fixed Investment in SSIs	15.6	13.3	27.9	14.6	3.7	-24.2	2.7	-1.0

Note: Calculated on the basis of Equations (2), (4), (5), (6), and (7) and the regression results given in Appendix 1 and Appendix 2.
Employment in public and private sector.

Table 3: Share of SSIs in Total Exports of Indian economy (Rs in crore)

Year	Export of India	Export of SSIs	Proportion (3)/(2)	Percentage change in (2)	Percentage change in (3)
1973	2,523.40	400.00	15.85	–	–
1974	3,328.80	500.00	15.02	31.92	25.00
1975	4,036.30	500.00	12.39	21.25	0.00
1976	5,142.70	800.00	15.56	27.41	60.00
1977	5,407.90	800.00	14.79	5.16	0.00
1978	5,726.10	1,100.00	19.21	5.88	37.50
1979	6,418.40	1,200.00	18.70	12.09	9.09
1980	6,710.70	1,600.00	23.84	4.55	33.33
1981	7,805.90	2,100.00	26.90	16.32	31.25
1982	8,803.40	2,000.00	22.72	12.78	-4.76
1983	9,770.70	2,200.00	22.52	10.99	10.00
1984	11,743.70	2,500.00	21.29	20.19	13.64
1985	10,894.60	2,800.00	25.70	-7.23	12.00
1986	12,452.00	3,600.00	28.91	14.30	28.57
1987	15,673.70	4,400.00	28.07	25.87	22.22
1988	20,231.50	5,500.00	27.19	29.08	25.00
1989	27,658.40	7,600.00	27.48	36.71	38.18
1990	32,557.60	9,664.00	29.68	17.71	27.16
1991	44,041.80	13,883.00	31.52	35.27	43.66
1992	53,688.30	17,784.00	33.12	21.90	28.10
1993	69,751.40	25,307.00	36.28	29.92	42.30
1994	82,674.10	29,068.00	35.16	18.53	14.86
1995	106,353.30	36,470.00	34.29	28.64	25.46
1996	118,817.10	39,248.00	33.03	11.72	7.62
1997	130,100.60	44,442.00	34.16	9.50	13.23
1998	139,753.10	48,979.00	35.05	7.42	10.21
1999	159,561.40	54,200.00	33.97	14.17	10.66
2000	203,571.00	69,797.00	34.29	27.58	28.78
2001	209,018.00	71,244.00	34.09	2.68	2.07
2002	255,137.30	86,013.00	33.71	22.06	20.73
2003	293,366.80	97,644.00	33.28	14.98	13.52
2004	375,339.50	124,417.00	33.15	27.94	27.42
2005	456,418	150,242	33.15	21.60	20.76
2006	571,779	157,230.3	32.92	25.28	4.65
Mean	101,948.7	32,800.95	–	–	–
SD	142,088.2	44,550.82	–	–	–

Source: Economic Survey (various issues) from 1975–76 to 2006–07.

same has been recorded 13.3%, 15.3%, 15.8%, and 19.8%, respectively for the sub periods 1973–80, 1981–90, 1991–2000, and 2001–06. There has been no change in SSIs export in 1975 and 1977 over the previous year, that is, 1974 and 1975 but in 1976 it reached the highest level of 60% (Table 3). For the period from 1973 to 1980, the average annual growth rate of exports of SSIs stood at 19.5% (Table 2). During 1981 through 1990, the average annual growth rate of exports of SSIs was 17.9% with negative shift in the growth rate (-1.6%) over the period 1973–80 (Table 2).

A large number of export promotional measures were adopted to promote exports from SSIs in the IPR 1991 had a positive effect on total exports of SSIs. The percentage change in export in the year 1991 was 43.66 over the year 1990 (Table 3). It is, thus obvious that the crisis year (1990–91). When 1990–91 is left out from the analysis, it was found that the average annual growth rate of exports of 1991–2000 has been 16.4% (Table 2). The shift in the growth rate during this period was -1.5%. The average annual growth rate during 2001 to 2006 was recorded at 16.8%. The shift in the growth rate during 2001 to 2006 is 0.4% over 1991–2000 (Table 2).

As is clear from Table 4 the total employment in SSI sector was 39.7 lakh in 1973 which rose steadily to as high as 312.52 lakh by 2006. As regards employment in public and private sector it was 188.2 lakh in the year 1973 and increased to 264.5 lakh in the year 2006. It is

Table 4: Employment in Public and Private Sector and SSIs (in lakh)

Year	Employment (Public and Private)	Employment in SSIs	Percentage change in (2)	Percentage change in (3)
1973	188.20	39.70	–	–
1974	192.74	40.40	2.41	1.76
1975	196.91	45.90	2.16	13.61
1976	201.66	49.80	2.41	8.50
1977	206.33	54.00	2.32	8.43
1978	212.43	63.80	2.96	18.15
1979	218.84	67.00	3.02	5.02
1980	223.04	71.00	1.92	5.97
1981	228.79	75.00	2.58	5.63
1982	234.93	79.00	2.68	5.33
1983	240.08	84.20	2.19	6.58
1984	242.14	90.00	0.86	6.89
1985	245.79	96.00	1.51	6.67
1986	250.58	101.40	1.95	5.63
1987	253.88	107.00	1.32	5.52
1988	257.12	113.00	1.28	5.61
1989	259.00	119.60	0.73	5.84
1990	263.53	158.30	1.75	32.36
1991	267.33	166.00	1.44	4.86
1992	270.56	174.80	1.21	5.30
1993	271.77	182.60	0.45	4.46
1994	273.75	191.40	0.73	4.82
1995	275.25	197.90	0.55	3.40
1996	279.41	205.90	1.51	4.04
1997	282.45	213.20	1.09	3.55
1998	281.66	220.60	-0.28	3.47
1999	281.13	229.10	-0.19	3.85
2000	279.60	240.90	-0.54	5.15
2001	277.89	252.30	-0.61	4.73
2002	272.06	263.70	-2.10	4.52
2003	270.00	275.30	-0.76	4.40
2004	264.43	287.60	-2.06	4.47
2005	264.58	299.85	0.06	4.26
2006	264.50	312.52	-0.03	4.23
Mean	249.77	152.02	–	–
SD	29.083	85.67	–	–

Source: Economic Survey (various issues) from 1975–76 to 2006–07.

worth mentioning here that the growth rate of employment in SSIs has always been higher than in public and private sector. The SSI sector witnessed a steady growth over the period not only in absolute terms, but also in relative terms. During the period from 1973 to 2006, average annual growth rate of employment in SSIs was 6.3% but at the same time the average annual growth rate in employment in the public and private sector has been recorded 1.0% (Table 2). The average annual growth rate of employment in public and private sector for the sub periods like 1973–80, 1981–90, 1990–2000, and 2001–06 has been 2.4%, 1.5%, 0.6%, and -0.9%, respectively.

After Independence, the government has given much importance to the development of SSI sector in various Industrial Policy Resolutions, Five Year Plans, and different committees have been appointed to look into the various aspects of SSIs. The government has realized their significance as they provide employment to millions of people, earn foreign currency by exports, etc. The support provided by the government has helped the SSIs to diversify and expand mainly in the sixties and seventies, making it a pacesetter for the developing world. Table 5 shows that there has been a phenomenal increase in the number of

Table 5: Estimated Number of Small Scale Units (No. in Lakh)

Year	Total Units	Registered Units	Unregistered Units	Proportion (3) to (2)	Proportion (4) to (2)	Percentage change in (2)	Percentage change in (3)	Percentage change in (4)
1973	4.16	1.64	2.52	39.42	60.58	–	–	–
1974	4.98	2.22	2.76	44.58	55.42	19.71	35.37	9.52
1975	5.46	2.46	3.00	45.05	54.95	9.64	10.81	8.70
1976	5.92	2.68	3.24	45.27	54.73	8.42	8.94	8.00
1977	6.70	2.96	3.74	44.18	55.82	13.18	10.45	15.43
1978	7.34	3.34	4.00	45.50	54.50	9.55	12.84	6.95
1979	8.05	3.92	4.13	48.70	51.30	9.67	17.37	3.25
1980	8.74	4.48	4.26	51.26	48.74	8.57	14.29	3.15
1981	9.62	5.23	4.39	54.37	45.63	10.07	16.74	3.05
1982	10.59	6.04	4.52	57.03	42.68	10.08	15.49	2.96
1983	11.55	6.84	4.71	59.22	40.78	9.07	13.25	4.20
1984	12.40	7.55	4.85	60.89	39.11	7.36	10.38	2.97
1985	13.53	8.53	5.00	63.05	36.95	9.11	12.98	3.09
1986	14.62	9.48	5.14	64.84	35.16	8.06	11.14	2.80
1987	15.83	10.55	5.28	66.65	33.35	8.28	11.29	2.72
1988	17.12	11.70	5.42	68.34	31.66	8.15	10.90	2.65
1989	18.23	12.67	5.56	69.50	30.50	6.48	8.29	2.58
1990	19.48	13.78	5.70	70.74	29.26	6.86	8.76	2.52
1991	20.82	14.98	5.84	71.95	28.05	6.88	8.71	2.46
1992	22.46	16.48	5.98	73.37	26.63	7.88	10.01	2.40
1993	23.88	17.76	6.12	74.37	25.63	6.32	7.77	2.34
1994	25.71	19.44	6.27	75.61	24.39	7.66	9.46	2.45
1995	27.24	20.84	6.40	76.51	23.49	5.95	7.20	2.07
1996	28.03	21.53	6.50	76.81	23.19	2.90	3.31	1.56
1997	29.44	22.82	6.62	77.51	22.49	5.03	5.99	1.85
1998	30.80	24.06	6.74	78.12	21.88	4.62	5.43	1.81
1999	32.12	25.26	6.86	78.64	21.36	4.29	4.99	1.78
2000	101.10	13.10	88.00	12.96	87.04	214.76	-48.14	1182.80
2001	105.21	13.75	91.40	13.07	86.87	4.07	4.96	3.86
2002	109.49	15.91	93.58	14.53	85.47	4.07	15.71	2.39
2003	113.95	16.97	96.98	14.89	85.11	4.07	6.66	3.63
2004	118.59	17.53	101.06	14.78	85.22	4.07	3.30	4.21
2005	123.42	19.3	104.12	14.78	85.22	4.07	3.03	10.10
2006	128.44	20.32	108.12	15.64	84.36	4.07	3.84	5.28
Mean	36.32	12.24	24.08	–	–	–	–	–
SD	41.28	7.24	38.14	–	–	–	–	–

Source: Economic Survey (various issues) from 1975–76 to 2006–07.

small scale units. The total number of SSI units was 4.16 lakh in 1973. This almost doubled to 8.05 lakh by the end of the seventies, 18.23 lakh by the end of the eighties, and 32.12 lakh by the end of the nineties. There were 128.44 lakh unit in the country out of which 20.32 lakh were registered working units and 108.12 lakh unregistered units recorded in the year 2006 (Table 5).

The average annual growth rate in the total SSI units, registered SSI units and unregistered SSI units were recorded at 9.8%, 9.4%, and 7.8%, respectively for the study period (Table 2). During the sub-period 1973–80 the average annual growth rate was highest in case of registered units (Table 2). Again the average annual growth rate was highest in case of registered unit during 1981–90, that is, 10.7% with a negative shift of 2.2% over the period 1973–80. The negative shift in average annual growth rate was recorded for unregistered unit (-5.0%) for the period 1973–80. In the period 1991–2000 the average

Table 6: Investment in SSI (in Rs billion)

Year	Fixed Investment in SSIs	Percentage Change in Fixes Investment
1973	22.96	–
1974	26.97	17.47
1975	32.04	18.80
1976	35.53	10.89
1977	39.59	11.43
1978	44.31	11.92
1979	55.40	25.03
1980	58.50	5.60
1981	62.80	7.35
1982	68.00	8.28
1983	73.60	8.24
1984	83.80	13.86
1985	95.85	14.38
1986	108.81	13.52
1987	126.10	15.89
1988	152.79	21.17
1989	755.97	394.78
1990	935.55	23.75
1991	1,003.51	7.26
1992	1,096.23	9.24
1993	1,157.95	5.63
1994	1,237.90	6.90
1995	1,257.50	1.58
1996	1,305.60	3.83
1997	1,332.42	2.05
1998	1,354.82	1.68
1999	1,399.82	3.32
2000	1,468.45	4.90
2001	1,543.49	5.11
2002	1,623.17	5.16
2003	1,702.19	4.87
2004	1,786.99	4.98
2005	188,113	5.27
2006	195,486	3.92
Mean	76,131.18	–
SD	70,491.59	–

Source: Economic Survey (various issues) from 1975–76 to 2006–07.

annual growth of unregistered unit was more than the registered units. It was recorded at 14.8% for unregistered unit and only 2.3% for registered unit. The shift in growth was -8.4% for registered unit and 12.8% for unregistered unit over the period 1981–90. Again for the sub period 2001–06 the average annual growth rate was 7.4% and 2.5% for registered units and unregistered units, respectively. The shift was negative in case of unregistered units, that is, -12.3 over the period 1991–2000 (Table 2).

Table 6 provides fixed investment in SSIs and percentage change over the previous year for the period from1973 to 2006. Fixed investment in SSIs was recorded Rs 22.96 billion in the 1973 which reached the level of Rs 195,486 billion in 2006. The average annual growth rate was recorded at 15.6% in the fixed investment in SSIs for the period 1973–2006. The average annual growth rate was recorded at 13.3% for the period 1973–80. During 1981–90 the average annual growth rate in fixed investment was 27.9% which has a positive shift of 14.6%. The average annual growth was only 3.7% during the period 1991–2000 and shift during this period was -24.2% over the period 1981–90. The average annual growth was 2.7% during the period 2001–06 and shift was -1.0% over the period 1991–2000.

Productivity of Labor and Capital in SSIs

Based on facts relating to production (output), fixed investment (capital), employment (labor) in case of small scale industries of Indian economy, marginal productivity of labor and capital for SSIs have been calculated for the total period, as well as for sub periods like 1973–80,

Table 7: Cob Douglas Production Function: Regression Results

Period	Constant	Capital	Labor	R^2	Adj R^2	SER	DW Stat.	AIC	SIC
Total Period (1973–2006)	-4.37	-0.33	2.67	0.961	0.958	0.245	1.14	0.116	0.250
t-value	-5.58*	-2.93*	9.23*						
Period (1973–80)	0.71	1.61	-0.41	0.979	0.971	0.074	1.55	-2.078	-2.048
t-value	1.06	3.52*	-0.61						
Period (1981–90)	-2.24	-0.02	1.91	0.699	0.624	0.781	1.48	0.737	0.846
t-value	-0.65	-0.10	1.95*						
Period (1991–2000)	-10.44	-0.36	3.83	0.985	0.980	0.058	1.15	-2.59	-2.50
t-value	-5.02*	-0.39	4.34*						
Period (2001–06)	-0.27	-4.11	6.94	0.966	0.949	0.051	1.76	-2.83	-2.85
t-value	-0.03	-0.46	0.69						

Notes: Estimated with the help of Equation (9) and data given in Tables 1, 3 and 5.
*1 percent significance level

Table 8: CES Production Function: Regression results

Period	Constant	X_2	X_3	X_4	R^2	Adj R^2	SER	DW Stat.	AIC	SIC
Total Period (1973–2006)	-2.77	0.61	1.40	0.94	0.969	0.966	0.223	1.346	-0.051	0.128
t-value	-3.05**	1.75	2.72**	2.83*						
Period (1973–80)	1.33	2.90	-1.80	-3.34	0.984	0.972	0.075	2.197	-2.047	-2.007
t-value	1.09	2.07	-1.15	-0.97						
Period (1981–90)	4.97	4.29	-6.19	3.95	0.955	0.932	0.123	1.327	-1.071	-0.951
t-value	5.19*	6.54*	-4.92*	6.57*						
Period (1991–2000)	-0.09	-0.68	4.16	-0.14	0.988	0.982	0.057	1.318	-2.595	-2.474
t-value	-2.61**	-0.18	1.09	-0.07						
Period (2001–06)	-0.92	-4.59	7.73	0.07	0.954	0.884	0.067	2.256	-2.319	-2.458
t-value	-0.08	-0.35	0.54	0.01						

Notes: Estimated with the help of Equation (12) and data given in Tables 1, 3, and 5.
* 1% significance level; ** 5% significance level

Table 9: Marginal Productivity of Capital and Labor for Small Scale Industries in India

Period	Cob Douglas Production Function		CES Production Function	
	Marginal Productivity of Capital	Marginal Productivity of Labor	Marginal Productivity of Capital	Marginal Productivity of Labor
Total Period (1973–2006)	-0.83	16.32	0.20	8.13
Period (1973–80)	5.82	-1.06	16.08	-5.61
Period (1981–90)	-0.08	12.08	-0.43	0.98
Period (1991–2000)	-0.46	30.38	-0.25	13.33
Period (2001–06)	-8.83	92.41	-7.89	8.26

Note: Elasticities as well as MP of Capital and Labor have been derived from the regression results as given in Tables 7 and 8 and Equations (10) and (13).

1981–90, 1991–2000, and 2001–06. For this purpose we have estimated the regression in Equations (9) and (12) and results are presented in Tables 7 and 8. Based on regression results of Equations (14) and (15) marginal product (MP) of capital and labor for SSIs has been calculated on the basis of Equations (10) and (13). The MP of capital and labor in case of Cob Douglas production function was recorded at -0.83 and 16.32, and also MP of capital and labor in case of CES production function was 0.20 and 8.13. Marginal productivity of capital in both the Cob Douglas production function was recorded at -0.08, -0.46, and -8.83, respectively for the sub periods 1981–90, 1991–2000, and 2001–06, and also for the CES production it was recorded at -0.43, -0.25, and -7.89, respectively for sub periods 1981–90, 1991–2000, and 2001–06. The MP of capital in both production functions was found negative, showing the less significant contribution of capital on output for SSIs. The marginal productivity of labor was 12.08, 30.38, and 92.41 for Cob Douglas production function and 0.98, 13.33, and 8.26 for CES production function for 1981–90, 1991–2000, and 2001–06. In both types of production function, marginal productivity of labor indicates that labor played significant contribution towards output of small scale industry. Thus, large proportion of incomes generated in SSI sector gets distributed among the workers and a large number of people. These factors flow from the fact that these industries are labor intensive and can be set up anywhere and everywhere in the country.

Findings and Future Outlook

The present paper has attempted to estimate performance of small scale industries in Indian economy for the period 1973–2006, and also for sub periods like 1973–80, 1981–90, 1991–2000, and 2001–06, and the results are quite interesting. The study reveals very important fact that during the post reform period (1991 onwards) the shift in the average annual growth rate in output, employment, and export was negative. The causal factors behind it were the new economic policy of 1991, various policy changes after 1991 and WTO arrangement which includes liberalization and globalization. In this changing scenario of liberalization and globalization the small scale industries are struggling for their survival because of de-reservation and for removal of quantitative restrictions.

Measuring the productivity of labor and capital has always been interesting and fruitful from viewpoint of estimating the ultimate contribution of these two inputs in the process of production, especially in industrial sphere. The present paper has attempted to estimate marginal productivity of labor and capital for SSI of Indian economy for the periods from 1974 to 2006, 1973 to 1980, 1981 to 1990, 1991 to 2000, and 2001 to 2006. The empirical evidences of the present paper have established the fact that marginal productivity of labor was highly significant in case of small scale industries. The marginal productivity of labor was found positive due to the fact

that the small scale and cottage industries can be established with small investment and with local resources these can be set up quickly and can cater to the immediate needs of consumer goods within a short-period of time. To sum up, SSIs need to be developed along with medium- and large-scale industries, because the role played by them in India's economic life and development is unavoidable.

