

Focus: Green Productivity

Energy Efficiency Initiative in India

Sustainable Development : Coal and Energy Sector

Development & Production of Eco-Friendly Humic Acid for Sustainable Agriculture

Municipal Solid Waste Management in India

Productivity Improvement in Engineering Firm Through Computer Applications

Implications of Global Financial and Economic Crisis on FDI Flows

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HRD & Empowerment

Growth and Performance of Selected Industry Groups of Punjab

Effect of JIT Purchasing Attributes in Automobile Industry

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Contents

Energy Efficiency Initiatives in India – <i>D. Pawan Kumar and J. Nagesh Kumar</i>	...	291
Sustainable Development : Coal and Energy Sector – <i>S. A. Khader</i>	...	295
Development & Production of Eco-Friendly Humic Acid from Neyveli Lignite for Sustainable Agriculture – <i>R. Kandasamy, B. Sivagnanam, S. Santhanam and V. Manoharan</i>	...	304
Municipal Solid Waste Management in India – <i>M. Balasubramanian and V. Dhulasi Birundha</i>	...	308
Productivity Improvement in an Engineering Firm through Computer Applications – <i>S. N. Jalwadi and Satyajit Patil</i>	...	315
Implications of Global Financial and Economic Crisis on Foreign Direct Investment Flows (FDI) : The Indian Perspective – <i>Arabi U</i>	...	321
Proliferation of Processed Food Products Exports : A Remedy for Indian Agriculture – <i>Kuldeep Singh</i>	...	335
HRD and Empowerment : A Study – <i>P. S. Swaminathan and S. Rajkumar</i>	...	346
Growth and Performance : A Study of Selected Industry Groups of Punjab – <i>Manjit Sharma</i>	...	352
Effect of JIT Purchasing Attributes in Automobile Industry (A Case Study) – <i>Sultan Singh and Dixit Garg</i>	...	360

Energy Efficiency Initiatives in India

D. Pawan Kumar and J. Nagesh Kumar

The article focuses on several energy efficiency measures taken by India, mainly during the 11th plan, resulting in significant reduction in energy consumption. Various initiatives such as National Action Plan on Climate Change, its eight national missions, including the NMEEE, have ushered in a new approach in the policy and regulatory regime. The article further presents an overview of the energy intensive sectors, which remain in the area of application of the aforementioned energy efficiency initiatives. It concludes with an analysis of energy saving margins in these sectors and the extent of energy saved during the 11th plan.

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Background

India, recognizing the significance of energy efficiency, proactively initiated several measures commencing with the 11th plan, targeted 5% reduction in energy consumption. The announcement of the National Action Plan on Climate Change by the Prime Minister in June 2008, with its 8 national missions, including the NMEEE, ushered in a new approach in the policy and regulatory regime.

The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight national missions under the National Action Plan on Climate Change. The Ministry of Power and BEE had prepared the implementation framework to upscale the efforts to create and sustain markets for energy efficiency. The Mission, over the next five years, is likely to achieve about 23 million ton oil-equivalent of fuel savings, in coal, gas, and petroleum products, along with an expected avoided capacity addition of over 19,000 MW. The carbon dioxide emission reduction is estimated to be 98.55 million ton annually. The implementation framework of the four initiatives of the NMEEE is as follows:

- a) Perform Achieve and Trade (PAT), which is a market-based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities through certification of energy savings that could be traded.
- b) Market Transformation for Energy Efficiency (MTEE) to accelerate the shift to energy-efficient appliances in designated sectors through innovative measures to make the products more affordable.
- c) Energy Efficiency Financing Platform (EEFP) to simulate necessary funding for ESCO based delivery mechanisms for energy efficiency.

- d) Framework for Energy Efficient Economic Development (FEED) to develop fiscal instruments to promote energy efficiency like the Partial Risk Guarantee Fund (PRGF) and Venture Capital Fund for Energy Efficiency (VCFEE).

Indicative Energy Balance and Energy Intensity Features

Out of the total annual primary commercial energy supply of 408.49 MTOE, 62.5% of total primary commercial energy is used in the form of coal, oil, gas for non-thermal power generation, etc., whereas 37.5% of total primary commercial energy is used for thermal power generation. Designated sectors (cement, iron and steel, paper and pulp, fertilizer, aluminium, textile, and chlor-alkali) except thermal power plant account for (122.26 MTOE) 29.9% of total primary commercial energy consumption.

Overview of Energy Intensive Sectors

Thermal Power Plants

Coal is expected to be mainstay of power generation for years to come. According to Central Electricity Authority (CEA), the all India installed capacity of thermal power plants as on January 2010 was 100,351 MW. Thermal capacity addition of 50,124 MW is expected during the XI plan period. The total thermal power generation was 558,815 MU and 5,889,915 MU in FY 2008 and FY 2009 respectively.

As per the Integrated Energy Policy Report (IEPR), prepared by the Planning Commission, GDP growth rate of 9% has been projected during the XI plan. Assuming the higher elasticity projected by the IEPR of around 1.0, thermal energy generation would be required to grow at 9.5% per annum during the XI plan period. For macro analysis, average station heat rate (SHR) is about 2,700 kCal /kWh.

Iron and Steel Sector

The iron and steel industry contributes about 2% to the GDP, and its weightage in the index of industrial production (IIP) is 6.20%. India has risen to be fifth largest crude steel producer in the world and the largest producer of sponge iron. However, the per capita consumption of steel in India is about 46 kg (2006) as compared to the global average of 150 kg and 400 kg in developed countries.

According to Ministry of Steel, Government of India, production of crude steel was 54 MMT in FY 2009.

Production of iron and steel industry is expected to grow at the rate of 7.3% over the future years. The average specific energy consumption in India for crude steel production is 33 GJ/ton (equivalent to 7.8 MKcal/ton).

Fertilizer Sector

India ranks third in the world, after China and USA, in the production and consumption of fertilizers. Nitrogenous, phosphatic, potassic, and complex fertilizers are the most widely used fertilizers. According to Department of Fertilizers, the total production of nitrogenous and phosphatic fertilizers during FY 2008 was 33 MT. The production from the Indian fertilizer industry is expected to grow at a rate of 5% in the future.

The share of energy consumption for ammonia production is the highest (about 80%) among variety of fertilizer products. The average specific energy consumption of the industry is 8.97 Mkcal/ton.

Paper and Pulp Sector

In India there are about 666 paper industries engaged in the manufacturing of pulp, paper, and paperboards. About 38% of the total paper production is based on recycled paper, 32% on wood, and the remaining 30% on agri-residue. The Indian pulp and paper industry is highly fragmented, with top five producers accounting for 25% of the total capacity.

The share of energy costs in the total manufacturing cost is close to 25%. Coal and electricity are two major energy sources used in paper production. Average specific energy consumption in Indian paper mills is very high. The average specific electrical and thermal energy consumption values for paper and pulp production in India are 1,600 kWh/ton and 5.4 Mkcal/ton, respectively.

Textile Sector

The Indian Textile industry contributes about 14% to the industrial production, 4% to the GDP, and 17% to the country's export earnings. The organized segment of the textile industry manufacturers 4% of the total fabrics produced in the country.

During FY 2008 the total production of cloth was 56,025 million m². The industry is expected to register an annual growth rate of 7%.

The textile industry is one of the most energy-intensive sectors with coal and FO as major sources for

process heating. The energy requirement for production of cloth is about 0.021GJ/m².

Cement Sector

With 148 large cement plants and a total installed capacity of around 231 million tons per annum (MMTPA) as of September 2009, the Indian Cement industry is the second largest in the world, accounting for about 6% of the world's production. In FY 2008, as per Cement Manufacturers Association (CMA), the cement production in India was 170 million metric tons (MMT).

During the eleventh plan period (2007–12), cement production is targeted to grow by 8% annually. The major energy source for cement production is coal, followed by electricity. For cement industry, energy cost accounts for as high as 40% to 45% of the total manufacturing cost. The average specific electrical and thermal energy consumption for cement plants in India is 98 kWh/ton and 0.76 MKcal/ ton of cement, respectively.

Aluminium Sector

India has the fifth largest reserves of bauxite, with deposits about 3.29 billion ton (5% of the world deposits). Total production of aluminium in FY 2008 was 1.2 MMT, which is expected to register an annual growth rate of 7%.

Aluminium production is electricity intensive. The current average specific energy consumption in the Indian aluminium industry is approximately 14.4 Mcal/ton, which is nearly two times that in the US, although significant reduction has been achieved over the years. Electricity cost forms about 40% of the total production cost, and hence energy efficiency continues to be a major area of focus for the Indian aluminium industry.

Chlor Alkali Sector

The Chlor Alkali industry mainly comprises of caustic soda, or sodium hydroxide, soda ash, or sodium carbonate, and chlorine manufacturing plants. Caustic soda is the main product of the industry, while chlorine and hydrochloric acid are treated as by-products. The total production of caustic soda in FY2008 was 2.2 MMT which is expected to increase to 2.7 MMT by FY2012 with an annual growth rate of 7%.

Majority of the caustic soda production is based on the membrane cell technology, as diaphragm cell and chemical process have become obsolete. The membrane

cell technology requires electricity in the range of 2500–2700 kWh/ton as compared to 2900–3200 kWh/ton required in the diaphragm technology and 3300–3700 kWh/ton required in the mercury cell technology. The average specific energy consumption by the chlor alkali industry is about 2.57 Mkal/ton of caustic soda

Energy Saving Margins in Energy Intensive Sectors

Indian average versus best practice values reflect the margins achievable as follows:

Table 1. Energy Saving Margins in Energy Intensive Sectors

Sectors	Average Specific consumption	
	Existing	Best Practice
TPP (Heat Rate)	2703.9	2432.2
Iron and Steel (kg OE/T)	788	600
Fertilizers (kg OE/T)	897	760
Paper and Pulp (kg OE/T)	678	505
Textiles (kg OE /Sq. M)	0.5	NA
Cement	84	70.6
Aluminium (kg OE/T)	1,440	1,100
Chlor Alkali (kg OE/T)	257	213

Overview of Savings Achieved During 2007–10

A recent NPC third-party verification study indicates achieved savings through various BEE initiatives during the first three years of the 11th five year plan period (2007–10) being 22.51 million TOE and cumulative avoided generation capacity being 4996 MW.

Accordingly, the financial savings amount to around Rs 100,000 crore, about Rs 66,000 crore by way of fuel savings at Rs 30,000 per TOE and Rs 40,000 crore by way of avoided capacity generation and transmission infrastructure at Rs 8 crore per MW for generating capacity and associated transmission capacity.

Conclusion

The first three years of the 11th plan have provided the right impetus to energy efficiency efforts spearheaded by BEE. The verified avoided capacity addition as a result of BEE initiatives have reached 5,000 MW, and is expected to exceed the targeted 5% reduction (10,000 MW) by 2012. NMEEE, replete with the first market-based energy efficiency tradable instrument, utility driven demand side

management, fiscal instruments, etc., will scale up this effort. The unprecedented success of the STAR rating program, the CDM-based CFL program, strong institutional structure with setting up of EESL and capacity building of state-designated agencies are pointers to ascendancy of energy efficiency in the policy landscape of India making the nation a global leader in demonstrating its efficacy.

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"We must adjust to changing times and still hold to unchanging principles."

— Jimmy Carter

Sustainable Development: Coal and Energy Sector

S. A. Khader

Coal and power sector by structure and style of its constitution & functioning (hitherto operating in the public sector environment) had been focusing on the social productivity & inclusive growth practices since its inception. However, renewed thrusts of the government in this area had made these enterprises to devote more efforts and resources for the community and regional development as well as eco-development. A few case-examples are illustrated in this article.

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Development and Indian Society

Advances in science and technology and, of late, in the management processes have made profound impact on the life of mankind. The technological revolutions continue to transform the work methods and processes and the quality of life. For instance, the number of mobile connections in India has crossed the half-billion mark signifying that every second person holds a cell-phone in this large country of over a billion people. On the other side, if Human Development Index (HDI) produced by the United Nations Development Program (UNDP) based on diverse social parameters as a direct measure of economic development and rate of progress, India is nowhere in the first 100 ranks out of more than 150 countries listed. Despite, currently, India is increasingly recognized as a prospective global economic power due to its impressive economic growth rate in this first decade of 21st century (ranging between 6% and 10%) and continuing to sustain it over 6% even during the days of global meltdown when many leading economies are either stagnant or experiencing negative growth. But, it also has around one fourth of its population below poverty line, possibly due to the dismal performance on the social development front and the inability to bring in better distribution of wealth amongst different sections of the society. On the socio-economic development front, India faces a number of hurdles emerging out of the historical factors such as ignorance of holistic development of the nation and regionalism, opportunistic policies and parochial outlooks, further aggravated by the stark imbalances in regional development. Further, the latest downturn has hit most of the underprivileged segments of the society, while the organized sector is relatively better protected through the government's support packages. Considering all this and also the need for increasing emancipation of the underprivileged segments of the society, it has become imperative on the part of the successive governments in the recent past to focus on issues of inclusive growth by

implementing a variety of programs and schemes to reach those below the poverty line, in terms of providing minimal wage employment, social and healthcare security, access to education and skill building to enhance employability, and investing in basic infrastructure to increase access to employment opportunities.

From the above discussion, one can argue that there are two dimensions to sustaining economic development and fostering societal harmony and tranquility—first, to maintain steady improvement in economic growth resulting in availability of affordable goods and services and other, to maintain societal harmony and tranquility by better distribution of wealth so that it minimizes disparities amongst different segments of the society and also minimize the disturbance to socio-cultural fabric of the society, so as all segments of the society live in harmony and peace. While recognizing that corporate world cannot be solely held fully responsible for the state of affairs (both for good and/or for bad), there is a lot that the business can do to address these issues of protecting the society from the ill-effects of uncontrolled growth and demonstration of wealth and prosperity. Possibly, it also has a lot to contribute to ameliorate the hardships of bottom of the pyramid classes by extending its helping hand in accelerating the processes and initiatives of government in the focused areas of inclusive growth; apart from taking on the direct roles of promoting the inclusive growth through its policies and programs of running their business. Industry too has been giving some attention to this aspect of socioeconomic development although in a small way in the form of social and religious philanthropy through the creation of foundations for serving the social causes. In fact, the very existence of business is to serve the society with goods and services, which implies by itself economic and societal development. It can become more inclusive if its policies and programs take care of the common man and the common man's affordability of its goods and services. Corporate are contributing through CSR, provision of employment for the less privileged ones, investment in skill enhancement of the work force particularly in rural areas. Further, business can also adversely impact through its policies, when they do not protect the local culture and tradition as well as the value system of the society and its diverse constituents in a pluralistic Indian society.

It is not out of place at this juncture to consider the kind of role energy sector comprising of coal and power companies can play in sustaining the much needed economic growth through making available affordable and reliable supply of power and energy resources to the

industry and other economic segments of the society, while attempting to ameliorate the hardships of hitherto neglected and underprivileged segments of the society in and around the project sites through their responsibilities as a corporate citizen both through philanthropy and also through people-friendly and societal-culture friendly policies and practices. The contribution of this sector in developing societal sustainability is of great significance owing to the reason that most of the project sites of coal and power sector are located in the remote and rural areas which are socially and economically backward. This article primarily focuses on the later role the sector can play and also its contribution in this regard.

Sustainable Growth and Productivity

Productivity growth is seen as a major means of economic progress and improvement in quality of life and also strengthening the competitive position. However, productivity is an evolutionary concept and as such it has become a matter of culture and tradition, in a sense a mindset of human resource to bring in continuous change and improvement. An attitude of mind to bring in continual improvement in all activities, that is, therefore, a *sine qua non* for productivity and it becomes a culture and a mind set, essential for any productivity improvement of quantifiable nature. Indian public sector is the first in installation of multi-tier union/employee participation and involvement with the enterprise management. PSUs are forerunners in all these aspects right through sixties to nineties and they still continue to give highest of attention to human resources with in it, apart from enhanced emphasis on corporate social responsibility (CSR) and corporate governance these days, except for a few private sector giants like Tatas. The public sector energy and coal sector enterprises too have not lagged behind; rather they were fore-runners in many such areas of humane approach to productivity and progress. Some of the important measurements of productivity are capacity utilization, inventory in relation to sales, and use of energy in the enterprise. In fact, global big player in this sector are in India—NTPC, Reliance, ONGC, Coal India. For sustaining continuous value addition and growth, an enterprise needs to fulfill the requirements of its customers and in turn satisfy the stakeholders and the society that surrounds it. It should focus on the following essential requirements:

- Customers – Best of Products and Services at Affordable Prices

- Employees – Best of satisfaction that they cherish and become responsible and proud members of the society, at the same time realize their hidden potentials.
- Shareholders – Reasonable returns, good image of corporate governance and a responsible corporate citizen.
- Suppliers – Reasonable compensation in time including support in development.
- Market/Competitors – Constructive and competitive cooperation (coopitation) to maintain market stability and growth.
- Public/Society (Government) – Conservation of resources, protection of environment, protection of culture and tradition and sustainability, demonstrating good social responsibility.

In other words, the entire policies and practices (internal environment in the enterprise) should lead the above results in a balanced and sustainable way to all its stakeholders. The emerging concept of Green Productivity (GP) primarily focuses on the triple bottom line aspects of productivity, that is, firstly, profitability for the investors and the customers and government; secondly, the environment and sustainable development (keeping the future generations in mind) for the society; and lastly, the social fairness in terms of equitable sharing the gains of development and growth with all the stakeholders of the enterprise. The regional body spearheading and catalyzing productivity movement in Asia-Pacific region, APO, has evolved this concept as the most practical concept relevant to Asian economic and societal environment. It is pursuing relentlessly the dissemination of these concepts, practices, and programs since early nineties. In this context, it is essential to recapitulate the basic foundations of our public sector and private enterprise development which includes major players from the energy and coal sector; where in the basic objective is to realize economic development through industrialization coupled with social justice and equity, as pointed out below:

1. to create employment opportunities
2. to secure balanced regional development
3. to promote redistribution of income and wealth
4. to provide and promote social services
5. to earn foreign exchange and incidentally,
6. to earn return on investment for generation of resources for development

Thus, the public sector was looked up as “A Model Employer” in totality, apart from creating an infrastructure which got the prime of positions globally such as the country with second largest pool of technical and scientific manpower, among the top ten industrial production countries, having acquired the unique capability of total self-reliance to manufacture products ranging from a small paper-pin to a supersonic jet domestically. It also acquired the dubious distinctions of having pampered the working class, frittering away of limited national resources in regional and equitable development and distribution in terms of giving much needed attention to weaker sections of the society (that is increasingly emphasized through inclusive development initiatives these days, first decade of 21st century)

Further, experience has shown that productivity of social systems and service sectors do not only affect the productivity of industrial sector but also quality of life of citizen in a significant manner. Environment enhancement, unemployment, poverty eradication, social justice, social welfare policies, education system, health system are some areas that should engage the attention of the government and the enterprise to be socially more relevant. The emerging approaches of 21st century primarily center around the concept of socioeconomic development and protecting the socio-cultural aspects of the society as a whole with sustainable development at its core, where in the issues like business ethics, societal contribution, and social productivity including CSR and corporate governance aspects of managing an enterprise take prominence. The productivity concept and improvement methodologies are focusing on safeguarding and improving the total environment, which integrates the man and his surroundings (society at large) as well as his future. Thus the concept of *sustainable productivity* has emerged and being practiced by the enterprise and governments world over.

Inclusive Development and Business

At its most basic, inclusive growth seeks to enhance social cohesion (and therefore stability), which in turn ensures there is a market for goods and services sold by a company in the longer term. While CSR efforts are usually undertaken with a view to increasing company legitimacy (that is, societal acceptance of a company's right to operate) or building brand equity (that is, public relations), inclusive growth focuses on identifying opportunities. Such opportunities can be on the demand side (that is, empowering consumers at the bottom of the pyramid by offering goods and services which cater to their unique

context and needs and affordability) or from the supply side (that is, building capabilities among the poor to ensure there is a talent pool from which companies will recruit in the future). The prime minister, Dr Manmohan Singh, in his address to industry leaders on the occasion of CII annual general meeting recently suggested a 10-point charter for industry to focus on inclusive growth as a part of its social responsibility and corporate governance:

- Healthy respect for workers and investment in their welfare.
- Corporate social responsibility.
- Employment to the less privileged.
- Resist excessive remuneration and discourage conspicuous consumption.
- Invest in people and in their skills.
- Desist from non-competitive behavior.
- Invest in environment-friendly technologies.
- Promote enterprise-innovation.
- Fight corruption at all levels.
- Promote socially responsible media and finance socially responsible advertising (maintaining the balance and tranquility in highly culture and tradition-ridden society).

However, business feels that wealth creation is the prime job of the business, while it is the responsibility of the government to bring in equitable distribution of wealth through its policies and programs. But, recognizing that business is a corporate citizen and has broader role as socioeconomic developer, a number of alliances between non-profit, non-governmental organizations (NGOs) and corporations as well as independent trust under the corporations have dramatically increased to support the governments resolve for inclusive growth. The NGOs and corporations, as part of the growing CSR movement, are forming strategic alliances at an unprecedented level. NGO–business partnerships are truly collaborative, with a jointly defined agenda that focuses on a clearly measurable goal of inclusive growth.

Sustainable Development and Coal and Energy Sector

Economic development (envisaged at 9% to 10% growth in annual GDP of India) primarily needs the most flexible

form of energy, be it for the industrial or agricultural production or enhancing the quality of life of the citizen in particular. These days, one speaks of energy security as a measure of sustaining the socioeconomic development and also ensuring that similar growth continues for the future generations as well. In the light of the earlier discussions in this article in particular the need for economic growth and also more importantly the inclusive growth for the hitherto underprivileged sections of the community, the pressures in the energy demand should be met adequately. But adequate attention need be given to ameliorate the adverse impacts of over exploitations of the energy resources, in particular the GHG and carbon foot print that makes on the society in general. Traditional power generation through the thermal route using fossil fuels such as coal and oil have their own impact on the carbon foot print apart from its depleting nature, threatening the very sustenance of development cycle in the years to come. In order to achieve energy security, most efforts are put in by the government and private sector agencies to bring in enhanced efficiency in the coal production and energy generation and its use and at the same time enhanced research to find alternative sources of energy including innovative approaches such as waste coal utilization, etc.

In contrast to the technical approaches as mentioned above, the business enterprises of power and coal sector have to look at the role they can play in tackling the societal and community level hardships as well as minimizing the impact it makes on the socio-cultural fabric of the country or the region where they do their business. Attempts should be to minimize the adverse impact of modern industrial-organizational functioning on the socio-cultural and traditional fabric of the society around. Further, a developing country of the size and complexity as India also has a variety of issues connected with the inclusive development of the society as whole. The power and coal sectors need to introspect as to how; it could lend a helping hand to the efforts of the government and the civil society in tackling the issues socio-cultural and socioeconomic sustainability. The contribution in this regard becomes increasingly relevant as it operates in remote and rural-cum-forest areas (which have difficult accessibility to the typical government and other machinery), where the need for such services are of utmost relevance and important. A few case examples are subsequently presented to illustrate the kind of initiatives and efforts by some of the enterprises from this sector.

Inclusive Growth Initiatives of Coal and Power Sector—Case Examples

Central Public Sector Enterprises (CPSE) generally have been giving the required attention to three areas as a part of their charter—community development, environment protection, and emancipation of neglected segments of the society, in addition to its core objective of making available the goods and services for direct economic development. These objectives are pursued with renewed vigor owing to the enhanced thrust of the government on inclusive growth. For instance, a PSU major has come up with philosophical statement as a responsible corporate citizen combining and integrating social responsibility with business objective, let us look at the case of NTPC as follows:

As a good corporate citizen, the company is committed to sound corporate practices based on conscience, openness, fairness, professionalism and accountability in building confidence of its various stakeholders in it, thereby paving the way for its long-term success.

This omnipotent and all encompassing and pervasive philosophical outlook of a typical power-major sets the tone for focusing on the requirements to its stakeholders, in particular the employees within the enterprise, the people and society/community around and also the shareholders and service providers as well as customers. When a commercial enterprise upholds the values of morality and ethics with respect to its operations/activities and actions, and it is committed to it, it is the pinnacle of its success and glory, because such a standing will never allow the enterprise to slip down, as evidenced by a number of global cases of “Built to Last” enterprises. To live up to a similar philosophical mooring, another public sector giant in energy sector namely ONGC, sets aside 0.75% of its net profits of the previous year towards socioeconomic development programs every year, while NTPC apportions 0.5% of its net profits for similar purposes. CSR is an article of faith for NTPC and is partnering in making Indian society more humane and just and has specific policies for addressing issues on Environment, Forestation, Community development, Resettlement and Rehabilitation and Human resource covering recruitment, recognition, gender equity, SC/ST, physically challenged people, education, health, post superannuating social, and safety.

NTPC

NTPC's community development initiatives focus on health, education, infrastructure, and skills development as well as livelihood. It had been extending support in setting-up polytechnics, improving the quality of education in ITIs, training of tribal women in the project areas for self-reliance and empowerment, etc. Extensive efforts are directed to enhance the employability of the village youth residing in the vicinity of projects and also employing them in the NTPC and its service providers. On health-support front, NTPC had been funding extensively to renowned medical centers nearby the project sites in developing modern facilities of diagnosis and treatment such as eye-centers, free medical facilities to the economically underprivileged, infrastructure development in hospitals of medical colleges. NTPC has the distinction of “Making Profit from Waste” by utilizing 23.7 million ton of ash accounting for 55.1% of total ash generation for productive use—manufacturing cement, concrete, ash-based products, etc., and construction of road-embankments, ash-dyke raising, mine filling, and land development. There would a number of such case examples from private sector too.

NHPC

NHPC, the premier hydropower utility in the country demonstrates its strong commitment to CSR and ethical behavior engrained in its mission that states:

To execute and operate projects in a cost-effective, environment-friendly and socioeconomic responsive manner.

It accomplishes this mission of socioeconomic response by bringing in best practices leading to smooth industrial relations, employee welfare, good corporate governance, and strong environmental commitment, which is the vital need in the project environment of massive hydropower plants. It has set apart large budgets in crore annually at each of the plants to provide thrust to a verity of programs adding value to the community, employees and the society at large. Some of the innovative activities are creation of herbal parks, bio-diversity conservations, catchments-area treatment, fisheries management, infrastructural developments (roads, bridges, etc.) thus empowering millions of rural poor through education, health care, etc.

With deep concern toward its environment of the project sites, NHPC took lead in conservation, recycling, preservation, beautification, etc., by way of afforestation,

re-use of wastes and creating recreational parks, etc. The initiatives include supply free fuel (Kerosene and LPG) facilities to construction workers to prohibit use of wood as fuel, re-use of waste-oils from the plant in painting, shuttering surfaces, etc. Spreading widely the message of "Green India – Clean India" and creating eco-clubs in the vicinity/colonies and in the rural areas and making profits out of green initiatives by planting fruit plants and flowers, developing herbal parks all over the project sites. NHPC, over the past three decades has been harnessing clean pollution free and inexhaustible power potential of the water to serve the country's multifarious power needs of its socioeconomic development.

Satluj Jal Vidyut Nigam Limited (SJVN)

This hydropower producing company has a major role to undertake resettlement and rehabilitation of the project affected people as is the usual case with any such environment impacting company like this. While, considerable portion of project funding includes the requirements for these social compulsions, SJVN spend about 2% to 3% of the current profits toward continuing to service the community around the project. Further, SJVN, in its ultimate analysis, is serving the social cause in a big way by embedding the CSR activities into its business processes and structure. Toward this, it adheres to the following dictum:

- 12% of the power produced free to the state of Himachal Pradesh.
- 100% of workmen are from Himachal.
- Taken 30% of Himachal electricity Board on the rolls of SJVN.
- 100% of petty contracts to local Himachalis.
- Eco-friendly environment, promoting education/literacy, health and social well-being of local people.

