CHAPTER – 4

SURVEY INSTRUMENT AND DATA COLLECTION

First three steps of the performance measures development process were discussed in the previous chapter wherein the environmentally conscious manufacturing related performance measures and their variables/items were developed. This chapter discusses about the survey instrument and data collection methodology.

4.1. INTRODUCTION

This chapter describes the development of a survey instrument, which is given in Appendix, focusing primarily on assessment of the reliability and validity of the instrument. It is important to conduct a thorough measurement analysis on survey instrument used for research. Measurement analysis provides the audience with assurance that the findings reflect accurate measures of underlying performance measures and the results are believable. This is particularly important when dealing with measures of non-observable construct, rather than objective data. Reliable and valid instrument provides practitioners with a tool for self assessment and continuous improvement.

Measurement analysis begins with assessing the instrument reliability, i.e., the ability of its scales to consistently yield the same response. Collecting data with an unreliable scale is like taking measurements with an elastic tape measure; the same thing can be measured a number of times, but it will yield a different length each time (Flynn et al., 1994). Individual measurements will differ, although the dimension being measured has not changed. One of the measurements may, indeed, be correct, but it is impossible to tell which one. Once a performance measure has been determined to be reliable, its validity can be assessed. Validity is a construct’s ability to measure what it sets out to measure. Using an invalid measure is like measuring inches with a meter stick; precise quantitative data can be collected, but it is meaningless (Flynn et al., 1994).
4.2. SURVEY INSTRUMENT

Survey instrument development process consists of the design of questionnaire and its pre-testing.

4.2.1. Questionnaire Design

Questionnaire was designed as a research instrument with the intention to make a sincere effort to tap the collective wisdom of professionals within the manufacturing industry, who truly care for it, in order to assess the relative importance of variables. Questionnaire was designed using 93 variables/items, which were identified in the previous chapter. A covering letter was drafted, which included general information about the research work and instrument - purpose of the study, confidentiality of the responses and request for returning the filled questionnaire. The definition of ECM as used in this study was also included on all the pages of questionnaire. Then, the questionnaire was divided into two parts to assist data interpretation:

- General information of participants and firms – Name & address of the organization (optional), type of organization, classification of the organization, primary product of the organization, number of employees, sales turnover, exports, primary export market, responding person’s name (optional), designation, department, experience and contact information (optional).

- Performance measures and related variables – These 93 variables were suitably divided into eleven proposed performance measures, namely: top management commitment; middle management commitment; employee involvement; employee training; human and technological resources; Product design/ product characteristics; Process design/ process characteristics; logistics design; vendor management; costs and benefits. Finally, in the questionnaire, the respondents were asked to note any additional comments they thought were not covered by the questionnaire, which might have significant impact on the study.

To ensure understandability, the questions were critically reviewed for their clarity and content and some modifications were incorporated into the questionnaire. A five point Likert scale (1-5) was used to allow experts to respond to the survey items where 1 means very low, 2 means low, 3 means medium, 4 means high and 5 means very high. Or 1 means completely disagree, 2 means rarely agree, 3 partly
Survey Instrument and Data Collection

agree, 4 means rather agree and 5 means completely agree. Respondents were requested to rate the degree or extent of practice of each variable with reference to the respective performance measures on the five point response scale. A typical example is shown below:

<table>
<thead>
<tr>
<th>Completely disagree</th>
<th>Rarely agree</th>
<th>Partly agree</th>
<th>Rather agree</th>
<th>Completely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization has an explicit environment policy/ vision</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

4.2.2. Questionnaire Pre-testing

The purpose of pre-testing is:

i. To establish the most appropriate respondents.

ii. To check whether the questions asked in the questionnaire are easy to understand.

iii. To ascertain the effectiveness of the measuring instrument.

iv. To ascertain that all central aspects of ECM are included in the questionnaire.