Appendix 1: Regression Results: Average Annual Growth Rate for the period 1973–2006

Equations	Coefficient				
	Constant	t	R^2	Adj R^2	SER
GDP	10.819	0.129	0.997	0.997	0.161
t-value	433.89*	103.90*			
Production of SSIs	9.162	0.119	0.964	0.963	1.715
t-value	112.82*	29.59*			
Export of India	7.573	0.163	0.987	0.986	1.131
t-value	114.84*	49.69*			
Export of SSIs	5.678	0.189	0.990	0.990	1.131
t-value	87.64*	57.66*			
Employment#	5.321	0.010	0.787	0.780	0.106
t-value	263.35*	10.89*			
Employment in SSIs	3.725	0.063	0.979	0.980	2.668
t-value	0.266*	13.331*			
Total unit SSIs	1.289	0.100	0.941	0.939	2.038
t-value	14.46*	22.61*			
Registered Unit	0.982	0.072	0.825	0.819	3.678
t-value	8.26*	12.28*			
Unregistered Unit	0.376	0.103	0.678	0.668	16.758
t-value	1.48	8.22*			
Fixed Investment in SSIs	7.598	0.156	0.905	0.902	8.361
t-value	42.39*	17.50*			

Notes: (i) * Significant at 1% level of significance;

(ii) calculated with the help of data given in Tables 1 to 5 and Equation 1.

Employment in public and private sector.

Appendix 2: Regression Results: Average Annual Growth Rate for the sub periods 1973–80, 1981–90, 1991–2000, and 2000–06

Equations	Coefficient										
	Constant	t	D1	D2	D3	D1t	D2t	D3t	R^2	Adj R^2	SER
GDP	10.947	0.100	-0.195	0.003	0.388	0.030	0.003	-0.018	0.999	0.999	0.24
t-value	456.15*	21.14*	-3.72*	0.04	1.58	5.31*	0.76	-2.26			
Production of SSIs	8.719	0.178	0.391	-0.471	0.963	-0.034	-0.005	-0.036	0.992	0.990	0.357
t-value	95.50*	9.89*	1.96	-1.33	1.03	-1.57	-0.28	-1.18			
Export of India	7.850	0.133	-0.385	0.296	-1.347	0.020	0.005	0.040	0.996	0.996	0.277
t-value	97.45	8.38	-2.18	0.95	-1.63	1.07	0.32	1.51			
Export of SSIs	5.776	0.195	0.001	0.816	-0.273	-0.016	-0.015	0.004	0.997	0.996	0.325
t-value	66.30	11.35	0.01	2.42	-0.31	-0.77	-0.91	0.15			
Employment#	5.210	0.024	0.099	0.174	0.425	-0.009	-0.009	-0.015	0.997	0.997	0.001
t-value	1002.30*	23.99*	8.71*	8.69*	8.00*	-7.74*	-8.75*	-9.03*			
Employment in SSIs	3.555	0.091	0.095	0.719	-0.080	-0.020	-0.031	0.003	0.997	0.996	0.037
t-value	119.50	15.49	1.46	6.24	-0.26	-2.84	-5.22	0.31			
Total unit SSIs	1.370	0.102	0.206	-0.792	2.713	-0.024	0.033	-0.071	0.978	0.972	0.763
t-value	10.26*	3.88	0.70	-1.53	1.98	-0.74	1.25	-1.59			
Registered Unit	0.458	0.129	0.270	1.684	-1.879	-0.022	-0.084	0.050	0.981	0.976	0.396
t-value	4.76*	6.80*	1.28	4.52*	-1.91	-0.96	-4.37	1.54			
Unregistered Unit	0.864	0.079	0.361	-2.820	5.109	-0.050	0.128	-0.123	0.919	0.898	4.190
t-value	2.76	1.29	0.53	-2.33	1.60	-0.67	2.06	-1.17			
Fixed Investment in SSIs	7.631	0.133	-1.836	5.064	-0.295	0.146	-0.242	0.010	0.976	0.970	2.065
t-value	34.75*	3.07	-3.82	5.96*	-0.13	2.74	-5.52*	0.14			

Notes: (i) * Significant at 1% level of significance;

(ii) calculated with the help of data given in Tables 1 to 5 and Equation 3.

Employment in public and private sector.

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Many of life's failures are people who did not realize how close they were to success when they gave up.

— Thomas Alva Edison

Focus

Time Overruns in Procurement Contracts and PPP Contracts—Reasons, Trends and Insights

Digvijay Singh Negi, Nitin Madan, and Pawan Gopalakrishnan

When the cat's away ... the mice will play

—An old saying

The existence of cost and time overruns in Engineering Procurement Contracts or EPCs (or Traditional Procurement Contracts, that is, TPCs) is not unheard of. Morris (in his 1990 and 2003 articles) has provided a detailed analysis in this regard for India. The major results, however, concentrated on the "cost overrun" issue supported with evidences in terms of factors generating the same. Morris (2003) gave some insights into geographical differences emphasizing on deeper issues. A similar analysis has been conducted by Bent Flyvbjerg et al. (2004) clearly indicating that such a phenomenon is not particular to India. This paper attempts to improvise on the definitions of overruns (of either kind) and plunges into a framework by first eliminating the bias due to simple cost escalations which might potentially overshadow the actual causes for cost overruns. Unlike its predecessors like Bent Flyvbjerg et al. or for that matter Morris, this paper shows that the relationship lies in the reverse direction, that is, cost overruns causes time overruns. The study is based on the completed projects in the Indian road sector from 1997 to 2008. The analysis also covers other aspects such as geographical barriers, governance issues, efficiency of PPPs v/s EPC and impacts due to project size. The main findings are: (i) cost overruns "lead to" time overruns in this sector; (ii) PPP projects are seen to have lower time overruns; (iii) and projects in the western region were found to have lower time overruns as compared to all regions together—raising the serious issue of governance hampering the performance outcome of essential infrastructural projects.

The paper is structured as follows. Section 1 provides a brief introduction to the concept of cost overruns and time overruns and a few trends regarding these in the Indian roads sector have been presented. In Section 2, the data sample used for empirical study has been described. Section 3 presents the econometric model specification which tackles some questions with relevant answers that have generated interest in the concerned field in Section 4. Finally Section 5 discusses the policy implications and conclusions of the results.

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Introduction and Literature Review

Cost Overruns or "Cost Escalations" or "Budget Overruns" is simply defined as an excess of actual cost over budgeted cost. These are very common in Engineering Procurement contracts like in infrastructure, building, or technology projects. Likewise, time overruns are defined in terms of time exceeding the actual budgeted time for completion of the project undertaken. Different factors (psychological, political—economic or technical) come into the picture acting as obstacles during the completion of a project undertaken. These may range from imperfect forecasting techniques, inadequate data, etc., to more strategic misrepresentation of the structure or design of the project which results in several rounds of renegotiation between the sponsor (government) and the contractors (who are competitively chosen through a process of bidding) (Ganuza, 2003). In fact these also occur as a result of accounting for any contingencies (also called cost contingency funds to cover for risks). These are over and above budget accommodations for any sort of scope changes.

Thus, poor risk analysis and contingency estimation practices account for cost overruns. Further project misspecification also leads to time overruns.

Method of calculating the cost overruns are as follows:

1. As a percentage: [(Actual Cost-Budgeted Cost)/ Budgeted Cost] x 100
2. As a ratio: Actual Cost/Budgeted Cost

Sebastian Morris, in two of his works (1990 and 2003), has analyzed the existence of cost and time overruns in India. Most notorious of the cases are usually reported in roads and highway projects—particularly the ones which are carried out by the government.

Figure 1 gives a visual representation of cost and time overruns in a traditional procurement scheme:

Looking at the number of projects that have been undertaken in the past, cases of overruns (of both types) are definitely not a handful. Ranging from smaller projects handled by the Public Works Department (PWD) to massive projects like that of the "Golden Quadrilateral," the end result is indeed shocking—the project undertaking process itself seems to be inefficient with issues of overruns, but such a cost to society does not in any way guarantee quality. The conditions of the roads are an apology to international standards and are further poorly managed by authorities like the National Highways

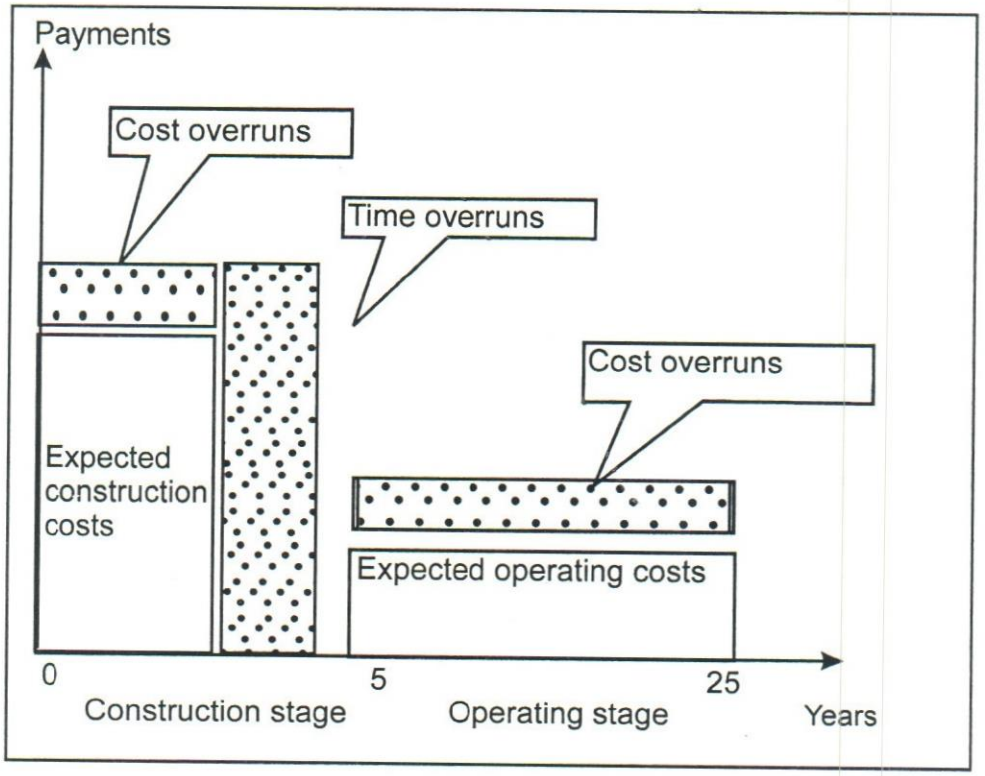


Fig. 1. Cost and Time Overruns in a Traditional Procurement Scheme

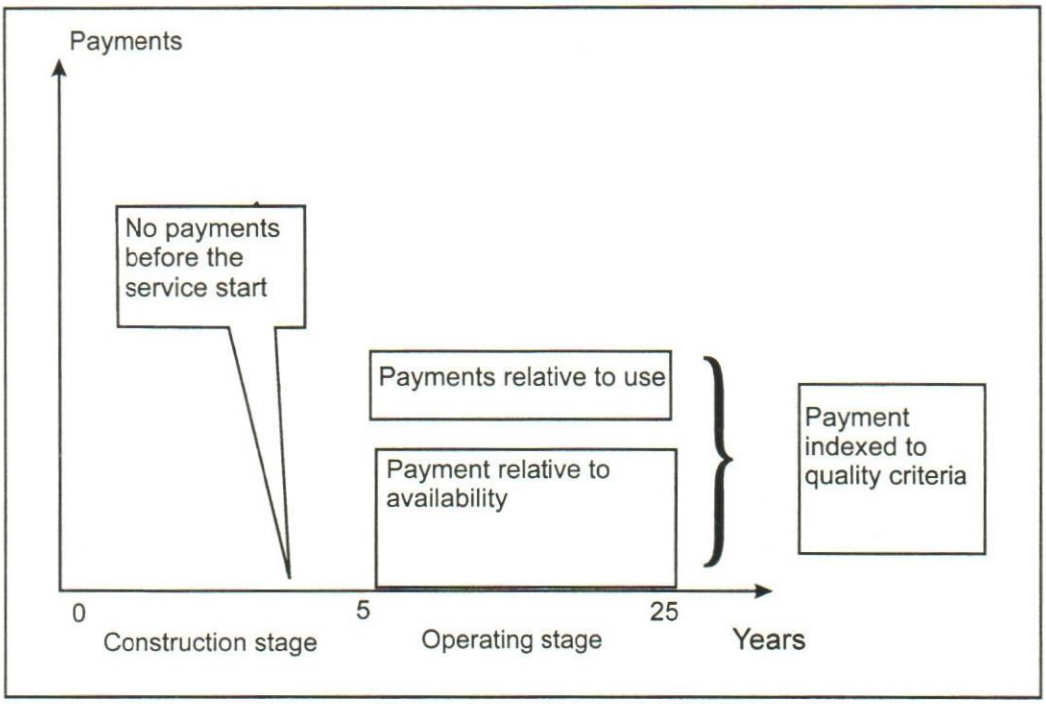


Fig. 2. Advantages of a PPP

Authority of India (NHAI), and following Morris (2006) it seems that the authorities "do not see the road from the users' point of view." Further they do not even recognize the need to coordinate towns and villages. But more importantly, there does not seem to be any sense of responsibility.

The notion of Build, Operate, and Transfer (BOT) has definitely provided to the infrastructure world a positive alternative. This has been the major cause for comparative analysis, and detailed studies have been done since the concept has internationally proven to be more efficient (see references—one can actually find a variety of instances where this has been admitted). Not surprising in any way, major contract offers commissioned by the government has switched gears to Private Public Partnership (PPP). There has been an increase in competition for winning contracts and the spectrum of the pocket size of players has only widened. Further the competition is in the "real sense" increasing thereby aiming for cost minimisation (Das, 2006). The advantages of a PPP over a Traditional Procurement (TPC) or an Engineering Procurement (EPC) contract are clearly indicated in Figure 2.

The PPP produces efficient contractual incentives and allows a joint optimization of construction and operating costs throughout the lifecycle of the assets as listed further:

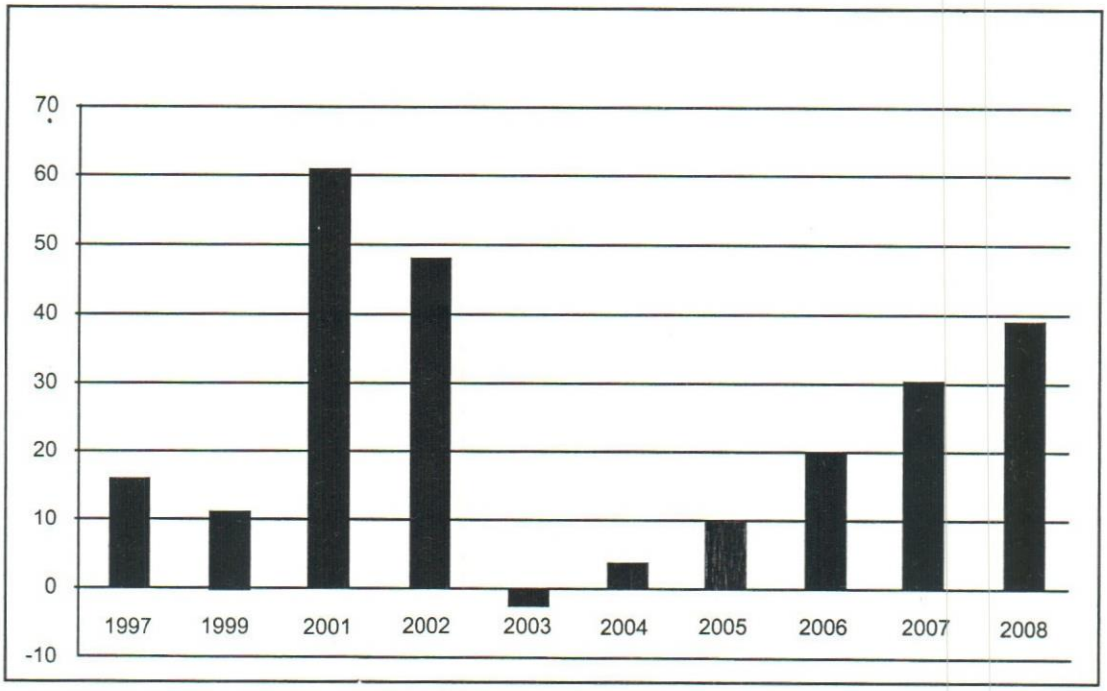
1. In case of delays in such contracts the public payments begin when the service is delivered, so the private partner bears both the cost induced by delays in the construction phase and contractual penalties.

2. In the operating stage, government payments are calculated on the basis of performance, quality, availability, and use of service.

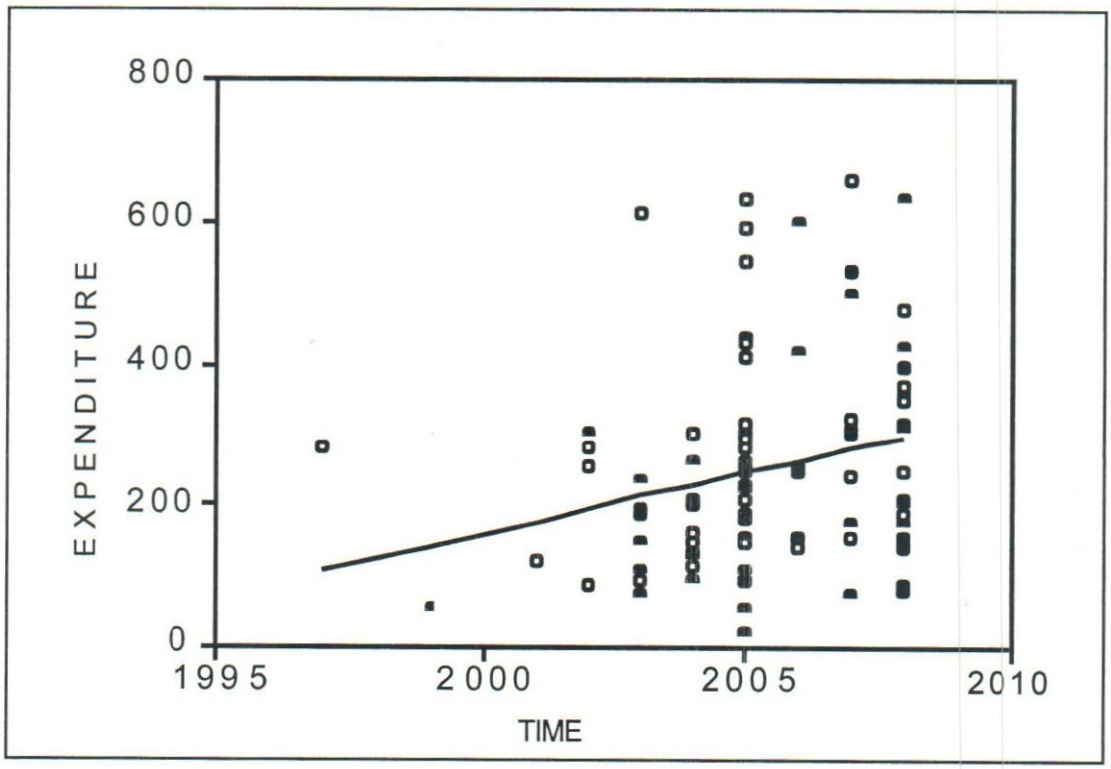
3. As the PPP contract is a global one, the builder is incited to minimize both construction and operation costs.

4. For complex services, the PPP could be seen as the most efficient contractual scheme as the government just has to give a functional specification of its needs and to take benefit from the skills and the experience accumulated by its private partner.

Recent trends in average time overruns for the road sector projects have of late seen a rising trend. With values much lower than the levels in early 2000s, the general figures have been far lower. But the cause of worry is that the figures are quickly catching up (Graph 1). Expenditure on road projects has steadily increased over time (Graph 2). The major contributor has traditionally been considered as cost escalation. (Refer to Appendix for composite cost index calculations.)