BPCL

BPCL pursues the following broad spectrum of initiatives towards addressing the developmental issues of the communities around its nation-wide presence as a long-term bonding and relations:

- Adoption of 37 villages in 13 states (health, education, and infrastructural development).
- Empowering women operating through NGOs.

- Vocational classes for realization of self-worth and supplemental incomes.
- Educational assistance to children from weaker sections.
- Aptitude test and career counseling in tribal areas.
- Ensuring full deployment of governments affirmative actions.
- Giving highest priority to environmental issues—bio-remediation methods of sludge, recycling of plastic pouches, reducing emissions and introduction of eco-friendly fuels.
- Construction of anti-sea erosion bund-walls.
- Enhancing infrastructure and medical facilities at hospitals in remote locations.

IOC

On the front of ushering in environment friendly hydrogen energy into the country, IOC initiated extensive research at its world-class R&D center. Green technologies such as IndMax process for refinery residue upgradation and revamp applications; IndeTreat and IndeSweet process technologies for LPG/Naphtha/Kerosene fractions sweetening, etc., have been developed. As a responsible corporate citizen and a conscientious employer, IOC implements and takes appropriate protective measures to identify, evaluate and control health risks related to its operations that potentially affect its employees, contractors or the public. All these lead to enhanced sustainability efforts as the contribution of the energy sector enterprises are making in the current context.

MRPL

As its social obligation, Mangalore Refineries and Petrochemicals Ltd. (MRPL) had been serving the local community through an initiative known as "Samrakshan." For instance, it provided drinking water projects, state-of-the-art medical equipment, water purifiers in hospitals, construction of *angan-wadi* buildings along with supply of scientific teaching aids, scholarships to students, in the rehabilitation colonies adapted and development of parks in the cities during 2007–08. In addition, MRPL has a practice of donating latest equipment in diagnostic and preventive medicine to renowned medical centers in the project area. These include for instance; lasers, dialysis machines, pediatric endoscope-units, obstetrics

and gynecological equipments, supply of free artificial limbs and free-distribution of spectacles to poor and deserving. All these are possible, as a result of excellent performance of the factory and generation of adequate profit to provide for 12% dividend and also keep considerable reserves and at the same time share the profits for the social causes such as the above. All these lead to inspired workforce, to take the plant to 130% capacity utilization and also the unique distinction of the lowest specific energy consumption among all Indian refineries with similar complexity.

NLC

Toward protection of environment and ecology, Neyveli Lignite Corporation (NLC) another giant in the coal and power sector, has three key strategies pursued very successfully are (i) Selection of appropriate technology (ii) implementation of timely mitigation measures and (iii) continuous monitoring of environmental parameters taken at every stage of the project implementation. NLCs case is a typical one illustrating the axiom "Pollution Prevention Pays" and "Waste Elimination means higher Profits." The typical innovative interventions pursued by NLC are:

- The mined out areas are scientifically and systematically developed to bring back to the original cultivable condition, developing bio-fertilizers consisting of humic acid extracted from lignite, a plant-growth stimulant
- The reclaimed area is put under integrated farming an innovative concept where in initially commercial crops, agricultural crops, silvi-pasture and grass species are grown followed by induction of animal components like cattle, birds, fish, goat etc. this had been giving good and continuous returns to the farmers
- Outside spoil-dumps are reformed into green surface by properly forming benches, irrigation facilities by harvesting rain water and forming of artificial lakes serving as natural habitat for migratory birds etc. All this has resulted in developing the mine areas as picturesque and attractive to the public and employees as picnic spot, when the project area is developed to have mini-zoo, aquarium, boating facilities and creation of a nursery, etc.

- Air pollution in the open-cast mining area is controlled by water spraying on the haul-roads and development of green belt around the roads and storage bunkers; in addition to using latest technologies in blasting that reduce vibration and impact on the surrounding structures.
- The treated water from the ETPs is used for raising the green belts in the mine areas. The storm water is harvested and treated and supplied to the colony and the nearby villages for agricultural purposes enabling three crops and enhancing the yield per hectare.
- To control the environmental impact of the thermal power plants, modern and state-of-the-art measures are put in place; such as circulating fluidized bed combustion (CFBC) to reduce SO_x, NO_x emissions, installation of 99% efficient ESPs, modern fly-ash collection systems, utilizing the fly-ash in producing building materials, dust-extraction and dust-suppression systems and developing green belts around the plants for absorption of dusts as well as using such belts for crops like cereals, pulses, oilseeds, flower crops and vegetable crops etc.
- Massive afforestation program in the vast residential complex has made the physical environment not only attractive but the ambience and climate control too is accomplished.
- The modern initiatives of rain-water harvesting in the colony, effective operation sewage treatment plant and a modern garbage disposal plant ensuring their dual objectives has proved that there is profit in taking care of the waste and "Pollution Prevention Pays", contrary to the widely held feeling that pollution control is a cost.

NLC continues to put its best efforts to harness the technology and innovations for the betterment of mankind in a true sense, living up to its commitment in this regard. NLC still continues to focus on these aspects of its social responsibility by spending Rs 25 crore annually to maintain and upgrade various control measures and other initiatives.

Western Coalfields Limited (WCL)

Coal mining is one industry; there are statutory requirements of CSR type responsibilities towards employees and also mining affected families and the community and peripheral development. The mission of Coal India Limited (CIL) broadens this requirement in a professional way by integrating even the sustainable development facet of the surroundings and also the society/community outlined as follows:

To Produce and market planned quality of coal efficiently, economically with due regard to safety, conservation, environment, welfare, customer satisfaction and optimal resource utilization to become self-supporting for sustainable growth.

The annual budget of WCL has distinct component towards welfare activities including community and peripheral development, where in the projects/activities are finalized by the welfare board and implemented by welfare committees in the area levels. The expenditure towards the CSR activities has been ranging from 5.9% to 6.2% of the net profits during the three years 2004–07. The coal companies bring out an annual CSR report for submission to CIL and also the government.

SECL

South-Eastern Coalfields Ltd (SECL) a mini-ratna subsidiary of CIL has her CSR policy adapted from the guidelines provided by CIL in the area of community development to cover three components target groups – Special Component Plan (SCP) and Tribal Sub-Plan (TSP), besides for general population. The seriousness is demonstrated by earmarking a fund equal to that of one rupee per ton of coal extracted from the mines and even the loss making components of CIL are provided funds according to same basis of the tonnage provided by the corporate office, that is, CIL. The target peripheral area extends up to 8 km around the mine, which, however, could be got extended through the approval of the corporate office.

The structure of programs includes creation of community assets, skill development and capacity building for income generation, enhancing literacy and health and environment awareness activities including village adoption. During 2007–08, it has earmarked about 9 crore for these activities, pursued in consultation with the community representatives and employees participation. SCCL attracts the local

community through its innovative program titled “SECL Rath Aap Ke Dwar”.

ONGC

ONGC has a very well-structured system to identify the societal and community needs for extending its well-conceptualized and delivered community development services and it follows its firm belief in corporate citizenship philosophy having the following policy:

ONGC Group Companies, as responsible corporate citizens, shall promote Education, Healthcare and Entrepreneurship in the community and support Water Management and Disaster Relief in the country.

It spends about 0.75% of its net profits of the previous year for community development, which itself amounted to Rs 108 crore for the year 2006–07 and out of which 40% is spent around the project locations and the remaining for the national level concerns. Some of the notable programs/projects are:

- ONGC PURA Trust Providing Urban amenities to Rural Areas
- ONGC Annual Component Plan for SC and ST
- SAHARA – A Helping Hand to the Destitute
- SWAVAVLAMBAN – Reach Where Needed
- SWAJALDHARA – Water Management in Andhra Pradesh
- Establishing a Coir Industry (Kurunji Women Self Help Group)
- ALISA WASHER - ONGC Fight against Child Mortality
- Recreating Lost Heritage – Chandheri
- Life Care Society – Reach the Poorest of the Poor
- Cachar Cancer Hospital and research center
- NANHI KALI – Girl Child Empowerment
- Special Children and Youth – Nature Study cum Adventure Camp
- Burn cum emergency Ward at Kumbhakonam

Conclusion

Coal and power sector in general by structure and style of its constitution and functioning had been focusing on the inclusive growth concepts and practices since inception. However, renewed thrusts of the government in this area had made these enterprises to devote more efforts and resources for the community and regional development as well as strengthening the focused efforts of the local

and state governments in this regard. However, its primary responsibility of enhancing energy security for sustaining the faster economic development is also not lost sight off and one feels reassured of the same when one hears about the forays the enterprises are making in enhancing the productivity and performance of the existing capacities and also augmenting the same through global acquisitions and joint-ventures with in and outside the country.

"The fundamental principles of ecology govern our lives wherever we live, and ... we must wake up to this fact or be lost."

— Karin Sheldon, *environmental lawyer* [1973]

Development & Production of Eco-Friendly Humic Acid from Neyveli Lignite for Sustainable Agriculture

R. Kandasamy, B.Sivagnanam, S.Santhanam, and V. Manoharan

Since majority of the population in India works in the agricultural sector, in order to improve the soil condition, humic acid application is an effective way to give a promising yield, resulting in an increase in productivity, so as to fulfill the growing population needs. Moreover the lignite available in India is the major source for the production of humic acid in future. The article focuses on Neyveli Lignite Corporation (NLC) Ltd, a Government of India enterprise that has a sustained growth and thus its contribution to India's social and economic development is significant.

Neyveli Lignite Corporation (NLC) Ltd, is the Mini Ratna, Government of India Enterprise. Presently, NLC has three opencast mines with an annual capacity of 24 million ton of lignite and three pit head thermal power stations with 2,490 MW capacity mines at Neyveli and 2.1 million ton capacity mines and 250 MW capacity thermal power station at Rajasthan. NLC's growth is sustained and its contribution to India's social and economic development is significant.

Centre for Applied Research & Development (CARD) is the in-house R&D centre of Neyveli Lignite Corporation Limited, a Mini ratna Government of India enterprise. This R&D Centre has been recognized by Department of Science & Technology since 1975. CARD is implementing various R&D projects on lignite utilization, diversification, product development, by-product utilization, solid waste utilization, wasteland reclamation, environmental monitoring, etc., funded by Ministry of Coal S&T and In-house scheme in association with various reputed institutions. Based on the R&D works, some of the processes have been scaled up to pilot plant scale like extraction of humic acid (HA) from lignite, etc.

Humic acids are complex organic molecules formed by the breakdown of organic matter in soil. They are the main fraction, the biological center, of natural humic matter. It is the collective term for humic acid and fulvic acid. Humic matter is formed through the chemical and biological humification of plant and animal matter and through the biological activities of microorganisms. Humic acids are an excellent natural and organic way to provide plants and soil with a concentrated dose of essential nutrients, vitamins, and trace elements. They are complex molecules that exist naturally in soil, peats, oceans, and

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fresh water. The best sources of humic acids are the sedimentation layers of soft brown coal, which are referred to as lignite. Lignite is organic matter, which has not reached the state of coal and differs from soft brown coal by its high oxidation degree, a result of the process of coal formation (bog>peat>coal), and high humic acids content as well as higher carboxyl groups.

The most important feature of humic acids is their ability of binding ions which produces biochemical reactions known as chelation. This makes the nutrients more readily available to the plants for the proper growing process. As a result, humic acids produce three types of effects on soil and plant—they physically modify the structure of soil, chemically change the fixation properties of the soil, and biologically stimulate the plant and the activities of microorganisms.

Countries like USA, Germany, Australia, Greece, Japan, and China are also producing humic acid-based product using oxidized low-rank coal (lignite, Leonardite, peat, etc.). The content of humic acid is more than 80% in oxidized low-rank coals. The sodium, potassium, and ammonium salts of humic acids derived through alkaline extraction are referred to as humates. Potassium humates are used extensively in agriculture. Only potassium humates are approved for organic agriculture by Organic Materials Review Institute (OMRI), USA.

Humic acid is naturally occurring organic substance found more in forest soil and rich in oxidized low rank coal, lignite, peat, etc., has major constituent of carbon and oxygen, about 90%. It increases water retention, retains nutrients, and enhances microbiological activity enzymes in soil. On bio-degradation, organic matter gets converted into humus, which contains humic and fulvic substances. The humic substance contains various functional groups of carboxylic, carbonyl, phenolic, alcoholic with higher molecular weight and higher cation exchange capacity. Neyveli lignite contains about 55–60% of humic acid. NLC's R&D department CARD has developed a process for extraction of humic acid from Neyveli Lignite and has erected a pilot plant with a capacity of 720,000 liter per annum for the production. For this process a patent has been obtained (Patent Number: 201577) and a MoU has been signed between NLC & NRDC, New Delhi to commercialize the technology. In this way the technology is made available now to many entrepreneurs for producing more humic acid in India. A model humic acid pilot plant developed was dedicated to our nation by Shri Sriprakash Jaiswal,

Honorable Minister for Coal, GOI, on 6 April 2010. This will in turn help to introduce humic acid in India and also help the farmers to a greater extent to increase the food production by sustainable agricultural methods. On appreciating in the development of innovative eco-friendly product from Neyveli lignite the world Environment Foundation has presented Golden Peacock eco-innovation award for the year 2008 to NLC. The Fertilizer Association of India (FAI) has recognized the contribution and appreciated the research, published the R&D findings of humic acid—an innovative product rich in organic nutrient" in the year 1999–2000.

Humic acid is extracted from lignite in the form of potassium humate. The liquid product contains about 2–4% of humic acid. It also has plant nutrients such as nitrogen, potassium, calcium, sulphur, manganese, iron, molybdenum, copper, zinc, magnesium, and boron. It has the properties of pH: 8.0–9.5, CEC: 100–130 meq/100g, total potassium: 7.64%, carbon and oxygen: 90–95%, nitrogen and hydrogen: 3–5%. It is an organic water-soluble humic substance. It is a good plant growth stimulant acting on soil and plants. It improves soil physical property, ion exchange capacity, water holding capacity, drought tolerance ability, plant protection from physical/soil stress and increases soil microorganisms, biological activity. This also prevents loss of nutrients from soil and acts as a storehouse by keeping plant nutrients in soil. It increases crop growth and yield, soil fertility status and reduces use of chemical fertilizers.

Applications

This is highly suitable for all kinds of crops, soil application and it is compatible to all methods of usage. The following methods of application are found to be highly beneficial to crops.

Soil Application

Liquid potassium humate may be applied 45 ml/M² area before planting/sowing/during irrigation. For aged grown-up trees, the dosage can be increased to about 50 ml per tree. Solid potassium humate may be applied at 10 kg/ha for all crops.

Foliar Spray

Dilute 1 liter of liquid in 30 liter of water, then spray on all crops before flowering ornamental plants and grass lawn, once in 30 days in the morning or evening for better results. This may be combined with fertilizer spray.

Fertigation

Twenty-five liters of liquid potassium humate (concentrated 2–4%) per acre through fertigation once in a month until completion of crop duration.

Other Uses

It can be used in algae, mushrooms, bio-fertilizer, vermi compost, compost production, etc.

Uses

For best results, this can be sprayed on ornamental plants, grass lawns, cereals, pulses, oil seeds, vegetables and commercial crops, trees, orchards, green house crops, nurseries in the soil before planting and foliar spray in two/three stages on plants before flowering.

Product Field Testing

The product was developed by CARD at Pilot Plant and used in field trials on different crops and soil conditions. It was tested in some of the major places in association with Tamil Nadu Agricultural University and the results were

Table 1. Field Trials Using Liquid Humic Acid (2–4 % concentrated) as Foliar Spray

S. No	Place	Crop	Yield increase
1	Kallakuruchi	Paddy (ADT-36)	150 kg
2	Coimbatore	Green gram (VBN-GG-2)	136 kg
3	Pollachi	G.Nut (JL-24)	100 kg
4	Attur	Sugarcane (CoV 92102)	16 ton
5	Coimbatore	Onion (Co-4)	350 kg
6	Coimbatore	Cotton (MCU-12)	300 kg

Note: 0.1% foliar spray used

Table 2. Cost benefit Analysis on Solid Humic Acid Application to Crops

Test crop	Highest yield achieved using solid humic acid	% increase over control	Increased Yield Achieved	Approx. unit price	Gain Rs./ha on using HA
Rice	6808 kg/ha	23.8	1308 kg/ha	Rs. 3.5/kg	4,578
Ground nut	1967 kg/ha	48.5	342 kg/ha	Rs. 25.0/kg	16,050
Sugarcane	138 t/ha	34.0	35 t/ha	Rs. 1000/ton	30,000
Black gram	985 kg/ha	33.1	245 kg/ha	Rs. 15.0/kg	3,675
Green Gram	1496 kg/ha	41.3	438 kg/ha	Rs. 15.0/kg	6,570

very encouraging. Particularly foliar spray at 0.1% is also highly beneficial to crops. Studies were made by TNAU in crops like sugarcane, cotton, rice, maize, groundnut, pulses, tomato, tea, etc. The result indicates increase of yield varying from 10 to 30% apart from other benefits. Table 1 shows the yield increase of the field trial conducted using liquid humic acid in association with TNAU. CARD has produced about 5,44,000 liters of potassium humate and supplied on sales to various crops users and introduced in Indian agriculture since 2003. All the users have reported that there is a good response in crops and achieved bumper yields besides good quality of product with improved soil conditions.

Economic Benefits of Humic Acids

Humic acids chelate nutrient compounds, especially iron, in the soil to a form suitable for plant utilization. Thus, the nutrient supply to plants is optimized. High increases up to 50% in yield, accompanied by a reduction up to 30% in the use of fertilizers and pesticides, as well as better and healthier growth of green grass, ornamentals, agricultural crops, and woods can be attained with the regular application of first-quality humic acids. Furthermore, water holding capacity of soils is increased considerably, which means that the use of water can be reduced substantially. Best economic results can be obtained in light and sandy soils poor in humus as well as on recultivation fields. The diverse positive impacts of humic acids are to be observed particularly in such soils. This is true for almost all soils in dry and warm regions. As a result of the high mineralization rate of organic substances, providing these soils with stable humic acids is indispensable for the maintenance and improvement of soil fertility. Tests have shown that humic acids benefit all types of agricultural crops and horticultural plants. Humic acids are organic and free of any harmful substances. They will not contaminate groundwater or soil and are environmentally safe. On the

contrary, humic acids reduce the availability of toxic substances in the soil, prevent that nitrate and pesticides mix in with ground water and decrease the use of fertilizers. They also reduce the over-salination problem in the application of water-soluble mineral fertilizers and are an effective means in erosion control. Table 2 shows the cost-benefit analysis of the field trial conducted using humic acid in association with TNAU.

Scope of Humic Acid in India

During the field experiment in association with TNAU, Coimbatore, crops like paddy, sugarcane, cotton, groundnut, pulses, and maize were tested with humic acid application. These crops occupy 30.97%, 2.83%, 6.45%, 5.26%, 16.54%, and 4.22% of the total cultivable area of 144 million hectare, respectively. Tested crops like pulses, groundnut, and cotton responded well to humic acid application and more than 20% of yield increase was reported. In the case of pulses, it is cultivated in about 23.82 million ha area and producing 14.81 million ton grains. Due to low production/large demand 0.312 million ton is being imported. On applying humic acid it is quite possible to increase an additional yield of 2.95 million ton of pulses worth of Rs 282.90 crore. This also saves up to 25% of nitrogenous and phosphatic fertilizers, which is worth of about Rs 70.70 crore, the soil application @ 20 kg/ha or foliar spray (0.1%) is very promising to increase yield

which may need about. to 476,000 and 12,000 ton of humic acid, respectively to our country for pulse crop alone.

Other than fuel, diversification of lignite utilization for the production of humic acid—a more valuable product—has lot of market potential in India and abroad. One kilogram raw lignite worth Rs 2 value yield becomes a product worth of Rs 100 to Rs 250 after processing. The lignite requirement is also very low when compared to the need of the power production. To meet the demand, production industries are needed. New industries can be set up, wherever lignite deposits occurs namely Rajasthan, Gujarat, and Tamil Nadu state, they may go for the manufacture of this product.

The English newspaper *The Hindu* issue dated 12 March 2009 highlighted the farmer's response on humic acid application to watermelon crop. The farmer informed that he can be able to get 2 ton more yield/acre on using humic acid and the fruit quality is also improved.

Conclusion

India is a big agricultural country where to improve the soil condition by sustainable practices the humic acid application gives promising yield increase to achieve higher productivity to fulfill the growing population needs. The lignite available in India is the major source for the production of humic acid in future. It is an eco-friendly product for sustainable agriculture.

"Do not wait for extraordinary circumstances to do good action; try to use ordinary situations."

— Jean Paul Richter

Municipal Solid Waste Management in India

M. Balasubramanian and V. Dhulasi Birundha

Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies revealed that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and environment. This article discusses the present status of municipal solid waste management and problems in India. It is also policy implication about improving waste management services.

Introduction

Economic, as well as social development has strong links with the environment and with sustainability. Without proper planning, design, and management, development activities result in considerable generation of waste and other environmentally objectionable materials. Rapid industrialization and population explosion in India has led to the migration of people from villages to cities, which generate thousands of tons of municipal solid waste daily. Generation of municipal solid waste (MSW) in India has increased significantly in the past few decades. Between 1991 and 2001, MSW generation in urban India increased from 23.86 million ton/year to more than 39 million ton/year (Sharholi et al., 2007). In per capita, the growth of MSW in Indian cities has been estimated to be 1–1.33%, and within next two decades, the annual waste generation is estimated to increase more than five times that of the present level (Singhal and Pandey, 2001).

The state of an economy, to a large extent, influences waste generation and municipal solid waste in particular. In developing countries, even though the per capita waste generation is low at 300g, changes in living conditions and the influence of western 'throw away' culture results in increased solid waste generation, leading not only to environmental degradation but also a huge loss of natural resources. Improper disposal of this waste leads to the spread of communicable diseases, causes obnoxious conditions, and spoils the biosphere as a whole. On the other hand, cleanliness is another factor that influences the development of any nation that is otherwise hampered owing to improper disposal of solid waste (Yedla and Parikh, 2001).

Current Problems

Poor collection and inadequate transportation are responsible for the accumulation of MSW at every nook and corner. The management of MSW is going through a critical phase, due to the unavailability of suitable facilities

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to treat and dispose of the larger amount of MSW generated daily in metropolitan cities. Unscientific disposal causes an adverse impact on all components of the environment and health (Gupta et al., 1998; Jha et al., 2003; Kansal, 2002; Kansal et al. 1998; Rathi, 2006; Ray et al., 2005; Sharholly and Mahmood, 2005; Singh and Singh, 1998). Due to the inadequate transport capacity and deficient workforce, collection efficiency in Indian cities has been in the range of 70–73% (Gupta, 1998; Nema, 2004). On an average, one-third of the total waste remains uncollected even though the municipal bodies allocate 85–90% of their total budget for collection and transportation activities (Sharholly et al., 2008). The uncollected waste mostly comprises of organic substance and in some cases human and animal excreta. It may also contain hazardous waste like industrial and medical waste. The uncollected garbage is often dumped indiscriminately resulting in clogged drains and sewage that serves as a breeding ground for rodent vectors and insects leading to spread of diseases (Zhu et al., 2009).

The predominant mode of disposal has been open dumping (94%), and only 5% of the total waste is taken for composing (CPCB, 2000). The dumping fields are mostly open grounds without any seepage proof lining for leachate collection involving huge risk of ground water contamination. In fact, analysis of physicochemical characteristics of groundwater samples from tube wells and bore wells near dumping sites in some major Indian cities have shown substantial concentration of heavy metals and chemicals in excess of permissible limits (Kumar et al., 2009). This becomes increasingly expensive and complex due to the continuous and unplanned growth of urban centers. The difficulties in providing the desired level of public service in the urban centers are often attributed to the poor financial status of the managing municipal corporation (Mor et al., 2006; Raje et al., 2001; Ahsan, 1999).

Solid waste management has been the most neglected area of urban development over the years and has accounted for severe health problems in urban areas all over the country. A number of cases have come to light because of mismanagement of municipal solid waste management. The devastating pneumonic plague in Surat, Gujarat, in September 1994 is a true example of how uncontrolled garbage led to the out break of the disease (Taori and Saxena, 2006). Huge expenditure on solid waste disposal with very poor efficiency, pollution due to the

burning of waste, local as well as global air pollution due to the uncollected and poorly disposed waste and dirty streets and cities fails to attract foreign investment and markets (Yedla and Parikh, 2001).

Present Status of MSW System in India

There are many categories of MSW such as food waste, rubbish, commercial waste, institutional waste, street sweeping waste, industrial waste, construction and demolition waste, and sanitation waste. MSW contains recyclables (paper, plastic, glass, metals, etc.), toxic substances (paints, pesticides, used batteries, medicines), compostable organic matter (fruit and vegetable peels, food waste) and soiled waste (blood stained cotton, sanitary napkins, disposable syringes) (Jha et al., 2003; Khan, 1994; Reddy and Galab, 1998). Presently, about 90 million ton of solid waste is generated annually as byproducts of industrial, mining, municipal, agricultural and other processes. It is also estimated that the total MSW generated by 217 million people living in urban areas was 23.86 million ton/year in 1991, and more than 39 million ton in 2001. Table 1 summarizes the waste generation and per capita as well as total waste generation in countries of different income levels. The quantity of MSW

Table 1. Waste Generation Per Capita and Total Waste Generation

	Waste generation rate per/ day	Total waste generation million/ton/year
Low income countries	1.3	569
Middle income countries	1.8	986
High income countries	3.1	566

Source: Cointreau (2008)

generated (CPCB, 2000) is shown in Table 2 and physical composition of Indian metro cities is given in detail in Table 3.

Storage of MSW

In India, in most of the cities, residents collect waste in plastic buckets and deposit it regularly in community bins located near the house. In some areas, the waste is collected from individual houses by corporate staff. Street sweeping are also collected in community bins. There are no separate bins exclusively for collection of waste paper, plastic, etc.

Table 2. Municipal Solid Waste Generation Rates in Different States in India

S.No.	Name of the State	No of Cities	Municipal population	Municipal solid waste ton/day	Per Capita generated
1	Andhra Pradesh	32	10,845,907	3,943	0.364
2	Assam	4	878,310	196	0.223
3	Bihar	17	5,278,361	1,479	0.28
4	Gujarat	21	8,443,962	3,805	0.451
5	Haryana	12	2,254,353	623	0.276
6	Himachal Pradesh	1	82,054	35	0.427
7	Karnataka	21	8,283,498	3,118	0.376
8	Kerala	146	3,107,358	1,220	0.393
9	Madhya Pradesh	23	7,225,833	2,286	0.316
10	Maharashtra	27	22,727,186	8,589	0.378
11	Munipur	1	198,535	40	0.201
12	Meghalaya	1	223,366	35	0.157
13	Mizoram	1	155,240	46	0.296
14	Orissa	7	1,766,021	646	0.366
15	Punjab	10	3,209,903	1,001	0.312
16	Rajasthan	14	4,979,301	1,768	0.355
17	Tamil Nadu	25	10,745,773	5,021	0.467
18	Tripura	1	157,358	33	0.21
19	Uttar Pradesh	41	14,480,479	5,515	0.381
20	West Bengal	23	13,943,445	4,475	0.321
21	Chandigarh	1	504,094	200	0.397
22	Delhi	1	8,419,084	4,000	0.475
23	Pondicherry	1	203,065	60	0.295
	Total	229	128,113,865	48,134	0.376

Source: Status of MSW generation, collection, treatment, and disposal in class-I cities (CPCB, 2000)

Collection and Transportation of MSW

The community bin collection system is adopted in most of the cities. In a few cities, the waste generated from various sources such as residential, street sweeping, garden, parks, office, and shopping complexes is collected separately. Waste from slaughter houses and hospitals are mixed with the MSW at the storage bins. A number of open collection spots exist in many cities and these cause poor sanitary conditions and pose health hazardous to the workers and near by population (Gupta, 1998).