Pre-testing was carried out in two stages. In the first stage, a draft of the questionnaire was provided to two academicians and they were requested to critically evaluate the variables from the standpoint of item specificity and clarity of construction. Based on critique received, some items were revised to improve their specificity and clarity.

The second pre-test involved administering the questionnaire to industrial professionals. The professionals were asked to complete the revised questionnaire and indicate any ambiguity or difficulty in responding to the variables, as well as to offer any suggestions they deemed appropriate. The pre-testing was done with four practitioners from two reputed organizations. After second pre-test, the questionnaire was reviewed based on experts’ comments and phrasings of some items were modified to make the final research instrument more effective. The questionnaire so
developed is given in Appendix. The pre-test indicated a questionnaire completion time of 30-35 minutes.

4.3. DATA COLLECTION METHODOLOGY

4.3.1. Sample

Once the instrument is ready, the next step of paramount importance is the selection of sample for which the instrument is designed. A sample is a part of population, which is selected for obtaining the necessary information. Nunnally (1967) argued that, when a measuring instrument is used for data collection, the subjects/samples used should be those for whom the instrument is intended. Since the primary objective is to develop an instrument to measure the participants’ (managers and above) perceptions of performance measures and their variables, managers and above are appropriate samples. The General Managers, Directors, Divisional General Managers, Chief Engineers, Sr. Managers, are likely to be “thought” leaders with respect to environmental activities in their organizations; therefore, they are the samples for this study. The selection of samples for this survey has been made based on the following criteria:

i. Participant should be holding the position not below the level of manager.

ii. Participant should be having working experience of at least 5 years.

iii. Participants should be responsible for managing the environmental activities of the organization.

iv. Participant should be fully responsible and involved in product design and development activities or involved in manufacturing of products with domain knowledge of product design and development.

Next, to select the sample industries, a brief literature review was done and it was found that from the Indian perspective, the major manufacturing sectors involving major environmental challenges are textile, chemical, rubber/plastics, cement, fabrication, machinery, electrical and electronics, automotive, pharmaceutical, steel/iron, food etc. (Manufacturing industry in India is made up of many different sectors, each of which is influenced by the overall manufacturing climate, but each of which
also has its own ups and downs. The relevance and importance of these sectors of the Indian economy can be gauged from the following;

4.3.1.1 Type of organization

Tiny/Micro, Small, Medium and Large Scale Enterprises

Definitions of Small and Medium Enterprises (SME) vary from country to country. The organizations are classified as tiny/micro, small, medium or large enterprises depending on one or more of thresholds laid down in respect of Investment, employment, turnover etc.

Government of India have adopted investment limit in terms of the value of plant and machinery items of an industrial unit, as the sole criterion for defining sector.

In India the enterprises engaged in the manufacture or production of goods pertaining to any industry specified in the first schedule to the Industries (Development and Regulation) Act, 1951 are classified as:

A **micro enterprise**, where the investment in plant and machinery does not exceed twenty five lakh rupees;

A **small enterprise**, where the investment in plant and machinery is more than twenty five lakh rupees but does not exceed five crore rupees. In its pursuit to help the sector to grow further, the investment limit of the SSI sector has been raised from time to time, ranging from Rs.5 Lakhs in plant and machinery value in the year 1960 to Rs.500 Lakhs in plant and machinery value in 2006.

A **medium enterprise**, where the investment in plant and machinery is more than five crore rupees but does not exceed ten crore rupees. All the same, Small and Medium Enterprises have been engines of industrial growth the world over. Broadly speaking almost 90% of the manufacturing units in the world fall in this sector and support over 80% of industrial employment.

However for this study small and medium enterprises are clubbed together.

A **large enterprise**, where the investment in plant and machinery is more than ten crore rupees.
In the case of the enterprises engaged in providing or rendering of services, as a micro enterprise, where the investment in equipment does not exceed ten lakh rupees, a small enterprise, where the investment in equipment is more than ten lakh rupees but does not exceed two crore rupees; or a medium enterprise, where the investment in equipment is more than two crore rupees but does not exceed five crore rupees and a large enterprise where the investment in equipment is more than five crore rupees.