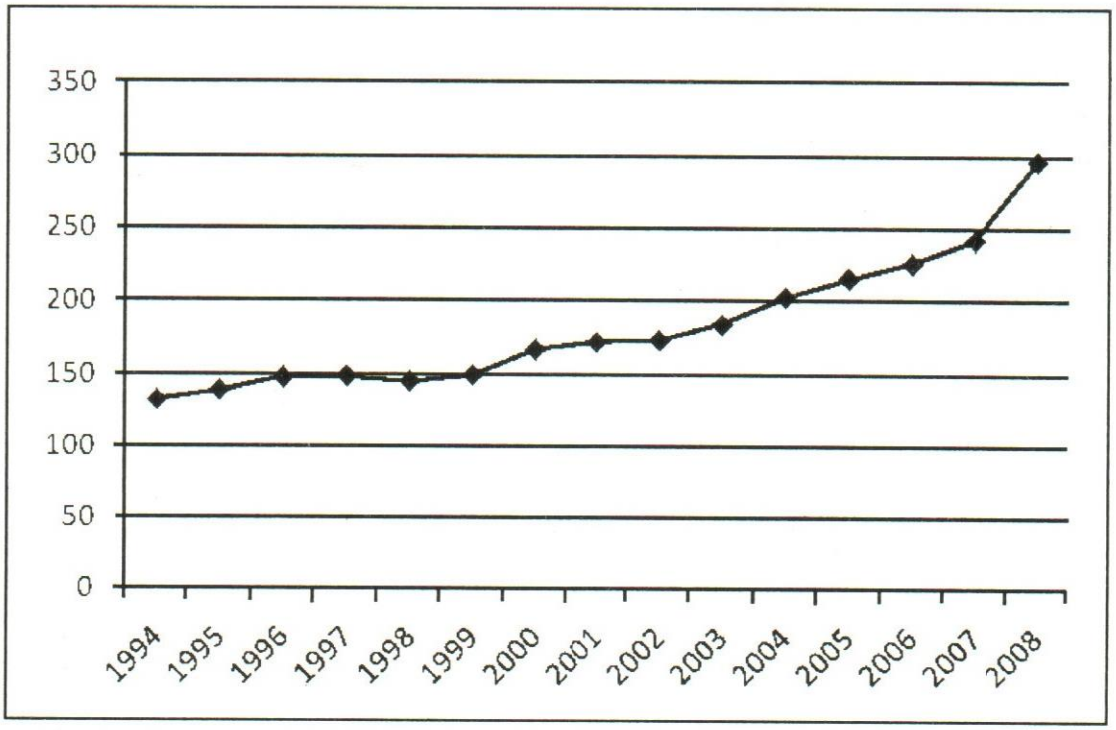


Graph 1: Average Time Overruns

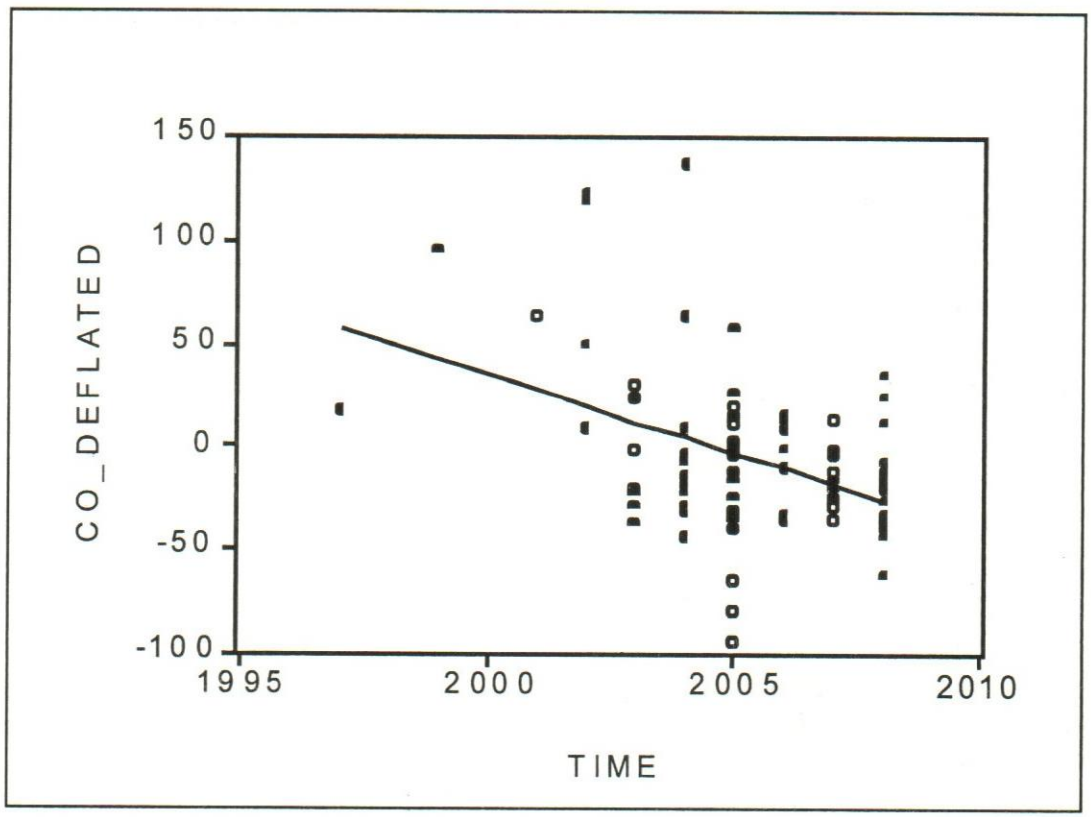


Graph 2: Expenditure Vs. Time

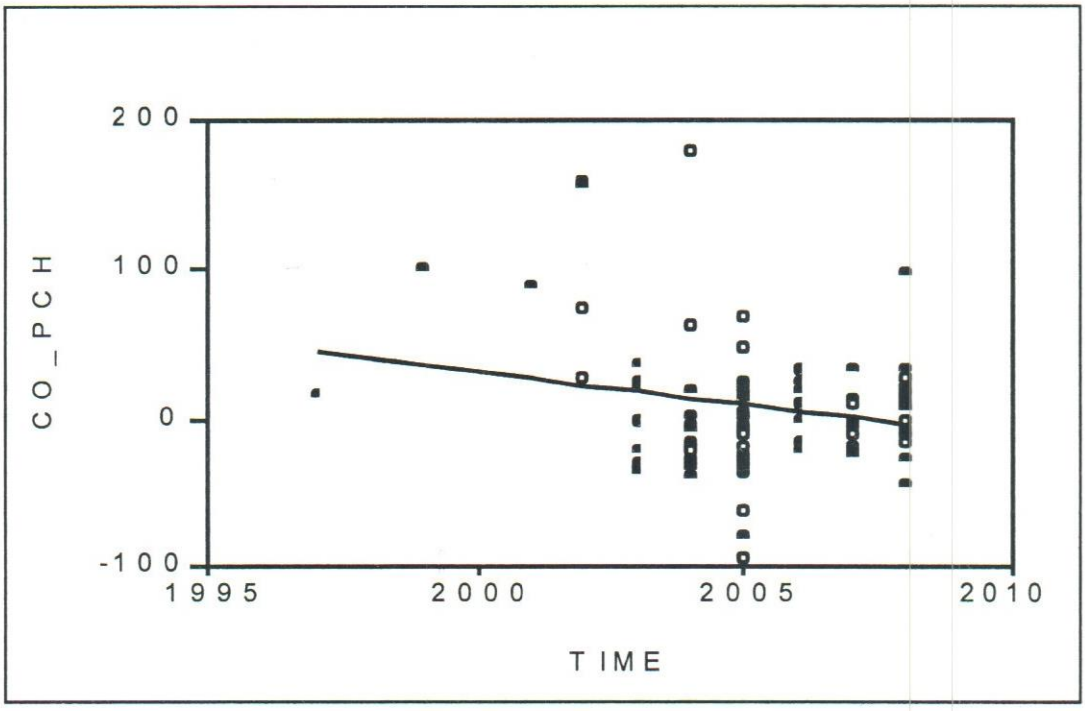
The cost indices for expenditure patterns have been prepared using basic information obtained from the Standard Bidding Document (Construction Industry Development Council or CIDC) in terms of the kind of materials that broadly come under factor inputs. Cost escalation is however not a factor that can fully explain overruns. Deflating costs of the project (original costs) using composite cost indices, suggests that the costs



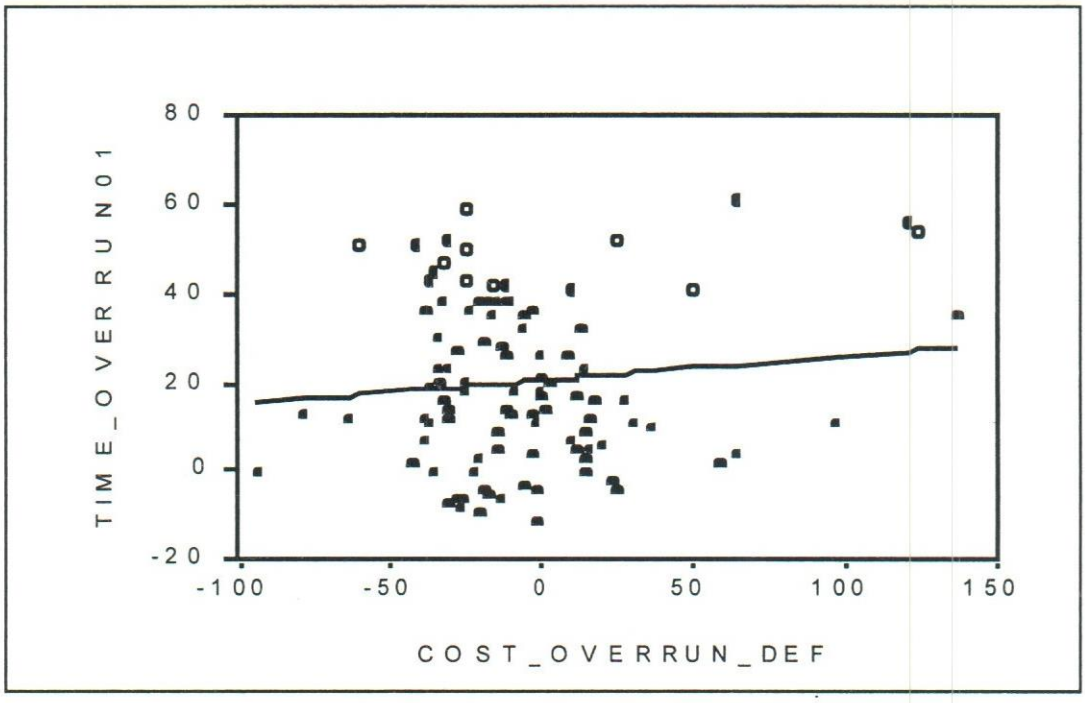
Graph 3: Composite Index



Graph 4 : Co_Deflated Versus Time



Graph 5: Co_PCH Versus Time



Graph 6 : Time_Overrun Versus Cost_Overrun_Def

budgeted for projects have actually gone down over time. In fact magnitudes of cost overruns have also declined over time (Graphs 5 and 6).

Giving the data a first-hand look is clearly insufficient since time overruns do not share the same trends of lowering over time. There are clearly deeper issues involved and this study is an attempt to take a plunge into them. A definitive motivation for the same is primarily the rising trends of time overruns.

Description of Data Used and Sampling Methodology

Source of the data used for the study is the quarterly reports of Ministry of Statistics and Programme Implementation (MOSPI)—the central government's quarterly reports on Programme Implementation status for infrastructure projects. Data collation was done for the road transport and highways sector for projects that got completed during the period of 1997 to 2008. Information pertaining to cost (original, revised, and anticipated), actual expenditure, commissioning date, and final date of completion was obtained, project location, project type (whether it is a Golden Quadrilateral Project, a port project, and so forth), length of implementation phase of the project proved useful for deeper analysis.

The relevant archive reports while the projects were ongoing was accessed for information regarding date of approval (original) for the corresponding projects and information pertaining to the funding source of the project (whether by NHAI or whether BOT) was obtained from the NHAI website.

The number of completed road projects collated was 155 in number. Treatment for outliers and across complete availability truncated the data set to 100. This was the final sample for the current study. Dummy variables were created for instance—whether the project is a bypass project, whether it is handled by more than one state or not, whether the project is located in the east or the west, etc. The final analysis was done with deflated values for costs and expenditures [deflated using the construction cost index generated by the authors (see Appendix for details on calculation of the index]. This has been done to eliminate any bias in the study due to cost escalations while carrying out the analysis.

The Model

The whole analysis adopts the methodology of multivariate regression analysis. Several regression models were tested. The following section summarizes evidences from the four most effective models. While "Yes" stands for inclusion of the variables, "No" stands for not having included the variable in the model estimation. The following is the variable definition:

Time Overruns = Actual Date of completion – Date of Commissioning (in months)

C = Constant

Cost_Overrun_Def = deflated cost overruns

DPPP = "1" if the project is a PPP project and "0" otherwise

DWEST = "1" if the project falls in the western region of the country, and "0" otherwise

DEAST = "1" if the project falls in the eastern region of the country, and "0" otherwise

Implementation_L = length of implementation phase of the project and so equals date of commissioning-date of approval (in months)

Dbypass = "1" if the project is a bypass project, "0" otherwise

Dpsize = "1" if the project is a big project, i.e., exceeding Rs 332 crores in cost, "0" otherwise

Following models were finally chosen after running various models with different specification:

Model 1:

$$\text{Time Overruns} = \beta_1 + \beta_2 \text{cost\_overrun\_def} + \beta_3 \text{DPPP} + \beta_4 \text{DWEST} + \beta_5 \text{Implementation\_L} + \varepsilon$$

Model 2:

$$\text{Time Overruns} = \beta_1 + \beta_2 \text{cost\_overrun\_def} + \beta_3 \text{DPPP} + \beta_4 \text{Implementation\_L} + \beta_5 \text{DWEST} + \beta_6 \text{DEAST} + \varepsilon$$

Model 3:

$$\text{Time Overruns} = \beta_1 + \beta_2 \text{cost\_overrun\_def} + \beta_3 \text{DPPP} + \beta_4 \text{DEAST} + \beta_5 \text{DWEST} + \varepsilon$$

Model 4:

$$\text{Time Overruns} = \beta_1 + \beta_2 \text{cost\_overrun\_def} + \beta_3 \text{DPPP} + \beta_4 \text{Implementation\_L} + \beta_5 \text{DWEST} + \beta_6 \text{DBYPASS} + \beta_7 \text{DPSIZE} + \varepsilon$$

	C	COST_OVERRUN_DEF	DPPP	DWEST	IMPLEMENTATION_L	DEAST	DBYPASS	DPSIZE
Model 1	Yes	Yes	Yes	Yes	Yes	No	No	No
Model 2	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Model 3	Yes	Yes	Yes	Yes	No	Yes	No	No
Model 4	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Results and findings

Lists the findings that would facilitate our analysis.

Table 1: Results of OLS Regression Techniques

INDEPENDENT VARIABLES	MODEL 1	MODEL 2	MODEL 3	MODEL 4
C	50.57803	50.44131	27.20111	49.29203
Std Error	7.698237	7.797905	2.490594	7.292251
T-Statistic	6.570079	6.468572	10.92154	6.759508
Prob.	0	0	0	0
COST_OVERRUN_DEF	0.108063	0.107701	0.091805	0.11651
Std Error	0.047974	0.048697	0.051139	0.047826
T-STATISTIC	2.252527	2.211643	1.795179	2.436141
Prob.	0.0266	0.0294	0.0758	0.0167
DPPP	-10.36	-10.3559	-12.8897	-14.3988
Std Error	4.476709	4.493704	4.198505	4.285238
T-Statistic	-2.3142	-2.30454	-3.07007	-3.3601
Prob.	0.0228	0.0234	0.0028	0.0011
DWEST	-20.1482	-20.0131	-17.0656	-20.8406
Std Error	3.246242	3.476327	3.712938	3.309358
t-Statistic	-6.20662	-5.75698	-4.59624	-6.29747
Prob.	0	0	0	0
IMPLEMENTATION_L	-0.4651	-0.46514		-0.46416
Std Error	0.14015	0.140178		0.127827
T-Statistic	-3.31861	-3.31819		-3.63112
Prob.	0.0013	0.0013		0.0005
DEAST		0.669222	0.650396	
Std Error		4.248911	4.428387	
T-Statistic		0.157504	0.14687	
Prob.		0.8752	0.8835	
DBYPASS				9.863103
Std Error				5.515818
T-Statistic				1.788149
Prob.				0.077
DPSIZE				8.630751
Std Error				4.109927
T-Statistic				2.099976
Prob.				0.0384
F-STATISTIC	9.658364	7.651305	7.024773	7.536742
P - Value (F-Stat)	0.000001	0.000005	0.000053	0.000001
R-SQUARED	0.2891	0.28926	0.228264	0.327162
Adjusted R-SQUARED	0.259168	0.251455	0.19577	0.283753
Jarque Bera STATISTIC	4.336515	4.357135	5.239277	3.259383
P - Value (JB)	0.114377	0.113204	0.072829	0.19599

Results of DLS Regression Techniques

Model 4 turns out to be the most robust of all models and hence the most effective in capturing the essence of the study.

Following is a brief summary of what Model 4 tries to capture:

1. Cost overruns have a positive impact on time overruns.

2. PPP projects have lower time overruns as compared to EPC projects.

3. Projects located in the western regions have lower time overruns as compared to projects located in the rest of the geographies.

4. Bypass projects have higher time overrun as compared to an ordinary project.

5. A project which is potentially a bigger project (exceeding a project size of Rs 332 crores) has higher time overruns.

Questions and Answers

Do Cost Overruns Lead to Time Overruns?

Time and cost overruns have made some of the central sector projects unviable even before their commencement.

> The proof is provided by the latest government reports which indicate that the total approved cost of about 470 projects, under the central sector, was Rs 1,25,057 crore. Today, the anticipated cost of these projects has increased to Rs 1,70,070 crore. There is an overall 36 per cent (about Rs 45,000 crore) cost overrun ...(Mishra, 2003)

Although Morris (2003) points that with reforms in late eighties and nineties delays and overruns have declined to about 40% at present, it is still rather high. While this has occurred of late, time overruns as noted earlier aggravated as a menace. Hence, it was decided to test the hypothesis whether the phenomenon that cost overrun leads to time overrun is corroborated by the empirical evidence. In other words, we decided to test the hypothesis that projects with higher cost overruns (deflated, as defined previously) tend to have larger time overruns. Graph 6 provides a simple scatter of these two variables.

The result of the causality test on time and cost overrun are highly indicative of the claim.

The OLS regression techniques, results of which are displayed in Table 1 were conducted. The statistical tests corroborate the fact that larger cost overrun leads to larger time overrun. In all the models taken above, the coefficient for cost overrun is significant at 10% level of significance. Hence the null hypothesis that larger cost overrun leads to larger time overrun cannot be rejected. It is important to stress here that the figures for cost overrun (%) are deflated and the possible cost escalations due to inflation have been taken care of. Thus the net cost overrun (explained by the factors other than inflation like innovations and changes in the design of the project, renegotiations etc.) has a significant positive impact on time overruns. The effect of cost overruns on time overruns can be decomposed into direct and indirect effects:

Direct effects

Cost overruns involve more money pumping into the project which in a case of EPC has to pass through various bureaucratic compartments and thus leading to delay.

Indirect effects

Cost overruns also act as proxy for the "renegotiations" which involve changes and innovations in the project design, which may take more time for implementation, thus leading to delays.

In general however, one can list financial and budgeting factors as follows:

1. *Financing of Projects*: Public sector projects are invariably funded from various sources, each with its own funding procedures and documentation. This often leads

Pairwise Granger Causality Tests
Date: 03/26/09 Time: 11:47
Sample: 2 151
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
TIME_OVERRUN01 does not Granger Cause COST_OVERRUN_DEF	148	0.58409	0.55894
COST_OVERRUN_DEF does not Granger Cause TIME_OVERRUN01		12.9246	6.9E-06

to long drawn-out procedures and time-consuming negotiations. Another factor is the intervention of extraneous factors, political and otherwise, which are an inherent part of such finance packages.

2. *Cost of Projects*: Incorrect estimation of project costs, deliberate or inadvertent, is often the fundamental reason for overruns. It can be that project planners deliberately underplay project costs initially to present a healthy situation and get project clearance. Once cleared, cost revisions are applied for, and sanctioned which will contribute to time overrun. Inability to read the dynamics of the market are also reasons for inaccurate cost estimates.

3. *Tenders*: One major problem with government projects is centralized decision-making and lack of efficient delegation. The proposals have also to move up and down the bureaucratic framework. Extra-constitutional influences too tend to influence decision-making, is such situations delays are inevitable.