Segregation of Waste

Segregation of recyclable (that is, paper, cardboard and plastics) by rag pickers was observed to be practiced in 22 cities, rag pickers were not observed in cities like Kolkata, Chennai, Surat, Kanpur, Coimbatore, Kochi,

Visakhapattanam and Panjim. In a few cities NGOs were observed to be involved in the collection of waste through the services of rag pickers. Proper segregation of waste would lead to better options and opportunities for its scientific disposal (Singhal and Pandey, 2000).

Processing of Wastes

In metropolitan cities like Bangalore, Hyderabad, Ahmedabad and Kolkata (13 cities total) compost plants have been established and commissioned by private agencies. The plants have installed capacity in the range of 40–700 ton/day. However, the plants in operation are underutilized for various reasons' the major reason is the poor quality of compost resulting in reduced demand from the end users. Although as per the MSW Handling Rules, 2,000 are under schedule installation and commissioning

Table 3. Physical Characteristics of MSW in Indian Metro Cities

Physical Composition								
City	Total Compo- stable waste	Paper	Plastic	Glass	Metal	Inert materials	Rubber and leather	Rags
Bangalore	51.84	11.58	9.72	0.78	0.35	17.34	1.14	2.29
Ahmadabad	40.81	5.28	5.29	0.79	0.3	39.28	0.92	5.00
Nagpur	47.41	6.87	7.45	0.92	0.29	18.01	5.38	9.48
Lucknow	47.41	6.87	7.45	0.92	0.29	18.01	5.38	9.48
Indore	48.97	6.1	5.77	0.55	0.15	31.02	2.95	2.41
Bhopal	52.44	9.01	12.38	0.55	0.39	18.88	0.09	2.65
Agra	46.38	6.12	8.72	0.85	0.11	30.07	1.97	3.92
Vadodara	47.43	5.98	7.58	0.47	0.47	27.8	1.28	4.86
Ludhiana	49.8	9.65	8.27	1.03	0.37	17.57	1.01	11.5
Patna	51.96	4.78	4.14	2	1.66	25.47	1.17	4.17
Jabalpur	48.07	7.67	8.3	0.35	0.29	26.6	2.15	4.42
Ranchi	51.49	3.17	3.45	1.79	1.45	25.92	1.45	4.97
Bhuwaneswar	49.81	5.74	5.7	0.46	0.79	27.15	2.1	3.21
Nashik	39.52	9.69	12.58	1.3	1.54	27.12	1.11	2.53
Raipur	51.4	8.31	7.07	0.76	0.16	16.97	1.47	3.9
Allahabad	35.49	7.27	10.33	1.23	0.4	31.01	1.83	7.34
Faridabad	42.06	8.57	13.73	0.83	0.18	26.52	2.52	4.14
Visakhapatnam	45.96	14.46	9.24	0.35	0.15	20.77	0.47	2.41
Meerut	54.54	4.95	54.48	0.3	0.24	27.3	0.49	4.98
Asansol	50.33	10.66	2.78	0.77	0	25.49	0.48	3.05
Dehradun	51.34	9.56	8.58	1.4	0.03	22.89	0.23	5.6
Guwahati	53.69	11.63	10.04	1.3	0.31	17.66	0.16	2.18
Jameshpur	43.36	10.24	5.27	0.06	0.13	30.93	2.51	2.99
Dhandabad	46.95	7.2	5.56	1.79	1.62	26.93	2.77	4.41
Gandhinagar	34.3	5.6	6.4	0.8	0.4	36.5	3.7	5.3
Daman	29.6	10.54	8.92	2.15	0.41	34.8	2.6	4.9
Agartala	58.87	8.11	4.43	0.98	0.16	20.57	0.76	2.17
Kohima	57.48	12.28	6.8	2.32	1.26	15.97	0.18	1.86

Source: Status of MSW generation, collection, treatment, and disposal in class-I cities (CPCB, 2000).

of processing plants, the desired success is yet to be achieved due to non-availability of any proven technologies for Indian wastes and conditions many municipal bodies have applied to state pollution control boards for authorization for installation of compost plants.

Disposal of Waste

MSW is normally disposed of in an open dump in many Indian cities and towns, which is not a proper method of

disposal because open dumps pose environmental hazards which cause ecological imbalances with respect to land, water, and air pollution (Kansal, 2002). More than 90% of MSW in India is directly disposed of on the land in an unsatisfactory manner (Das et al., 1988).

Overall, it was observed that the land filling of MSW has an adverse impact on groundwater quality. However, to confirm this and to future assess the magnitude of impact, detailed investigations are required that

consider various aspects related to the landfills and ground water.

The analysis of waste processing initiatives in India support the need to develop integrated waste management plants for all major urban centers in India. Proper segregation of waste into different components and their separate collection can definitely lead to remarkable changes in the better options and opportunities for scientific processing and disposal of waste. This world is a long-drawn exercise as it involves attitudinal changes in people and will have to be alone will careful planning in a phased manner. To start with, the municipalities must change their own habits and immediately practice the discipline of collecting inerts (readout, drain silt, debris) in a separate trip from garbage. Appropriate provisions should be made for the ultimate disposal/utilization of the by products/residues from the waste processing facilities (Josph, 2006).

It is also to be noted that the municipal authorities often do not have properly trained personnel for managing the waste processing activity. This has often resulted in failure of the latest equipment and facilities that were introduced in the past. It has also resulted in improper designs being taken by persons who did not have necessary expertise. It is hence necessary that suitably trained manpower be deployed which will ensure section and optimal utilization of various equipments, vehicles and process. Private participation may help to address this issue to a greater extent, provided the contracts are drawn and executed with commitment.

Suggestion and Policy Implication

Need for an Integrated Waste Management Approach

In order to handle growing volumes of waste, proper policies need to be enacted and implemented. In the developed world, the approach to waste management is regarded as the most compatible with an environmentally sustainable development is called 'integrated waste management'. This approach consists of a hierarchical and coordinated set of actions that reduces pollution, seeks to maximize recovery of reusable and recyclable materials, and protects human health and the environment. Integrated waste management aims to be socially desirable, economically viable, and environmentally sound. The integrated waste management approach, however, should be adapted to the local conditions when implemented in third world cities.

Integrated waste management comprises waste prevention, re-use, recycling, composting, incineration, and sanitary landfilling.

Waste Prevention

Waste prevention is given the highest priority in integrated waste management. This is a preventive action that seeks to reduce the amount of waste that individuals, businesses, and other organizations generate. By not creating waste, fewer collection vehicles and fewer refuse collectors would be needed; fewer and smaller waste handling facilities would be required, and it would extend the life of the landfills. Society, as a whole, would benefit from a successful implementation of a waste prevention program.

Re-use

Once the waste prevention program has been implemented, the next priority in an integrated waste management approach is promoting the re-use of products and materials. Re-use consists of the recovery of items to be used again, perhaps after some cleaning and refurbishing. Re-using materials and products saves energy and water, reduces pollution, and lessens society's consumption of natural resources compared with the use of single-application products and materials.

Recycling

After the re-use of materials and products, recycling comes next in the integrated waste management hierarchy. Recycling is the recovery of materials for melting them, repulping them, and reincorporating them as raw materials. It is technically feasible to recycle a large amount of material, such as plastic, wood, metal, glass, textile, paper, cardboard, rubber, ceramic, and leather. Besides technical feasibility and knowhow, demand determines the types and amounts of materials that are recycled in a particular region. Areas with a diversified economy and industrial base usually demand more different types of raw materials that can be recycled.

Recycling can render social, economic, and environmental benefits. Factories that consume recyclable materials can be built for a fraction of the cost of building plants that consume virgin materials. Recycling saves energy and water, and generates less pollution than obtaining virgin raw materials, which translates into lower operating costs. Recycling also reduces the amount of waste that needs to be collected, transported, and disposed of, and extends the life of disposal facilities, which saves money for the municipalities. Recycling can result in a more competitive economy and a cleaner environment, and can contribute to a more sustainable development.

Composting

Composting is the process of aerobic biological decomposition of organic materials under controlled conditions of temperature, humidity, and pH, so that the result is a soil conditioner that can be used in landscaping, agriculture, and horticultural projects. Considering the high proportion of organic matter in the waste generated in developing country cities (typically, over 50 per cent), composting can be an option to reduce the amount of waste that is currently disposed of as landfill, thus extending the lifespan of dumps. When composting is conducted under controlled conditions, it does not generate odors and does not attract flies or other animals. Composting recycles nutrients by returning them to the soil.

Incineration

In an integrated waste management approach, incineration occupies the next to last priority, after waste prevention, reuse, recycling, and composting have undertaken. Incineration is the burning of waste under controlled conditions, usually carried out in an enclosed structure. Incineration could include energy recovery.

Sanitary Landfilling

Final disposal of wastes at sanitary landfills is given the lowest priority in an integrated waste management approach. A sanitary landfill is a facility designed specifically for the final disposal of waste in ways that minimize the risks to human health and the environment associated with solid waste. Sanitary landfills commonly include one, two, or three different liners at the bottom and sides of the disposal area in order to prevent the underground movement of methane. Waste arriving at landfills is compacted and then covered with a layer of earth, usually every day. This prevents animals from having access to the organic matter to feed. Sanitary landfills can also include other pollution control measures, such as collection and treatment of leachate, and venting of flaring of methane. It is possible to produce electricity by burning the methane of the landfills generate.

Conclusion

Waste management in India is unsatisfactory. The improper waste management of solid waste represents a source of air, land, and water pollution, and poses risks to human health and the environment. The current regulations (MSWM rules, 2000) are very stringent. Norms have been developed to ensure a proper MSWM system.

Unfortunately, clearly there is a large gap between policy and implementation. The producer responsibility is to avoid having products on the market that cannot be handled effectively and environmentally correctly when they become waste products. A new survey should be carried out on the generation and characterization of MSW in India. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. They urgently need to reform waste management policy and more funds allocation for the services. Moreover, recognized is waste recycling informal sector through the reduction of urban poverty. A decentralized system could help solve the seemingly intractable problem of waste management in India in an economically viable, socially desirable, and environmentally sound manner.

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"What we do today, right now, will have an accumulated effect on all of our tomorrows."

— Alexandra Stoddard

Productivity Improvement in an Engineering Firm through Computer Applications

S. N. Jalwadi and Satyajit Patil

This article presents contribution in productivity enhancement of design process of an engineering company located in western Maharashtra. The design task should take the least amount of time so that sufficient time is made available for manufacturing task. This will lead to lesser cycle time of product and services which provides competitive edge to the organization.

The repetition of the design task and the time period involved is eliminated by adopting a standard design approach for all types of belt conveyor systems to be delivered by the company. A C program was coded based on this design approach so as to provide major system specifications as the output. This resulted in drastic reduction in lead time for the design task of the company.

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Introduction

In present competitive environment, productivity and quality have become key issues for any manufacturing firm, be it a multinational or a small-scale industry. The organizations seek to be productive so that they can respond to the dynamic market demands; however this rise in productivity should not come at the expense of quality. Various means can be adopted for increasing productivity levels. These may range from sophisticated automations to simple design and process improvements. The costs involved, time for implementations, and expertise available are going to be the deciders in most of the cases.

This article presents an attempt to increase productivity level at a small engineering company at Satara (MS) wherein a design procedure for sand-belt conveyor system, a repetitive task there, was standardized and translated in a C program so as to reduce development time, thereby increasing the productivity. The benefit came at no additional cost, the major constraint for any small- or medium-size firm. The company is a medium-scale engineering industry which has business interests in design, development and manufacturing of high-quality engineering equipments required for foundries, construction and process industries and located in western part of Maharashtra (District Satara). The company is often engaged in design and fabrication of belt-conveyor systems for transport of foundry sand. Though the requirements vary, the process essentially remains the same and since the task is of repetitive nature, significant amount of time is spent on similar tasks. According to rough estimations, this time may vary from two to three days for an order.

Design of System and Standardization

This section describes the engineering design approach adopted for a typical sand-belt conveyor system to be

fabricated in the company. It has been presented in brief as the focus of this article is on productivity and not design-process validation.

Typical belt conveyor system consists of following mechanical elements:

1. Conveyor belt
2. Drive pulley or head pulley
3. Troughing and return rollers
4. Gearbox and motor selection
5. Drive shaft
6. Bearings

Conveyor Belt

Conveyor belts are standard elements and are chosen according to requirements. Type of belt, number of plies, tension rating, load support capacity, troughability, minimum pulley diameter, belt thickness, and mass are the parameters involved in belt selection. Knowing the value of mass and density of material to be conveyed, allowable maximum belt speed, troughing angle and angle of repose, width of belt can be calculated and selected accordingly from standard charts. The mathematical expression involved is:

$$\frac{m_c}{\rho} = \frac{1}{2}(0.6w + 0.6w + 2 \times 0.2w \cos \theta) \times 0.2w \sin \theta + \frac{1}{2}(0.6w + 0.4w \cos \theta) \times \frac{1}{2}(0.6w + 0.4w \cos \theta) \cot \Phi$$

where,

m_c = Mass of material conveyed per unit length of belt (kg)

ρ = density of materials $\left(\frac{\text{kg}}{\text{m}^3}\right)$

w = Width of troughed belt (m)

θ = Troughing angle of belt (degrees)

Φ = Angle of repose (degrees)

The belt safety factor is calculated based on RMBT (recommended maximum belt tension) and **calculated belt tension** per meter of width of belt. It is ensured to be above one.

Calculation of Motor Power

Motor power required is calculated on the basis of work done in transporting the material horizontally and against

gravity. The mathematical expression used for motor power calculations is:

$$P = F_3 \times v$$

where,

F_3 = Total force required for transportation $F_3 = (F_1 + F_2) \times c_1$

where,

F_1 and F_2 are forces required to transport the material horizontally and against gravity, respectively.

c_1 = Constant whose value is to be referred from standard catalogues.

v = Speed of belt

Transmission efficiency needs due consideration here.

Drive Pulley or Head Pulley

The minimum drive pulley diameter d_p can be calculated as:

$$d_p = \frac{F_3 \times C_2 \times 180}{w \times \beta}$$

where

β = Angle of contact

C_2 = Constant to be taken from standard catalogues

Gearbox and Motor Selection

Gearbox reduction and shaft diameter can be found using analytical equations presented in standard machine design texts. The shaft diameter is found for combined effect of bending and twisting. Also, rolling contact type of bearing can be selected based on dynamic load carrying capacity.

Development of C Program

The above-mentioned design approach for belt conveyor system was coded using Turbo C as it could be made available very easily and hence could be accessed without any difficulty. The program consists of 135 lines in total and the whole approach was divided in 07 modules so that the program could be understood and could be modified later if desired by the company. The program includes following modules in the same sequence.

1. Module for width of belt
2. Module for minimum pulley diameter
3. Module for motor power
4. Module for belt tension

5. Module for belt safety factor
6. Module for shaft design
7. Module for selection of bearing

The program requires eight inputs—length of conveyor (m), speed of belt (m/s), bulk density (kg/m^3), capacity of conveyor (ton/hr), troughing angle (degree), angle of repose (degree), angle of wrap (degree), angle of elevation (degree), and mass of rotating parts (kg).

On execution of program, it outputs the parameters—width of belt (mm), minimum pulley diameter (mm), speed of pulley (rpm), motor power (HP), belt tension (kN/m), belt safety factor, diameter of shaft (mm) and dynamic load capacity of bearings (N).

As a sample, one module on width of belt has been presented in Appendix I.

Validation of the Program

The program was run for various input values and validated for the outputs. The output values were compared with calculator computations. Some wrong values were intentionally used as an input so as to check the response of the program. The program outputs the variables which facilitates the design process of the belt conveyor system. These values can be used for selection of elements which comprise of belt conveyor system. As an illustration, a set of outputs for a typical run has been presented in Appendix II.

Result and Conclusion

The C program mentioned here was successfully used in the company to expedite the design process of typical belt conveyor system. Due to the simplicity and modularity,

the program was well-received by the company employees. If not an exact final design, the outputs give broad system specifications which could be synchronized with the knowledge base of the company so as to arrive at final design specification in quick time. Use of the program in the company resulted in reduction in design lead time which was brought from few days (two to three days) to few hours (two to three hours). However, exact measurement of reduction in time or improvement in productivity was not possible due to very nature of engineering design process.

However, it can be concluded here that simple computing applications can be leveraged effectively so as to gain substantially in productivity of an engineering firm and the application need not be an expensive one. Simple applications like the one presented here, may save valuable time for the company and improve the productivity.

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- Manual of Transilon Conveyor and Processing Belts

"Cleaning anything involves making something else dirty, but anything can get dirty without something else getting clean."

— Laurence J. Peter

Appendix I

// Module for Width of Belt

```
area=((1.2+0.4*cos(th))*(0.1*sin(th))+((0.6+0.4*cos(th))*(0.6+0.4*cos(th))*(1/tan(ph))*0.25);
    //printf("\n %f",area);
    w=1000*sqrt((0.278*capty)/(area*dnsty*v));
    printf("\n\nWidth of belt          :%fmm",w);
    //w=500; from table
    if(dnsty<=1000)
    {
    if(w<=650)
    {
    w=650;
    mn=4.54;
    rmbt=20;
    }
    else if(w>650 && w<=800)
    {
    w=800;
    mn=4.9;
    rmbt=25;
    }
    else if(w>800 && w<=1000)
    {
    w=1000;
    mn=5.96;
    rmbt=40;
    }
    }
    if(dnsty>1000 && dnsty<=1600)
    {
    if(w<=500)
    {
    w=500;
    mn=4.54;
    rmbt=20;
    }
    else if(w>500 && w<=650)
    {
```

```
w=650;
mn=4.9;
rmbt=25;
}
else if(w>650 && w<=800)
{
w=800;
mn=5.96;
rmbt=40;
}
}
    if(dnsty>1600 && dnsty<=2500)
    {
if(w<=400)
{
w=400;
mn=4.54;
rmbt=20;
}
else if(w>400 && w<=500)
{
w=500;
mn=4.9;
rmbt=25;
}
else if(w>500 && w<=650)
{
w=650;
mn=4.96;
rmbt=40;
}
    else if(w>650 && w<=800)
    {
w=800;
mn=7.2;
rmbt=63;
}
}
printf("\n\nWidth of belt      :%fmm",w);
```


Implications of Global Financial and Economic Crisis on Foreign Direct Investment Flows (FDI): The Indian Perspective

Arabi U

The unusual magnitude of the ongoing global financial and economic crisis is raising major concerns for the movements in international investments. The crisis has affected the decline of FDI flows. Despite the global slowdown, India has managed to display resilience and attract good investments. The improved sentiment for the country's economic outlook backed by strong political mandate and fiscal reforms helping India to enhance its overall share in capital flows marked for emerging markets. Despite these, the global financial crisis poses new challenges for the foreign investment policies of developing countries and also created the fear of investment protectionism and potentially negative indirect impact of bailout and rescue packages on FDI flows on the developing economies. This study aims to evaluate the current status of FDI flows to India and the factors affected the slow down of FDIs in India since the global crisis, the structural reforms packages ensured by the RBI and the government which aimed at renewed commitment to an open environment for inward and outward FDI and targeting the implementation of policies promoting investment climate and innovation.

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The global financial meltdown and consequent economic recession in developed economies have clearly been major factor in India's economic slowdown. Given the origin and dimension of the crisis in the advanced countries, every developing country has suffered to a varying degree, including India, and no country has remained immune to the global economic shock. In fact the unusual magnitude of the ongoing global financial and economic crisis has raised major concerns for the movements in international investments, as a result of two major factors. First, the capability of firms to invest has been reduced by a fall in access to financial resources, both internally, due to a decline in corporate profits and externally, due to the lower availability and higher cost of finance. Second, the propensity to invest has been affected negatively by economic prospects, especially in developed countries that are hit by the most severe recession of the post-war era. Importantly, the crisis has affected FDI flows, which also declined since the last two years firstly due to the capability of firms to invest has been reduced by a fall in access to financial resources, both internally due to a decline in corporate profits and externally due to the lower availability and higher cost of finance and secondly, the propensity to invest has been affected negatively by economic prospects in developed countries. The impact of these factors is compounded by, as of early 2009; a very high level of risk perception is leading companies to extensively curtail their costs and investment programs in order to become more resilient to any further deterioration of their business environment. In fact, all of the market-seeking, efficiency-seeking and resources-seeking FDI flows impacted by these factors, although with different magnitudes and consequences on location patterns. The setback in FDI has particularly

affected cross-border mergers and acquisitions (M&As) on large scale, the value of which was in sharp decline in 2008 as compared to the previous year's historic high. However, the impact on FDI is different, depending on region and sector. Developed countries have so far been the most affected, with a decline in FDI inflows in 2008, mainly due to sluggish market prospects. Flows into developing economies continued to grow in 2008, but at a much lower rate than the year before. An outright decline in FDI inflows to those countries is possible in 2009, due to a pull-back both in efficiency and resource-seeking FDI aimed at exporting to advanced economies that are currently depressed, and in market-seeking FDI aimed at servicing local markets with growth prospects that, although still positive, have receded. Among industries, FDI flows to financial services, automotive industries, building materials, intermediate goods and some consumption goods have been the most significantly affected to date. But the consequences of the crisis are now quickly expanding to FDI in other activities, ranging from the primary sector to non-financial services.

Global Financial Crisis and FDI Flows

FDI is considered to be the most attractive of capital flow for emerging economies as it is expected to bring latest technology and enhance production capabilities of the economy. During 2003–2007, FDI flows followed an upward trend, fuelled by steady world economic growth, ongoing liberalization in investment regimes and the implementation of large-scale internationalization strategies by a growing number of transnational corporations (TNCs). This led to an unprecedented level in FDI flows in 2007, with flows reaching a historic record of \$1.8 trillion. The financial instability triggered by the United States sub-prime crisis which began in summer 2007 has led to a progressive deterioration of the investment situation. Various indicators during the first half of 2008 already suggested a decline in world growth prospects as well as in investors' confidence. This deteriorating climate began to leave its first negative marks in investment programs, including FDI, in early 2008. According to UNCTAD's 2008-2010 World Investment Prospects Survey conducted April–June 2008, 40 percent of the respondent companies at that time had financial instability or had a "negative" or "very negative" impact on their investment expenditures and programs. The study also showed that, on average, TNCs' views on their medium-term investment prospects were already significantly less optimistic than in the previous year's survey (UNCTAD, 2008).

In many developed countries, preliminary data suggest that in 2008, as a result of the protracted and deepening problems affecting financial institutions, as well as the liquidity crisis in the money and debt markets, FDI flows have fallen, leading to a decline estimated at about 33 percent for this group as whole. Inward flows might be particularly low in Finland, Germany, Hungary and Italy, even compared with 2006 levels, while flows to the United Kingdom, France and the United States are estimated to have declined by a significant margin in the case of France and the United Kingdom compared to their 2007 historical high levels. Decreased earnings of developed-country TNCs and a decline of syndicated bank loans have particularly limited financing for investment. A decline in leveraged buyout transactions also dampened cross-border M&As further depressing FDI flows. Cross-border M&A sales in developed countries fell by a similar magnitude (33 percent) in 2008.

The growth rate of FDI inflows to developing countries while lower than in 2007 (when it exceeded 20 percent) should still reach an estimated 4 percent. Flows to Africa are expected to grow further to more than \$60 billion, despite the slowdown in global economic growth and its negative consequences for the region. Flows to East, South and South-East Asia (the largest recipient of FDI among developing economies, accounting for almost half of all flows to developing countries) might rise, but by a slower rate compared with 2007. West Asia is projected to see flows decline significantly (more than 20 percent), following the record level registered last year, due to slower growth in oil demand, rising costs and lower funds from export proceeds (due to lower prices of oil). By contrast, FDI flows to Latin America and the Caribbean are expected to show significant resilience to the world economic slowdown, with an estimated 13 percent increase, partly as a result of a strong rise in FDI flows to South America. However, Central America and the Caribbean – which are traditionally highly dependent on the United States economy – are most likely to register a decline. FDI flows to the transition economies of South-East Europe and the Commonwealth of Independent States should maintain their upward trend despite the financial crisis and regional conflicts, registering an increase of about 6 percent. In contrast to developed countries, M&As in developing countries rose by 16 percent in 2008, particularly in Africa and Asia, although from a generally low level.

During the first eight months of 2008, the world financial system went through a period of relative relief, leading to some optimism regarding the outcome of the

on-going crisis. But subsequently, a brutal crisis erupted again, when first, major United States financial firms, such as Lehman Brothers and AIG and then European financial institutions, such as Fortis, Dexia, and a number of Icelandic banks showed signs of insolvency. It then became clear that this crash was a symptom of a wider underlying malaise in the global financial services industry, reflecting in particular serious lacunae in the regulatory system. The crisis then expanded in magnitude, and full-scale turmoil ensued in financial markets, buffeting many developed and emerging economies. A number of emerging economies such as Hungary, Latvia and Ukraine, as well as Iceland, had then to turn to the International Monetary Fund (IMF) for assistance. The crisis then quickly spread far beyond the financial sector, with serious repercussions for the "real economy". Much tighter credit conditions unavoidably affected firms' ability to spend on factories and equipment as well as on acquisitions. Consumer confidence fell sharply in many parts of the world, reaching historical lows first in the case of the United States and later on in the European Union. And large companies in many industries were seriously affected by the decline in sales. Starting with financial services, which have been directly affected by the crisis, the shock waves have hit many other industries, ranging from extractive industries and manufacturing to infrastructure services.

A global economic slowdown is now projected and recession is already gripping a number of major economies, tighter credit conditions and falling corporate profits, many companies have announced plans to curtail production lay off workers and cut capital expenditure, all of which has implications for FDI. However, the impact of the crisis varies widely, depending on region and country, with consequences for the geographic pattern of FDI flows. One has to keep in mind that the present situation is very different from that of the most recent previous financial crisis, which originated in developing countries (such as the 1997 Asian crisis, see UNCTAD [1998a]) and had a significant negative influence on FDI inflows in a number of them (such as Indonesia). In contrast, the current crisis began in the developed world, though it is rapidly spreading to developing and transition economies. Developed countries have thus been directly hit by the financial crisis, while its effects on developing economies have so far been indirect in most cases, with varying degrees of severity among regions and countries. This has direct consequences on the geographical patterns of FDI inflows.

FDI Trends: The India's Status

Emerging market economies like India were not significantly affected by the global financial crisis in the initial stages, which had set in around August 2007. In fact, the initial effect of the global financial crisis was positive, as India received huge FDI inflows of US\$ 22.5 billion during September 2007 to January 2008, as against US\$ 11.8 billion during April–July 2007. This contributed to the debate on "decoupling" where it was believed that the emerging economies might remain largely insulated from the crisis and provide an alternative engine of growth to the world economy. The argument was proved unfounded as the global financial crisis intensified and spread to emerging economies through capital and current account routes of balance of payments.