4.3.1.2 Classification of organization

Automotive Industry

On the canvas of the Indian economy, auto industry occupies a prominent place. Due to its deep forward and backward linkages with several key segments of the economy, automotive industry has a strong multiplier effect and is capable of being the driver of economic growth. A sound transportation system plays a pivotal role in the country's rapid economic and industrial development. The well-developed Indian automotive industry ably fulfils this catalytic role by producing a wide variety of vehicles: passenger cars, light, medium and heavy commercial vehicles, multi-utility vehicles such as jeeps, scooters, motorcycles, mopeds, three wheelers, tractors, etc.

The automotive sector is one of the core industries of Indian economy, whose prospect is reflective of the economic resilience of the country. Continuous economic liberalization over the years by the Government of India has resulted in making India one of the prime business destinations for many global automotive players. The automotive sector in India is growing at around 18 per cent per annum. With the gradual liberalization of the automobile sector since 1991, the number of manufacturing facilities in India has grown progressively. At present there are 15 manufacturers of passenger cars & multi utility vehicles, 9 manufacturers of commercial vehicles, 16 of 2/3 wheelers and 14 of tractors besides 5 manufacturers of engines. The industry had an investment of about Rs. 50,000 crore in 2002-03 which has gone up to Rs. 80,000 crore by the year 2007. Production of the automotive industry grew at a rate of 11.5 per cent over last five years. The industry has a strong multiplier effect on the economy due to its deep forward and backward linkages with several key segments of the economy. While the industry has been witnessing impressive growth during the last two decades, the performance after 2006-07 has not
been encouraging. The automobile sector recorded growth of 13.6 per cent in 2006-07. In 2007-08, the industry registered negative growth rate of (-) 2.3 per cent. However, in 2008-09, the industry has witnessed a modest growth of 3.0 per cent. While passenger vehicle, two-wheeler and three-wheeler registered a growth of 3.4 per cent, 4.9 per cent and 0.1 per cent respectively, the utility vehicles and commercial vehicles segment registered negative growth of (-)11.9 per cent and (-)24 per cent 8.55 respectively. The turnover of the automobile sector in 2008-09 was Rs 2,18,966 crore and exports were at Rs 31,782 crore. The turnover and the exports of the automobile vehicle industry in 2008-09 was at Rs 1,42,646 crore and Rs 16,782 crore whereas for the automobile component industry this was at Rs 76,320 crore and Rs 15,000 crore. The percentage of exports to the total turnover for the automobile industry and the automobile components sector in value terms was 12 per cent and 19.7 per cent respectively. It is estimated that the automobile industry generates direct and indirect employment for 10.5 million people (in thousands). The industry provides direct and indirect employment to 1.31 crore people. (http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/automobile.htm) viewed on September 24th, 2009. http://indiabudget.nic.in

Textiles

Until the economic liberalization of Indian economy, the Textile Industry was predominantly unorganized industry. The opening up of Indian economy post 1990s led to a stupendous growth of this industry. India Textile Industry is one of the largest textile industries in the world and has an overwhelming presence in the economic life of the country. Apart from providing one of the basic necessities of life, the textiles industry also plays a pivotal role through its contribution to industrial output, employment generation, and the export earnings of the country. Currently, it contributes about 14 percent to industrial production, 4 percent to the GDP, and 17 percent to the country’s export earnings. It provides direct employment to over 35 million people. The Textiles sector is the second largest provider of employment after agriculture. Thus, the growth and all round development of this industry has a direct bearing on the improvement of the economy of the nation. The Indian textiles industry is extremely varied, with the hand-spun and hand-woven sector at one end of the spectrum, and the capital intensive, sophisticated mill sector at the other. The
decentralized power looms / hosiery and knitting sectors form the largest section of the textiles sector. The close linkage of the industry to agriculture and the ancient culture, and traditions of the country make the Indian textiles sector unique in comparison with the textiles industry of other countries. This also provides the industry with the capacity to produce a variety of products suitable to the different market segments, both within and outside the country. The data show that during 2008-09, cotton textiles declined by 2.8 per cent, wool, silk and man-made fibre textiles by 0.3 per cent and jute textiles by 10 per cent while textile products increased by 3.7 per cent, compared to 2007-08. The production of textile fabrics that increased by 4.96 per cent during 2007-08 (provisional), declined by 1.9 per cent during 2008-09. Despite modest increase in the production in hosiery and mill sectors, the decline in the production in power looms and handlooms resulted in the decline in the overall production of fabrics. Factors such as higher price of cotton, high interest rates, problems in credit availability, high cost of power and power cuts and demand slowdown in major importing countries led to the decline in cotton textiles.