Do PPP Projects Show Lower Time Overruns than EPC Projects?

"There has been a resurgence of interest in private sector involvement in the provision of infrastructure" (Flyvbjerg et al., 2003, Ch. 6; Seidenstat, 1996; Wright, 1994). It is much pronounced in the media and academic research that PPP contracts will lead to lower cost and time overruns as compared to EPC as it is usually construed that private sector is inherently more efficient. They are expected to be much more efficient because the private party involved in the agreement has enough incentives to complete the project at stipulated date/time and within the budgeted costs as it would have an impact on the profitability and economic viability of the project. A good example of the efficiency of the private sector is the DND toll expressway linking Delhi to NOIDA, as it is a known fact that no expenses have been incurred on its maintenance since its inception (the authors are indebted to Dr Ram Singh for having mentioned this in his classroom lectures). That is a clear evidence of fact that the quality of the materials used for construction would have been superior to what is normally used in road projects. It is also indicative of the fact that the private firm involved would do inter-temporal optimization and take account of the maintenance cost while planning for design, materials to be used, and implementation of the design during the construction phase.

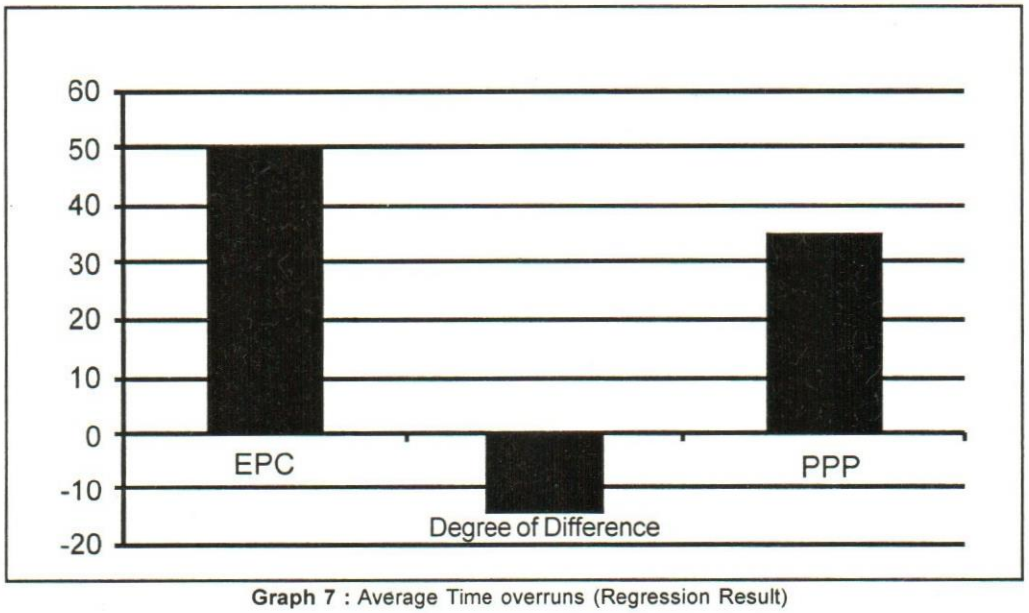
Flyvbjerg et al. 2004 decided to test whether cost development varies with the type of ownership of the projects. Instead of using the traditional approach of public–private division, they decided to operate with a slightly more complex "trichotomy" as they call it, employing the following categories: private, state-owned enterprise, and, finally, other public ownership.

The reason they provide for subdividing public projects into two different categories is that in their previous research (Flyvbjerg et al., 2003) they find that projects run by state-owned enterprises were subject to regulatory regimes that were significantly different from those found for projects under other public ownership and thus, such differences in regulatory regimes may influence performance differently.

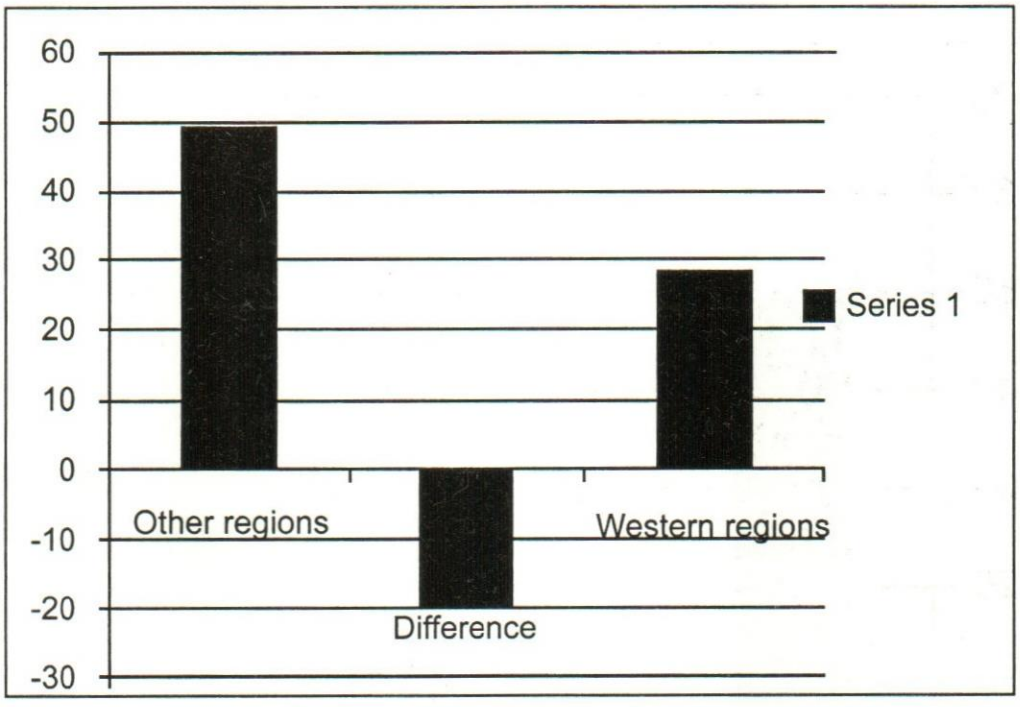
They conclude that ownership and cost development for fixed links, in planning and decision-making for this type of project, the conventional wisdom, which holds that public ownership is problematic whereas private ownership is a main source of efficiency in curbing cost escalation, is dubious. Although they point out that this, does not rule out the possibility that other reasons may exist for preferring private over public ownership; for instance:

> ...that private ownership may help protect the ordinary taxpayer from financial risk and may reduce the number of people exposed to such risk. However, our study shows that the issue of ownership is more complex than usually assumed. We find that the problem in relation to cost escalation may not primarily be public versus private ownership. The problem appears more likely to be a certain kind of public ownership, namely ownership by state-owned enterprises. (Flyvbjerg et al., 2004)

In view of the existing literature of null hypothesis that PPP projects will have lower time overruns as compared to EPC was tested. In all the models reported above, the coefficient for DPPP, that is, the dummy variable for the PPP projects (= 1 if the project is a PPP and = 0 otherwise) has an expected negative sign and is significant at 5% (in Models 3 and 4, at 1% significance level) level of significance (as shown in Table 1).



Graph 7 : Average Time overruns (Regression Result)



Graph 8: Efficiency of Region-wise Projects

Graph 7 summarizes the regression result (taking regression Model 4 into account). Clearly average time overruns are higher in EPC contract.

Are Projects More Efficient in One Region vis-à-vis Another?

The reason for posing such question is to test the hypothesis that difference in states in terms of governance, development, social, and political environment can translate into difference in time and cost overrun.

Significant results are obtained with respect to western dummy in all the four models which is not surprising given the fact that western dummy consist of Maharashtra, Gujarat, and Rajasthan (Graph 8). A "not so significant" result was with respect to eastern dummy.

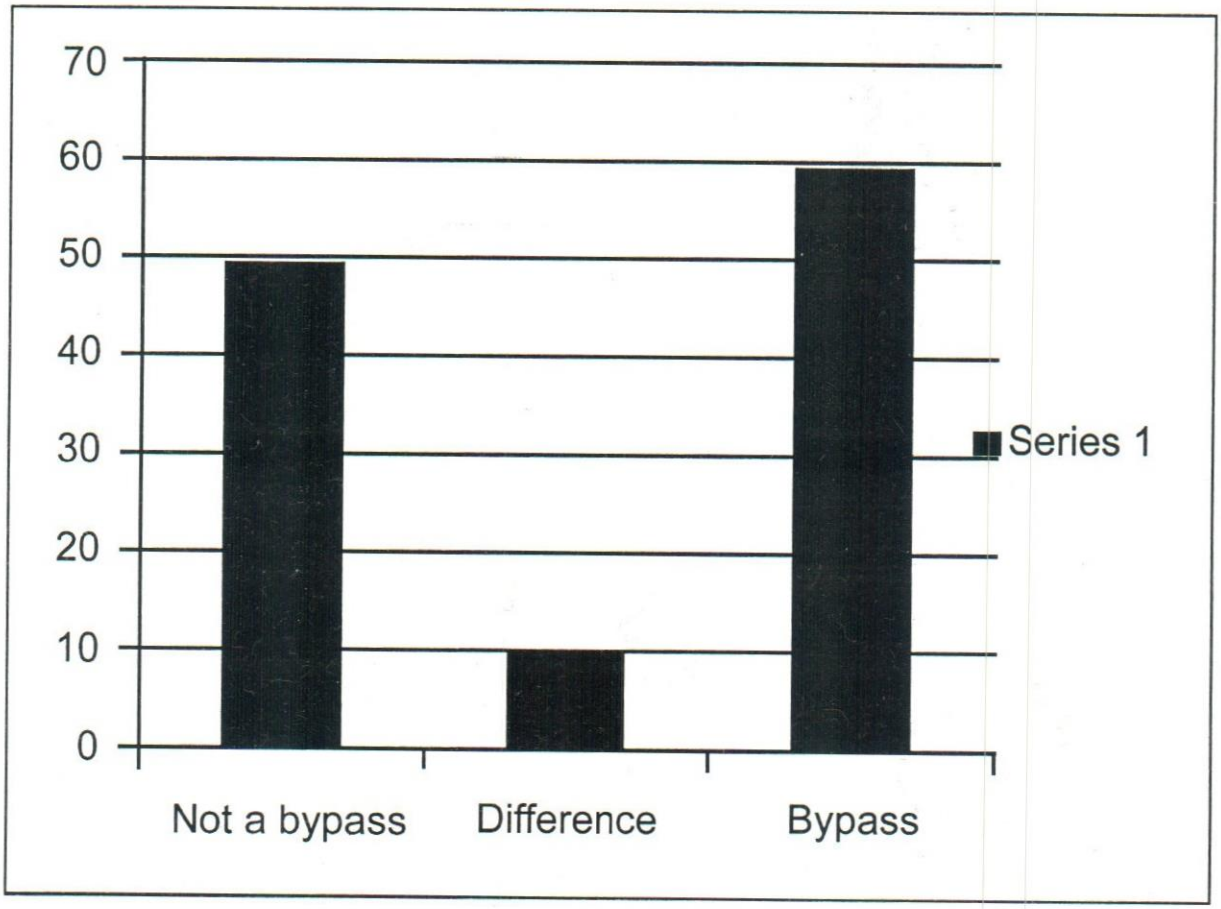
Morris points in his 2003 study: "The time overrun figures show that the North-Eastern region projects (projects which span more than one state in the region) have significantly higher time overruns." But he mentions that any further statements will be meaningful only in a multivariate context.

Nonetheless, such a result (though not so significant vis-à-vis the eastern region but correct in terms of sign) does capture the issue with regards to governance. Eastern regions have been quite behind in terms of governance and sadly have been the front-runners with respect to bureaucratic issues (West Bengal, Bihar, and Orissa).

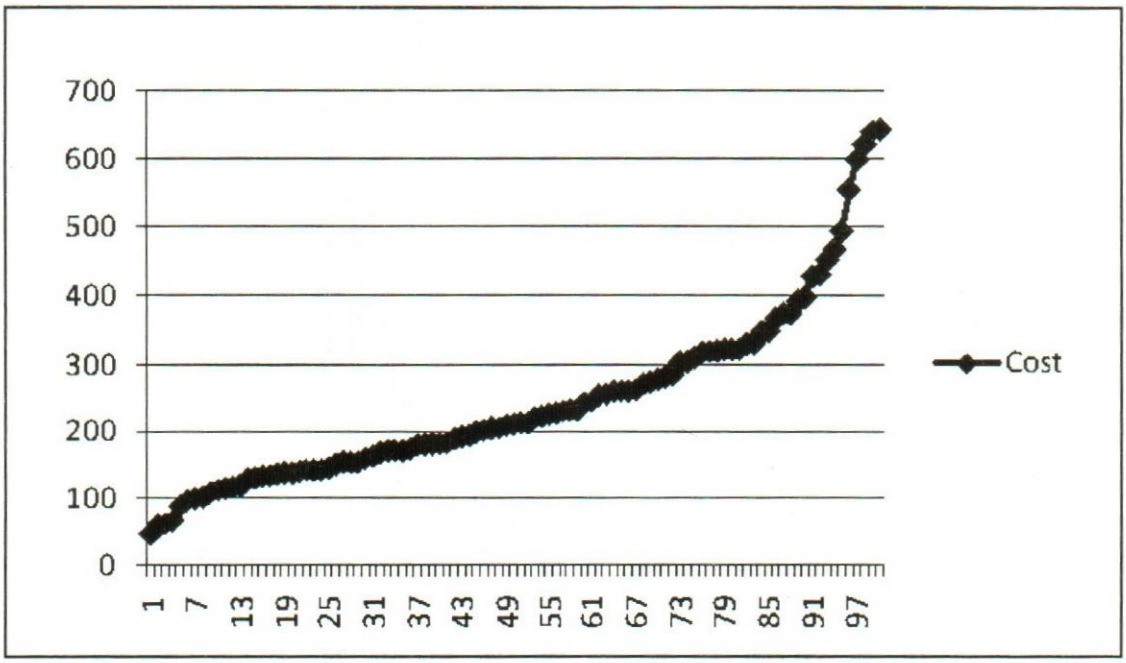
Do Bypass Projects Show Higher Time Overruns as compared to Other Projects?

Bypass projects are the ones which involve construction of bypass roads meant to avoid congested city roads and building an alternative route to bypass a particular city. It usually involves acquisition of agricultural land on the outskirts of the concerned city; such acquisition has to happen through various long bureaucratic procedures. Moreover, such acquisitions often involve land disputes where farmers claim they have not been compensated enough and then there are legal battles and often a stay on the project. Thus, all these factors are expected to have a longer time overrun in bypass projects as compared to others and we also decided to test this hypothesis in our empirical study.

Such a notion was again tackled using a dummy variable "dbypass" in the regression model (Model 4). The coefficient of the dummy variable has a positive sign and is significant at 10% level of significance, which clearly supports the null hypothesis (Graph 9). Bypass projects indeed have higher time overruns as compared to non-bypass projects.



Graph 9 : Bypass Projects : Higher Time Overrun



Graph 10 : Cost

Does the Length of Implementation of Project (which is Defined as the Difference in Months between the Date of Commissioning and the Actual Date of Origin) have an Impact on the Time Overruns?

It can be said that the length of implementation or "inherent sluggishness" (Flyvbjerg et al., 2004) of the preparation, planning, authorization, and evaluation procedures for large infrastructure projects creates obstacles to the implementation of such projects. There is a fear that obstacles in planning and implementation phases translate into cost escalation, if they do not block projects altogether (Ardity et al., 1985; Chan and Kumaraswamy, 1997; Morris and Hough, 1987; Snow and Dinesen, 1994).

Length of implementation phase does affect time overrun in a positive manner as in all the models in which we include the implementation phase variable give us very significant results (at 1% confidence level).

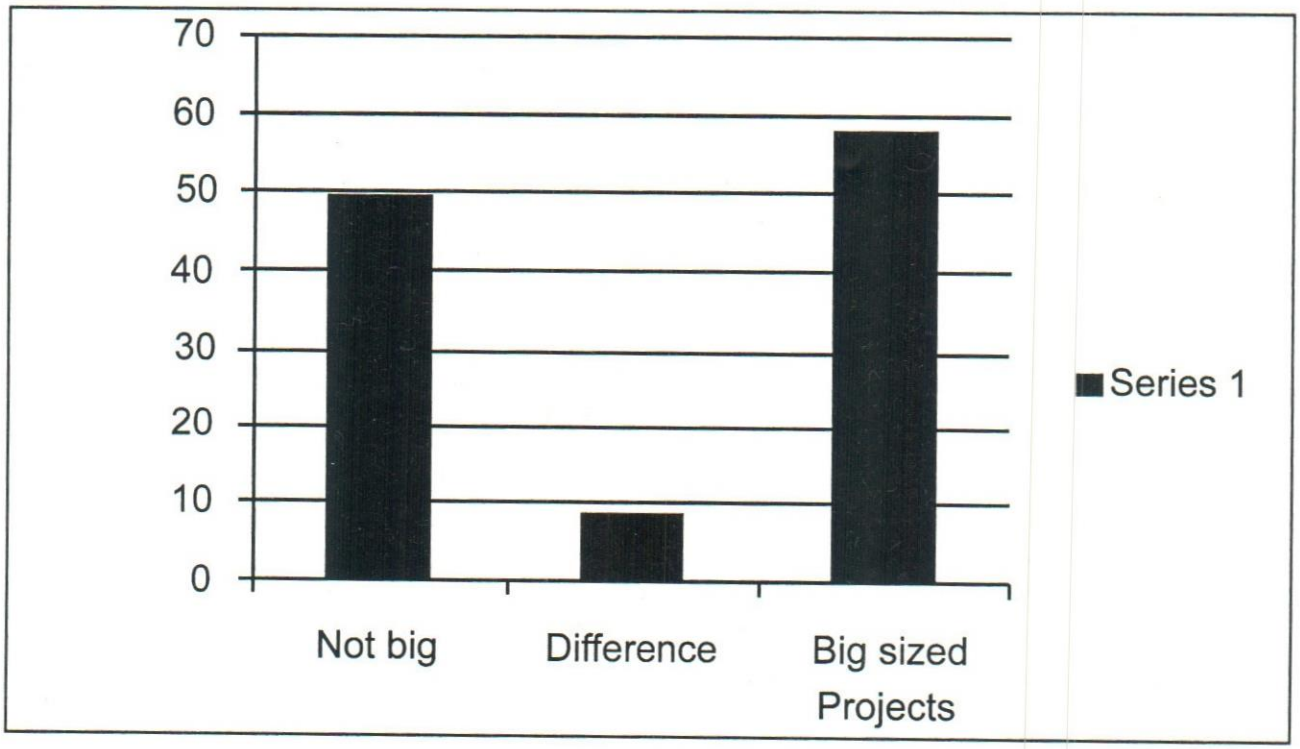
Does Project Size Matter? Does it have an Impact on Time Overruns?

One might speculate that larger projects would have larger percentage cost escalations than smaller projects, because, other things being equal, implementation phases would be longer for larger projects with resulting increases in cost escalation. In short the question is whether larger projects are therefore more prone to cost escalation and thus time overrun?

Original cost of the project is taken as a proxy for project size and we use dummy variable (DPSIZE) to capture the effect of size on time overrun. To generate this dummy variable a simple exercise was carried out. The project size was plotted in increasing order (original cost of all projects in ascending order; also see Graph 10). This was useful to obtain a series break. It can be seen that somewhere around 300 crores (actually at 332 crores) there is a sudden increase on slope of the curve. Taking that point as the margin all projects above Rs 332 crores were classified as "big" (DPSIZE = 1 for all such projects zero for the others). This variable (Table 1, Model 4) is found to be significant at 5% level (Graph 11). In fact including DPSIZE into the model improves the statistical robustness of the model considerably.

Conclusions and Policy Recommendations

Unlike the conventional belief in terms of theoretical understanding and in terms of existing literature like



Graph 11 : Project Size

Flyvbjerg et al. (2004) and Morris (2003) this paper suggests that the causality lies on the opposite direction (after having deflated costs and expenditure figures)—which is that cost overruns significantly affects time overruns. Differences with regards to project locations, project funding sources, bypass projects, etc., seem to also have interesting trends.