The global financial crisis began to impact emerging market economies through slowing down and reversal of capital flows. The portfolio flows to India (net) turned negative due to sale of equity stakes by Foreign Institutional Investors (FIIs) to replenish overseas cash balances. This had knock-out effect on the stock market and the exchange rates. As of early 2009, a very high level of risk perception led companies to extensively curtail their costs and investment programs in order to become more resilient to any further deterioration of their business environment. The setback in FDI has particularly affected cross-border mergers and acquisitions (M&As), the value of which was in sharp decline in 2008 as compared to the previous year's historic high. It has also taken the form of a rising wave of divestments and restructurings. International Greenfield investments have been less impacted to this point, but could be increasingly affected in 2009 as a large number of projects are presently being cancelled or postponed. However, the impact on FDI is different, depending on region and sector. Developed countries have so far been the most affected, with a decline in FDI inflows in 2008, due mainly to sluggish market prospects. Flows into developing economies continued to grow in 2008, but at a much lower rate than the year before. An outright decline in FDI inflows to those countries is possible in 2009, due to a pull-back both in efficiency and resource-seeking FDI aimed at exporting to advanced economies that are currently depressed, and in market-seeking FDI aimed at servicing local markets with growth prospects that, although still positive, have receded.

Among industries, FDI flows to financial services, automotive industries, building materials, intermediate goods and some consumption goods have been the most

significantly affected to date. But the consequences of the crisis are now quickly expanding to FDI in other activities, ranging from the primary sector to non-financial services. In the short term, the negative impact of the present economic recession on global FDI prospects should be the dominant one. Medium-term FDI prospects are more difficult to assess, due to the exceptional magnitude of the present crisis and to the fact that it could lead to major structural changes in the world economy. Nevertheless, some favourable factors for FDI growth are still at work, some of which are even a consequence of the crisis itself. Driving forces such as investment opportunities triggered by cheap asset prices and industry restructuring, large amounts of financial resources available in emerging countries, quick expansion of new activities

such as new energies and environment-related industries, and a resilient trend in the internationalization of companies will presumably trigger, sooner or later, a new pickup in FDI flows.

FDI into other sectors, especially services, grown dramatically faster than manufacturing; a quite relevant matter for policy analyst since the services sector in India is attractive; the growth in FDI is very dramatic. But manufacturing has a lot more constraints. Transforming capital into assets or output is more difficult in manufacturing than in services. Manufacturing is more impacted by constraints in infrastructure, policy delays due to red-tapism, etc than services. The Sectors attracting highest FDI Equity Inflows are shown in the Table 1.

Table 1. Foreign Direct Investment (FDI) (Amount US \$million)

S No.	Year	FOREIGN DIRECT INVESTMENT (FDI)						Investment by FII's Foreign institutional Fund (net)
		Equity		Re-Invested Earnings +	Other capital +	FDI Flows into India		
		FIPB Route/RBI,s Automatic Route/ Acquisition Route	Equity Capital of nincorporated Bodies #			Total FDI Flows	%age growth over previous year	
FINANCIAL YEARS 2000-2010								
1	2000-01	2,339	61	1,350	279	4,029	-	1,847
2	2001-02	3,904	191	1,645	390	6,130	(+)52%	1,505
3	2002-03	2,574	190	1,833	438	5,035	(-)18%	377
4	2003-04	2,197	32	1,460	633	4,322	(-)14%	10,918
5	2004-05	3,250	528	1,904	369	6,051	(+)40%	8,686
6	2005-06	5,540	435	2,760	226	8,961	(+)48%	9,926
7	2006-07	15,585	896	5,828	517	22,826	(+)146%	3,225
8	2007-08	24,573	2,291	7,679	292	34,835	(+)53%	20,328
9	2008-09 (P) +	27,329	666	6,428	757	35,180	(+)01%	(-)15,017
10	2009-10 (P) {+}{++}	25,609	1,155	5,958	1,445	34,167	(-)03%	29,047
11	2010-11 {for April'10}	2,179	-	-	-	2,179	-	3,159
CUMULATIVE TOTAL (from April '00 to april'10)		115,079	6,445	36,845	5,346	163,715	-	32,206

Source: RBI

During 2005–06 to 2008–09, FDI flows to assumed greater significance. High inflows indicate India as an attractive investment destination as a consequence of its liberalized investment climate, stable and sound economic and political base, opportunities for economic growth, while capital investment abroad reflects growing global competitiveness of the Indian corporate sector. The two-way flow of FDI, therefore, means that while the world is taking note of India's market potential, Indian companies are also constantly looking for synergistic acquisitions abroad (E.S, 2008-09). With the reforms in policies, better infrastructure and vibrant financial sector, FDI inflows into India accelerated since 2006-07. On a gross basis, FDI inflows into India increased from US\$ 8.9 billion in 2005-06 to US\$ 22.8 billion in 2006-07 and further to US\$ 34.44 billion. FDI inflows are spread across a range of economic activities like financial services, manufacturing, banking services, information technology services and construction. FDI has grown significantly on net basis. The year to-year growth in FDI (net) was 153.6 percent in 2006-07 and 100.2 percent during 2007-08. Even as FDI flows into India grew substantially, a simultaneous pick

up in outward investment moderated the overall net inflows. Outward investment by India increased from less than US\$ 2.4 billion during 2003-04 and 2004-05 to US\$ 15.8 billion in 2006-07 and US\$ 21.3 billion in 2007-08. During fiscal 2008-09, FDI into India (net) remained buoyant at US\$ 27.4 billion reflecting relatively better investment climate in India and the continuing liberalisation measures to attract FDI. Outward FDI (net) continued to remain high at US\$ 12.0 billion.

The year 2008 will mark the end of a growth cycle in international investment that started in 2004 and saw world foreign direct investment (FDI) flows reach a historic record of \$1.8 trillion in 2007. Due to the impact of the ongoing worldwide financial and economic crisis, FDI flows could decline by more than 20 percent in 2008. A further decrease in FDI flows can be expected in 2009, as the full consequences of the crisis on transnational corporations' (TNCs) investment expenditures will continue to unfold.

At a time of the global slowdown, India is an attractive FDI destination. However, poor infrastructure, lack of clarity

Table 2. Share of Top Investment Countries FDI Equity Inflows (Amount Rupees in crore (US\$ in million))

Ranks	Country	2007–08	2008–09	2009–10	2010–11	Cumulative Inflows	%age to total Inflows (in terms of US Dollars)
1	Mauritius	44,483 (11,096)	50,974 (11,208)	49,633 (10,376)	2,528 (568)	213,434 (47,808)	43%
2	Singapore	12,319 (3,073)	15,727 (3,454)	11,295 (2,379)	1,933 (434)	47,080 (10,625)	9%
3	U.S.A	4,377 (1,089)	8,002 (1,802)	9,230 (1,943)	404 (91)	37,593 (8,369)	7%
4	U.K.	4,690 (1,176)	3,840 (864)	3,094 (657)	265 (59)	26,263 (5,944)	5%
5	Netherlands	2,780 (695)	3,922 (883)	4,283 (899)	312 (70)	20,438 (4,557)	4%
6	Japan	3,336 (815)	1,889 (405)	5,670 (1,183)	1,455 (327)	18,350 (4,041)	4%
7	Cyprus	3,385 (834)	5,983 (1,287)	7,728 (1,623)	123 (28)	17,900 (3,927)	4%
8	Germany	2,075 (514)	2,750 (629)	2,980 (626)	102 (23)	12,571 (2,822)	3%
9	France	583 (145)	2,098 (467)	1,437 (303)	184 (41)	7,102 (1,571)	1%
10	U.A.E	1,039 (258)	1,133 (257)	3,017 (629)	31 (7)	7,054 (1,556)	1%
TOTAL FDI INFLOWS		98,664 (24,581)	123,025 (27,331)	123,378 (25,888)	9,854 (2,214)	526,357 (117,943)	-

Source: Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Government of India

in the FDI guidelines for making investments, red-tapism and shortage of skilled professionals' issues were found significant for a decline. FDI into India declined in five of the last six months till March 2009 (barring January 2009). The average FDI (including reinvested earnings) is now about \$2.5-3 billion a month, leading to \$33-36 billion a year. There is a fundamental optimism about FDI in India. India will not go back to FDI of \$5-billion-per-annum kind of a situation. Instead of investing in one go, they may invest smaller amounts initially. The underlying resilience of the investment will continue owing to Indian market's attractiveness. India's GDP may not be growing at 9%, but even at 6% it is higher compared with many other countries. In absolute terms, we don't think India will have the same FDI inflows in 2009-10 as it had in 2008-09. But in terms of how it is overall compared with the global figure, it will be okay (Table 2)

In this current economic environment, the world is looking to emerging market economies for growth. India has been one of the best performers in the world economy and has been relatively less affected from the global economic slowdown. India was one of the faster growing economies in the world in the last two decades. The high domestic growth rate encouraged firms in the country to explore opportunities overseas. The recent ravages in global banking and its aftermath across the world, didn't impact the country's banking sector noticeably, which ended fiscal 2008-09 with very good results and impressive cost management strategies. In the short term, the negative impact of the present economic recession on global FDI prospects should be the dominant one. Medium-term FDI prospects are more difficult to assess, due to the exceptional magnitude of the present crisis and to the fact that it could lead to major structural changes in the world economy. Nevertheless, some favourable factors for FDI growth are still at work, some of which are even a consequence of the crisis itself. Driving forces such as investment opportunities triggered by cheap asset prices and industry restructuring, large amounts of financial resources available in emerging countries, quick expansion of new activities such as new energies and environment-related industries, and a resilient trend in the internationalization of companies will presumably trigger, sooner or later, a new pickup in FDI flows.

Channels of Transmission of the Crisis to FDI Flows

The current global financial and economic crisis influences firms' capacity to invest as a result of reduced availability

of finance and their propensity to invest due to gloomy economic and markets prospects.

Reduced Access to Finance

Financial factors have negatively affected TNCs' capacity to invest, both internally and externally, as tighter credit conditions and lower corporate profits curtail TNCs' financial resources for overseas investment projects (as well as domestic ones). On the one hand, credit has become less abundant and more expensive. The external funding environment for non-financial companies has deteriorated markedly since mid-2008, making it more difficult for them to invest in foreign operations or to make cross-border M&A deals. For instance, spreads in corporate bonds soared dramatically in the last months of 2008 (IMF, 2008). On the other hand, poor earnings of large companies in a broad range of industries in the United States, Europe and Japan, as evidenced by declared or projected profits from the third quarter of 2008 onwards, reduce the companies' self-financing capabilities. For example, operating earnings of S&P 500 companies are projected to decline by 22 percent in 2008. At the same time, a more than 40 percent decline in stock markets worldwide has reduced TNCs' ability to turn to stock markets for financing purposes and to leverage their M&A activities using stock shares.

Gloomy Prospects

The gloomy evolution of markets, including the looming sharp economic recession worldwide (and even recession in a number of developed countries) and a heightened appreciation of risk, has also reduced firms' propensity to invest for further expansion both domestically and internationally of production capacity. As indicated above, according to the latest IMF forecasts, world output is predicted to expand by only 2.2 percent in 2009, a decline of almost three percentage points compared to 2007. Total output in advanced economies as a whole would contract on a full-year basis in 2009, the first such fall in the post-war period, from 1.4 percent in 2008 to -0.3 percent in 2009, while emerging and developing economies would maintain a positive though reduced growth rate (+ 5.1 percent). The United Nations and the World Bank point to similar declines.

International investment theory usually distinguishes between types of FDI according to three major motives for investing abroad (UNCTAD 1998): market-seeking, efficiency-seeking, and resource-seeking. All three are impacted by the ongoing financial and economic crisis,

but with differences in magnitude and location pattern of impact.

The most directly affected types of investment so far have been **market-seeking** projects, especially those aimed at developed countries. As advanced economies might experience a negative growth in 2009, companies are restraining the launching of new projects aimed at increasing their market-oriented production capabilities there, while they remain more committed to capacity expansion in emerging and developing economies. But this commitment might weaken in 2009 as growth slows in the latter group of economies, due – among other reasons – to a decline in the value of their exports as a result of weakening external demand from the developed countries and a fall in commodity and energy prices.

The impact of the crisis on **efficiency-seeking** projects is more difficult to assess. On the one hand, these projects will suffer globally from the decline in the companies' financial capabilities. On the other hand, many companies might be compelled by the ongoing crisis to restructure their international activities to cut cost and boost overall efficiency. This means above all closing or downsizing obsolete or non-cost-competitive facilities (often located in advanced economies), but also opening some new cost-efficient facilities, especially in emerging economies.

Finally, **resource-seeking** FDI projects could suffer, at least in the short-term, from the decline in world demand and consequently in prices, with particularly negative effects on resource-rich developing countries. It should be noted, however, that this setback in resource-seeking investment closely follows a period of euphoria, when quickly-rising world demand triggered imbalances in commodity markets, boosting prices and leading companies to launch many new projects. It is highly probable that these imbalances will quickly arise again once the present recession is over, putting resource-seeking FDI back on the road to growth.

Policy Implications

The effectiveness of government policy responses at both the national and international levels in addressing the financial crisis and its economic aftermath will play a crucial role for creating favourable conditions for a new pickup in FDI. The challenge is to restore the credibility and stability of the international financial system, to provide stimulus to economic growth in order to prevent the risk of a spiraling depression, to renew a pragmatic commitment to an open

economy, potentially put at risk by rising protectionist tensions, and to encourage investment and innovation. So far, however, it is hard to say that the crisis has led to a clear set of measures either favourable or not to FDI. But, as it has revealed some structural shortcomings in the way the global economy is operated, it can also pave the way for the implementation of public policies aimed at maximizing the positive impact of FDI on development.

Up to now, no signs of a significant direct impact of the crisis on FDI policies have been observed. This is understandable, given the fact that FDI is not at the root of the current crisis. Therefore, specific FDI policies would not offer per se a promising avenue to tackle the existing problems. However, as will be explained below, some national policy reactions of a more general scope (e.g. stricter regulation of the financial sector, more infrastructure investment, state aids for individual economic sectors, tax reductions) are likely to indirectly impact FDI, negatively or positively. A number of measures have already been introduced to prevent a further deterioration of the global economy; and these will influence FDI flows both in the financial and non-financial sectors.

On the one hand, a number of policy initiatives at the national level could stimulate FDI. Three categories of policy measures can be distinguished. First, many developed countries have adopted large-scale bailout plans and rescue packages for the financial sector. Providing State guarantees to financial institutions could have a crowding-in effect on FDI, as these companies might be considered as "safe" investments by foreign investors. Moreover, some countries have even actively sought the participation of foreign investors in individual rescue deals. Second, several countries – such as the United States, France, Germany and Spain – have announced large public investment programs, mainly aimed at infrastructure investments, which not only builds confidence in economy but also opens up investment opportunities by TNCs. Third, a number of countries have adopted fiscal or monetary stimulus measures which might also have a positive impact on FDI flows. For example, the United Kingdom Government has announced a value added tax cut, and the German Government decided to launch a financial package to help small and medium-sized enterprises (SMEs) in difficulty get access to credit. Also, the French Government announced measures to make credit more easily available for SMEs. The United States Federal Reserve Board has cut interests rates to a level close to zero, and the bailout program has been extended to cover

the three major automotive manufacturers. The Japanese Government lowered the corporate tax rate for SMEs. For large Japanese TNCs, it decided to allow loans by the Japan Bank for International Cooperation, which are excluded from loan businesses under normal circumstances, to be extended to them in order to support activities of their foreign affiliates operating in developing countries.

Public policies will obviously play a major role in the implementation of favourable conditions for a quick recovery in FDI flows. Structural reforms aimed at ensuring more stability in the world financial system, renewed commitment to an open environment for FDI, the implementation of policies aimed at favouring investment and innovation are key issues in this respect. For effectively dealing with the crisis and its economic aftermath, it is important for policymakers to resist the temptation of quick-fix solutions or protectionism, and to maintain an overall favourable business and investment climate.

The unusual magnitude of the on-going crisis is raising major concerns about the future of the world economic outlook, especially as it relates to international investment. Some developing countries are also introducing public support measures. Facing the negative impact of the global financial crisis, for example, the Chinese Government announced in November 2008 a RMB 4 trillion (about \$600 billion) public investment plan to boost economic growth. It will last three years—until the end of 2010—and may help keep the annual gross domestic product growth rate of China at 8–9 percent during the period. By enhancing growth prospects and increasing investor confidence, the plan may help attract or maintain FDI inflows to China. Though on a smaller scale, the following countries have similar packages—the Republic of Korea (35 trillion won or \$32 billion), India (200 billion rupees or \$4 billion), Thailand (300 billion Baht, or \$8.6 billion), Malaysia (7 billion ringgits or \$2 billion), Philippines (300 billion pesos or \$6.3 billion), and Viet Nam (up to \$6 billion). Furthermore, the corporate tax rate was lowered in the Republic of Korea (from 13–25 percent to 10–20 percent) and the Philippines (from 35 percent to 30 percent). Special measures are also provided for SMEs in such countries as Singapore and Vietnam.

Foreign Direct Investment (FDI) flows are usually preferred over other forms of external finance because they are non-debt creating, non-volatile and their returns depend on the performance of the projects financed by the investors. FDI also facilitates international trade and transfer of knowledge, skills and technology. In a world of

increased competition and rapid technological change, their complimentary and catalytic role can be very valuable. Foreign Direct Investment in India has constituted 1 percent of Gross fixed capital formation in 1993, which went up to 4 percent in 1997. The Tenth Plan approach paper postulates a GDP growth rate of 8 percent during 2002–07. Given the Incremental Capital-Output Ratio (ICOR) and the projected level of domestic savings it leaves a savings gap/current account deficit of around 2.2 percent. This implies an increase in FDI from the present levels of \$3.9 billion in 2001–02 to at least around US \$8 billion a year during 2002–07.

Reasons for FDI Flows to India

1. India has one of the most transparent and liberal FDI regimes among the emerging and developing economies. By FDI regime we mean those restrictions that apply to foreign nationals and entities but not to Indian nationals and Indian owned entities.
2. Unlike many countries including China, India extends National Treatment to foreign investors. There is absolutely no discrimination against foreign invested companies registered in India or in favour of domestic owned ones. There is however a minor restriction on those foreign entities who entered a particular sub-sector through a joint venture with an Indian partner. If they (i.e. the parent) want to set up another company in the same sector it must get a no-objection certificate from the joint-venture partner. This condition is explicit and transparent unlike many hidden conditions imposed by some other recipients of FDI.
3. The differential treatment is limited to a few entry rules, spelling out the proportion of equity that the foreign entrant can hold in an Indian (registered) company or business. There are a few banned sectors (like lotteries & gaming and legal services) and some sectors with limits on foreign equity proportion.
4. Foreign equity is limited only in production of defense equipment (26 percent), oil marketing (74 percent) and government owned petroleum refineries (26 percent). Most of the mining sectors are similarly on the 100 percent automatic route, with foreign equity limits only on atomic minerals (74 percent), coal & lignite (74 percent), exploration for oil (51 percent to 74 percent) and diamonds and precious stones (74 percent). 100 percent equity is also allowed in

non-crop agro-allied sectors and crop agriculture under controlled conditions (e.g. hot houses).

5. In the case of infrastructure services, there is a clear dichotomy. While highways and roads, ports, inland waterways and transport, and urban infrastructure and courier services are on the 100 percent automatic route, telecom (49 percent), airports (74 percent), civil aviation (40 percent) and oil and gas pipelines (51 percent) have foreign equity limits. India also has a clear policy of FDI in services, with 100 percent automatic entry into many services such as construction, townships/resorts, hotels, tourism, films, IT/ISP/ email/voice mail, business services & consultancy, renting and leasing, VCFs and VCCs, medical/health, education, advertising and wholesale trade. The financial intermediation section has sectoral caps like banking (49 percent), insurance (26 percent), as do some services like professional services (51 percent).
6. Subject to these foreign equity conditions a foreign company can set up a registered company in India and operate under the same laws, rules and regulations as any Indian owned company would.
7. The entry rules are clear and well defined and equity limits for foreign investment in selected sectors such as telecom quite explicit and well known. Most of the manufacturing sectors have been for many years on the 100 percent automatic route.
8. There are also a few prudential conditions on the sale of shares in unlisted companies and the above market price sale of shares in public companies.

Limitations

1. The domestic policy framework affects all investment, whether the investor is Indian or foreign. To an extent, foreign companies or investors that have set up an Indian company or Joint Venture have become indigenised and thus can operate more or less competitively with other Indian company. They adjust themselves to the milieu. This is not, however, true of foreign direct investors who are coming into India for the first time.
2. Monopolies that do not have contemporary relevance. Illustratively, the outdated Food Price Order (FPO) and Prevention of Food Adulteration Act is a major hurdle for FDI in food processing. The latter makes even a technical or minor violation subject to criminal

liability. As a Task force had recommended some years ago, that we need to formulate a single integrated Food Act (including weights & measures). This should also make provision for a modern Food Regulatory system with a single integrated regulator.

3. Labour laws discourage the entry of green field FDI because of the fear that it would not be possible to downsize if and when there is a downturn in business. Labour laws, rules and procedures have led to deterioration in the work culture and the comparative advantage that is even beginning to be recognised by responsible Trade Unions.
4. The Urban Land Ceiling Acts and Rent Control Acts in States are a serious constraint on the entire real estate sector. This is another sector that has attracted large amounts of FDI in many countries including China. Like the labour-intensive industrial sectors it can also generate a large volume of productive employment. These Acts need to be repealed if a construction boom is to be initiated that would reverse the decline in overall investment, attract FDI, generate employment and make rental accommodation available to the poor. The Centre has already repealed the Urban Land Ceiling Act but each State has to issue a notification to repeal the Act in that State.
5. Weak credibility of regulatory systems and multiple and conflicting roles of agencies and government has an adverse impact on new FDI investors which is greater than on domestic investors. All monopolists have a strong self-interest in preventing new entrants who can put competitive pressure. In the past, government monopoly in infrastructure sectors has slowed down policy reform. FDI was discouraged by the fear that pressure exerted by government monopolies through their parent departments would bias the regulatory system against new private competitors.
6. Investors find it frustrating to navigate through the tangles of bureaucratic controls and procedures. The time taken for application/bidding/approval of FDI projects was too long. Multiple approvals, excessive time taken (2–3 years) such as in food processing and long lead times of up to six months for licenses for duty free exports, lead to "loss of investors' confidence despite promises of a considerable market size."

7. Bureaucracy and red tape topped the list of investor concerns. Of the three stages of a project, namely general approval (e.g. FDI, investment license for items subject to licence), clearance (project specific approvals e.g. environmental clearance for specific location and product) and implementation were the most affected by India's red tape. Though the number of approvals/clearances may not always be much lower in the OECD countries such as the USA and Japan the regulatory process is transparent with clear documentation requirements and decision rules based largely on self-certification, and generally implemented through the legal profession.
8. In the context of FDI, poor infrastructure has a greater effect on export production than on production for the domestic market. FDI directed at the domestic market suffers the same handicap and additional costs as domestic manufacturers that are competing for the domestic market. Inadequate and poor quality roads, railroads and ports, however raise export costs vis-à-vis global competitors having better quality and lower cost infrastructure. As a foreign direct investor planning to set up an export base in developing/emerging economies has the option of choosing between India and other locations with better infrastructure, India is handicapped in attracting export oriented FDI.
9. Taxes levied on transportation of goods from State to State (such as Octroi and entry tax) adversely impact the economic environment for export production. Such taxes impose both cost and time delays on movement of inputs used in production of export products as well as in transport of the latter to the ports. Differential sale and excise taxes (States and Centre) on small and large companies are found to be a deterrent to FDI in sectors such as textiles. Investments that could raise the productivity and quality of textiles and thus make them competitive in global markets remain unprofitable because they cannot overcome the tax advantage given to small producers in the domestic market.
10. Though India's Anglo Saxon legal system as codified is considered by many legal experts to be superior to that of many other emerging economies it is often found in practice to be an obstacle to investment. One of the reasons is the inordinate delay are the interlocutory procedures that characterise judicial procedures. As a result the "Rule of law," which has often been cited as one of the attractive features of

the Indian economy for foreign investors, is found to be a significant positive factor by only 3 percent for FDI in India.

Public policies will obviously play a major role in the implementation of favourable conditions for a quick recovery in FDI flows. Structural reforms aimed at ensuring more stability in the world financial system, renewed commitment to an open environment for FDI, the implementation of policies aimed at favouring investment and innovation are key issues in this respect. For effectively dealing with the crisis and its economic aftermath, it is important for policymakers to resist the temptation of quick-fix solutions or protectionism, and to maintain an overall favourable business and investment climate. Addressing infrastructure constraints at local levels are more important than macro-level policy issues. Issues like land acquisition, power and logistics can subtract 50% from profitability. These are the main challenges that will have to be addressed at local and the state government levels. If you want to get more FDI, especially into manufacturing, then focus on infrastructure development, talent pool and local policy.

Suggested Recommendations

1. Consideration may be given to the enactment of a foreign investment promotion law. This law would be administered by the Department of Industrial Policy and Promotion as against the present administration of the Foreign Exchange Management Act (FEMA) by the Directorate of Enforcement. Even optically the activity of encouraging FDI is a promotional one and not a regulatory one. A separate investment promotion law would meet this objective and signal a change in attitude from regulation to promotion. A legal group should be constituted to draft a new law that would have as its objectives, (i) the promotion of FDI and (ii) National treatment for FDI. This law could also deal with issues such as double taxation, making a provision for preferential treatment of FDI, where this is considered to be in the national/public interest and help overcome obstacles arising from hurdles created at the State level for infrastructure sectors that are on the Central list. It has to be kept in mind, however that the Indian system is much more democratic in practice and has stronger rights for States.
2. Infrastructure investment and exports can be key drivers of productivity change and economic growth. Both domestic private and foreign direct investment

can play an important role in these areas, but FDI can potentially play a more than proportionate role because of the special features of these sectors. Critical infrastructure investments are capital intensive. Easier access of foreign investors to capital resources and their global expertise can expedite investment, if the policy framework and regulatory structures are appropriate. Similarly the knowledge, experience and connectivity of foreign companies to global markets give them an advantage in export markets for manufactured goods. We therefore recommend that the States consider enacting a special Investment Law covering infrastructure investment. This law would apply to both domestic and foreign investment. The Andhra Pradesh Infrastructure Act provides a useful template on which other States' laws could be based.

3. Within the government, the Department of Industrial Policy and Promotion (DIPP) is responsible for foreign investment, with the Secretary (DIPP) chairing the Foreign Investment Promotion Board (FIPB), the nodal agency for FDI. The Foreign Investment Implementation Authority (FIIA), designed to assist foreign direct investors with respect to post-approval operational problems is also serviced by the Secretariat for Industrial Assistance (SIA) in the DIPP. There is a need to strengthen both the FIPB and the FIIA so as to increase their effectiveness in removing procedural bottlenecks and reducing bureaucratic red tape.
4. An investment facilitation fund can be set up to provide assistance to those States who need assistance in modifying policies and procedures for promoting foreign and domestic investment. This could have two components: technical assistance and financial assistance. The latter could be made contingent on State specific reforms.
5. Some industry associations such as CII are already taking steps to help foreign direct investors in dealing with unfamiliar Indian procedures. This effort needs to be supported and expanded. A non-governmental Society or Council should be set up by industry associations with the help and encouragement of the government (DIPP), for assisting first time foreign investors. This organisation would operate on a non-profit basis and supply information, approval and clearance services to FDI investors. These could range from giving advice and information to a

comprehensive service, which obtains all clearances and approvals for the FDI investor. For instance, first time FDI investors also find it difficult to find genuine and sincere joint venture partners. This society would facilitate the search for joint venture partners. This society/council could have representatives from industry associations, Multinational & other companies.

6. We should have no objection in principle to publications on culture, society and entertainment being published and sold in India as long as this is not at the expense of Indian culture, social norms and practices. One touchstone for deciding on foreign equity could be a criterion of true cultural globalisation. In other words globalisation of culture must be a two way street, with the rest of the World having the same access to Indian culture as we do to theirs. Globalisation of media cannot merely mean that all the existing cultural (e.g. soap operas) and nationalistic (e.g. war news) content created in democratic USA, UK and other English speaking countries is merely transferred to India. Globalisation must also mean that the cultural and nationalistic content created by one-sixth of the humanity living in democratic India is also in due course brought to a global audience. Our experience with the opening of TV media demonstrates the strength of Indian culture in that most foreign companies have been forced by the market to increase content based on Indian cultural and entertainment traditions and reduce transplanted foreign culture sensitive programs.
7. In the case of tradable goods competition arises not just from domestic production but also from imports. A limited number of domestic producers need not denote monopoly power. Modern competition law emphasizes control of the abuse of monopoly power rather than focusing on the number of producers in a narrowly defined sub-sector. FDI can in fact enhance domestic competition if a global player sets up a green field project thus expanding the number of domestic producer of the good. There can, however, be a genuine concern if a foreign producer with very high global share tries to acquire an existing domestic producer from among a few remaining domestic producers. This is a potential problem that can and should be dealt with under the proposed competition law and does not require a cap on foreign equity holding.

8. The ownership of natural resources such as the electro magnetic spectrum and sites for dams, harbours, vests in the people and their government. The resource rent is defined as the difference between market price and the efficient costs of exploitation of the particular resource at a particular time and place. The resource rent depends on scarcity of the resource and its quality. Resource rent tax systems and auctioning procedures have been designed to extract the highest proportion of such resource rent to the government. If these are effective there is no reason to discriminate between FDI and domestic investment in production/use of such resources and consequently to put FDI limits on the former.
9. An important reason for encouraging FDI is the productivity gains that can accrue. But the flip side of this coin is the short-term transition costs that it imposes on existing less productive competitors. For instant FDI in food retailing (entry of food department store chain) would lead to more efficient supply chain management systems that can reduce the large gap between the price received by farmers and that paid by consumers. It would thus benefit both farmers and consumers besides creating profitable avenues for FDI. But in the short term, traders and intermediaries in direct competition with these new entrants would suffer a loss in income. Over time the productivity gains would generate much more income and employment opportunities, even for these intermediaries, by stimulating agricultural growth and consumer demand. Similar opportunity and difficulties arise in the case of FDI in the organized retail sector.
10. Across the world, disinvestment has acted as a magnet for FDI. Though foreign companies are allowed to bid for government strategic share sale, there is some apprehension about doing so. If a clear signal is given that foreign companies are not only allowed but also encouraged to bid in disinvestment auctions, this could attract a significant amount of FDI. This in turn means that additional outside capital and investment will flow into industry from outside the system rather than existing private investment moving from one industry or sector to another. FDI flow into privatisation is more likely to be complimentary, strategic purchase by domestic investors may have some element of substitution. As the strategic sale route has now crystallised into a transparent, time-bound, non-discretionary process, FDI investors should have confidence in

the mechanism. A well-programd "Road Show" for large value high profile disinvestments to target FDI should be encouraged.

Conclusion

The present crisis may be a source of both threats and opportunities for public policies on FDI. Among the dangers looming for the years ahead, one can mention the risk of shifting efforts away from achieving a pro-investment and pro-business environment and the emergence of protectionist tensions. The crisis, however, also opens a chance to implement efficient global policy responses to enhance the stability of the financial system and stimulate economic growth. Joseph Stiglitz (Stiglitz, 2008) and UNCTAD (2008c) advocated the necessity to go beyond the mere short-term management of the ongoing crisis and to set up the bases of sounder economic regulations, especially in banking, with more control and restriction on the activities of commercial banks, hedge funds and other financial institutions. This requires action at a coordinated international level to rebuild financial multilateralism, foster the stability and equity of the worldwide financial system promote stronger transparency or disclosure standards, create guarantee funds to help emerging and developing countries to secure the debt of their corporations, and to reassess the importance of public policies and regulations.

In addition, at the country level, measures specifically aimed at stimulating investment could also be more extensively implemented. Investment promotion agencies could also play a key role in fostering after-care policies aimed at retaining existing activities by TNCs and in implementing targeted investment promotion programs on promising activities.

The global economic crisis is an opportunity for India to deepen their economic ties. There is a sense that the international institutions will be remade to reflect the current balance of power, and that India may be able to turn this crisis into a permanent place at a new high table. Notably, for quite some time, India has been demanding its rightful place in international financial institutions like the International Monetary Fund and the World Bank by arguing that they no longer represent the realities of the world and the balance of power in these organizations is tilted more towards the developed countries. India has been hurt by the global financial crisis, but it may be better positioned for a quick recovery and for future growth than many of the other developing economies. Indian financial sector is relatively insulated; the rupee is not fully convertible; and Indian banks did not have significant

exposure to sub prime loans in the United States. However, its stock market has been badly hit as foreign institutional investors have sold almost \$10 billion of their investments in Indian companies to cover losses accrued in their home markets.

Even as there are lot of issues of concern, the Indian economy will be unable to avoid the fallout of a US and European recession. But, how quickly India could turn the corner? Because, domestic demand could remain a strong driver of growth; farm income and rural employment are both up and consumers received large tax breaks in this year's budget. India imports 80 percent of its oil, so it will benefit from prices hovering around \$70 a barrel as well as from the declining prices of other commodities.

To conclude, beyond its immediate negative impact on FDI flows in 2008 and presumably 2009, the ongoing crisis opens a period of major uncertainty. For effectively dealing with the crisis and its economic aftermath, it is important that policymakers maintain an overall favourable business and investment climate (including for FDI) and refrain from protectionist tendencies.

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"Earth provides enough to satisfy every man's need, but not every man's greed."

— Mahatma Gandhi

Proliferation of Processed Food Products Exports: A Remedy for Indian Agriculture

Kuldeep Singh

At the threshold when the effects of global financial meltdown seem to be over in India, it becomes mandatory to explore the areas or industries which performed well even during the meltdown. One such industry is the food-processing industry which grew at an impressive rate of 14.7 percent during 2008–09 despite the economic slowdown. A vibrant and dynamic food-processing industry plays a vital role in employment generation, foreign exchange earnings, diversification, and commercialization of agricultural sector. Thus the industry has, undoubtedly, the potential to take the lead that can transform India's agricultural economy.

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Prologue

The processing of agricultural products along with productivity are the two crucial aspects for Indian agriculture. It may, further, be proved a robust economy if India is able to export these processed agricultural products to other countries. India is the largest producer of milk, pulses, and tea in the world and is likely to become the second-largest dairy products producer in the coming years. It is the second-largest producer of fruits and vegetables and the third-largest producer of food grains in the world. It shows that India is the world's second-largest producer of food baskets only next to China. Despite India having a huge agricultural production base, its share in exports of processed food in global trade has remained merely 1.5 percent. International trade in food and processed food products has expanded enormously over the turn of the century. The reason behind this upward trend outflow in processed food products may be assigned to the factor that the developed countries' changing food consumption patterns and the growing demand for "ready of eat" food. The size of the global processed food market has been estimated at US\$ 3.2 trillion. The food-processing industry in India grew at an impressive rate of 14.7 percent in 2008–09 despite the economic slowdown. Therefore, it seems a tremendous potential for export-led growth and investment in this buoyant industry.

The food-processing industry, though a part and parcel of agriculture, may be termed as an industry on account of its modus operandi. Currently, the food-processing sector has emerged and blossomed into a profitable agribusiness in India for both domestic and global markets. The food-processing industry plays an important role in the Indian economy by its contribution to employment generation and foreign exchange earnings. The growth in the food-processing sector and progressive

improvement in the value-addition chain are also of great importance for achieving favorable terms of trade for Indian agriculture both in the domestic as well as global markets. Besides, the efficient food-processing industry also contributes in the nation's food security as well.

Indian food-processing sector has been undergoing rapid transformation. As the country moves on the path of development, agricultural sector evolves from traditional subsistence level farming to commercial agriculture producing high value and processed products. The strong macro-economic fundamentals, that is, sustained economic growth rate of 8–9 percent and the changing socioeconomic scenario have been driving the traditional small-scale processed food production system into a modern industry aimed at catering to the evolving tastes and needs of discerning consumers. On the supply side, with vast arable land and agro-climatic diversity, India has the potential to be the food basket of the world. However, the levels of processing in India are extremely low, at around 6 percent compared to 60–80 percent in developed countries and over 30 percent even in most other Asian and Latin American developing countries. There is clearly very high wastage and very low value-addition in our country with corresponding loss of business opportunities as well as losses in farm income. The food-processing sector has undoubtedly the potential to take the lead that can transform India's rural economy.

Review of Literature

Many researchers have investigated the area of food processing and explored it from different dimensions. The development of export-oriented food-processing industry offers enormous potential for rural development and economic growth in developing countries (Athukorala and Sen, 1998). The fruits and vegetables processing industry occupy a unique position among the different sectors of the food-processing industry (Subrahmanyam, 2000). Processed food exports must become an instrument to sustain and enhance social welfare in developing countries through poverty alleviation. However, the push for use of highly capital-intensive technologies to gain compliance with SPS regulations leads them to face non-tariff barriers for the exports of the developing countries (Mehta et al., 2003). Singh and Goyal (2004) studied export concentration, growth and instability for Indian agricultural and processed food products by using the data for the periods 1993–94 to 2001–02. They found that the extent of growth in value terms has been invariably higher than the amount of growth in quantity terms except

a few commodities. The instability has been, by and large, higher for quantity than the export earnings with some exceptions. India can be a largest food-production industry in the world. Its food production is equal to that of the USA and second to China (Gupta and Garg, 2005). The world exports of processed food products increased at the rate of 8.5 percent per year during 1970–2003, and the share of processed products in agricultural exports increased from 42 percent in 1990–91 to 48 percent 2001–02 (Mohanty, 2006). Sustained growth of the industry is possible in a competitive market environment only when the firms operate at a high level of technical efficiency and adopt best technologies (Kalirajan and Bhide, 2007). Mattoo et al. (2007), in a World Bank Report, pointed out that the high costs of products delivery are today probably as big an impediment to export as foreign protection and demanding standards. A large part of high costs is attributable to weaknesses in the transport, storage, and marketing infrastructure. Kumar and Rai (2007) in their study revealed that export of tomato and its products has registered an impressive growth during the recent years, after the liberalization trade. Export competitiveness of Indian tomato and its products can be improved through socialization of improved techniques of production and processing and by providing adequate government support for making production and marketing of these products more economical. The establishment of infrastructure for various sanitary and phytosanitary measures may also help in improving Indian competitiveness in the international market. The issue of food safety standards and export competitiveness in the food and processed food industry in Asia-Pacific countries has also been addressed. The empirical evidence showed the adverse effect of food safety standards on export performance in food and food manufacturing (Babool and Reed, 2007). Goyal and Gupta (2009) in their study revealed that the production of fruit has grown at an annual compound growth rate of 3.76 percent and of vegetables at 3.34 percent, respectively, during 1980–2006. The growth of fruits production has been more in India than world production whereas in case of vegetables production, it is reverse. The production of processed fruits and vegetables products has increased at an annual compound growth rate of 11.25 percent. The capacity of fruits and vegetables processing units increased by 8.5 percent per annum and still the industry has been able to utilize only half of the installed capacity. India witnessed substantial increase in export value of processed fruits & vegetables (16.85 percent CGR) during the period under study. The dried and processed

vegetables ranked first in India's total export of processed fruits and vegetable products in value terms whereas in quantity terms pickles and chutneys occupied first position.

Need of the Study

The growth of the food-processing industry in India, ipso facto, lies in the consistently increasing agricultural production. The year 2008 has been witnessed as a record year for India's food-grain sector with acreage under cultivation, record procurements, and increased production despite internationally low productivity per hectare. Therefore, it seems a tremendous potential for export-led growth, investment and employment opportunities in the Processed Food Product (PFPs) Industry. In fact, food-processing industry plays a significant role in terms of its contribution to employment generation and foreign exchange earnings in the Indian economy. However, its potential has not been exploited on account of underdeveloped features beset in the industry. One of the most important challenges facing the country is to ensure remunerative prices to the farmers for their produce. The issue could be addressed to a great extent if the surplus production of cereals, fruits, vegetables, milk, fish, meat and poultry, etc., was processed and marketed both inside and outside the country. A vibrant and dynamic food-processing sector plays a vital role in diversification and commercialization of agriculture. It enhances productivity, shelf-life, income of farmers, ensures value addition to the agricultural produce, generates employment and markets for export of agro processed foods products. In this manner, the impact of increased economic growth in agribusiness through food-processing can play a hallmark role in reducing rural poverty and increasing rural income and employment. The striking feature of world merchandise trade over the past two decades or so has been the expansion of high-value processed food products (PFPs) at much faster rate than traditional agricultural commodities.

Objectives of the Study

The objective of the study is aimed at comprehending the position of India's trade of processed food products (PFPs) in the global market. The specific objectives are the following:

1. To analyze India's position in the global trade of processed food products.
2. To examine the measurement of stability in the exports of PFPs at the global level.

3. To assess the overall scenario of the sector of processed food products exports from India.
4. To suggest certain policy implications for upliftment of these exports.

Sources of Data

The study is mainly based on the secondary data available from various authenticated sources. Most of the data was collected from Foreign Trade Statistics of India, Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce, Government of India, New Delhi. The data were also collected from the Export Statistics for Agro and Food Products, Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry. Annual reports of the Ministry of Food Processing industry, Government of India, New Delhi and various other publications of food-processing industry were also consulted.

Methodology

The present research work is primarily an analytical and critical study of the figures related to the performance of Indian processed-food sector in the global market. The exports of processed food products (PFPs) are contributing significantly in the domain of Indian exports and play a vital role for the overall economic growth and sustainable development of the Indian economy. To achieve the various objectives of the study, some mathematical and statistical tools like coefficients of variation and a variety of different indices are used in the study. To measure the market/country concentration of PFPs from India to forty five major importing countries of world, six indices have been used. These indices are: (I) Index of Maximum Proportion (D_1), (II) Hirshman-Herfindhal Index (D_2), Entropy Index (D_3), Concentration Ratio of CR_4 (D_4), Concentration Ratio of CR_8 (D_5) and Concentration Ratio of CR_{16} (D_6). In the study, all the six concentration measures are based on the share (export coefficients) of the individual importing countries of the PFPs.

Let m denote the numbers of importing countries and q_{it} represents the imports from i^{th} partner country at time t . Then the sum of q_{it} from 1 to m will be q_t and the share of each country in the import of PFPs for year t , would be expressed as:

$$S_{it} = \frac{q_{it}}{q_t} \quad \text{and} \quad q_t = \sum_{i=1}^n q_{it}$$

where

S_{it} : Share of each importing country at time t
 q_{it} : Imports of each importing country at time t
 q_t : Sum of the total of each importing country
 $i = 1, m$ and $t = 1, \dots, T$

All the concentration measures below are based on S_{it} .

Index of Maximum Proportion

$$D_1 = \max S_{it}$$

This is a measure of market concentration. D_1 takes a value equal to 1 when there is a complete concentration of PFPs exports in one country out of total countries included in study.

Hirshman–Herfindhal Index

$$D_2 = \sum_{i=1}^n S_{it}^2$$

where,

S_i : Share of i^{th} importing country at time t .

Herfindhal Index (D_2) takes the values ranging from 0 to 1 where 0 indicates perfect diversification and 1 refers to perfect specialization.

Entropy Index

$$D_3 = \sum_{i=1}^n S_{it} \log 1/S_{it}$$

The higher value of the Entropy Index (D_3) signifies greater information about the concentration of importing countries.

Concentration Ratio (CR_n)

The Concentration Ratio (CR) measures the total share of n countries, which have the largest share in the imports of PFPs from India. It is denoted by $CR(n)$ and calculated as:

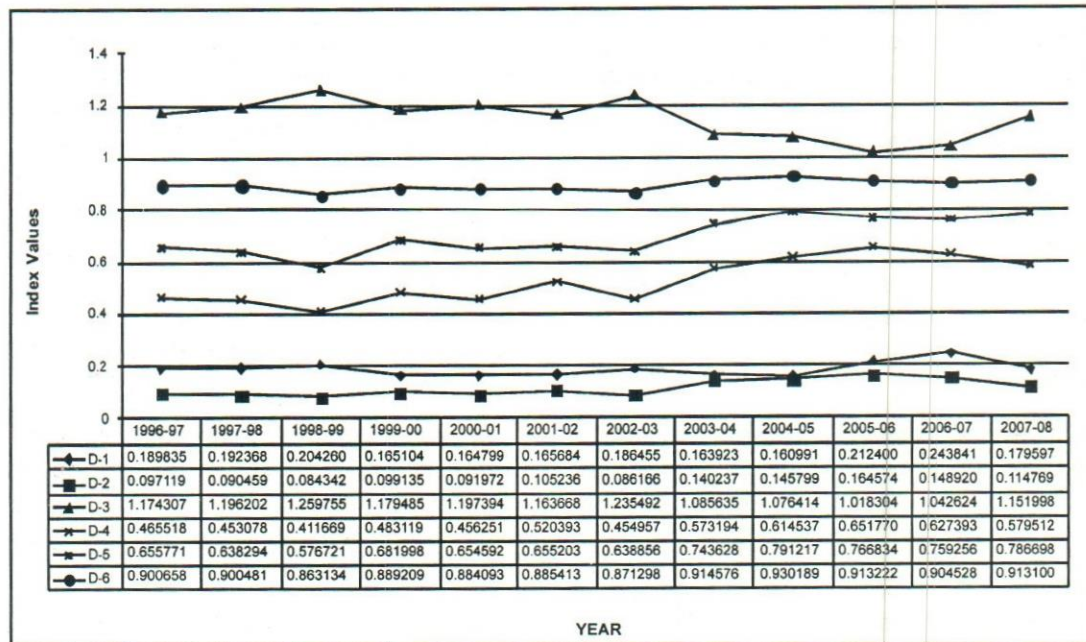
$$CR_n = \sum_{i=1}^n S_{it} \quad n < m$$

In most cases $CR_4(D_4)$, $CR_8(D_5)$ and $CR_{16}(D_6)$ have been used in the study. The selection of n (markets/countries) in the concentration measure is arbitrary. This is its main disadvantage but is widely used because of its user-friendly applications.

Empirical Findings

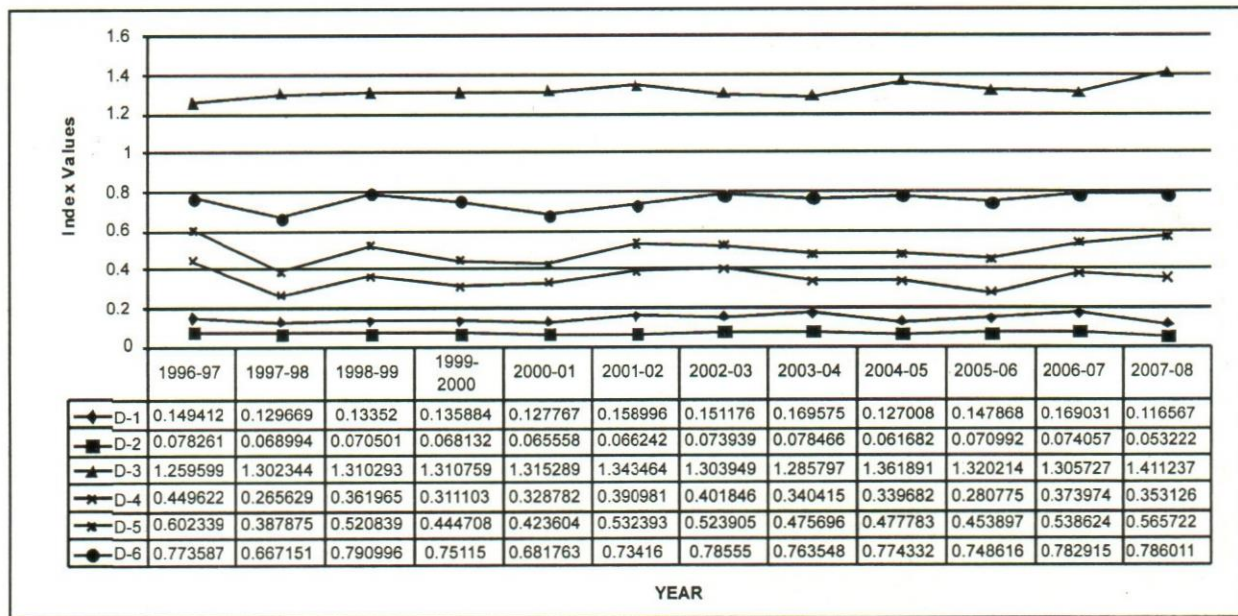
The indices represented in Figure 1 demonstrate the country concentration of the exports of processed food

Figure 1: Country Concentration Indices of Fruits and Vegetables Exports during the Period from 1996–97 to 2007–08



Source: Calculated on the basis of data collected from Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry, Government of India, New Delhi.

Figure 2: Country Concentration Indices of Processed Fruits and Vegetables Exports during the Period from 1996–97 to 2007–08



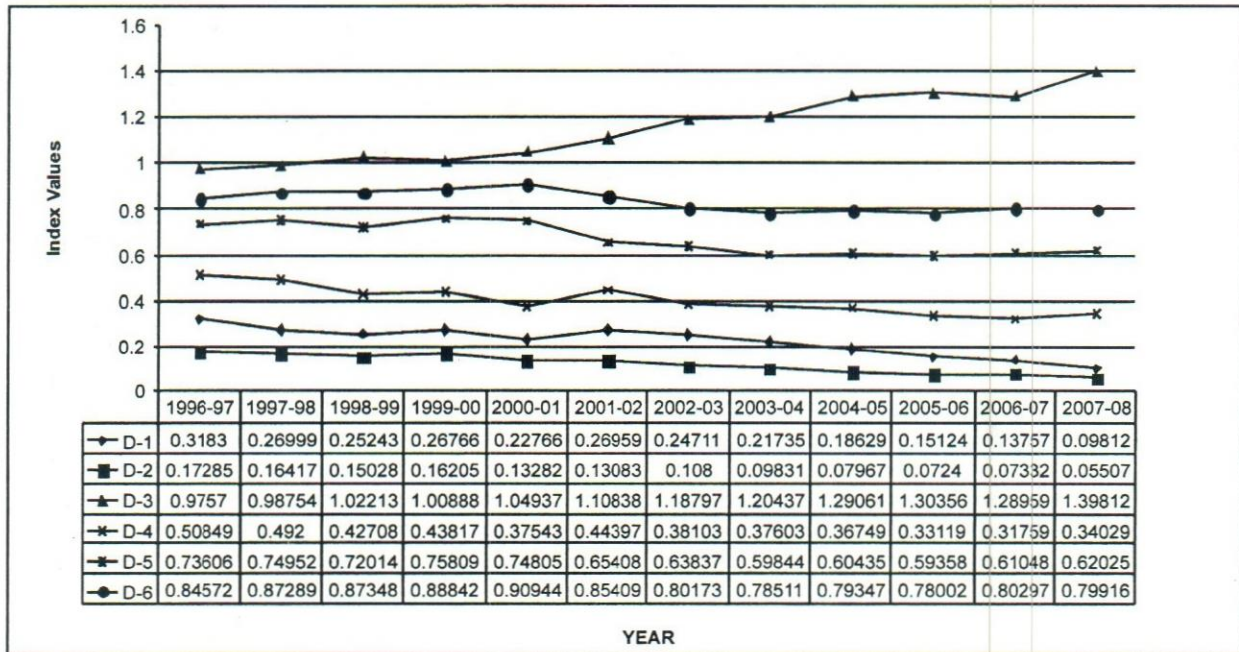
Source: As in Figure 1

product's constituent (fruits and vegetables) among the forty five major importing countries during the period 1996–97 to 2007–08. The indicators below the figure denoted by D_1 , D_2 , D_3 , D_4 , D_5 , and D_6 represent Index of Maximum Proportion, Herfindahl Index, Entropy Index, the concentration ratio of major four importing countries, major eight importing countries and major sixteen importing countries, respectively. In the figure the different measures of concentration viz., Index of Maximum Proportion (D_1) ranges from 0.160991 to 0.243841, Herfindahl Index (D_2) from ranges 0.084342 to 0.164574, Entropy Index (D_3) ranges from 1.018304 to 1.259755, concentration ratio of four major importing countries CR_4 (D_4) ranges from 0.411669 to 0.651770, concentration ratio of major eight importing countries ranges from CR_8 (D_5) 0.576721 to 0.791217 and concentration ratio of major sixteen importing countries CR_{16} (D_6) ranges from 0.863134 to 0.930189. Here, the index D_2 reveals the presence of diversification (low concentration) of fruits and vegetables' exports among the various importing countries of the world. The index D_3 represents the entropy index of these exports over the study period. The higher value of the entropy index signifies greater information about the concentration of importing countries. The concentration Index D_4 , of this group depicts that it has been almost stable in nature for Bangladesh, UAE, Malaysia, and Netherlands for the first seven years and after that it has been showing an increasing trend.

Figure 2 reveals the country concentration indices of the exports of processed fruits and vegetables among the forty five major importing countries during the period 1996–97 to 2007–08. In the figure, the different measures of concentration viz., Index of Maximum Proportion (D_1) ranges from 0.116567 to 0.169575, Herfindahl Index (D_2) ranges from 0.053222 to 0.078466, Entropy Index (D_3) ranges from 1.259599 to 1.411237, concentration ratio of four major importing countries CR_4 (D_4) ranges from 0.265629 to 0.449622, concentration ratio of eight major importing countries CR_8 (D_5) ranges from 0.387875 to 0.602339, concentration ratio of sixteen major importing countries CR_{16} (D_6) ranges from 0.667151 to 0.790996. Subsequently, index D_2 shows the presence of diversification (Low Concentration) of processed fruits and vegetables exports among the various importing countries of the world. Further, index D_3 displays the higher values of the entropy index that signifies high concentration of Indian processed fruits and vegetables exports in the year 2007–08 to the various importing countries. Apparently, it has been observed that the concentration measure CR_{16} (D_6) gives high concentration figures in comparison to CR_4 (D_4) and CR_8 (D_5) index.