The main findings are: (i) cost overruns "lead to" time overruns in this sector; (ii) PPP projects are seen to have lower time overruns; and (iii) projects in the western region were found to have lower time overruns as compared to all regions together—raising the serious issue of governance hampering the performance outcome of essential infrastructural projects. These findings are also supported for by relevant intuitions and logical reasoning beyond useful literature.

These findings carry some important policy implications in the wake of huge expenditures being done by the government to help the economy recover out of the recession. First, as suggested by the paper cost overruns "leads to" time overruns in this sector. Hence, the government should tackle the root causes which lead to these cost overruns, not just cost escalations (over time due to inflation as mentioned in the paper), viz., issues relating to the financing of the projects, the cost estimation of the project, and bureaucratic delays in handing over the contracts. Cost estimation should be properly (and more realistically) done instead of underestimating it to get it approved only to know that its cost gets escalated by huge multiples by the time of completion of the project. Second, the government should utilize the PPP model even further to achieve the twin goals of meeting the funding gap for infrastructure projects and providing a life to recession-hit infrastructure companies. Finally, there is a need on the part of the state governments to better coordinate and cooperate with the central government and state owned enterprises for speedier and more efficient implementation of these projects. The recent decision of the government to constitute a 12 member committee headed by Prime Minister Dr Manmohan Singh "to fast-track the implementation of the infrastructure sector projects and monitor their performance" (Mehra, 2009) is a welcome step in this direction, but there is a need for more such steps to be taken.

The methodology that was used for deriving the composite index is as follows:

1. First, the major components of construction material were identified to be as follows: cement, steel, coal, petroleum, and electricity.

2. Indices for the prices of all of these commodities (with base as 1994) were found from www.Indiastat.com and www.eaindustry.gov.in.

3. Finally, a simple average of these indices was taken to obtain the final composite index.

Use of the Index

1. Final expenditure was deflated using the index for the date at which the project was completed.
2. Original cost was deflated using the index for the date of commission, as it was supposed that inflation till the date of commission is already taken care of in the initial budgeted costs.

Acknowledgement

The authors wish to thank their teacher Dr Ram Singh, at DSE for his guidance, support, classroom lectures, and for constantly mentoring them throughout this project during the winter semester of 2009 at DSE. The following governmental officials have been extremely generous in extending help during data collection and for the "nitty-gritty" of the real world: Mr R.C. Negi, MOSPI; Mr J.L. Narayan, MOSPI; Mr Praveen Jha, Udyog Bhavan; and Mr Anil Chadha, CIDC.

Appendix: Construction Cost Index

The data set was deflated using the following figures:

Calendar Year	Cement Index	Steel Index	Coal Index	Petroleum index	Electricity Index	composite index
1994	110.5	104.2	232.6	103.74	111.5	132.508
1995	124.9	114.9	231.6	104.06	121	139.29
1996	137	121.9	231.5	120.98	129.1	148.096
1997	129.2	128.4	214.9	125.92	146.1	148.9
1998	129.3	132.7	189.4	126.2	150.5	145.62
1999	129.5	133.9	181.1	136.86	168.2	149.91
2000	129.3	136.2	180.3	200.54	190.2	167.308
2001	150.5	136.6	156.2	208.2	211.4	172.58
2002	145.1	140.8	146.1	218.1	220.2	174.06
2003	146.2	168.3	143	242.7	225.2	185.08
2004	151.1	222.5	135.8	276.5	232.8	203.74
2005	162.5	253.5	113	315.18	239.1	216.66
2006	190.1	246.1	106.3	349.1	242	226.72
2007	213	269.4	104.7	384.34	241.9	242.67
2008	222.68	339.94	253.87	423.14	245.83	297.09

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The success of any great moral enterprise does not depend upon numbers.

— William Lloyd Garrison

Focus

Quality Management: An Essential Ingredient for JIT Implementation

D.K. Singh

Quality management has an important role in JIT implementation. Quality has become a demand of today's customer and total customer satisfaction through quality is the need of the hour. Quality is being used as a competitive tool to out-perform competitors. The quality awareness of everyone in the organization forms the base for the success of quality management. Total quality management (TQM) is an integrative management philosophy having quality in the central focus of every activity and thrusts upon its continuous improvement. With increased level of quality, JIT implementation becomes faster since a higher quality product has increased customer's acceptance resulting in increased flow and decreased level of inventory. Quality management facilitates JIT implementation by providing conducive atmosphere. This paper is based on extensive informal meetings and discussions held covering a large number of concerned personnel in various organizations.

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Quality management uses best industrial practices to produce zero-defect products and fulfills global quality standards. The manufacturing methods are continuously improved upon in order to ensure "total product quality" (TPQ). Products are manufactured using JIT philosophy at high speed of delivery. JIT calls for immediate availability of raw materials to manufacture the current demand of the market and is totally against storage of inventory. Hence, associated cost of storage and handling the inventory are drastically minimized. It is equally important to eliminate all the non-value added activities from every operation to ensure smooth flow of inventory, as is required to speed up JIT implementation. Quality products prove cheaper in the long run, as losses due to poor quality exceeds 20% of gross sales for defective or unsatisfactory products (Adam and Ebert, 2003), and may result in the form of scrap, rework, maintenance, and replacement. Initially, high cost of quality can be justified due to product's increased life and enhanced performance. Quality consciousness of Japanese manufacturers is well-known to the entire world. This characteristic has driven them to implement the concept of world-class manufacturing. Majority of Japanese industries are world leaders of their products. Their world-class status is because of their continuous effort to improve quality and making it meet the requirements of a customer. This thinking has given them a competitive edge, which is proving to be a formidable barrier for others. Quality consciousness and customer satisfaction are two vital components, which can put forward a company ahead of its rivals. It forms the theme for quality management as is shown in Figure 1.

Fig. 1. Two Essential Components of Quality Management: Quality and Customer Satisfaction

Definitions of Quality

Quality can be defined in many ways. Some such definitions are:

Manufacturer sees quality as a characteristic, which makes the product defect-free. Their defects may occur because of manufacturing errors resulting from defective materials or equipment failure.

Designer sees quality as a requirement to meet the well-defined specifications laid down for a product. These specifications may be with respect to product's dimensions, look, color, and other similar requirements.

Customer sees quality in the form of good look, good color, and meeting his expectational requirements. A customer feels satisfied if he finds a product designed according to his choice. It can be truly called universal quality and has broader acceptance.

Quality Improving Tools

Quality Circle

It represents a small group of 8–10 people who discuss quality-related problems of an organization and recommend their suggestions to higher levels of authorities. This concept is quite useful for any type of organization irrespective of the nature of the organization. It is the most effective way of sorting out routine problems in a short interval of time and can go a long way in improving manufacturing environment through mutual trust and cooperation among circle members. It may eliminate many problems, which may arise on the shop floor and need immediate attention. Sometimes the collective effort produces amazing result, which otherwise is difficult to achieve.

Poka Yoke

This technique acts as a foolproof against any defect in a production system. Andon is a visible control technique under this category, which flashes immediately once an error is noticed, thus alerting the worker to the error.

Six Sigma

Six sigma approach puts a limit on the number of defective items produced and ensures a production system to behave as a perfect system with almost zero defects. It allows only 3.4 defective parts in one million parts produced. It is perhaps the biggest tool of total quality control.

Kaizen

Kaizen lays emphasis on every little effort made in order to improve the performance of the system. All little efforts when viewed in totality have significant impact which otherwise in a single step perhaps cannot produce. The principle of Kaizen is applicable to any type of process or organization and the objective is to improve overall performance. Quality needs to be continuously improved upon in order to keep it always at the highest level. Kaizen is extremely useful in improving the existing features or adding new features in the product, thereby increasing the level of customer satisfaction.

Kaizen can bring the following changes:

- Improvement in product quality
- Reduction in inspection cost
- Improvement in manufacturing environment
- Improvement in level of customer satisfaction

These listed changes can lead to improved performance and increased productivity.

Benchmarking

Benchmarking encourages quality to be improved continuously and attain its highest level by setting higher standards for products and services. It is used to compare the quality of a product with a benchmarked product, which is treated as a reference. The manufacturing system is designed to follow the standards adopted for the benchmarked products.

Quality Certification

Quality certification is the manifestation of a product about its defect-free nature and customer satisfying capability. A quality certified product gives confidence to a customer and eliminates any doubt regarding its quality and performance. It is used as a confidence-building measure between supplier and customer and has a great commercial appeal. The most trusted and globally accepted certification is ISO certification. An ISO certified company commands good reputation in the market and has increased market share. Its products are seen as flawless products with increased quality.

Quality certification encourages a company to continuously improve its products and services and acquire dominance over its rivals in the market. A relationship between quality and quality certification is shown in Figure 2.

Fig. 2. Effect of Quality Certification on Product Quality

"Quality remains" signifies the fact that some quality always exists in a product and has nothing to do with quality certification (Singh, 2007). Quality certification can prove to be a strong competitive tool and has strategic importance too. World-class companies always follow global standards and certification to maintain their broader market and increased sales.

People Factors in Quality Management

People factors are recognized as a major determinant of organizational performance and a key competitive tool. Management of organizational climate or culture is of great significance in the context of overall improvement in the organizational system. Teamwork spirit and collective approach for solving a problem are extremely useful in the implementation of TQM. Collective atmosphere being cohesive in nature allows quick problem-solving and makes the decision-making process easier. For a unit to function effectively, it is essential that entire section/ departments work to their fullest capacity. The role of suitable organizational climate, infrastructure, and human involvement in the successful implementation of JIT and TQM has been emphasized by many researchers such as Bright and Cooper (1993), Emery et al. (1996), Glover (1993), Morris (1994), and Shetty (1989).

A flexible structure characterized by the absence of formality and hierarchy supports innovation more effectively than conventional structure involving long chains of command, rigid work methods, extensive procedures, and well-defined hierarchy (Trott, 2000).

Awards and incentives can produce immense impact in improving product quality. These measures act as a catalyst in motivating an employee to deliver his best and contributing directly in achieving the goals of TQM. Their contributions can be recognized by awarding them in terms of monetary benefits or some other form.

Quality Management through Education and Training

Training and education can prove to be of immense use in increasing awareness about quality. Quality awareness is essential for the success of quality management. It helps an employee improve his efficiency through better understanding of work methods and helping him perform the task without committing any error. Quality training should be a continuous process to take care of changes in technology as well as in the environment in order to keep sustained growth. Professor Ishikawa has rightly stated that quality begins and ends with education and training. According to Peter Drucker, the first and most important component of managing quality project is training and education (Adam and Ebert, 2003).

Training, workshop, and seminar help to update knowledge, skill and efficiency of the worker and contribute significantly in improving the productivity level of the organization. Multiskilled workforce has positive effect on JIT implementation by way of more realistic recommendations (Bowman, 1991).

Quality Management through Improved Manufacturing Environment

Manufacturing environment includes factors such as supply chain, automation, preventive maintenance, customization, flexibility, and group technology.

A strong supplier relationship makes the production system more reliable and dependable and eliminates any uncertainty regarding manufacturing schedule, thus helping to achieve a predictable lead time.

Manufacturing environment is enormously improved by automation. The processes tend to be accurate and defect-free, because of least human involvement and are useful in producing quality products. An automated manufacturing system fulfills the requirements of modern manufacturing. Increased use of computers in design and manufacturing has resulted in the production of customized products with considerable reduction in lead time. The benefits of automation appear in the form of increased productivity, increased product quality, and reduced manufacturing costs. Product design is considerably improved by using computer aided design (CAD), as changes required are easily incorporated and its integration with computer aided manufacturing (CAM) has resulted in increased operational efficiency. The use of computer integrated manufacturing (CIM) has offered many advantages, important among which include reduced cost of manufacturing, increased product quality, better production control, better customer responsiveness, reduced inventory, greater flexibility, and reduced lot size (Kalpakjian, 1995). CIM contributes in speedy implementation of JIT (Yasin and Wafa, 1996). Flexible manufacturing system (FMS) has the ability to react according to the needs of a customer in terms of products variation. Use of robots in materials handling has resulted

in improved flow of materials in the production system and has made it work more effectively and efficiently.

The automated JIT manufacturing system is useful to realize the goals of "factory of the future," which is based on continuous improvements in production activities leading to manufacturing of high quality, customized products having higher level of customer satisfaction. The company gets strategic advantage to fulfill the requirements of world class manufacturing (Singh, 2006).

Preventive maintenance measures are closely related to manufacturing environment. These measures are needed to reduce the untimely breakdown or failure of machine or its components, which may cause frequent interruption in the operations of a production system, leading to inventory pile up, which is against the spirit of JIT. A tentative quality-preventive maintenance relationship is shown in Figure 3. Initial in-built quality level at S, better called "quality remains," can be increased to a certain level, after which quality becomes constant even if preventive maintenance measures are improved/upgraded further. It is to be noted here that "quality remains" is fundamentally different than "quality at source." "Quality at source" starts and ends with raw materials, whereas "quality remains" represents quality inherited in a product during its manufacturing stage before any quality improving measures are used to upgrade its quality further. Thus "quality at source" is a subset of "quality remains."

Manufacturing flexibility has increased scope of customization and hence higher level of customer satisfaction can be achieved. Customization, on account of its better acceptance possibility, has very positive effect on JIT implementation. Manufacturing flexibility helps in achieving the goals of customization.

Manufacturing efficiency is observed to be improved by the use of group technology as it arranges the parts based on similarity in their design or processing methods. It eliminates unnecessary duplication and possibility of starting the work from scrape, thus reducing the setting times (Groover and Zimmers, 1992). Group technology facilitates in streamlining manufacturing operations and reducing inventory level. De Vries et al. (1976) has reported a reduction of about 69% in set-up time, a reduction of about 70% in production times, a reduction of 10% in the number of drawings, and a reduction of about 62% in the size of in-process inventory by the use of group technology.

Hence, on summarization, we can achieve the following benefits due to improved manufacturing environment:

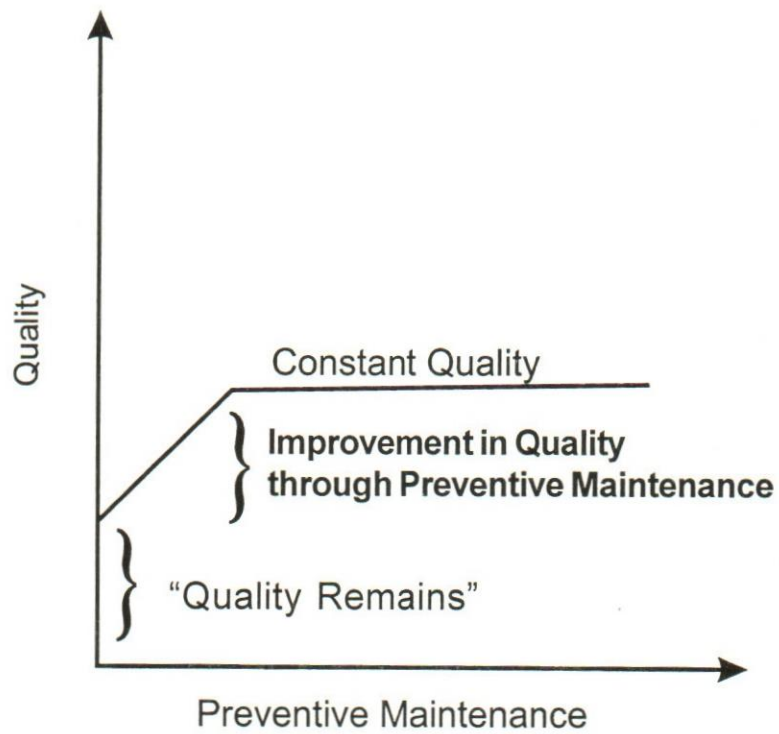


Fig. 3. Quality versus Preventive Maintenance

- Reduced lead time
- Dependable production system
- Committed production schedule
- Committed workforce
- Strong quality management team

Quality and World-class Companies

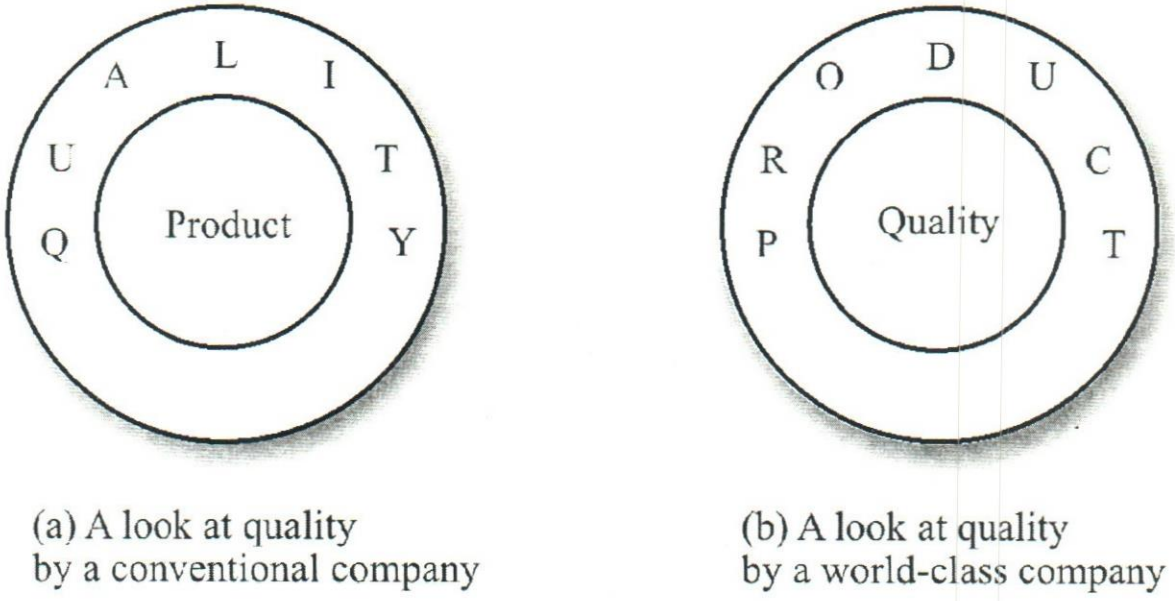
World-class companies believe in improving every aspect of their business in order to become a global player. Continuous improvement is probably the most powerful weapon in making a company of world-class status. They are innovative and are willing to adapt to the changing environment to meet challenging requirements of the dynamic market. These companies improve those areas in which they already excel as well as the areas that need further improvement.

Quality has proved to be a vital tool to attract customers, and industries are increasingly becoming aware of the importance of quality. Quality is being used as a business strategy to increase market share (Besterfield et al., 2001). They truly believe in the concept of "quality at source" to eliminate any scope of inspection in the final product, thus making it cent-percent defect-free. These are ISO certified companies, which means that their products are of high quality able to meet global standards. Perception about quality by two groups of companies: conventional and world class is compared in Figure 4. Quality is in the centre of product for world-class companies.

Customer Satisfaction through Quality in Quality Management and JIT Implementation

Every organization is trying to learn the art of satisfying the customers, an element which is critically required for it to stay longer. Focused plant is gaining momentum because of its dedicated purpose of producing customized products with zero-defect possibility and streamlined flow with reduced work-in-process (WIP) inventory. The increased quality level along with reduced lead-time and production cost has positive effect on increasing the level of customer satisfaction.

Figure 5 shows a relationship between quality and customer satisfaction. A company gains world-class status when its products attain total quality with ability to ensure total customer satisfaction (Singh, 2007). A company's future now depends on the fulfillment of customer's requirements. To implement JIT successfully, quality is an essential requirement, be it quality of raw materials, work-in-process, or finished products. Quality products have increased acceptance possibility; JIT works faster under such condition. TQM is meant for improving quality of every activity performed in the organization relating to



(a) A look at quality by a conventional company

(b) A look at quality by a world-class company

Fig. 4. Difference in quality perception

Fig. 5. Relationship between Quality and Customer Satisfaction

infrastructure or human resources. Hence, TQM considers quality improvement in totality and has broader areas of application. It includes engineering, manufacturing, sales, and customer support (Mazda, 2000). This concept is radically different from the old notion that quality is only associated with a manufactured product.