On the pattern of earlier figures, Figure 3 highlights the country concentration indices of the exports of processed animal products among the same forty five major importing countries during the period 1996–97 to

Figure 3: Country Concentration Indices of Processed Animal Products Exports during the Period from 1996–97 to 2007–08



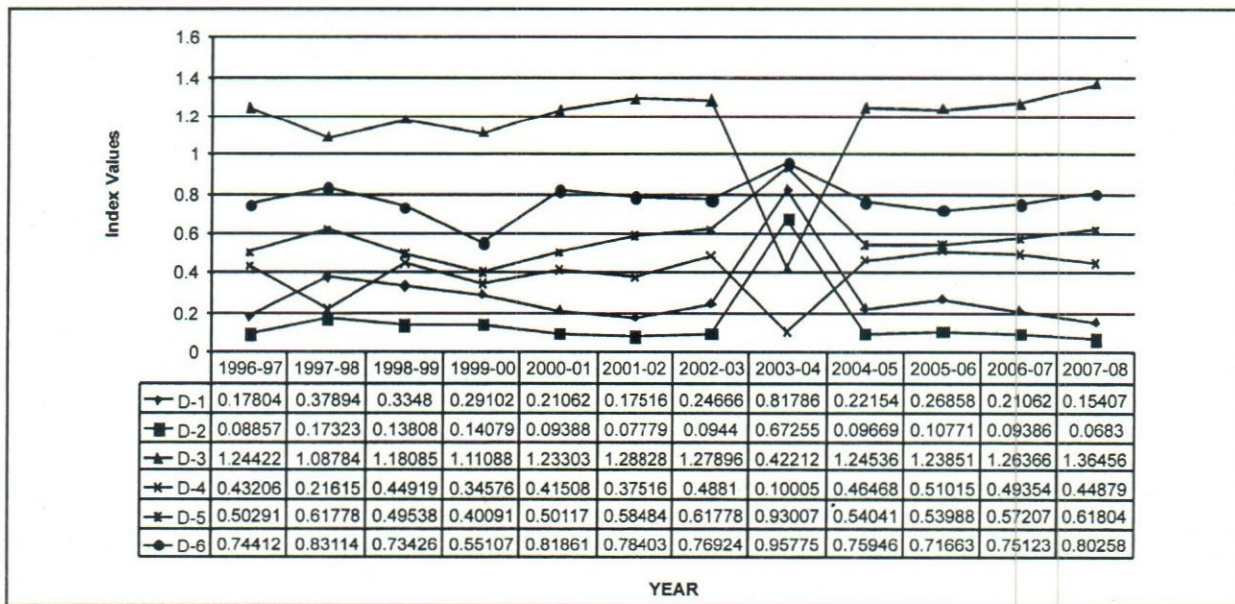
Source: As figure 1.

2007–08. These measures of concentration viz., Index of Maximum Proportion (D_1), Herfindhal Index (D_2), Entropy Index (D_3), CR_4 (D_4), CR_8 (D_5) and CR_{16} (D_6) ranges from value 0.09812 to 0.3183, 0.05507 to 0.17285, 0.9757 to 1.39812, 0.31759 to 0.50849, 0.59358 to 0.75809 and 0.78002 to 0.90944, respectively. Further, index D_2 has been stable in the beginning and starts declining after the year 2002-03, which is also revealed in the figure. The

index D_3 which measures the information about the concentration of the group has been of increasing nature over these years. Furthermore, the concentration ratio CR_4 (D_4), CR_8 (D_5) and CR_{16} (D_6) also indicate stable exports of processed animal products for these countries in the global market.

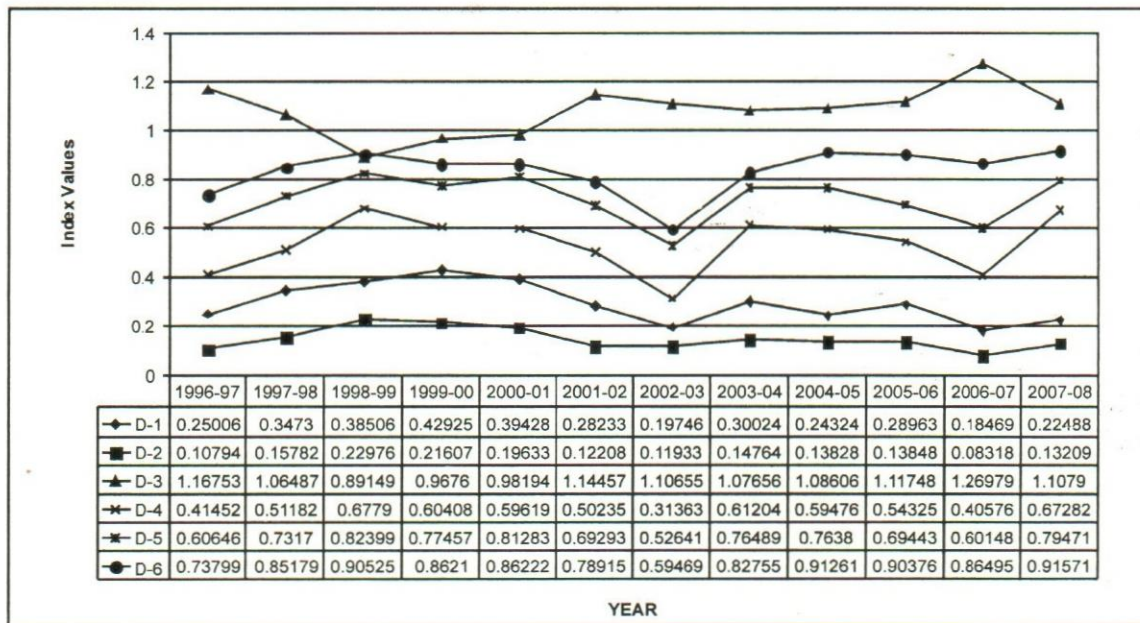
Figure 4 exhibits the country concentration indices of the exports of other processed food products among

Figure 4: Country Concentration Indices of Other Processed Foods Exports during the Period from 1996–97 to 2007–08



Source: As in figure 1.

Figure 5: Country Concentration Indices of Processed Cereals Exports during the Period from 1996–97 to 2007–08



Source: As in figure 1.

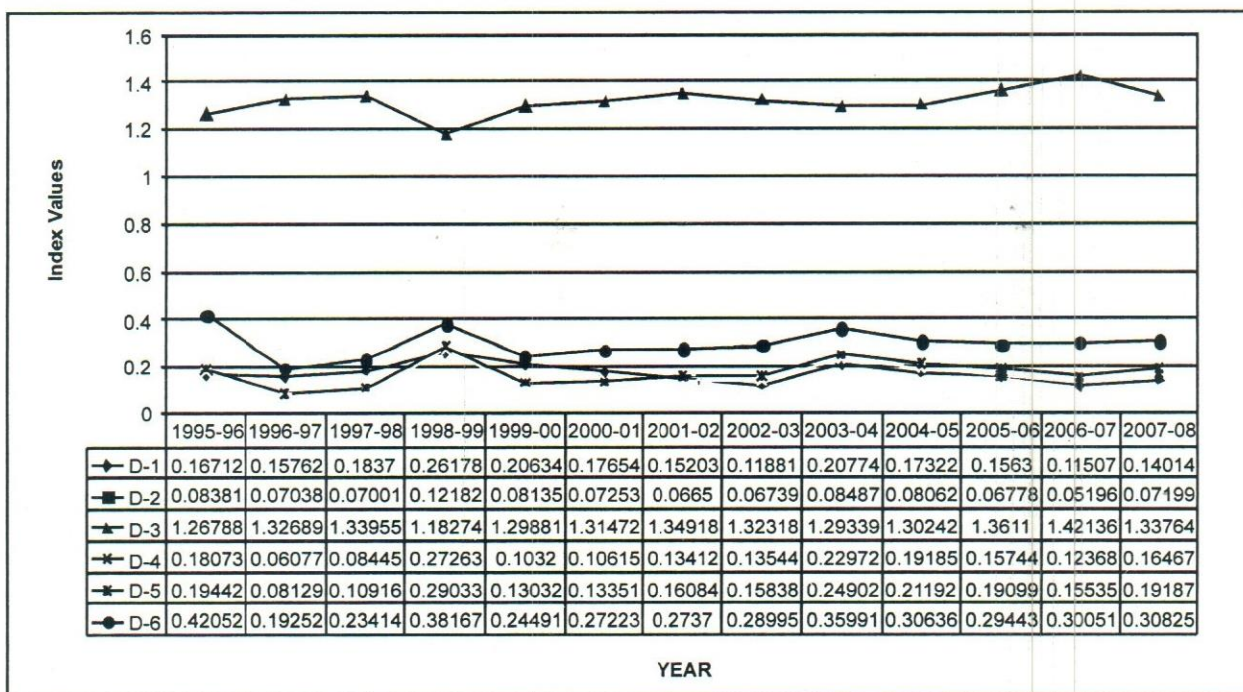
the same forty-five major importing countries again during the period 1996–97 to 2007–08. In the figure, the different measures of concentration viz., Index of Maximum Proportion (D_1), Herfindhal Index (D_2), Entropy Index (D_3), concentration ratio of four major importing countries CR_4 (D_4), concentration ratio of eight importing countries CR_8 (D_5) and concentration ratio of sixteen importing countries CR_{16} (D_6) ranges from value 0.15407 to 0.81786, 0.0683 to 0.67255, 0.42212 to 1.3645, 0.10005 to 0.51015, 0.40091 to 0.93007 and 0.55107 to 0.95775, respectively. Subsequently, in the Figure 4, index D_2 has been revealing mixed nature regarding the concentration of the group and index D_3 depicts the fluctuating information about the concentration except the year 2003–04, which is also exhibited in the figure.

Likewise, Figure 5 illustrates the country concentration indices of the exports of processed cereals among the same 45 major importing countries again for the same period 1996–97 to 2007–08. These measures of concentration viz., Index of Maximum Proportion (D_1), Herfindhal Index (D_2), Entropy Index (D_3), CR_4 (D_4), CR_8 (D_5) and CR_{16} (D_6) ranges from value 0.19746 to 0.42925, 0.10794 to 0.22976, 0.89149 to 1.26979, 0.31363 to 0.6779, 0.52641 to 0.79471 and 0.54969 to 0.91571, respectively. However, index D_2 has been revealing almost uniform nature regarding the concentration of the processed cereals. Similarly, index D_3 shows the fluctuating information about the concentration over these

years. Moreover, the concentration index D_4 of this group depicts that it has been almost stable nature for the countries Bangladesh, Saudi Arabia, the UAE and Malaysia. Likewise, D_5 has also been showing the stable nature for the countries like Bangladesh, Saudi Arabia, UAE, Malaysia, Kuwait, South Africa, Yemen Arab, and the UK over above said period.

Figure 6 shows the value of the same six different measures of exports concentration indices of total processed food products among the 45 major importing countries during the same period 1995–96 to 2007–08 again. These measures of concentration viz., Index of Maximum Proportion (D_1), Herfindhal Index (D_2), Entropy Index (D_3), CR_4 (D_4), CR_8 (D_5) and CR_{16} (D_6) ranges from value 0.11881 to 0.26178, 0.05196 to 0.12182, 1.18274 to 1.42136, 0.06077 to 0.27263, 0.08129 to 0.29033 and 0.19252 to 0.27263, 0.08129 to 0.29033 and 0.19252 to 0.42052, respectively. All these concentration measures indicate the presence of diversification for total processed food products exports during the study period. Further, in this figure, the concentration ratio CR_4 (D_4), CR_8 (D_5) and CR_{16} (D_6) indicate low concentration of total processed food products exports in the first 16 importing countries of the world. Therefore, it may be analyzed that the above measures have shown potential in the different sub categories of the processed food products (PFPs) separately as well as in toto.

Figure 6: Country Concentration Indices of Processed Food Products Exports during the Period from 1995–96 to 2007–08



Source: As in figure 1.

Table 1: Descriptive Statistics of Exports of Processed Food Products during the Period from 1995–96 to 2007–08

(Value in Rs Lakh)

I	II	III	IV	V
Sr. No.	Year	Mean	Standard Deviation	Coefficient of Variations
1	1995–96	14772.650	24871.210	168.3598
2	1996–97	14418.800	21465.660	148.8728
3	1997–98	14467.580	21454.560	148.2941
4	1998–99	19772.480	42332.730	214.0993
5	1999–00	15320.430	25273.350	164.9651
6	2000–01	19050.360	28987.640	152.1632
7	2001–02	20540.490	29320.870	142.7467
8	2002–03	28005.440	40377.080	144.1758
9	2003–04	28185.280	47858.980	169.8013
10	2004–05	32977.170	54062.420	163.9389
11	2005–06	34558.660	50040.230	144.7979
12	2006–07	40140.950	46957.770	116.9822
13	2007–08	60310.210	91271.170	151.3362

Source: Calculated on the basis of data collected from Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry, Government of India, New Delhi.

Table 1 divulges the descriptive statistics of the processed food product's exports to various countries during the period from 1995–96 to 2007–08. Column III of the table represents the mean values of exports for respective years. Similarly, Column IV displays standard deviations of the exports to various countries for respective years which show the dispersion among the importing countries. The last column of the table provides coefficients of variations which is reflected as a relative measures of inequality in the exports of India's processed food products. The mean value of year-wise processed food products exports has increased from 14772.650 to 60310.210 which is almost four times increase from the year 1995–96 to 2007–08. Moreover, the absolute dispersion measured by standard deviation has increased from 24871.210 to 91271.170, which is almost again four times increase over the study period. The coefficients of variation in these years have been of fluctuating nature. However, one may conclude that the stability over the years in the exports of processed food products has, to some extent, improved. It is because in the year 1995–96, the figure of coefficient of variation was 168.3598 and in the year 2007–08, the figure reduced to 151.3362, which means the reduction in the inequality of the exports of processed food products. Obviously, an improvement in the stability of the exports of processed food products and India's exports are leading towards uniform distribution among the countries which may be considered as a good sign for the Indian economy.

Conclusions

The present study has examined the dynamic behaviour of India's exports of processed food products and reached the following conclusions:

1. Herfindhal Index reveals the presence of diversification (low concentration) of fruits and vegetables' exports among the 45 major importing countries of the world (figure 1).
2. In Figure 2, Index D_3 displays the higher values of the entropy index that signifies high concentration of Indian processed fruits and vegetables exports in the year 2007–08 to the various importing countries.
3. The country concentration indices of processed animal products exports have been stable in the beginning and starts declining after the year 2002–03 (figure 3).
4. The Index D_2 has been revealing mixed nature

regarding the concentration of the other processed foods (figure 4).

5. The country concentration indices of processed cereals exports have been illustrating almost uniform nature regarding the concentration (figure 5).
6. All these concentration measures indicate the presence of diversification for total PFPs exports during the period 1995–96 to 2007–08 (figure 6).
7. In the end, the coefficients of variation demonstrate that the variations in these exports have been of fluctuating nature (table 1).

Policy Implications and Suggestions

Based on the findings of secondary data on various aspects of processed food products industry in India, some strategic suggestions/policy implications have been presented here. These policy implications will be instrumental in creating a conducive environment for the development of processed food products industry and will also increase the share of PFPs industry in the country's total exports.

1. The food-processing industry has been growing at 14.7 percent per annum currently against 6–7 percent growth in 2003–04. However, the present study logically emphasizes the need of providing additional stimulus for the exports of processed food products and to address some policy issues like reforming labour law, SSI, de-reservation, high transaction costs, high taxation, high packaging costs, and infrastructure bottlenecks.
2. It has been observed that the quality of Indian processed food products is not up to the mark as per tastes and preferences of consumers in the global market. Therefore, it has been suggested that the Union and State Governments should organize regular seminars to update the technology. Thus, there is an immediate need for upgrading the skills, product diversification, SPS standards, market-oriented products, and participation in exhibitions in India as well as abroad.
3. An eco-friendly sound and subsidized public transport system is the need of the hour. Therefore, the transport facilities should be improved, and proportion of the transportation costs may be borne by the government to motivate the exporters. Keeping in mind the perishable nature of processed

fruits and vegetables and dairy products, a chain of cold-storage facilities must be developed from the place of production to airports and ports.

4. The functioning of the agencies like ITPO, IIFT, APEDA, etc., facilitating the exports promotion must be improved in order to sustain and develop long-term potential of PFPs units. Over a span of time, these agencies have become bureaucratic in their modus operandi. Keeping in view certain corrupt practices prevailing underneath the Indian economy, these agencies have also not been devoted honestly to the noble cause of their objectives.
5. The enterprises engaged in the production of PFPs, how so ever small in size, must endeavor to obtain ISO 9000 quality certification in addition to various countries-specific product certifications to improve their quality image in the eyes of overseas buyers in the market of the developed countries.

The statement of prime minister Manmohan Singh asserted,

There are a number of constraints both in the forward and backward linkages in the sector. But if we can get our act together, as we must, India can emerge as a leader in the global food-processing industry. That should be our ambition. Most of India's large industrial houses have a growing presence in the food-processing sector. I would like the Indian industry to think big and to think globally about the future of this very important sector of our economy. There is no reason why they should not emerge as global brand names just as in our IT industry has done to our great satisfaction.

In accordance with "Vision 2015—Strategy and Action Plan" food-processing sector has been given "priority status" and several measures have been taken to bring dynamism in the sector—liberalizing the sector by de-licensing, automatic approvals of the FDI, tax exemptions for exports, processing and imports of processing technology. Several schemes have been proposed to enhance post harvest infrastructure—processing and packing houses for fresh produce, modern abattoirs, creation of Agri Food Parks, value-added centers and irradiation facilities.

In such a manner, the industry has an ample potential to chalk out the development path of the Indian economy in the 21st century.

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"We do not inherit the earth from our ancestors; we borrow it from our children."

— Chief Seattle

HRD and Empowerment: A Study

P. S. Swaminathan and S. Rajkumar

With changing business scenario, the market has become extremely competitive. There are now more players in the market in almost every area of business. Therefore it has become imperative for every organization to achieve corporate excellence. Competition necessitates improving the quality of products, reduction in the cost, ability to sell at a competitive price, innovation in product development and enhancement of productivity leading to achieving corporate excellence. Organizations, therefore, before looking at technological upgradation, should ensure human competency upgradation to cope with the technological change. The new economic policies have created tremendous opportunity for the industrial enterprises to grow, develop, and excel. Experience shows that successful companies follow a combination of policies of growth, that is, those related to efficiency, productivity, and human resource development. Few of the important HR issues for achieving corporate excellence are: aligning business strategy with HR strategy, competency mapping and skill development, job enlargement, job enrichment, development of mutual trust, and synergy among work teams. Corporate excellence is the combination of people, systems, products, and marketing excellence. Out of these, people excellence is important because it has a direct bearing on systems, products and marketing. Therefore, HR is no more a support service in an organization; rather it is a partner in the strategic function of every organization.

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Corporate India has yet to invest in intangible assets in a big way. The critical crunch of competition has yet to envelop the commercial landscape on account of limited exposure at the international level. This is made evident since the share of foreign investment in India vis-à-vis Asian countries is a meager 1.00 while the ratio vis-à-vis the world is a minuscule 0:14. The share of FDI to GDP is 1.0 percent for India as compared to 4–5 percent share for growing economies like China, Malaysia, and Singapore. Actual inflows of FDI are about one-fifth of approved investment.

Yet there has been a fair amount of activity in recent times. For example, Motorola India acquired a small Delhi-based company which makes microchips with the precondition that the expertise of its 20 employees would continue to be utilized by the unit.

Similarly, a number of Indian companies are realizing that a successful organization needs people with appropriate skills and competencies who can work together effectively. It is felt that prosperity of the organization would be assured if the workforce is committed, competent (competencies can be developed and can bring improved product quality and productivity), and cost effective.

Hence a number of Indian companies have developed ingenious methods of channelizing human resources to achieve productivity improvement. At the plant level, many firms have been engaged in the task of productivity enhancement through HRD within their organizations and have demonstrated that with strong efforts and determination it is possible to succeed. For example, Godrej Soaps Ltd adopted the Japanese system of Kaizen, involving continuous improvement, with excellent results.

Some of the other companies which have emerged as winners are Larsen and Toubro, Modi Xerox, TISCO. An outline of their strategies are as follows. TISCO gave a thrust to technology upgradation and modernization through its TISTECH program wherein technology push was made possible through effective manpower management. For this purpose, extensive overseas trainings were arranged for workmen to acquire the latest technical know-how and special training courses were organized for employees to update their knowledge. Generous rewards were also provided for innovative ideas. Such measures, according to the company, helped greatly in inculcating the right attitudes which contributed, in a large measure, to augment productivity levels in the company. This example has been emulated by many other companies which aim to become front-runners in technology development in their area of operation. Larsen and Toubro recognized that to become, pioneers in the engineering industry, it is of utmost importance to go in for sophisticated and modern technology. This meant utilizing human talent for in-house R&D activities to assimilate and adapt acquired technology. Some of the other efforts aimed at productivity enhancement included dissemination of technology information at shop-floor level to generate awareness among employees, decentralization of technical operations, etc. Modi-Xerox, another successful company, attributes its growth to successful management of strategic alliances. The efficiency of the technology assimilation procedure adopted by the company aimed at manufacturing internally critical components demanding high reliability through technicians who were sent to Japan for training. Modi-Xerox thus adopted skill transfer through strategic alliance as its strategy for assimilation and adaptation of foreign technology.

Objectives

- 1) To make a study on factors effecting empowerment, viz, technology, customers, and organizations.
- 2) To study steps in work in empowerment cycle.
- 3) To analyze the benefits of empowerment.
- 4) To evaluate the productivity through empowerment.

Research Methodology

The researcher in a systematic, orderly and scientific way made a survey of professionals, from different

organizations, industries, using structured questionnaire and subsequently interviewed them on the following five items:

- Their definition of the term empowerment.
- Their feeling the need to be empowered in their organizations.
- Their feeling that they are already empowered in their positions/ jobs.
- Their views that employees should be empowered.
- Their views as to how to empower people in an organization.

A well-structured questionnaire, covering all facets, keeping in view the objectives outlined above, was used. Responses were recorded by way of interaction with senior managers, managers and supervisory personnel. Opportunity was availed to meet them in their organizations. The selected companies are based at Chennai metro, located in the industrial areas.

Primary Data Sample

The respondents were selected from the top, middle, and operating levels of hierarchy of large, multinational public and private organizations. The study covered directors, general managers (heads of divisions), functional managers (heads of departments) and supervisory personnel. The sample represented the decision makers as well as the decision implementors.

The questionnaire was administered to the respondents of industries located in the Chennai metro city as well as in the adjoining districts such as Chenglepet, Kancheepuram, and Tiruvellore. At a few places, especially interior villages, courier/ mail was used to send the questionnaire. Telephone was used to remind the far-off respondents to send their responses. Only 138 responded. Two responses were incomplete. Personal interviews conducted by the researcher were also analyzed.

Secondary Data

The researcher utilized opportunities to discuss with chiefs/ heads of successful business entrepreneurs with a view to share their views/opinions and experience of empowerment, especially those who have made a mark in India as well as globally. Their views were codified and analyzed so as to examine them from the points of support or otherwise of the primary data revealing.

Data Analysis

Table 1. Demographic Details of the Respondents

	Managerial Cadre	Percentage	Supervisory Cadre	Percentage
EDUCATIONAL QUALIFICATION				
Non-Graduate	2	4	8	10
Graduate	10	20	31	40
Post-Graduate	18	36	10	12
Technical	20	40	29	38
Total	50	100	78	100
Age				
< 30 years	9	18	12	15
31-40 years	11	22	9	10
41-50 years	17	34	30	40
> 51 years	13	26	27	35
Total	50	100	78	100
MARITAL STATUS				
Married	47	94	72	91
Unmarried	3	6	6	9
Total	50	100	78	100
EXPERIENCE				
< 1 Year	-	-	-	-
2-5 years	7	14	11	14
6-9 years	8	16	10	12
10-13 years	19	40	32	40
> 13 years	16	30	25	34
Total	50	100	78	100

NB: (1) Names of the companies/managers/executives selected for the study are disguised at the company's request.
 (2) The above table analysis covers 128 against 138, as details of 10 respondents were incomplete.

Table 2. Definition of Empowerment

S. No.	Responses	Respondents	
		Number	Percentage
1.	Delegation of Authority	107	78.1
2.	Freedom of decision making	37	27.0
3.	Enabling people to perform and make effective use of power delegated	35	25.5
4.	Participation and teamwork	22	16.1
5.	Developing confidence and trust	12	9.5
6.	Sharing of knowledge and proper feedback	3	2.2

Source: Primary Data

Note: *Total is more than 138 because of multiple responses
 N = 138

While defining empowerment 78.1 percent of respondents defined it as power and authority, 27 percent defined it as freedom and flexibility in decision making, 25

percent defined it as enabling, 16 percent defined it as the capability in decision making, acquisition of talent and process of building self-confidence, 9.5 percent felt empowerment to be enthusiasm and a feeling of responsibility and 2.2 percent understood it to be the

Table 3. Do you feel the need to be empowered?

S. No.	Responses	Respondents	
		Number	Percentage
1.	Not at all	5	3.6
2.	To a little extent	9	5.8
3.	To some extent	18	13.1
4.	To a considerable extent	63	46.0
5.	To a great extent	43	31.5
	Total	138	100.00

Source: Primary Data

Note: N = 138

sharing of knowledge. Since the respondents gave more than one definition, the percentage does not total to 100. The content analysis of the responses to item number 1 on definition of empowerment is summarized in Table 2.

The need for empowerment was measured on a five-

Similarly on the responses on feeling empowered which was measured on a five-points scale, ranging from "not at all" to "to a great extent", 3.6 percent felt not at all empowered, 18.3 percent felt empowered to a little extent, and 39.4 percent felt empowered to some extent. This

totals to around 61 percent which indicates towards the

need to improve the empowerment.

point scale ranging from "not at all" to "to a great extent."

The results suggest that 46 percent of the respondents felt that there is considerable need for empowerment and 77.5 percent felt a positively definite need for empowerment. This indicates that empowerment has distinct supportive tool, method and system to make employees work better, achieve good and accomplish their goals and objectives.

Table 4. Do you feel empowered?

S. No.	Responses	Respondents	
		Number	Percentage
1.	Not at all	5	3.6
2.	To a little extent	26	18.3
3.	To some extent	54	39.4
4.	To a considerable extent	34	24.8
5.	To a great extent	19	13.9
	Total	138	100.00

Source: Primary Data
Note: N = 138

Table 5. Do employees need to be empowered?

S. No.	Responses	Respondents	
		Number	Percentage
1.	Not at all	2	1.5
2.	To a little extent	10	6.6
3.	To some extent	26	19.0
4.	To a considerable extent	57	41.6
5.	To a great extent	43	31.3
	Total	138	100.00

Source: Primary Data
Note: N = 138

As can be seen from Table 5, 1.5 percent of the respondents expressed no necessity to empower employees; 6.6 percent expressed the necessity to a little extent, 19 percent felt the necessity to some extent, 41.6 percent felt the need to a considerable extent, and

Table 6. How to empower?

S. No.	Responses	Respondents	
		Number*	Percentage
1.	Clear job definition, responsibility and accountability through proper communication to reduce role ambiguity and to increase satisfaction	48	35
2.	Proper delegation of authority with required skill development to improve competence and confidence.	39	28.5
3.	Adequate training for skill development and to achieve required attitudinal change.	34	24.7
4.	Providing regular feed back on individual and team performance to develop trust.	33	24.0
5.	Encouragement for innovation and autonomy through team building, care and love to improve competence and trust.	21	15.3
6.	Involving employees for participation in decision making to improve commitment.	17	12.4
7.	Flexible organization structure and a climate of open communication to encourage innovation.	14	10.2
8.	Providing required resources and enough opportunities for self development.	13	9.5
9.	Proper recognition and reward.	10	7.2
10.	Restructuring business into a profit centre, proper orientation to company policies.	9	6.6

Source: Primary Data
Note: Total is more than 138 because of multiple responses

31.5 percent expressed the necessity to a great extent. This indicates that over 73 percent expressed the necessity, which is an overwhelming percentage and goes to show how employees also feel the necessity to be

empowered in doing their work to their satisfaction as well as to benefit the organizations.

Table 7. Human Resource Strategic Contribution Organisation Strategy

		Reduce Costs	Create close agent relations	Cross sell products	Total
Human Resource strategy	Delayer and empower	70%	10%	20%	100%
	Create Multiskills	10%	10%	80%	100%
	Develop performance oriented culture	-	50%	50%	100%

Source: Primary Data

Table 8. HR activity contribution

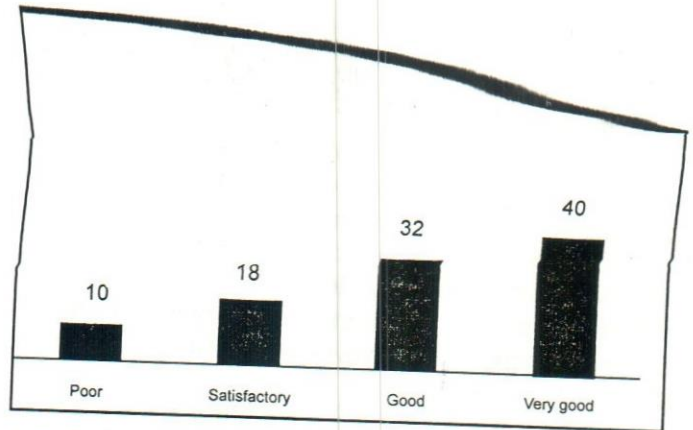
Training Activities	Delayer and Empowerment	Create Multi-skilling	Develop a performance oriented culture	Total
Cross train employees to handle all product areas	20%	80%	-	100%
Implement performance management training for all supervisory staff	20%	-	80%	100%
Establish basic training for all employees in how to act in an empowered way, including limitations (e.g., how to seek and obtain an authorization)	80%	-	20%	100%

Source: Primary Data

Tables 7 and 8 indicate the HR contribution matrix and HR activity contribution matrix as was revealed during the study. Most managements have adopted their HR strategy dovetailing them with organization strategy. The empowerment activities through continuous training/development in chosen areas have their impact on the overall confidence and competence levels of employees and managers. The effects of these strategies have been shown in the contribution they have received from the employees and managers. The tables demonstrate the

extent to which the training have led to development in terms of performance-oriented culture.

Table 9. Survey results on working environment

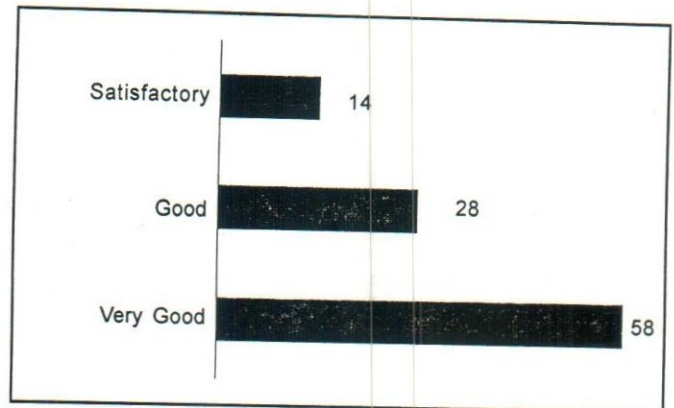


Note: Environment: In percent

The study revealed that the managers and supervisory staff had a positive outlook in that excepting 10 percent stated that the working environment was poor, the balance 90 percent was favorable disposed with 72 percent reporting that the working environment is good and very good.

This shows that with the management's commitment for empowerment, the positive and congenial working environment would foster a state of continued cooperation and contribution to the profitability of the organizations. This trend was perceivably most suited for a competitive situation.

Table 10. Survey Results Showing the Companies are Good Places to Work



Note: Satisfaction: In percentage

Table 10 categorically proves the positive and overwhelming outcome of empowerment. The satisfactory report of 14 percent is in respect of those organizations which have not fully implemented the various facets of empowerment due to variety of reasons, a contributing

factor being financial restructuring; 58 percent of the management personnel reported the improvement as very good, mainly from the point of trouble-free, smooth functioning with everyone endeavoring to put in his best for the betterment of the organization, keeping their individual egos and concerns as secondary and non-vital.

Conclusions

1. Twenty out of 138 top executives/middle-level managers and senior supervisory staff were selected for personal interview, based on the content analysis of their response. Prior appointment was taken and meeting with 19 executives could be arranged. It was observed during personal discussions that the understanding of the term "Empowerment" was partial as they focused their attention toward power, delegation, communication, responsibility, etc. The analysis of data shows that the understanding of the concept is partial, limited, and varied.
2. At the same time, on feeling the necessity to be empowered, it is seen that majority of the respondents felt that it is necessary to be empowered and only a handful of persons feel that they are empowered.
3. There is an urgent requirement to study and develop wider framework in the field of empowerment. Empowerment is the most desired and required path to follow to achieve the goals of organization for sustenance and growth.
4. Several suggestions came out during interview:
 - a. Team work with emphasis on good superior-subordinate relationship—discipline should be enforced in the team by way of motivation.
 - b. Developing the work force through mutual cooperation, proper persuasion, effective communication and team spirit.
 - c. Proper planning of the task with clear cut contribution of each member.

- d. Good quality of work life.
- e. Appropriate reward system.
- f. Multi-skilling and continuous development plans.

Of all the suggested measures, the respondents considered team work and developing the workforce to be crucial while implementing empowerment.

5. To foster a culture of cooperation, altruism as a corporate value must be encouraged. The researcher found that those managers who valued altruism (that is, helping others) reported to value authority (that is, willingness to assume responsibility for other people), creativity (to discover develop or design new things) and working conditions (the congenial physical atmosphere of the work set up).

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"True wisdom consists in not departing from nature and in moulding our conduct according to her laws and model"

— Seneca,
ancient Roman writer

Feature

Growth and Performance: A Study of Selected Industry Groups of Punjab

Manjit Sharma

The study reveals that organized manufacturing sector experienced "jobless growth" during post-reform period. Manufacture of food, transport equipments, and parts industries and organized manufacturing sector are labor-intensive industries during the study period. This is a good sign for labor-abundant economy of Punjab. Manufacture of textile and basic metal and alloy industries are relatively of capital-intensive nature during post-reform period. It implies either employment reaches to maximum position or these industries require more capital for production process. Labor and capital are complementary to each other in manufacture of textile, transport equipment, and parts industries and entire organized manufacturing sector during post-reform period. It signifies that above industries use capital and labor in such a proportion that more usage of capital generates more employment opportunities. Capital-output ratio declined for organized manufacturing sector, manufacture of basic metal and alloy, and transport equipment and parts industries, which is a good indicator for economy.

Punjab state underwent a vast change in the political and economic set-up since last 30 years. In the first phase (1980 to 1991) state was inflicted with militant activities. There was lack of popular government and bureaucracy ruled the state. The over bureaucratization of administration, frequent power shortage, special package to hill states, and indifferent political attitude leading to business insecurity have discouraged industrial units in Punjab as compared to the neighboring states. In the second phase, government of India introduced policies of macro-economic reforms. In this background, the analysis of growth and performance of selected industries of organized manufacturing sector of Punjab is discussed for the period of 1980 to 2003. An analysis of selected industries at three-digit level has been attempted to understand the contours of industrial growth of the state.

Economic theory states that the development pattern of any economic set up is dominated by agricultural sector in the initial stages of its development and gradually when the process of growth starts rising, the manufacturing and service sector attain the greater share (Kuznet, 1973). Same phenomena have been observed in Punjab. Agriculture, which is mainstay of the state economy, has been experiencing stagnation, as it has recorded negligible growth during last decade (Singh and Singh, 2002). The cropping pattern of the state is dominated by wheat-paddy rotation and seems to be unsustainable due to increasing costs, irrigation, and environmental problems. Attempts made by the government to change this cropping pattern in favor of new and commercial crops through contract farming could not bear fruitful results. Unfortunately the state has failed to maintain its top position in per capita income and slipped to fourth rank (Statistical Abstract of Punjab, 2007). Economic growth which the state is experiencing is less than the national average and failed

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to generate enough employment opportunities for rising army of unemployed peoples (Kumar, 2005).

Under such circumstances, all hopes lie on the development of the manufacturing sector of Punjab, which is considered engine of growth. When agriculture had reached its plateau, development of manufacturing sector was the only way out to develop the state on modern lines.

Data Sources, Time Period and Prices

Our data source is Annual Survey of Industries published by Central Statistical Organisation annually. Time period under consideration is 1980 to 2003. To understand the impact of economic reforms on the performance of important variables time period has been divided into two periods, period before reforms, that is, 1980–81 to 1990–91 and period after reforms, that is, 1990–91 to 2002–03. To adjust the data on fixed capital, wholesale price index for transport and machinery has been used. Prices of gross output, input, and value added have been deflated with the wholesale price index of corresponding industries. Consumer price index has been used to deflate the emoluments and wages. Every deflator has 1993–94 as a base year.

Variables Defined

Value of output: It is the aggregate market value of products manufactured for sale, work done for customer, and sale value of goods sold in the same condition as purchased and is adjusted for the difference in stocks of semi-finished goods at the beginning and the end of the survey year.

Value added: Gross value added equal gross expected market value of output less the gross market value of inputs.

Labor (L) the alternative measures of labor input often used are:

- (i) man-hours worked,
- (ii) man-days worked,
- (iii) workers, and
- (iv) employees, etc.

Number of employees as a measure of labor input is used and is published by the ASI, and this represents workers and non-workers.

Total emoluments as provided by Annual Survey of Industries (ASI) have been first converted into the real value through the use of relevant price deflator.

Capital Stock: Capital stock is estimated with the help of perpetual inventory accumulation method.

Methodology

Trend growth rates have been calculated by using the semi log linear regression analysis and comparative analysis has been presented for pre- and post-reform period.

Employment Elasticity has been calculated by using the following equation:

$$\text{Log } L_t = a_0 + a_1 \text{ log } Y_t - a_2 \text{ log } K_t$$

where,

L_t : is level of employment in period "t"

K_t : is level of capital in period "t"

Y_t : is level of output in period "t"

a_1 and a_2 are elasticity of employment with respect to output and capital, respectively, $a_2 > 0$ implies labor and capital are compliments and $a_2 < 0$ implies labor and capital are substitutes.

Output elasticity with respect to labor and capital measure the change in output due to one unit change in labor and one unit change in capital. For estimating output elasticity the following equation is used:

$$\text{Log } Y_t = a_0 + a_1 \text{ Log } L_t - a_2 \text{ log } K_t$$

Here a_1 a measure elasticity of output with respect to labor and a_2 measure elasticity of output with respect to capital.

The percentage share of the four selected industries (manufacture of food industry, textile, basic metal alloy and transport equipment and parts industry) in terms of employment, output and emoluments, out of entire organized manufacturing sector of Punjab turned out to be approximately 60 per cent, 1980 onward.

The industrial classification has been changed in 1998 and it is impossible to make the discrete series directly. For this purpose a vigorous exercise has been done by going to three-digit level to make the matching series by either clubbing or splitting the existing classification.

Present study has been divided into four sections. In the first section trend growth rate of important variables have been calculated and comparative analysis is done for pre and post reform period. In the second section employment and output elasticities are calculated. In the third section selected technical ratios are presented. In

Table 1. Trend Growth Rate of Important Variables: An Inter-industry Analysis

Variables	Industry	1980-81 to 1990-91	1990-91 to 2002-03	1980-81 to 2002-03
EMPLOYMENT	Food	5.65 (9.89)*	3.99 (6.79)*	3.25 (11.63)*
	Textile	3.61 (4.97)*	-0.39 (-0.74)	0.72 (2.39)*
	Metal	-1.86 (-1.35)	-1.99 (-2.07)*	-2.45 (-6.25)*
	Transport	5.60 (11.7)*	2.49 (3.05)*	4.79 (15.29)*
	OMS	5.69 (13.01)*	-2.03 (-2.00)*	1.87 (3.69)*
OUTPUT	Food	10.45 (9.15)*	5.09 (5.76)*	5.93 (12.66)*
	Textile	9.20 (10.84)*	3.56 (3.18)*	4.26 (8.56)*
	Metal	5.74 (3.12)*	17.91 (9.12)*	7.26 (6.76)*
	Transport	11.20 (11.95)*	2.69 (2.31)*	8.08 (13.05)*
	OMS	9.50 (12.22)*	5.13 (7.60)*	7.02 (21.11)*
GVA	Food	11.87 (8.91)*	7.78 (9.61)*	8.69 (20.54)*
	Textile	12.84 (15.10)*	2.57 -0.004	5.39 (8.16)*
	Metal	1.85 -0.52	8.50 (2.94)*	1.37 (1.12)*
	Transport	10.93 (7.91)*	27.68 (6.22)*	17.84 (12.40)*
	OMS	9.86 (8.08)*	3.47 (3.61)*	6.90 (13.75)*
EMOLUMENTS	Food	9.34 (13.25)*	4.05 (5.41)*	5.83 (15.44)*
	Textile	6.41 (6.65)*	-1.19 (-1.21)*	2.65 (5.00)*
	Metal	1.82 -0.93	-2.42 -0.69	-0.64 (-0.64)
	Transport	9.58 (20.63)*	0.59 (0.63)*	7.04 (11.03)*
	OMS	9.62 (20.27)*	0.56 (5.27)*	4.31 (6.15)*
FIXED CAPITAL	Food	5.33 (5.84)*	5.61 (5.27)*	5.99 (17.36)*
	Textile	5.48 (2.82)*	8.70 (2.37)*	9.20 (8.49)*
	Metal	-3.99 (-2.99)*	-1.04 (-0.38)	-0.69 (-0.87)
	Transport	-4.82 (-2.99)*	16.66 (6.76)*	12.84 (13.39)*
	OMS	0.78 (1.38)*	13.00 (8.89)*	5.49 (7.00)*

Note: Figure within bracket are 't' values

*1% level of significance, **5% level of significance

the last section concluding remarks and policy implications are given.

Section -1

Trend Growth Rate: An Inter-industry Analysis

It is clear from table 1 that the organized manufacturing sector of Punjab experienced 5.69 percent per annum, a significant growth rate of employment in pre-reform period, whereas in post-reform period there was negative (-2.03 percent per annum) growth rate, that is, era of "jobless growth" as mentioned in literature. In all the selected industries growth rate of employment was more in pre-reform era vis-à-vis post reform period. Growth rate of emoluments of the organized manufacturing sector and selected industries is higher than that of growth rate of employment of the corresponding industries, in the pre-reform period, however in post-reform period, growth rate of emoluments of manufacture of food industry and the organized manufacturing sector is higher than that of growth rate of employment for the corresponding industries. It implied existing skilled labor force has been paid higher wages and perks rather than creating new employment opportunities.

This is well-documented in literature that the output of industrial sector can either be increased by the setting up of new factories (capital formation) or by raising the productivity and efficiency of industry. This issue initiates us to explore the output scenario. Growth rate of output in entire organized manufacturing sector of Punjab is higher and significant (9.50 percent per annum) in pre-reform vis-à-vis post-reform period, where it was 5.13 percent per annum but significant. Same momentum of output was not maintained in post-reform period. Growth rate of output is significant and higher (manufacture of food, textile, and transport equipment and parts industry) in pre-reform period than that of post-reform period. However, the manufacture of basic metal and alloy industry is an exception where growth rate of output is higher and significant (17.91 percent per annum) in post-reform period as compared to pre-reform period (5.74 percent per annum).

Growth rate of output and value added did not maintain same pace. Their difference helps us to capture undercurrents. Growth rate of gross value added of entire organized manufacturing sector, manufacture of food and textile sector is higher than that of growth rate of output of corresponding industries in pre-reform period, which implies that these industries must have fetched the higher prices from the market. However growth rate of gross value added in manufacture of food and transport equipment and parts

industry is higher than growth rate of output in post-reform era. The growth rate of fixed capital of entire organized manufacturing sector and in all the selected industries is higher in post-reform as compared to pre-reform period. It implies fixed capital has followed acceleration principle. The probable reason is that entrepreneurs hesitated to invest in militancy-affected areas during pre-reform period. Most surprisingly higher growth rate of fixed capital failed to achieve higher growth rate of employment and output during post-reform period.

Section - II

Employment and Output Elasticity Pattern

Expansion of industrial manufacturing alone cannot be expected to solve the unemployment and underemployment problems in many less-developed countries (Morawetz, 1974). The employment elasticity with respect to output and capacity expansion should also be highly significant. Elasticity measures the rate of growth of employment in a specific sector resulting from one percent rate of growth in output and capital stocks. Level of employment and employment elasticity theoretically wears a relationship (Ghose, 1994). Keeping it in view, employment elasticity with respect to output and capital has been calculated to discern the potential of industrial sector in generating employment.

Employment and Output Elasticity Pattern: An Inter-industry Analysis

Employment elasticity with respect to output describes how far output of an industry has been able to generate employment in that industry. It is clear from table 2 that employment elasticity with respect to output in manufacture of food and transport equipment and parts industry turned to be low but positive significant in pre-reform as well as post-reform period. Demand for labor is derived demand, with increase in output, demand of labor is expected to increase, and same phenomenon has been noticed here. But the employment elasticity with respect to output was abysmally low for organized manufacturing sector of India (Ghose, 2005). In pre-reform period the value of employment elasticity with respect to output has turned to be low positive (less than one) but significant in the textile sector, basic metal and alloys, and the organized manufacturing sector. Positive employment elasticity indicating till now these industries is labor-intensive, that is, employment is generated in these industries. However, in manufacture of textile and basic metal and alloy industry this value is turned to be negative. Negative employment

Table 2. Employment and Output Elasticity of Selected Industrial Groups

Manufacturing Group	Employment Elasticity				Output Elasticity			
	Output		Capital		Capital		Labor	
	T ₁	T ₂	T ₁	T ₂	T ₁	T ₂	T ₁	T ₂
Food Industry	0.32** (2.42)	0.63** (2.53)	-0.38 (1.57)	-0.05 (0.22)	-0.40 (0.75)	-0.43** (2.43)	1.31** (2.42)	0.66** (2.52)
Textiles	0.29* (3.88)	-0.06 (0.67)	0.2** (2.28)	0.07** (2.07)	0.16 (0.51)	-0.02 (0.14)	2.23* (3.88)	-0.76 (0.67)
Basic Metal And Alloys	0.19** (3.18)	0.09* (4.49)	-0.89* (9.47)	-0.32* (7.62)	2.73* (3.12)	-2.22* (3.31)	2.97* (3.18)	-7.22* (4.48)
Transport Equipment and Parts	0.27* (2.85)	0.37* (2.60)	-0.27* (3.11)	0.10 (1.11)	0.07 (0.28)	-0.24 (1.52)	1.85* (2.85)	1.16* (2.6)
Organized Manufacturing Sector	0.58* (11.84)	0.52 (1.87)	-0.14 (0.57)	0.36* (3.12)	0.14 (0.34)	-0.44* (5.21)	1.62* (11.84)	0.53 (1.87)

Note: T₁ – 1980–81 to 1990–91

T₂ – 1990–91 to 2002–03

*1% level of significance

**5% level of significance

Figure with in bracket are "t" ratios.

elasticity imply decline in employment with increase in output, meaning thereby they are relatively capital intensive. In these industries one unit of output generation leads to decrease in employment implying: either employment of labor reaches to its maximum position or these industries require more capital for production of one unit of output.

The employment elasticity with respect to capital indicates whether an extra unit of capital leads to decrease in employment of labor or increase it. In the former case capital acts as substitute for labor and the latter implies complementarity between the two. Employment elasticity with respect to capital for organized manufacturing sector is 0.36 and significant in the post-reform period, which indicates that labor and capital are complimentary to each other. This is a good sign for Punjab industry because organized manufacturing sector uses labor and capital in such a proportion that more use of capital generates more labor. In pre-reform period this variable is turned to be negative (-0.14 and statistically insignificant value), which depicts that labor and capital are substitutes for each other. Besides, all the selected industries recorded negative coefficients that do not support the labor absorbing character in the pre-reform period. In manufacture of textile, basic metal and alloy, and transport equipment and parts industries the negative and significant value (in pre-reform period) of employment elasticity with respect to capital puts a question mark on the absorption of labor with

increase in capital. Further the manufacture of textile sector has shown complimentary nature of labor and capital in post-reform period and substitute nature of labor and capital in the pre-reform period. Food industry has shown negative and statistically insignificant value in both the periods indicates labor and capital are substitutes to each other.

Output elasticity with respect to capital and labor provides a measure for relative importance of the factors of production. The results depict (table 2) that in the organized manufacturing sector of Punjab, capital variable is turned to be low and negative (-0.44) but significant in the post-reform period. However, the output elasticity with respect to labor is observed to be positive (1.62) and significant in pre-reform period. Labor has remained the important factor of production during pre-reform period and capital variable has played secondary role, that is, its value is turned to be low positive but statistically insignificant.

Labor has remained an important factor of production in the manufacturing of food industry in both the periods however, capital variable is negative (-0.43) and significant in post-reform period. In the manufacture of textile sector, labor has significant value (2.23) in pre-reform period, but capital variable has witnessed statistically insignificant value in pre-reform as well as post-reform period. In manufacture of basic metal and alloy industry, labor and

capital variables have the values 2.73 and 2.97, respectively, which are statistically significant. It indicates that both labor and capital have played an important role in the production process during pre-reform period. However, the value of output elasticity with respect to capital and labor (-2.22 and -7.22), is negative and significant in the post-reform period. Hence, it is inferred, that instead of generating output in the post-reform period, the increase in labor and capital variables have created obstacles in the production process in manufacture of basic metal and alloy industry. Positive output elasticity with respect to capital for manufactures of textile, basic metal and alloy, transport equipments and parts, and organized manufacturing sector during pre-reform period, implies marginal productivity of capital is positive for these industries. This clearly suggests that use of capital will raise the production level. Negative output elasticity with respect to labor for manufacture of textile and basic metal and alloy industry during post-reform period, implies that

extra unit of labor will reduce the output level. Hence marginal productivity of labor is negative for these industries.

There is significant contribution of labor but the capital variable has failed to contribute more output in manufacture of transport equipment and parts industry during the study period.

Section III

Selected Technical Ratios: An Inter-industry Analysis

Under the impact of new regime, it is expected that factor intensity would experience change, whether the factor intensity has tilted in favor of labor or capital, capital-output ratio, and emoluments-output ratio have been calculated in real terms and presented in average for pre and post-reform period in table 3. Two efficiency-measuring ratios namely value added to output ratio and value added to capital ratio have been presented in averages.

Table 3. Selected Technical Ratios: An Inter-industry Analysis

Industry	Ratios	(Average Value)		
		1980-81 to 2002-03	1980-81 to 1990-91	1990-91 to 2002-03
Organized Manufacturing Sector	Value Added to Output	0.18	0.18	0.18
	GVA to Capital	0.29	0.25	0.32
	Capital to Output	0.70	0.79	0.63
	Emolument to Output	0.06	0.07	0.05
Food Industry	Value Added to Output	0.13	0.11	0.15
	GVA to Capital	0.98	0.86	1.08
	Capital to Output	0.14	0.13	0.14
	Emolument to Output	0.04	0.04	0.04
Textile Industry	Value Added to Output	0.18	0.17	0.19
	GVA to Capital	0.73	0.90	0.57
	Capital to Output	0.32	0.20	0.42
	Emolument to Output	0.06	0.06	0.06
Basic Metal and Alloy Industries	Value Added to Output	0.23	0.29	0.16
	Value Added to Capital	0.88	0.84	0.91
	Capital to Output	0.29	0.37	0.22
	Emolument to Output	0.06	0.08	0.05
Transport Equipment and Parts Industry	Value Added to Output	0.35	0.37	0.32
	GVA to Capital	1.12	1.14	1.10
	Capital to Output	0.32	0.33	0.31
	Emolument to Output	0.07	0.07	0.07

Source: Calculated from various issues of ASI

Investment in fixed capital is made for (i) to build capacity for higher growth in output (ii) capital intensive innovation (iii) diversification or change in the composition of output. In all these cases, use of fixed capital is justified if it leads to higher growth in value of output along with increase in production efficiency. Hence change in capital output is one of the best ways to identify, whether investment in fixed capital is justifiable or not. Capital-output ratio, measure of factor intensity is also a determinant of efficiency. It has followed a decreasing trend for organized manufacturing sector, manufacture of basic metal and alloy, and transport equipments and parts industry sector from pre-reform to post-reform period, which is a good indicator for economy. Declined ratio can be attributed to general improvement in the quality of investment. Declined ratio is also suggestive of shift in the composition of manufacturing sector, that is, toward less capital-intensive product or processes. However, this ratio has followed an increasing trend for manufacture of food and textile sector from pre-reform to post-reform period, which indicates deteriorating condition of these two sectors. Declining trend in emoluments to output ratio is obvious for organized manufacturing sector and manufacture of basic metal and alloy industry. Declining trend in emoluments to output ratio is a negative trend for labor-abundant economy of Punjab. However the ratio remained same for manufacture of food and textile sector in post-reform period.

Value added to output ratio highlights the importance of expenditure on basic raw material used in production process. Value added to output ratio has also remained the same for organized manufacturing sector, which indicates that output and value added have followed the same growth rate. This ratio followed increasing trend for manufacture of food and textile sector which reflects that growth rate of value added is higher than that of output for these sectors. Conclusion emerges that this may be possible either due to sale at higher prices or production at lower cost. However, declining ratio of value added to output in manufacture of basic metal and alloy and transport equipments and parts industries indicate that growth rate of output has failed to generate more value addition. Declined ratio suggests an increasing share of raw material and inputs in values of output. At organisation level, it indicates the gradual shifting towards smaller factory size in manufacturing sector. Gross value added to capital ratio followed an increasing trend for organized manufacturing sector, manufacture of food industry and basic metal and alloy industry whereas this

ratio has followed the decreasing trend for textile and transport sector.

Section IV

Concluding Remarks

Entire organized manufacturing sector experienced negative growth rate in employment in post-reform period, that is, era of jobless growth, as mentioned in economic literature. In all the selected industries growth rate of employment and output (except basic metal) was more in pre-reform period, vis-à-vis, post-reform period.

The study reveals that manufacture of food, transport equipments and parts industries, and organized manufacturing sector are labor-intensive industries during the study period. This is a good sign for labor abundant economy of Punjab. As labor demand is derived demand, so with increase in output there is employment generation in above industries. Manufacture of textile and basic metal and alloy industries are relatively of capital-intensive nature during post-reform period. It implies either employment reaches to maximum position or these industries require more capital for production process.

From the above discussion it is clear that labor and capital are complementary in nature for manufacture of textile, transport equipment and parts industries, and organized manufacturing sector in post-reform period. These industries use labor and capital in such a proportion that more usage of capital generates more employment opportunities. Manufacture of textile, transport equipment and parts industries, and organized manufacturing sector in pre-reform period and manufacture of food industry during both the periods show substitute nature of labor and capital.

Marginal productivity of capital and labor is negative for manufacture of textile and basic metal and alloy industries during post-reform period. It is a serious cause of concern because it will reduce the output production in above-mentioned industries. Marginal productivity of capital and labor is positive for manufacture of textile, basic metal and alloy, transport equipment and parts industries, and organized manufacturing sector of Punjab during pre-reform period. Positive marginal productivity indicates that extra unit of factor of production will raise the production level.

Capital-output ratio followed a decreasing trend for organized manufacturing sector, basic metal and alloy

industry, and transport sector from pre-reform to post-reform period, which is a good indicator for economy. It can be attributed to general improvement in quality of investment. This declined ratio suggests shift in composition of manufacturing sector, that is, toward less capital-intensive product or process.