TQM is meant for improving the overall effectiveness of an organization keeping quality in the center of every activity (Lau, 2000). The importance of quality in JIT implementation is shown in Figure 6. If quality is centrally focused, JIT implementation can be further accelerated.

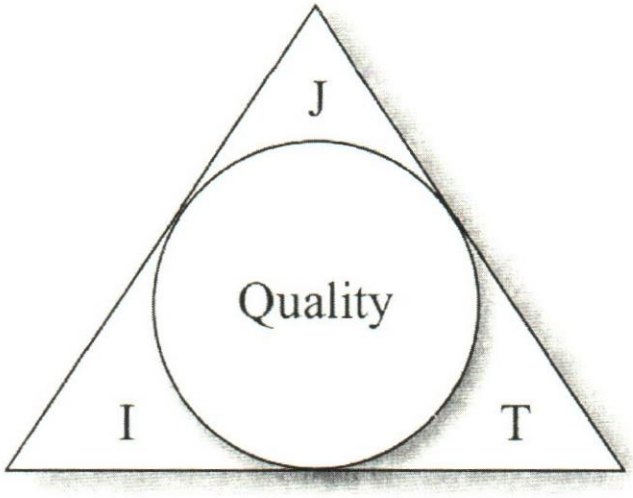


Fig. 6. A Model Signifying the Central Role of Quality in JIT Implementation

Role of Information Technology (IT) in Quality Management

Globalization has completely changed the way of doing business today. It has necessitated companies to expand their business in order to attract global customers. The tools of IT such as the Internet, intranets, extranets, and telecommunications, are helping to establish a link between various units of an organization spread globally to facilitate their business operations. This link is needed to maintain uniformity level in the quality of products or services produced, making quality management processes easier to be implemented. IT helps in managerial decision-making and gaining competitive advantage needed for a company to survive in the market.

Statistical Tools in Quality Management

Statistical tools are extremely useful in improving product or service quality. Statistical process control (SPC) is one such tool which finds extensive applications. Pareto diagram, cause-and-effect diagram, check sheets, histograms, and control charts are some of the techniques required to analyze data to infer conclusive results and make the task of quality management faster and easier. Deming emphasized on the use of control charts to check the variations in the quality of manufactured goods.

Conclusion

Quality has strategic importance. It is an important tool to increase productivity with increased level of customer satisfaction. It helps in manufacturing defect-free products with increased acceptance possibility. It also facilitates JIT implementation through increased pace of inventory flow and reduced lead time. A world-class company focuses on quality in the process of JIT implementation to acquire broader market share and increased dominance in the global market.

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Success consists of going from failure to failure without loss of enthusiasm.

— Winston Churchill

Investigating Impact of Organizational Citizenship Behaviors on Performance: An Indian Experience

Mushtaq Ah. Siddiqi

The concept of Organizational Citizenship Behavior (OCB), though fairly new to the services marketing literate, it continues to receive considerable attention from research scholars and business professionals in developed countries. However, the concept has remained almost unexplored in India though various organizational outcomes are purported to result from OCBs in developed countries. Very little or no such research has been focused on understanding the complex relationship between various dimensions of OCB and organizational performance in a developing country like India. In order to plug the gap, the present study has been conducted in Indian service sector with samples from its four prestigious banks. The study that matches perceptions from both contact employees and customers reveals that Perceived Organizational Support (POS) and job satisfaction exert its strong impact on OCB that in turn positively affects organizational performance. Conclusions and implication of the study are drawn, and, finally, the directions for future research are discussed.

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Service employees' behavior is often stressed as being crucial for customer satisfaction and a high service quality (for example, Bitner et al., 1990). These behavioral dimensions, if taken care of, can even become a competitive weapon for it is not easily copied by competitors. Thus, it is of interest to identify the numerous ways to ensure that service employees behave in a way, desired by customers, possesses a sunny disposition and willingness to serve their customers better. Among the ways, the focus of the present study is Organizational Citizenship Behavior (OCB, hereafter in this article), which has been left as an unexpected area by researchers in India.

OCB is employee's voluntary behavior towards co-workers and customers to help its organization perform better. These behaviors go beyond the specified role requirements and are not formally recognized by the organization's reward system (Organ and Ryan, 1995). Since India is in midst of coping with the breeze of liberalization and globalization, a transition, which is more difficult for Indian service managers as the experience of service marketing itself, is new to them. Hence, to diffuse the understanding of a concept like OCB and creating of a professional service couture in India has become the need of the hour. Consequently, this study aims to develop an understanding of relationships between employee job attitudes and his or her OCBs, which in turn positively affects organizational performance. First, a brief review of literature about various constructs involved in analyzing this relationship is presented. This is followed by research gaps, methodology, analysis, results, implications, and directions for future research.

Review of Literature

Review of the pertinent literature on OCB leads us to make two important observations. First, the same concept or

idea has been given different labels by researchers (Podsakoff et al., 2000), such as pro-social organizational behavior (George, 1990) extra role behavior (Van et al., 1995), organizational spontaneity (George and Brief, 1992), and contextual performance (c.f. Borman and Motowidldo, 1993). Second, there is still lack of consensus with regard to dimensionality of the OCB construct (Le Pine et al., 1983; Podsakoff and Mackenzie, 1994) referred to as "extra role" behavior.

Individual behavior, that which is beyond the standard, is normally expected of employees by their employers. The other key element of "extra role" behaviors, according to this approach, emphasizes that it is based on individual initiative. This does not appear in the context of the organizational formal reward structure, and is important for the effective functioning of the organization. The ordered stream of researchers, however, argues that it is difficult to differentiate between in-role stream of researcher; however they argue that it is difficult to differentiate between in-role and extra-role behaviors (for example, Graham, 1991) on the plea that employee and managerial perceptions about employees performance and responsibilities may not necessary correspond with each other. Accordingly, this school of thought conceives OCB as a concept that includes all relevant and positive employee behavior for the effective functioning of the organization. For instance, Graham (1991), who opposed the earlier thought of in-role versus extra-role behaviors, defined OCB from the standpoint of civic citizenship, that is, he referred it to employee concern to participate in corporate life of organization more responsibly.

Another way to understand the concept of OCB is to understand its dimensions in the light of the related literature. A number of dimensions of OCB have been identified by various researchers. Some such researched fields are: altruism and compliance (Smith et al., 1983); conformity, cooperation, punctuality, and expense (Bateman and Organ, 1983); altruism, courtesy, sportsmanship, civic virtue, and conscientiousness (Organ, 1988); obedience, loyalty, and participation (Graham, 1991); helping behavior, sportsmanship, individual initiative, civic virtue, organizational commitment, complacence, and personal development (Podsakoff et al., 2000); and sportsmanship, civic virtue, conscientiousness, and altruism (Netemeyer et al., 1997). Our study adopts the approach of Netemeyer et al.'s (1997) four-dimensional construct that corresponds with those of the original construct proposed by Organ (1988). The dimensions are discussed further in detail.

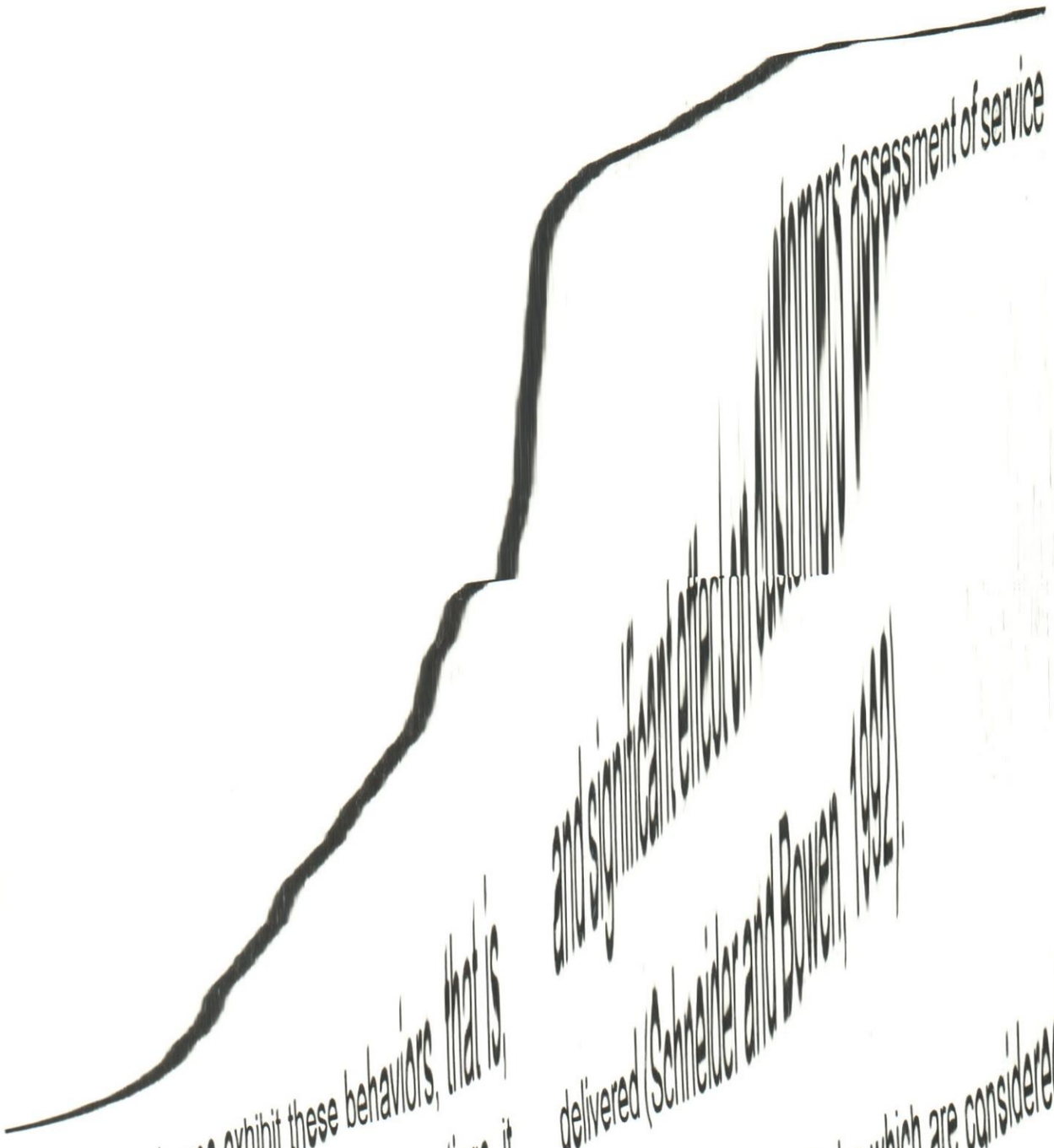
Sportsmanship

This form of citizenship behavior is referred as willingness to tolerate inevitable inconveniences and imposition of work without complaining (Organ, 1990). As Podsakoff et al. (2000) stated that people with "good sports" maintain a positive attitude even when things do not go their way, are not offended when others do not follow their suggestions, are willing to sacrifice their personal interest for the benefit of the work group, and do not take rejection of their ideas otherwise. It is employees' goodwill in tolerating less than ideal circumstances without complaining (Organ, 1988). Although, this form of citizenship behavior has received much less attention in literature (Podsakoff et al., 2000), it is reported to have association with various desired organizational outcomes like improvement in quantity and quality of production (Podsakoff et al., 1996), reduction in material wastage, and number of customer complaints (Walz and Niehoff, 1996).

In service firms, employees, by exhibiting sportsmanship, do not complain unnecessarily. This results into a positive climate among employees and consequently influences customer employee interaction facet of quality service (Schneider and Bowen, 1992). Further, service employees, by not complaining about trivial matters, set examples for others. This develops a sense of belongingness and commitment to the organization which in turn become the foundational ingredients used to create and deliver superior customer value. Therefore, on the basis of this discussion we assume that OCB will be positively related to customer service quality perception and satisfaction.

Civic Virtue

This is referred to organizational participation (Graham, 1989) or protecting the organization (George and Brief, 1992) that represent employees' macro-level interest in the organization as a whole (Podsakoff et al., 2001). It indicates employees' concern for participating in corporate life, such as to participate in its governance (attend meetings, express one's opinion about what strategy the organization ought to follow, engage in policy debates, etc.), to monitor its environment for threats and opportunities, and to look out for its best interest (say, for example, locking doors). Although these tasks are not formally required by the organization, employees perform them for the benefit of the organization.



When employees exhibit these behaviors, that is,

attend and actively participate in corporate meetings, it results in speedy exchange and dissemination of information. The employees by making suggestions about how to respond to changing market requirements enhance organizational responsiveness. The dissemination of information and organizational responsiveness are some of the vital drivers of market orientation and consequently to organizational performance (see for example, Jaworski and Kohli, 1993). Accordingly, it is assumed that employees with these behaviors will positively affect organizational performance.

Conscientiousness

This kind of citizenship behavior involves engaging in task-related behaviors that go beyond the prescribed requirements of the organization, that is, going beyond the call of normal duty. According to Podsakoff et al. (2008), such behaviors include voluntary acts of creativity and innovation designed to improve one's task or organizational performance, persisting with extra enthusiasm to accomplish one's job, volunteering to take extra

others in the organization

The employee job attitudes which are considered predictors of employee OCBs in the present study are now discussed in the light of existing literature as follows:

Perceived Organizational Support (POS hereafter in this article) is conceived as employees' cognitive assessment of organizational support or the degree to which they perceive their organization to be considerate, supportive, responsive to their contribution, and above all, as one that cares about their well-being (Eisenberger et al., 1990). As a positive perception about the organizational support, it helps employees satisfy their social, self esteem, needs, and also help them understand their organization's readiness to compensate their extra efforts with extra rewards; it leads to better performance through increased job satisfaction. Service employees and customers are psychologically close because of the interactive nature of service delivery. Therefore, how these service employees are supported by their organization can clearly have consequences for the customers' evaluation and success of the organization.

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This definition of conscientiousness clearly indicates that employees who exhibit the kind of behavior invest more time and energy than normally expected in their work activities (that is, engage in more work or service effort). Since effort is referred to the amount or expenditure of energy put into a behavior or a series of behaviors (Locke et al., 1981), it is positively related to customers' evaluation (Gardner et al., 1989; Siddiqi, 2007). Therefore, investigating relationship between conscientiousness (one form of OCB) and organizational performance would be a significant research attempt.

Altruism

The literature suggests that this form of OCB by an employee is aimed to help co-workers thereby preventing the occurrence of work-related problems. Altruism and conscientiousness have been grouped by some researchers which is referred to helping behavior (Mackenzie et al., 1998). The skilled employees, who exhibit altruism, were expected to help less-skilled co-workers or those who are overburdened. This behavior can also spread best practices throughout the organization (Podsakoff et al., 2000). This behavior also results in cohesive climate in the organization which has positive and significant effect on customers' assessment of service delivered (Schneider and Bowen, 1992).

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The relevant literature supports that service employees' POS is positively related to their attitudinal responses like attendance, diligence, commitment, innovation, compliance (Eisenberger et al., 1990), service efforts (Mohr and Bitner, 1995), and sense of obligation towards their organization (Shore and Wayne, 1993). These attitudinal responses resemble with those of OCBs discussed earlier in this article. Therefore, it is believed that POS will be positively related to employee OCBs and consequently to customers' service quality perception and satisfaction.

Job Satisfaction

Job satisfaction is referred as a pleasurable or positive emotional state that results from the appraisal of one's job or job context factors (Locke, 1970). Numerous empirical studies show a strong relationship between employee job satisfaction and their OCBs (Organ, 1988; Organ and Ryan, 1995; Netemeyer et al., 1997). The relevant literature to date offers several explanations as to why employee satisfaction affects employee OCB. Satisfied employees are motivated and have motivational resources to deliver adequate effort and care beyond what is normally expected of them (Mackenzie et al, 1998). They have enough emotional resources to show empathy, understanding, respect, and concern, thus, can positively

shape their OCB and, consequently, the customer service quality perception and satisfaction.

The customer outcomes that are expected to be consequences of employee OCB in the present study are now discussed in the light of existing literature.

Customer Service Quality Perception and Satisfaction

Numerous studies have shown a positive relationship between employee OCB and organizational performance (Organ, 1988; Podsakoff et al., 1997; Walz and Nieboff, 1996). At the same time, the relationship between service quality and organizational performance is undisputed. In a meta-analysis carried out by Capon et al. (1990), they identify 20 studies that find a positive relationship between quality and business performance. Although organizational performance can be assessed from various perspectives, customer-perceived service quality and their satisfaction is one of the most important performance achieved by service employees in customer employee interaction. In fact, the underlying reason for seeking service quality improvement and customer satisfaction is a belief that can contribute significantly to performance (Barnes and Cumby, 1995; Berry et al., 1985). Therefore, to investigate the impact of OCB upon organizational performance, it was felt logical to investigate impact of employee OCB on customer service quality perception and their satisfaction.

Research Gaps and Rationale of the Study

Although the growing interest of researchers in OCB stems from the belief that these behaviors enhance organizational performance, research in the area that explore relationship between OCB and organizational performance is limited. As stated by Podsakoff et al. (2000) out of the total 160 studies that identify determinants of employee OCBs, only five studies have tested the impact of these OCBs on organizational performance. Even if some studies (Mackenzie et al., 1996; Podsakoff and Mackenzie, 1994; Waltz and Niehoff, 1996) have recently tested the relationship, relatively little attention has been paid to explore relationship between QCB and customer service quality perception (Yoon and Suh, 2003). In fact, OCB has been studied mostly from the management perspective and has only recently been of increasing interest in the field of service marketing (Gonza'lez and Teresa, 2005). Therefore, the present study that investigates the impact of OCB dimensions on customer outcomes like their service quality perception and satisfaction would be a valuable attempt to plug the gap. Our study attempts to add incrementally to the existing literature in three ways. First, while examining the OCB-performance link, much of research work has mostly focused on job satisfaction, organizational commitment, perceived organizational fairness, leadership style, etc., as determinants of OCB. However, to the best of our knowledge, excepting with the work of Moorman et al. (1998), employee POS has been the subject of interest as a determinant of OCB in the past. Second, this study makes use of response from both the employees and customers in response to call by various researchers (for example, Schneider and Bowen, 1985) to enhance the dependability of the results. Finally, though the authors assume the consequences of OCB that hold true for developed countries, they should be equally applicable to Indian service market. Nevertheless, in view of the dynamics of the environment, culture that is different from what prevails in developed countries, testing of the relationship in Indian context with samples from its banking sector, would be a useful attempt.

Methodology

Investigations were carried out to ascertain the relationships between three main dimensions, that is, antecedents of employee OCB (POS and job satisfaction in this study), employee OCBs, and organizational performance. While employee OCBs are a result of POS and job satisfaction, organizational performance (customer service quality perception and satisfaction) in turn is the result of the employee OCB.

Hypotheses

In view of the review of literature, discussions, and scope of the study, the following fundamental hypotheses are proposed:

- H1: Greater the level of employee POS and job satisfaction, greater will be the employee OCB and
- H2: Greater the level of employee OCB, greater will be organizational performance (service quality perception and customer satisfaction in the present study).

Field of Study, Data Collection, and the Sample

Employees' responses for multiple operations have to be actively involved in creating and delivering services in banks. These activities and the people, who perform them, have a major influence upon the final outcome. The employees have high level of interdependence on each other to accomplish the task. This demands a considerable amount

of cooperative effort or OCBs on part of the employees in banks, thereby, justifying the selection of banking sector as our field of study. Further, only contact employees were considered for our sample. This was done deliberately for most of the "moments of truth," customers experience with the service organization takes place with contact employees.

The primary data was collected from several branches of four prestigious banks in India [State Bank of India (SBI), Punjab National Bank (PNB), J&K Bank Ltd, and Standard Chartered Bank], located in the states of Delhi, Punjab, and Jammu and Kashmir, by employing proportionate stratified sampling procedure using Delhi, Ludhiana, Chandigarh, Jammu, Srinagar, Anantnag, and Udhampur as its various strata. The selection of first three banks for the present study is governed by the fact that in comparison to other banks, they had considerable presence in rural, semi urban, urban, and metropolitan areas of the country. This made it possible to include all possible categories of respondents in the required sample. Among the public sector banks, the two banks (SBI and PNB), considered for the sample, at an average have 46% of their branches in rural, 24% in semi urban, 17% in urban, and 13% in metropolitan areas of the country (RBI 2005). Although the presence of some of the other public sector banks is not considered for the present study, they happen to be equally good (for example, Dena Bank) at the national level. Yet, comparatively their presence is far low in the region particularly in the state of Jammu and Kashmir considered for the present study (RBI 2005). J&K Bank Ltd is the second largest old private sector bank with 54% of its branches in rural, 9% in semi urban, 25% in urban, and 12% in metropolitan areas of the country (RBI 2005).