Policy Implications

The state should encourage agro-based industries, which have greater access to raw material and have greater potential to absorb the unemployed labor force. The selected industries should be strengthened with labor-intensive technologies and its share should be increased in gross domestic product of state. The state government should welcome foreign technology and foreign direct investment, grant more roles to private sector and upgrade industrial infrastructure so existing unemployed technically educated labor force may exploit the advantage. There is need for restructuring the industrial process and organization. While establishing new units, it must be kept in mind that the new units must be based on local material and local demand.

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"To forget how to dig the earth and tend the soil is to forget ourselves."

— Mahatma Gandhi

Effect of JIT Purchasing Attributes in Automobile Industry (A Case Study)

Sultan Singh and Dixit Garg

Just-in-Time (JIT) purchasing has become a subject of much interest throughout the world today. Due to its huge potential of cost reduction of the product in all the areas by eliminating wastes, it has been implemented in many countries. The objective of this article is to study the effect of attributes in JIT purchasing implementation in an automobile industry.

Introduction

JIT purchasing is an uninterrupted flow of 100% acceptable materials delivered on due dates and time at optimal cost 100% of time. It is a process of buying, which involves determining the need, selecting the supplier, proper price, terms and conditions, order and proper delivery. Purchasing is carried out in small lots with frequent deliveries in small standard containers of exact quantity and specifications from local supplier with long-term contract. In implementation of JIT purchasing, its attributes (Cusumano and Takeishi, 1991) have shown a greater effect at each stage. The characteristics of Japanese JIT purchasing (Daesung and Kim, 1997) are unique, in terms of both general philosophy and in detailed procedures. The term JIT purchasing suggests an emphasis on timing, which is true but it does not suggest the broad philosophical underpinnings of the system. Although the term comes from the emphasis on supplying materials just in time for use on the factory floor, equally important are the close relationships with a few long-term suppliers (approaching sole source in the ideal), geographically close suppliers, loose specifications and contracts, and frequent deliveries of small, exact quantities.

The Company selected for case study is spread over in many acres of land with fully integrated production facilities. The plant has already rolled out over six million vehicles. The Indian consumer had a dream. He aspired to own a world-class vehicle at an affordable price. Unfortunately, the Indian automobile industry, dominated by just one or two names, offered no choice. The company triggered the automobile revolution in India symbolizing mobility and trust, technology and innovation, value and performance, with a commitment to deliver the latest technology at an affordable price.

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Quality Policy

The Company's focus is on producing 'Best Quality in First Attempt'. All the vehicles are inspected and once they confirm to stringent quality checks and performance tests, only then they let a vehicle to roll out of the plant for customers. The company is working on Plan, Do, Check and Act (PDCA) cycle. The quality policy is consumer satisfaction through continuous improvement of the product and services by following PDCA in all functions and levels of the organization.

The Super Factory

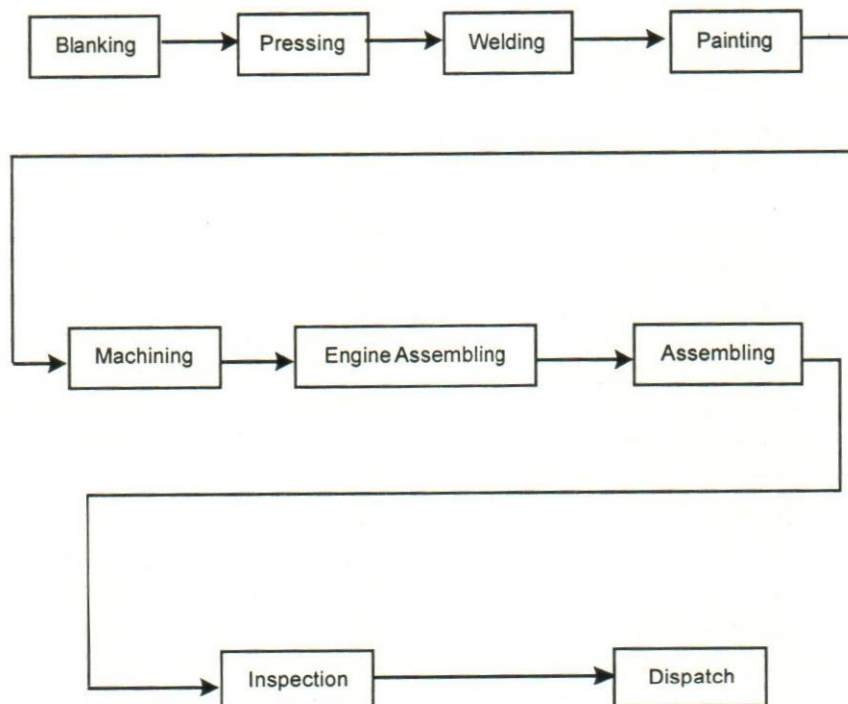
The Company has crossed a cumulative export figure of more than 4 lakh vehicles since its first export in last 20 years. It has exported vehicles to over 100 countries. On an average, two vehicles roll out of the factory every minute in the plant. It takes an average of just 14 hours to make a complete vehicle. In the last 20 years more than six million vehicles have rolled out of the factory. The company is aiming to increase its reach to wider global audience.

How a Vehicle Takes Shape in the Plant

Thousands of parts need to work in perfect unison to make a vehicle. They are put in place by a number of specialized people working at various locations. To get the final shape of the vehicle, it passes through the following processes:

- i) **Blanking:** Steel coils are cut into blanks of various shapes and sizes by blanking machines.
- ii) **Pressing:** Blanks are pressed into various panels by presses.
- iii) **Welding:** Pressed panels are welded together to form body shells.
- iv) **Painting:** Body shells are painted into various shades using automatic painting machines and robots.
- v) **Machining:** Various raw materials for engine components are machined using automatic machining centers.
- vi) **Engine Assembling:** The machined parts and various components of an engine are assembled together to make engines.
- vii) **Assembling:** Various components like harness, glass, instrument panel, suspension, engine, wheels, seats, etc., are assembled in the painted body to make a complete vehicle.
- viii) **Inspection:** Assembled vehicles are tested for their functionality and roadworthiness.
- ix) **Dispatch:** After vehicle inspection process, the vehicle is handed over for dispatch. The various processes of manufacturing are shown in Figure 1.

Figure 1. Process of Manufacturing



Environmental Policy

The Company makes more than just world-class vehicles. It also ensures the environment in which they are produced is managed and taken care of in the best possible manner. Extra care is taken to control pollution and prevent wasteful use of energy. For a greener tomorrow, the company encourages recycling and environment-friendly practices as the duty of a responsible corporate citizen. The company is committed to:

- maintain and improve upon environmental management system performance;
- strictly observe environmental laws and follow own standards;
- reduce the pressure placed on the environment resulting from business activities and product;
- promote environmental communication.

Realizing responsibility on environment the company emphasizes to:

- prevent pollution;
- promote energy reduction and the use of alternative energy;
- manage/reduce those materials that put stress on environment;
- promote the three R's (Reduce, Reuse, Recycle);
- promote 'green' procurement;
- provide environmental education to employees to increase awareness.

Effect of Attribute in JIT purchasing Implementation

Profile of the Company

The company selected for case study is situated in Haryana. It emphasizes on continuous improvement and high quality standard products in its quality policy. It had an annual turnover more than of Rs 140 billion in 2010. The total suppliers of different types of components are nearly 250, supplying more than 7,000 components to the company having number of employees 5,000. Two vehicles roll out of the factory every minute. The general profile of the company is shown in Table 1.

Methodology

It would be not irrational (Farzad Tahriri et al., 2008) to suggest that the supplier selection issues need further attention in order to harmonize the combination of

qualitative and quantitative criteria to develop the best decision-making models for the selection of the best suppliers.

The questionnaire of JIT purchasing and supplier evaluation criteria attributes was given to senior manager of the Company to make him aware about the research work on JIT purchasing attributes. Stamm and Golhar (1993) identified 34 attributes, having input- and output-action attributes. Later on 10 more attributes were added (Singh and Garg, 2005) to study the effect of these total 44 attributes. All the attributes are of information sharing. The inputs of buyer action, supplier action and joint buyer-supplier action create the purchasing environment to improve quality of parts. The outcome attributes are the resultant of the action of input attributes. A detailed discussion was held with manager and he was impressed with JIT purchasing attributes in the pro forma. He has visited many times to Japan for training in JIT purchasing context.

He has visited Japan many times for training in JIT purchasing context. The company has implemented JIT system and the purchase work is being done on JIT purchasing. The manager had a valuable knowledge about JIT concept.

The required information was collected by visiting several times in the company, deep discussion and general talks in different sections like purchasing, production, and planning, quality assurance and with other shop-floor personnel. The present processes were studied for effect of attributes in JIT purchasing implementation.

Implementation of JIT purchasing attributes

Various researchers have emphasized the significance of JIT purchasing. A number of studies (Cusumano and Takeishi, 1991; Daesung and Kim, 1997; Garg, 1997; Garg, Deshmukh, and Kaul, 1997; Husseini, Brien, and Husseini, 2006; Kaujlagi, and Lingaraj, 1997; Muralidharan, Anantharaman, and Deshmukh, 2001) have shown that in this present scenario of modernization and industrialization, an industry can survive and become competitive by successful implementation of JIT purchasing.

The Company has improved the manufacturing processes and has overcome many problems related with plant layout and manufacturing processes in the industry by implementing JIT purchasing practices. More emphasis is given to market research. The necessary measures, such as adequate advertising, improvement in quality and

Table 1. General Profile of Company

Type of Company	Large scale industry
Products being manufactured	Vehicle (4 wheelers)
Location	Haryana
Annual turnover (last year)	Rs 140 billion (approx)
Number of employees	5,000
Number of component suppliers	250
Number of components	7,000
Annual (local) buying (2006-07)	Rs 80,000 million
Percentage of material cost to total cost	70%
Has the Company heard about JIT	Yes
Scope of JIT implementation in India according to company	Very good

design, customer's feedback, better services to customers were also being taken. The factors must be considered to work effectively, efficiently, and economically in saving space and reducing wastage of material and minimizing material handling that will save the time in product manufacturing reducing the manufacturing cost of the product. The company faced many problems in implementing JIT purchasing.

Human problems

The cooperation of workers always plays a major role in implementing a new system. For a worker to become multi-skilled, he has to devote more time to attend training for other works to acquire extra knowledge. The company is sending its executives for training of JIT purchasing to Japan. Many helpers thought that implementation of JIT purchasing would render many helpers jobless. But in real sense the JIT purchasing has many benefits if it is implemented partially or fully, like reduced production lead time, reduced inventory, reduced space requirements,

increased equipment utilization, fatigue reduction, work simplification, job satisfaction and increase in profit margin and improved quality production.

System problems

In the present working system the employer and employee relations are not so good. In the industry the rejection rate and product cost is increasing, due to more lead-time production, more material handling, increased wastage and poor layout, poor profit, poor quality, poor customer relations, etc. The system has to be changed to eliminate these problems. To achieve the desired objectives and to become more competitive some latest management techniques are required to be implemented in the industry. JIT purchasing has a potential to solve these problems by achieving the goals of the organization.

Vendors' Location

The Company was facing many problems from the local suppliers and outside suppliers, in receiving the raw material and other facilities. It was decided that for uninterrupted flow of material these vendors must have godowns in the vicinity of the company. In any case of emergency the supply order may be implemented without any delay. Particularly the outside suppliers must establish their godowns near the plant.

Quality Problems

The quality of incoming material must be as per the supply order. Still some problems may arise while inspecting the material. To avoid this lot rejection, time to time, various visits have been paid to audit the supplier plant. It is ensured that there is no compromise with quality. Inspection needed is reduced.

Analysis and Results

The received responses from the company to the degree of importance given to JIT purchasing attributes are given in Table 2. In the pro forma of JIT purchasing attributes,

Table 2. Importance of JIT Purchasing Attributes in the Company

Attributes	Importance
Long-term contract, increased volume to suppliers, supplier evaluation, supplier certification, supplier training and development, supplier plant audit, freight consolidation, contract carrier, emphasize performance not specifications, reliable network of suppliers, ability of suppliers, statistical process control, close proximity, quality circle, reduced set up, increased customer support, mutual trust and cooperative relationship, increased information sharing, continuous improvement, joint value analysis programmes, standardized packaging, motivation, coordination of work centers, team work spirit, managing skills, reputation in market, reliable delivery (on time), exact quantity, reduced delivery lead times, high quality, elimination of receiving inspection, fair price, reduced paper work.	Very good
Fewer suppliers, buyer responsible for inbound freight, stable production schedule, supplier attitude, flexible suppliers, supplier involvement in design, transportation reliability, workforce flexibility, history and background, frequent deliveries, small shipment size	Good

'very good' importance was given to most of the attributes and no attribute was considered least important as 'fair', 'little', and 'not at all' were neglected. The company gave due weightage to maximum JIT purchasing attributes, as 'very good' to 33 and 'good' to 11, out of total 44 attributes. The total received responses for the degree of importance of different JIT purchasing attributes are shown in Table 3.

Table 3. Total Received Responses of JIT Purchasing Attributes

Degree of Importance	Total Received Response
Very good	33
Good	11
Fair	0
Little	0
Not at all	0

The received responses from the company to the degree of importance given to JIT purchasing supplier evaluation criteria attributes are shown in Table 4. Out of

Table 4. Importance of Supplier Evaluation Criteria Attributes in the Company

Attributes	Importance
Quality, reliable delivery, exact quantity, technical expertise, statistical process control, communication, product design development, cooperative relationship, proximity, flexibility, capital investment, financial stability	Very high
Frequent delivery, small quantity, price	High
Nil	Average

15 attributes of supplier evaluation criteria; 'very high' response was given to 12 attributes, 'high' was given to 3 attributes. No attribute was found least important. The total received responses in the questionnaire for the degree of importance of different supplier evaluation criteria attributes are shown in Table-5. The effect of attributes after JIT purchasing implementation in industry is found very beneficial. The comparison of the results before and after, the effect of JIT purchasing attributes implementation shows that the production level is improved, quality of the product is improved, sale of the product is improved, profit margin is increased, reputation in market is increased, team-work spirit is increased and motivation level of the employees is also increased. The space requirement is reduced, material wastage is reduced, inventory, manpower, product design related problems are also reduced. Material movement, number of suppliers, inspection, supervision, overhead costs, fair price, and capital investment is also reduced, by implementing JIT purchasing in the company.

Table 5. Total Received Responses of Supplier Evaluation Criteria Attributes

Degree of Importance	Total Received Responses
Very high	12
High	3
Average	0
Below average	0
Not at all	0

JIT Purchasing System

Since the company started JIT purchasing practices for the production in various processes, it has established a long-term relationship with local buyers having good reputation. Earlier it was working with traditional purchasing, facing many problems like excess inventory, wastage of material, poor quality and high production cost. JIT is a business philosophy that focuses on reducing time and cost and eliminating poor quality within manufacturing and non-manufacturing processes. While reducing inventory it is assumed that river is inventory, and as long as the river (the inventory) covers the rocks, the (production) problems are hidden. If the water level (inventory) is reduced the following problems are exposed:

- poor quality
- unreliable suppliers
- machine breakdowns
- untrained employees

Sometimes it is called *short-cycle* or *lean manufacturing*. The suppliers receive the order of supply from the company well in advance of 15 days' time. These suppliers send the supply in small standard containers having no requirement of inspection. The company receives the material on a regular interval of two hours throughout the production time, so that inventory level can be maintained at zero level. The annual purchase from these local buyers is around Rs 80,000 million. Thus the company has established a progressive and proactive vendor base in its area. Nearly 70% of our suppliers are located within 100 km radius, meeting more than 80% of the requirements. The company is committed to produce:

- world class quality
- leadership in cost
- JIT delivery
- responsive
- progressive, proactive vendor base

The various stages in the company are shown below from the starting till date, along with delivery system.

Stage 1: Initial Material Flow

The buyer used to make the monthly production plan which was communicated to each supplier. The material was received as a heavy inventory in the store, which was difficult to handle. Always problems of uncertainties were there to manage transporter either by the buyer or the supplier. The material was sometimes heavily loaded for transportation resulting in excess inventory at the company store. After parts' inspection the material was utilized for making the finished product. The more material handling was leading to more wastage of the material with long lead time. Rejection rate was high; due to low productivity the company was having more financial losses.

Stage 2: Monthly Scheduling System

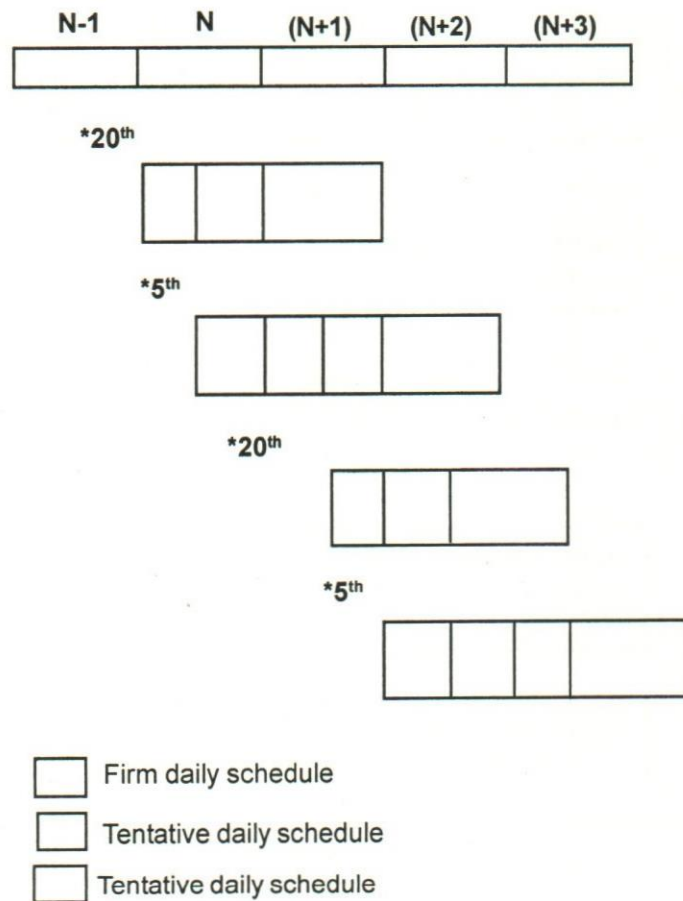
Production planning and control (PPC) department along with marketing department made monthly production plan.

The buyer then communicates this monthly production plan to each supplier. The monthly schedule is then communicated to each supplier through central system. The supplier makes the necessary requirement of the buyer; the large inventory was stored in a nearby store, which will be transported to the buyer's store as per requirement. After the parts' inspection of the material it will be delivered to the various process division, where the outcome is the finished product.

Stage 3: Fortnightly Delivery System

Production planning and control (PPC) department along with marketing department made monthly production plan. The monthly schedule is then communicated to each supplier through a central system. The delivery schedules are communicated to each supplier on fortnightly basis. Material from the supplier's store is transported to buyer, where after parts inspection the material is delivered to the plant for utilization of the material for product manufacturing.

Figure 2. Fortnightly Delivery System

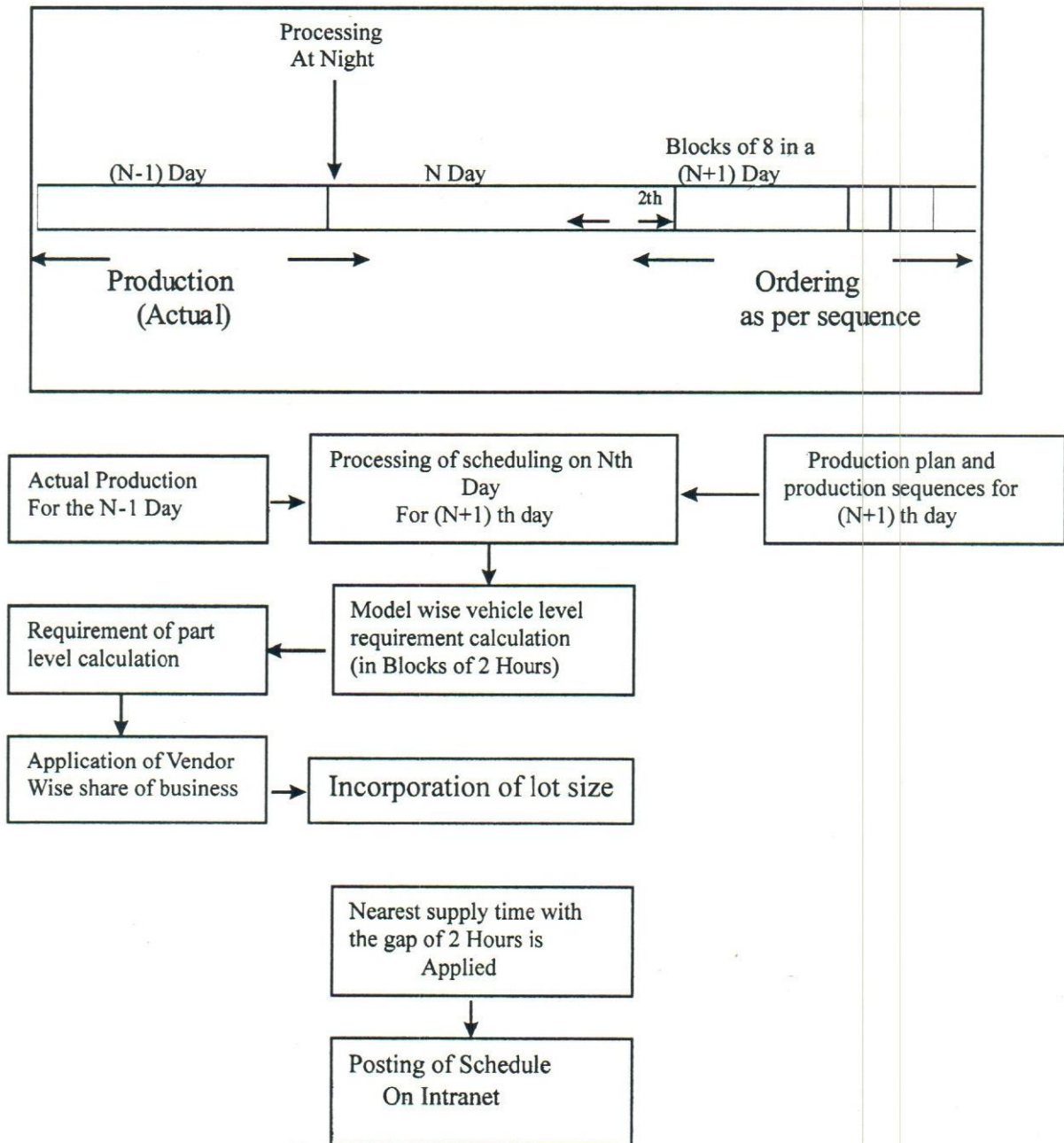


Stage 4: On-line System

The company is working with an on-line system, which is part of JIT purchasing system for continuous improvement. In this improved vendor system the material uploading and

downloading takes place automatically from the truck to the production line. The inventory of two hours is sufficient for the processes, for continuous manufacturing. Continuously improving pull based inventory replenishment system leading to inventory reduction by 65%.

Figure 3. Principles of on-line system.



Effects of JIT Purchasing Attributes in Advanced Scheduling Systems

The company has achieved a significant success and good reputation by dominating in the revolution of vehicle manufacturing. Various attributes of JIT purchasing like long-term contract, supplier-plant audit, coordination of work centers, team-work spirit, managing skills, reputation in market, reliable delivery (on time), exact quantity, reduced delivery lead times, high quality, elimination of receiving inspection, fair price, reduced paper work, etc., have a tremendous effect in achieving the goals of the company. The following are the various benefits achieved:

- reduced inventory
- better planning for vendors
- space saving
- reduced manpower
- reduced vendor personnel
- fewer production disruptions
- better distribution of business for common parts improved quality
- reduction in inventory variance
- near-zero obsolescence
- agility—improved responsiveness to market fluctuations

Key Enablers of On-line System

The following factors are the strength of the on-line system:

- quality control by vendors
- IT infrastructure
- proximal location of vendors
- firm VBS (Vehicle Build Sequence)
- improved highways
- productivity enhancement (as shown in Figure 4)

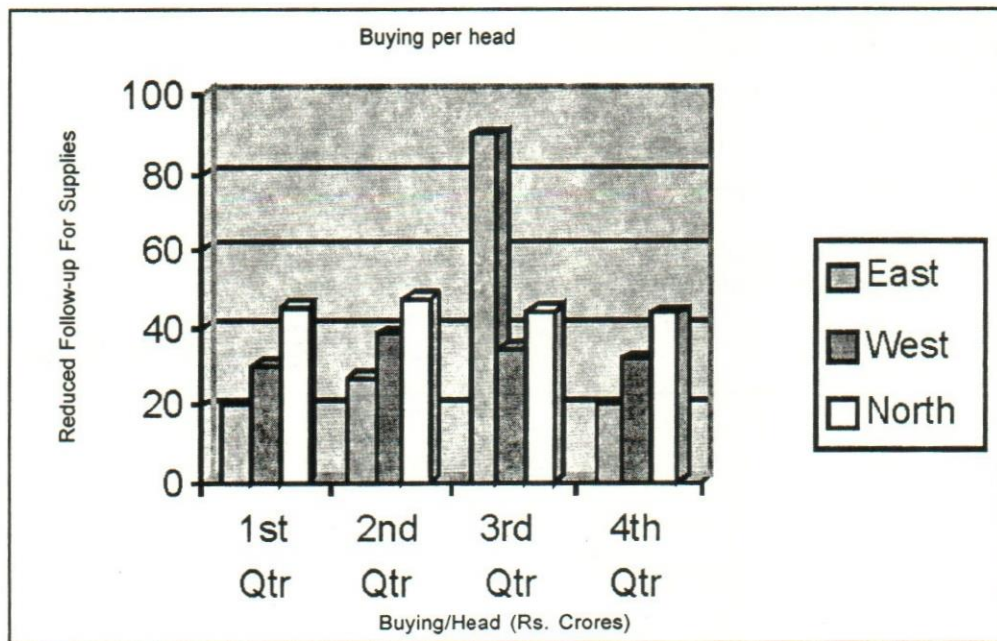
Emphasizing Zero Defects

The company is emphasizing on zero-defects quality. Poor quality results in:

- increased need for inspection
- more production interruptions
- increased need for rework
- a higher cost from scrap and
- additional warranty costs

The Company's motive is to make it right the first time, every time, with in-process checks and controls to eliminate inspection time.

Figure 4. Productivity Enhancement



Improvement in Material Feeding with Direct On Line (DOL)

Before implementing JIT purchasing there was a provision of intermediate storage for air cleaner on rack under canopy. Total variants were five. But after improvement overhead feeding of the components direct from truck to line side was taking place. The benefits of this improvement are:

- Man movement reduction = 118 km/month
- Material movement reduction = 7.7 km/month
- Space saving = 48 m²

Summary

When the company started implementing JIT purchasing practices, the inventory level had reduced with improved quality. By adopting latest techniques like JIT purchasing it has expanded its plant capacity of production. The direct on-line delivery schedule to various lines of production eliminates material handling and material wastage. With continuous supply of the material a vehicle takes only 14 hours to take its complete shape. The product of the company has been recognized number one on customer satisfaction index, sales satisfaction index, initial quality study, and automotive performance execution and layout. On continuous improving pull-based inventory reduced to 65%. Factors like space saving, reduced manpower, reduced inventory, better planning with emphasis on zero defects, and inspection elimination make an ideal industry.

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— Franklin Delano Roosevelt

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