Each contact employee (those who work on frontline counter or usually respond and interact directly with the customers) received one employee questionnaire and four customer questionnaires which were divided into two main sections, one addressed to contact employee and the other to the manager. (The questionnaire is provided at the end of the article.) Both the sections comprised of the same statements, measuring contact employees' OCB. The employees' section, besides OCB, also included statement measuring employee POS and job satisfaction. The contact employees were requested to complete the first section of the employee questionnaire by themselves and get the other one completed by any senior manager at their branch. The responses from both the contact employees and managerial personnel were ascertained and were then averaged to increase the dependability of the OCB survey as recommended by Organ and Ryan (1995). However, statements of employees' job satisfaction and POS were responded by employees alone. Further, the same contact employees were requested to distribute four customer questionnaires to their customers (preferably those who are regular and have good service experience of their branch) to get the customer questionnaire completed. The survey questions for the customer were reference to the employee behavior they had just encountered and from whom they received the questionnaire. Additionally, the customer questionnaire included statements to measure customer satisfaction with the organization. In this way, the contact employees were evaluated by individual customers on the basis of the employee's service quality, and the responses were then aggregated (averaged) and matched with the mean scores of employee OCB dimensions like contact employees' sportsmanship, civic virtue, conscientiousness, and altruism. Similarly, customer responses measuring their satisfaction were also averaged and matched with the employee OCB dimensions. A common identification number was allotted to contact employee and customer questionnaires to facilitate the matching process of contact employees OCB and customer outcomes. This kind of matching process is suggested by numerous authors (see, for example, Schneider and Bowen, 1985). Out of a total of 350, as many as 199 completed the questionnaires: completed by managerial and contact employees. This led to a response rate of 57%. On the other hand, 594 of 1400 customer questionnaires were received (42%). The average response of number of customers per contact employee was approximately three. Besides mean, regression coefficients were estimated with the help of regression equations to estimate interdependence of various dimensions considered in the present study.

The Research Instruments

Using Lickert's 5-point scale throughout the study, responses to items were scored in such a way that a response indicative of most favorable was given the highest score and vice-versa (strongly disagree—1; strongly agree—5). The instruments used in the present study were mostly drawn from previous studies in marketing and organizational behavior. The dimensions of OCB like sportsmanship, civic virtue, altruism, and conscientiousness were measured by using scales originally developed by Netemeyer et al. (1997). For measuring employee POS, seven most suitable items were drawn from POS scale originally developed by Eisenberger et al., (1986).

Scarpello and Campbell's (1983) single items scale for measuring employees, overall job satisfaction was used. Six items measuring employees' overall job satisfaction was used. Six items measuring only employee behavioral attributes were drawn from various dimensions of the SERVQUAL scale (Parasuraman et al., 1988) to measure customer service quality perception because the main purpose here was not to assess the service quality perception. This is also because the main purpose here was not to assess the service quality at a broader service provision level rather at the employee encounter level to examine the impact of OCBs upon service employee attitudes towards customer. Finally, customer satisfaction was measured with a nine-item unidimensional scale developed by Maloles (1997), slightly adapted for the present study.

Analysis and Result

After taking respondents data of all the banks together, the first activity was to assess its reliability. The Cronach Alpha values were found well around the prescribed cutoff point (Nunnally, 1978). The reliability coefficient of employee job attitudes are 0.67 (POS), 0.54 (job satisfaction), respectively. The overall reliability of the customer questionnaire measuring service quality and customer satisfaction as a whole was 0.72; whereas the individual values were 0.35 and 0.57, respectively. The reliability alpha of various dimensions of OCB like employee sportsmanship, civic virtue, consciousness, and altruism, was 0.63, 0.54s, and 0.62, and 0.67, respectively.

The impact of employee POS and job satisfaction on various employee OCBs like sportsmanship, civic virtue, conscientiousness, and altruism is proved via standardized regression coefficient with the help of following regression equations:

$y1 = b1 \times 1 + b2 \times 2 + e$

$y2 = b1 \times 1 + b2 \times 2 + e$

$y3 = b1 \times 1 + b2 \times 2 + e$

$y4 = b1 \times 1 + b2 \times 2 + +e$, *whereby*

$y1$ = *sportsmansip,*

$y2$ = *civic cirtue,*

$y3$ = *conscientiousness,*

$y4$ = *altruism,*

$X1$ = *POS,*

$X2$= *job satisfaction, & e = error term,*

SPSS 11.0 for windows was made to run, whereby using "forward methos," data pertaining to $y1$ to $y4$ was entered as dependent variables one by one and that of pertaining to $X1$ to $X2$ was entered as independent variables. The results obtained are presented in Table 1.

The result in Table 1 indicates that both the employee POS and job satisfaction are significantly correlated with almost all the employee OCB (sportsmanship, civic virtue, conscientiousness, and altruism) increases, thus, positively influences their sportsmanship ($b = 0.21$, p value = < 0.001), civic virtue ($b = 0.13$, p value = < 0.05), conscientiousness ($b = 16$, p value = < 0.01), and altruism ($b = 18$, p value = < 0.01). Additionally, greater the employee job satisfaction, greater the employee sportsmanship ($b = 0.26$, p value = < 0.01) and altruism ($b = 0.31$, p value = < 0.001). These findings are supported by authors in past (Mackenzie et al., 1998; Organ, 1988; Organ and Reyan, 1995; Yoon and Suh, 2003). On comparing the regression coefficients and the corresponding p values, job satisfaction appears to be the more influential driver of employee OCBs. Another important observation is that both POS and job satisfaction exert their influential driver of employee OCBs. Also, that both POS and job satisfaction exert their influence more on sportsmanship than on any the other forms of OCBs.

Table 1: Regression Coefficients from Multiple Linear Regressions between Employee Job Attitudes and Various OCB Dimensions

Independent Variables		Dependent Variables			
		Sportsmanship	Civic Virtue	Conscientiousness	Altruism
	POS	0.21*	0.13***	0.16**	0.18**
	JS	0.26*	0.31***	0.28**	9.11*
	R2	0.31	0.28	0.24	0.27

Notes: POS = Perceived Organizational Support; JS = Job satisfaction; *<.001; **<.01; ***<.05

(See corresponding *p* value in Table 1.) The significant relationship between job satisfaction and altruism (*p* value = <.001), revealing that satisfied employees are more likely to assist other employees (new or temporary overburdened employees) who have work-related problems, share their expertise with others, and try to prevent work related problems of their co-workers, is in line with the findings in past (Organ and Ryan, 1995; Podsakoff et al., 1996). Therefore, in view of the statistical results of Table 1, it is quite safe to accept H1 (Hypothesis 1, as mentioned earlier) that greater the level of employee POS and job satisfaction, greater will be the employee OCB.

On assessing the linkage in between the employee OCB and organizational performance (customer outcomes), again the regression coefficients were calculated in a similar way with the help of following regression equipments:

$$y1 = b1 \times 1 + b2 \times 2 + \ldots, b4 \times 4 + e;$$

$$y2 = b1 \times 1 + b2 \times 2 + \ldots, b4 \times 4 + e$$

whereby, *y*1 and *y*2 refer to two customer outcomes, that is, cusstomer service quality perception and customer satisfaction respectively and *X*1 to *X*4 refer to data pertaining to the four forms of employee OCB like sportsmanship, civic virtue, conscientiousness, and altruism, respectively. The results obtained thereof are presented in Table 2.

The statistics in Table 2 reveal that among the various forms of OCBs, conscientiousness is the most significant (*b* = 0.19, *p* value = < 0.001) factor that determining customer service quality perception. The influence is followed by sportsmanship (*b* = 0.18, *p* value = < 0.001) and then by altruism (*b* = 0.16, *p* value = < 0.05). The relationship between altruism and service quality supports the basic assumption of Organ (1988) and Gronroos (1985) that service quality is enhanced to be extend employees view each other as customers and thus willingly help each other so that external customer is better served. The assumption was also empirically tested by Podsakoff et al., (1997) and more recently by Yoon and Suh, 2003). Another important observation is the non-significant relationship between civic virtue and service quality perception that should be taken with care. This is perhaps due to the fact that even if employees who exhibit high civic virtue behavior, that is, actively participate in their corporate meetings or make suggestions, their behavior cannot affect service quality with an immediate effect (Yoon and Suh, 2003). Therefore, the insignificant relationship does not imply that service firms need not to improve employees' civic virtue behavior. Although OCB as a global measure was reported unrelated to customer satisfaction by Castro et al., (2004), our dimension-wise analysis result indicate that two of the four forms of OCB (conscientiousness and altruism) are positively related to customer satisfaction. The most powerful driver of customer satisfaction as identified in this study is conscientiousness (*b* = 0.17, *p* value = < 0.10) in between sportsmanship and customer satisfaction is nearer to cut off significance level of < 0.05 considered in this study. Nonetheless, the findings are in need of replications before generalization. In view of the overall results of this study, ample evidence is found in support of H2 (Hypothesis 2, as mentioned earlier) that greater the level of employee OCB, greater will be the organizational performance (service quality perception and customer satisfaction in the present study).

Table 2: Regression Coefficients from Multiple Linear Regressions between OCB Dimensions and Organizational Performance

Independent Variables		Dependent Variables (Customers)	
	(Employees)	Service quality Perception	Customer Satisfaction
	Sportsmanship	0.18*	ns
	Civic Virtue	ns	ns
	Conscientiousness	0.19**	0.17*
	Altruism	0.15***	0.14***
	R2	0.27	0.19

Notes: *< .001;**< 0.1;***< 05; ns = not significant

Conclusion and Implications

The present study focused on empirical examination of the relationships between employee POS, job satisfaction, OCB, and the consequent organizational performance to the Indian banking context. In view of the findings that OCB positively related customer service quality perception and satisfaction, service organizations need to continuously monitor the four dimensions of OCB to facilitate their service oriented environment. The discretionary behaviors or at least the OCBs emphasized in the present study need to be given due importance in employee performance appraisals and linking them with rewards, incentives, promotions is a welcome idea. For instance, service organizations can link one's compensation with the results of the team, he or she belong to, in addition to his or her individual performance. This will make employees more conscious about group results and boost their helping behavior (altruism) towards co-workers. The upward communication needs to be encouraged to improve quantity and quality of suggestion from contact employees. The management needs to reduce general fear among its frontline staff of being marked or criticized by senior management in case they voice critical views or participate actively in corporate life of their organizations. The identification and offering various organizational supports to its employees can enhance OCBs. Further organizations would benefit from understanding, measuring, and diagnosing each dimension of OCB to benchmark and monitor the performance of their particular division or business unit in each of these areas. Each business unit can be then monitored and managerial and employee rewards can be based, in part, on levels of OCB so found within the specific business units.

Limitations and Directions for Future Research

First, while examining the complex relationship between various dimensions of OCB and organizational performance, customer service quality perception and their satisfaction were the only two measures of organizational performance considered in this study. Therefore, exploring relationship between OCB dimensions and other measures of organizational performance like profitability, ROI, corporate image, cost of producing services, innovativeness, adaptability, customer complaints, customer relation, and their behavioral intensions, seems to be an immediate research requirement especially in Indian context. Second, in the present study customer questionnaires were distributed by customer contact employees themselves. It is possible that this kind of data-collection process, although convenient for matching customer and employee perceptions, might have introduced some bias into the final results of the research. Third, prioritizing various OCBs on the basis of their utility in different service settings is expected to open useful and new areas of research. Finally, as the survey was conducted in an Indian context with samples from its banking sector within a limited geographic area, there are always concerns of generalization. Therefore, research in other service sectors with samples from different geographic are needed to replicate the present findings in India.

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Questionnaire

Dear Respondent,

You are requested to read the following statements carefully and express your degree of agreement/ disagreement by encircling a number that most closely represent your perception, using the following scale:

Scale: **1——————2——————3——————4——————5.**

1 = 1 strongly disagree with the statement; 2 = 1 disagree with the statement; 3 = 1 neither agree nor disagree with the statement; 4 = 1 agree with the statement; 5 = 1, strongly agree with the statement.

STATEMENT	SCORE				
	1	2	3	4	5

Service quality perception (customers' evaluation about employee behavior), (Parasuraman et al., 1988)

01. The employee provides prompt service
02. The employee is never too busy to respond to my request
03. The employee instills confidence in me
04. The employee is courteous
05. The employee has adequate knowledge to answer my questions
06. The employee understands my specific needs

Customer Satisfaction (Maloles, 1997)

01. I am very satisfied with my branch
02. My branch satisfies my needs
03. Compared to other branches, my branch is as good or better
04. My complaints/problems are always addressed in a fair manner
05. My branch is very reliable
06. I like the people of my branch
07. My branch gives me the service I expect
08. My branch provides excellent service
09. Overall, my experience with my bank is positive

Perceived organizational support (POS) (Eisenberger et al., 1986)

01. My bank values my contribution to its well-being
02. My bank strongly considers my goals and values
03. Help is available from my bank when I have a problem
04. My bank really cares about my well-being
05. My bank cares about my opinion
06. My bank takes pride in my accomplishments at work
07. My bank tries to make my job as interesting as possible

Employee Job Satisfaction, (Scarpello and Campbell, 1983)

01. I am satisfied with my job in general

Employee OCB (Netemever et al., 1997)

Sportsmanship

01. I do not consume time on complaining trivial matters
02. I tend to make "mountains out of molehills," that is, make problems bigger than they are*
03. I always focus on what's wrong with my situation, rather than the positive side of it*

Civic virtue

01. I attend functions that are not required but help my company image
02. I read and keep up with my company's announcements, memos, and so on
03. I risk disapproval in order to express my beliefs about what's best for the branch

Conscientiousness

01. Conscientiously follow branch regulations and procedures
02. I meet my tasks earlier than is required
03. I respond to requests for information promptly

Altruism

01. I help orient new staff even though it is not required
02. I am always ready to help or lend a helping hand to other staff around me
03. I willingly give of my time to others

*reverse coded items

Everyone is a genius at least once a year. The real geniuses simply have their bright ideas closer together.

— George C. Lichtenberg

Focus

Indian Economy: Emerging Trends

Badar Alam Iqbal

India has been on the path of fast economic growth. During the last three years, the growth rate ranged between 8% to 9.4%. These trends are of encouraging nature and needs sustainability. These growth rates could be possible if performance in agriculture, manufacturing, and infrastructure sectors is on the higher side. India has enormous potential and opportunities for becoming an economic power in the world and also may become the third largest economy in the world after the US and China. The present paper tries to evaluate the performance potential of Indian economy in the present century. The paper is divided in two parts.

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Part I

There are doubts that India has not been performing well. This is not true. The income ratio of our richest 10% to our poorest 10% is around 73% as compared to the biggest economy of the world, that is, the USA, with a figure of 15.9%. This does not mean that India is among the most equal societies of the world. However, India is far better than Bolivia and Brazil (Table 1). According to the Human Development Report of 2006, India is the second country in the world in terms of GDP growth (8.5 %) after China (10.5 %).

Table 1: How Equal is India and where does India Stand?

Rank	Country	Percapita	Growth Rate (%)	Income Ratio	GINI Index
1	USA	39319	3.4	15.9	41
2	China	5453	10.5	18.4	45
3	Japan	29620	2.8	4.5	25
4	India	3113	8.5	73	33
5	Germany	28215	2.2	69	28
6	UK	30315	2.7	13.8	36
7	France	28758	2.0	9.1	33
8	Italy	27905	1.6	11.6	36
9	Brazil	7968	2.8	57.8	58
10	Russia	9822	6.6	12.7	40

Source: Human Development Report, 2006; World Bank Statistics, Washington.

The most noteworthy feature of the data given in Table 1 is that India has been figuring among the world's most developed countries of the world. Added to this, India is actually one of the more economically equal economies of the world. The most global equal economy is Azerbaijan, wherein the richest 10% of the total population earns 3.3 times the income of the poorest 10%. Japan comes next to Azerbaijan with a figure of 4.5 times followed by Czech Republic with a figure of 5.2 times (Table 2).

Table 2: How Equal are the Economies in the World in terms of Income Ratio?

Countries with highest income ratios of richest 10% to Poorest 10%	Income ratio
Bolivia	168
Namibia	129
Lesotho	105
Sierra	87
Botswana	78
Countries with lowest income ratios of richest 10% to poorest 10%	
Azerbaijan	3.3
Japan	4.5
Czech Republic	5.2
Hungary	5.4
Bosnia	5.5

Source: Human Development Report, 2006; World Bank Statistics, Washington.

It is an undisputed fact that the globe is full of economic peaks and valleys. According to World Institute of Development Economics Research (WIDER), Helsinki, the richest constitute of only 1% in the world and this 1% accounted for 40% of the world's total assets. Similarly, the richest 10% constitute 85% of the total global assets. The most astonishing fact is that the bottom half of the global population has only 1% of the global wealth.

Some Harsh Facts

The most known fact is that global wealth is concentrated in Western Europe, North America, and high income Asia and Pacific nations: the share of these countries in global wealth is 90%. The most depressing trend is that there is huge and unimaginable disparities in terms of wealth per person ranging between US$ 181,000 in Japan and US$ 144,000 in the USA to US$ 1,100 in India and US$ 1,400 in Indonesia. The concentration of wealth within nations too varies alarmingly. The richest 10% accounted for 40% wealth in China and 70% in the US.

Another indicator of inequality that may give much better picture is the GINI coefficient. This coefficient is zero for complete equality and 100% for complete inequality. For measuring income inequality, GINI values range between 35% and 45% in most nations. In contrast, GINI values for wealth inequalities range between 65% and 75%, and, sometimes, even exceed 80%. The world's two wealthiest economies, namely, Japan and the USA, have GINI values of 55% and 80%, respectively. Wealth inequality for the globe is still on the higher side. According to WIDER study, global wealth GINI is 89%, meaning in a group of 10, 1% takes 99% of the pie and the other nine persons' share is negligible, that is, 1%.

Reasons for Such Trends

A nation's place among the wealthiest nations depends on three vital components: size of the population; average wealth; and wealth inequality. The reasons for the US and Japan being the world's two wealthiest economies are their large populations and high average wealth. China does not figure in the category of the wealthiest nations because its average wealth is modest and evenly spread according to international standards.

India in Terms of GINI Index

India in terms of GINI measure of income inequality stood at 32.5. According to National Sample Survey Organization (NSSO), nearly 70% of the country's population has monthly per capita income expenditure below the national average Rs 555. This means low levels of income are prevalent in the country even when aggregate economic growth is speeding along the rate of 8%. The fact remains that in the present trajectory, prosperity means unequal distribution of incomes and wealth, and, hence, the immediate need is to find out ways and means for reducing such disparities of incomes and wealth.

Performance

The Central Statistical Organization (CSO) has recently provided a flattering scenario of the countries. During 2006–07, the Indian economy registered a growth rate of 9.4%, the highest since 1988–89, when it grew by 10.5%. That year, the economy was bouncing back from a low base after a severe agricultural drought. Performance for 2005–06 was particularly commendable as it came to a 9% growth. Besides, the 9.4% growth figure goes beyond all other estimates including Reserve Bank of India (RBI), that is, 8.5% and the CSO's own earlier projection of 9.2%. It is easy to identify the strong growth drivers as well as sectors that underperformed in relation to their potential and opportunities.

Indian economy is now a trillion-dollar economy. Buoyed by spectacular performances by manufacturing and certain services sectors, the Indian economy ended

2006–07 with a growth rate of 9.4%, exceeding the earlier projection of 9.2% made by CSO. Coming as it did on the back of a high growth base of 9% during 2005–06, so robust were the performances of the said two dependable sectors, that they not only made up for the slowdown in construction and agriculture, but also helped the economy achieve the fastest growth rate in 18 years, next only to the 10.5% GDP expansion recorded during 1988–89.

Higher Growth Path

Because of the sterling show, India's economy has clearly shifted to a higher growth trajectory and hence, higher growth rate was possible in the year 2007–08. Aided by high growth along with a strengthening of rupee in the forex market, the country's economy has graduated to that of a trillion dollar, the 12th such nation globally to reach this milestone.

As per the CSO figures, the country's economy at market prices stood at a figure of Rs 4,125,724 crore at the end of 2006–07, which at the current exchange rate of the rupee at Rs 40.72 to a dollar is equivalent to nearly US$ 1,010 billion. On the other side of it, the overall economic growth as measured by GDP at factor cost was 9.1% between January and March 2006–07 as compared to the 10% growth rate achieved during the said period in 2005–06. Pulling it down were the sectors, namely, agriculture, construction, financial, and social services. For the year as a whole, however, the growth in manufacturing and some services more than made up for the slowdown in the other mentioned sectors.

In absolute terms, the country's GDP stood at Rs 24,481,576 crore during 2006–07 as against the earlier estimate of Rs 2,844,022 crore. The per capita income stood at Rs 22, 483 in 2006–07 as compared to Rs 20,734 during 2005–06. In effect, the income of an Indian, on an average, increased by 8.4% in real terms (based on 1999–2000 prices). However, while not taking into account the inflation, the per capita income increased by 14.3% to Rs 29,382 in 2006–07 as compared to Rs 25,716 in 2005–06.

Sectoral Contribution

Manufacturing and services sectors have been growing at double digit rates, the former by 12.3% as against 9.1% during 2005–06. Services grew by 11%, up from 9.8%. Mining and quarrying also grew to 5.1% during 2006–07 as compared to 3.6% in 2005–06. However, agriculture registered a lower growth rate of 2.7% compared to 6% in 2005–06. Clearly, agricultural revival holds key to sustain high growth path as well as making the growth process more inclusive which is the need of the hour. Hence, there is an immediate need of taking tough decisions and concrete actions to achieve a 4% annual growth in agriculture. The industrial output and services are estimated to grow to a healthy 10.6% and 10.4%, respectively during 2007–08.

At the start of the XI Five Year Plan, the progress and performance of the Indian economy has strengthened the confidence that it has entered a high-growth path or trajectory wherein an average annual growth rate of 9% or more might become the norm. However, what could act as a reminder is that increasing and ever higher growth rates cannot be taken for granted. The CSO, through a report released simultaneously, has estimated economic growth during 2006–07 at 9.1%, which is lower than 10% growth rate achieved in the earlier year. Apart from agriculture, there has been a decline in construction, financial, and social services. Some of these sectors, especially construction, have been registering robust growth during the earlier quarters. It is too early to say whether these are the first sign of a more general slowdown. It is likely that some of these sectors have started feeling the impact of recent monetary tightening.

Issues of Great Concern

Despite a 15% increase in the per capita income and buoyant GDP growth of 9.4%, the common man is reeling under the burden of rising prices of essential commodities. The rising national and per capita incomes have hardly had any positive reflection in prices of essential goods. An analysis carried out by the ASSOCHAM on the rise in essential goods prices in the period between January 2006 and May 2007 showed that prices of all essential commodities other than sugar, such as wheat, pluses, spices, condiments, and edible oil, shot up by more than 25%. Although inflation has come down below cent in the last one year and supply–demand gap of essential commodities has narrowed down to some extent, in totality, the prices of essential commodities are refusing to settle down at a justifiable level. The first priority of the central government should be to bring down the prices by maintaining a balance between demand and supply of essential commodities.

Another issue of great importance is to narrow down income and consumption disparities within the country and within the states. It is a matter of great concern that while Indian economy has entered into high GDP trajectory

path, nearly 26 crore of the Indian population still lives below the poverty line, grappling with the scourge of malnutrition, illiteracy, and diseases. Indian economy requires development that makes quality of life and education affordable to all section of society, and which provides infrastructure to rural and backward areas as well as power supply for balanced growth of the economy.

Overcoming underdevelopment, alleviating poverty, and narrowing down the rural–urban gap are the biggest issues for Indian planners to tackle on war footing so that higher growth path could be of sustainable nature.

Trends during 2007–08

The Prime Minister's Economic Advisory Council (EAC) has said that the Indian economy would grow by 9% in the current year, assuming normal monsoons and other external conditions, down from 9.4% in 2006–07. This is a more optimistic estimate than the RBI's 8.5% GDP growth projection for the year. Presenting its economic outlook for 2007–08, the Council emphasized that growth was sustainable because a large part of it was driven by investment and not consumption as was believed earlier.

Most early forecasts for 2008–09, including one by the RBI, have, after factoring in the impact of the anti-inflation strategies, placed growth rate at 9%. That by itself would be a commendable achievement, especially if the accompanying objectives of price stability and inclusive growth are met with.

Challenges before the Indian Economy

The Indian economy has many challenges to meet for providing sustainability to Indian economic progress and growth. Some of the challenges are being discussed briefly in the following points:

1. The biggest and the foremost challenge is the availability of sound and effective infrastructure in terms of quality and quantity. This requires a huge investment on infrastructure. The availability of the same would depend on the regulatory framework and overall investment climate. Added to this, another concern is the cost recovery infrastructure that is expected to bring the desired improvement in public-private partnership which is the sine-quo-non for speedy economic growth.
2. Rationalization of tax structure or fiscal consolidation is another strategic challenge before the Indian economy. This could only be possible if two vital components are rationalized, namely, elimination of subsidies and elimination of tax exemptions. But it is very hard to address these two segments. Ways and means must be explored to address these two strategic components of fiscal consolidation.
3. Ensuring higher growth rates in agriculture is vital for accelerating economic growth in terms of GDP. The Indian economy cannot sustain itself if higher growth rates are not achieved in agriculture. This is because a large part of the population depends on agriculture. The most astonishing trend is that growth rate in agriculture is slightly higher than the growth rate in population of the country. This all calls for legislative, institutional, and attitudinal changes essential for creating an effective and efficient relationship between public and private partnership, the only option left out for adoption.
4. Concentration on social sector or social segments of Indian economy—education and health care—and substantial expenditure on these are required. Economic progress cannot be possible without social progress. Here too public–private partnership could go a long way in providing sufficient funds on these segments of social emancipation. Socialization of people is a must as the same would empower the poor to participate in the growth process and the large gaps in availability of health in terms of minimum access to poor needs will not remain unattended.

Proper Utilization of Strengths

The Indian economy is fortunate enough in terms of strengths. These strengths must be utilized most effectively and efficiently in the process of accelerating economic growth on the one hand and to give desired sustainability to economic growth on the other hand. Some of the strengths are as follows:

1. Vast pool of science and technology graduates. The need is how to make best use of these graduates in enhancing the degree of economic growth. Areas have to be identified wherein these graduates could make worthwhile contribution.
2. India has an edge over China in terms of availability of people speaking English. In the present scenario of globalization, English language has become more vital. In India there is availability of a large number of English-speaking people. This asset should be utilized. These people can easily get

access in international system. Today the need is to produce global manager not national manager.

3. India has better and free judicial system and more awareness of rules, regulations, and laws. There is also freedom of expression that ensures accountability.

4. Despite coalition at the center, stability in the government is seen. There is also stability in existing political system. Center and states relations are of better nature. Coordination is also in existence. These things may go a long way in providing better governance which is the need of the day.

5. The Indian economy is friendly to investors. Investment climate is positive and congenial. This is essential for better economic growth rates. Entrepreneurial development is also taking place which is sine-quo-non for industrialization of an economy.

Part II

The US economy was expected to slow down in 2008, sending markets the world over, including India's into a flutter. Oil is close to US$ 100 a barrel and the sub-prime crisis cloud has not blown over. Now the question that arises is: What are the possible consequences for India? Rupee appreciation is set to increase, as a weak US economy and easy interest rates spur capital flow into India. A stronger rupee will continue to neutralize some of the increase in oil prices. However, exports are likely to be hit by a strong currency and weak demand. Should India be worried?

India's current account deficit, now nearly 2.1% of the GDP, is unlikely to worsen, as remittances now amount to US$ 27 billion, has never been affected by slow downs in the world economy. Merchandise exports are expected to come to terms with a rising rupee and grow at 12% in the medium term, even as services exports no longer rise at 30% per annum. However, India's best bet against the inevitable ebbs and flows in the global economy is to generate internal demand.

Sliver Lining

India has secured all all-time higher rating of 6.6 on a scale of 10 in the Index of Economic Freedom of the world 2005–06 and has been ranked 69 out of 141 economies. This is because India has been following a path of economic reform that was initiated to suit its particular needs. The most pertinent trend is that this is the highest increase rating witnessed by any of the 141 nations on the index in the last 15 years. Though India is ranked higher than China (86), the nation is lagging behind other countries of the third world such as Botswana 38) and Mongolia (44).

The highest rank is registered by Hong Kong followed by Singapore and New Zealand. This is because India is doing well in pursuing economic reforms; other economies are doing even better. When we talk about economic freedom, it has to be tempered with social justice for a country like India. No one will accept inequality growth in the country. India should also look at institutional freedom enjoyed by bodies like SEBI and TRAI, as well as judiciary freedom. This is what has brought India on the global radar.

India is better placed to do so than China. India's foreign trade accounts for nearly 35% of its gross GDP against 80% in China's case. India's growth took off in the X Five Year Plan (2002–07) when savings and investment picked up dramatically to cross 30% of the GDP. The private sector accounts for nearly 75% of capital formation, a trend that could be sustained if the government continues to create the right environment.

Investment in education is essential to sustain growth, in view of the skills shortage in industry and services. The XI Five Year Plan proposes to increase spending on education from 7.7% of the Central Plan Outlay to 19% or Rs 275,289 crore. Skill creation will transfer nearly 50 million surplus people out of agriculture to industry and services and enhance farm productivity. A US$ 500 billion investment in infrastructure through public–private partnership will address supply bottlenecks and generate a stream of incomes. Apart from capital infusion, higher output per unit of labor and capital used can alone sustain long-term growth. This, rather than short-term market and currency movements, should concern India's policy making entrepreneurs.

The performance of the Indian economy during last few years has been good and this is because the demand, which pent up a system of obnoxious controls, was freed. Producers were freed—largely though not wholly—from the perversity of senseless licensing controls and went on to supply consumers with things they coveted, but were denied some things like phone connections and cars. Consumers were freed from the enervating wait for cars, telephone lines, and even cement. This freedom resulted in an entrepreneurial burst of energy that led to the economic boom that Indian economy is witnessing today.

But maintaining a high growth rate depends on proper planning. This needs nothing more than a triumph of common sense over ideology. Alas, the fractured and myopic polity is determined to derail this growth. Senseless continuation of a subsidy on petroleum goods, much written about, is one, when oil prices are approaching US$ 100 a barrel. It is foolish to prevent fuel prices from rising and put the burden on state-owned oil companies (60%) and the government (40%). The government's share is not reflected in the budget using an accounting technique and is a legacy to future taxpayers. Meanwhile, undeterred by increasing fuel costs, the number of cars sold is increasing, causing huge environmental problems and congestions. There is thus no consumer pressure on automobile makers to improve fuel efficiency, nor, strangely, is there any legislative pressure.

Indians seem to be borrowing more and more, and for wrong reasons. An extensive survey has found that people are borrowing not for creating assets like building a house or buying a car, but for meeting consumption needs such as food, transport, medical bills, and even repaying loans (Table 3).

Table 3: Reasons for Borrowing (Figures represent percenatge of households borrowing under a particular head)

Food, housing, transport	6.8%
Health treatment	6.6%
Marriages, births, deaths	4.3%
Loan repayment	1.5%
Education	1.5%
Consumer durables	1.3%
Machinery	0.6%

Source: The Times of India, 2007

Performance

The most significant trend is that consumers using credit facilities, probably credit cards, for purchasing fuel and renovating their houses, which is a big chunk of the borrowings. The survey confirmed the trend towards urban India's transformation into a consumerist society with the stigma associated with debt diminishing. Hence, while housing loan business may be big in terms of value, in terms of number of loans, it is still the odd renovation expenditure or a loan to buy jewelry during weddings that dominates. Whereas banks may be pestering one with calls offering a variety of loans, many urban households do not mind tapping the much maligned money lender or friends and relatives to borrow for meeting routine expenses.

Though only 7% of urban households borrow from money lenders, compared with nearly 21% in rural areas, the figure is significant because of the widening institutionalized credit bouquet. Then again, one-third of the city borrowers who approach moneylenders do so for meeting routine expenses. In villages, the number is a little lower at 25%. People today are living in a world where there is more produce than ever before, yet 800 million people are starving when at the same time as 1 billion people are overweight or obese. The world's poorest people are the farmers.

A Comparative Scene

India has crossed 60 years of independence. Hence, it is necessary to explore and examine the areas where India has witnessed much better progress, areas where the country's performance is lagging far behind, and areas where India has to improve to become an economic progress. The answer or analysis of these three vital issues can be judged from Tables 4, 5, and 6.

At 60 years of independence, our country is young. Independence and patriotism have taken on new purposes and meanings. The political dinosaurs may be raving and ranting in regard to economic reforms and liberalization, but they are obviously out of touch with India's next generations.

According to a well-known survey conducted by AC Nielsen captioned "How people perceived India's growth," found that 63% of Indian people especially youths feel that globalization has been extremely beneficial.

Table 4: Areas (Sectors) where India has Progressed the Most

Business and commerce	57%
Science and technology	43%
Education	19%
Quality of life	15%
Infrastructure and transportation	14%
Art, culture, entertainment	11%
Defense	10%
Tourism	6%
Equality of women	6%
Human rights	5%
Health	3%
Poverty Eradication	2%
Environment	2%
Politics	2%
Spiritualism and Religion	2%
Social Equality	2%
Law and Order	1%
Sports	1%

Source: AC Nielsen India and *Business Today.*

From the Table 4, it is clearly evident that India has done much on the economic horizon as compared to social counts and hence, there are imbalances. Law and order is at the lowest in the ladder which is also important for accelerating the pace of growth and development of Indian economy.

Table 5: Areas (Indicators) where India has Progressed the Least

Politics	39%
Poverty eradication	34%
Law and order	23%
Social equity	13%
Infrastructure and transportation	13%
Environment	11%
Equality of women	9%
Education	9%
Sports	9%
Health	8%
Defense	8%
Standard of living	6%
Spiritualism and religion	6%
Human rights	6%
Tourism	4%
Business and commerce	2%
Arts, culture, entertainment	1%

Source: AC Nielsen India and *Business Today.*

Table 6: Areas (Sectors) where India Needs to Improve to Become Developed Country

Poverty eradication	65%
Infrastructure and transportation	64%
Law and order	64%
Education	62%
Science and technology	54%
Business and commerce	49%
Politics	48%
Health	39%
Quality of life	39%
Human lights	37%

Source: AC Nielsen India and *Business Today.*

The World Bank's annual series on Doing Business ranks economies on the ease of doing business. In the latest report, India's ranking stood at 120 out of the 180 nations covered. It is worst in South Asia: the countries that fared better are Maldives (60), Pakistan (76), Bangladesh (107), and even Maoist-hit Nepal (111). China (83) is better than India but worse than Pakistan, revealing the fact that red tape still inhibits some of the fast growing economies.

In terms of various indicators of doing business, India is virtually at the lowest of the ladder in regard to enforcement of contracts (at the rank of 177). This means, in effect, that contracts are pretty meaningless, the rule of law does not prevail and property rights are insecure.

Some Hard Facts

India's performance is also not satisfactory in regard to demanding payment of multiple taxes (at the rank of 165) out of 180 nations. With regard to hiring and firing of workers, India stood at 85 that is poor but actually much better than country's scores on some other criteria. It is evident that in India, businessmen could find ways and means due to inflexible labor laws. India's ranking in terms of opening business and closing business is 111 and 137, respectively. India is faring unsatisfactorily on policy and governance horizons. Country's fiscal deficit stood at 6% of the GDP. Similarly, subsidies are 14% of the GDP.

World Economic Forum ranks India at 114 out of 128 nations on women's role. Women in India have a long way to go as far as empowerment is concerned and hence the same has kept India among the bottom 10 when it comes to their participation in economic agenda.

According to the Forum's latest Gender Gap Index Report, India has been ranked at 114 after taking into account economic and political, educational, and health parities among a total 128 economies. With regard to economic participation and opportunities alone, our country has performed worse standing at 122, pushing it into the bottom 10 of the Index. In terms of overall placing, India slipped from rank 98 in 2006 when the index included only 115 nations. But compared to its rank at 122 for economic participation, India has performed better in terms of political empowerment by standing at 21.

India has 106 women in the parliament, and has seen a female head of the country in the last 60 years. India is placed at 4th position with 43% gender equality when compared in terms of women state head. This year's Gender Gap Index has been topped by Sweden with a gender equality of 81.5%, followed by Norway, Finland, Iceland, and New Zealand.

The countries placed below India are Bahrain, Cameroon, Burkina Faso, Benin, Saudi Arabia, Nepal,

Pakistan, and Yemen, with lowest equality of 45.1%. India has an overall 59.4% gender equality, while for economic participation and opportunity, the same is ranked at 39.8%.

Global Trade Logistics

India continues to become strong in regard to expanding business across the globe, but when it comes to cross-border transportation of goods, India's rank is becoming low in comparison to other major economies such as the US, the UK, and China. India ranked 39 in terms of Logistic Performance Index (LPI) which is based on the ability to transport goods reliability and in a cost effective manner to and from a country.

In a World Bank study titled "Connecting to Compete: Trade Logistics in the Global Economy," 150 economies were taken into consideration. The list of 150 nations is topped by Singapore, followed by the Netherlands, Germany, Sweden, Austria, Japan, Switzerland, Hong Kong, the UK, and Canada. India is placed below the US (14), China (30), Finland (15), Australia (17), France (18), New Zealand (19), Italy (22), and South Africa (24).

India has got its place higher than as many as 111 economies that including Saudi Arabia, Poland, Qatar, Cyprus, Pakistan, Bangladesh, and Sri Lanka. India occupied the second spot among BRIC economies after China. Brazil and Russia's positions are 61 and 99, respectively.

India has come up as one of the comprehensive reformers in logistics along with South Africa and emerging economies in East Asia and Latin America. India is placed at 46 in terms of logistic costs. These costs are much higher in economy compared to China (43), but less than Sri Lanka (47) and Bangladesh (48). In regard to timeliness, country's place at 47 as compared to China with a rank of 36.

On a scale of 1 to 5, India has been given an overall score of 3.07 on LPI reflecting parameters such as customs, infrastructure, international shipments, logistics competence, tracing and tracking of shipments, domestic logistics costs, and timeliness. Nations that have topped the LPI placing are typically key players in the logistics industry, while those at the bottom are often trapped in a vicious circle of over-regulations, poor quality services, and under-investment.

The planners and policy makers should look beyond road infrastructure and technology in customs and make reforms in logistics services markets, especially in reducing coordination failures involving public agencies.

Conclusion

From the foregoing discussion, it is evident that since liberalization, India has made progress more on economic horizon as compared to social count. As a result, the real fruits of liberalization have not come up and thus have not been shared by the people. India has to go miles in transforming its economy in modern economy on the one side and for becoming a developed nation on the other side. There are certain vital areas that have to be developed for accelerating the pace of growth and development and then to sustain it. India immediately needs a more integrated, and comprehensive approach all along for speeding up reforms that could be called as Third Generation Reforms. Major issues on economic and social fronts must be dealt with zeal and sincerity. The Indian economy has entered the era of higher growth path. What is required is sustainability in growth rates. This is possible if agriculture provides higher growth rate, that is, growth rate in agriculture should be higher than the growth rate in population. The Indian economy has been facing some challenges and these challenges must be met with the strengths of the Indian economy must be utilized for accelerating the pace of economic growth. As the Indian economy has become a trilliondollar economy, it is essential on the part of the government, planners, and policy makers to make joint efforts to provide result-oriented policies that could make India the third largest economy of the world. Indian has enormous potential and opportunities to become an economic force and may surpass China in years to come. The question is: How to give shape to this?

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The achievements of an organization are the results of the combined effort of each individual.

— Vince Lombardi

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