The textile sector had gathered momentum consequent to the termination of the quota regime in December 2004. During 2007-08, textile exports recorded an increase of 15.6 per cent in US dollar terms and 2.8 per cent in rupee terms. During April 2008–February 2009, however, exports of textiles and clothing stood at US$ 18.52 billion, recording a decline of 5.3 per cent growth. Total textile exports amounted to US $ 1,602.05 million during February 2009, which meant a decline of 24.4 per cent from February 2008. However, it declined to 6.3 per cent in rupee terms during the same period over February 2008.

(http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/textile.htm)

http://indiabudget.nic.in

**Food**

Food processing involves any type of value addition to agricultural or horticultural produce and also includes processes such as grading, sorting, packaging which enhance shelf life of food products. The food processing industry provides vital linkages and synergies between industry and agriculture. The food processing industry sector in India is one of the largest in terms of production, consumption,
export and growth prospects. The government has accorded it a high priority, with a number of fiscal reliefs and incentives, to encourage commercialization and value addition to agricultural produce, for minimizing pre/post harvest wastage, generating employment and export growth. India's food processing sector covers a wide range of products such as fruit and vegetables; meat and poultry; milk and milk products, alcoholic beverages, fisheries, plantation, grain processing and other consumer product groups like confectionery, chocolates and cocoa products, soya-based products, mineral water, high protein foods etc.

India produces annually 90 million tonnes of milk (highest in the world), 150 million tonnes of fruits & vegetables (second largest), 485 million livestock (largest), 204 million tonnes food grain (third largest), 6.3 million tonnes of fish (3rd largest), 489 million poultry and 45,200 million eggs.

At present the food processing sector employs about 13 million people directly and about 35 million people indirectly. Over the last few years, there has been a positive growth in ready-to-serve beverages, fruit juices and pulps, dehydrated and frozen fruits and vegetable products, tomato products, pickles, convenience veg-spice pastes, processed mushrooms and curried vegetables.

Consumer food industry includes pastas, breads, cakes, pastries, rusks, buns, rolls, noodles, corn flakes, rice flakes, ready to eat and ready to cook products, biscuits etc. Bread and biscuits constitute the largest segment of consumer foods. Manufacturing of bread is reserved for SSI sector. It is estimated that out of the total production of bread, 40% is produced in the organized sector and the remaining 60% in the unorganized sector. Similarly, production of biscuits in the organized sector is about 80% and quantity of biscuits produced in the unorganized sector is about 20%. The index of production of food products declined by 9.6 per cent in 2008-09 compared to a growth of 7.0 per cent in the previous year. This has been largely due to steep decline in the production of sugar, which has the highest weight in the “food product” group. Sugar had recorded robust production growth in 2007-08. The other important items like mustard oil/rapeseed oil and malted food also witnessed significant reduction in production during 2008-09. The high-weighted wheat flour/maida, milk powder and tea recorded slack production growth during the year.
In contrast, edible oils like groundnut oil, cotton seed oil and hydrogenated oil recoded high production growth. Beverages, tobacco & related products (http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/food-process.htm), http://indiabudget.nic.in

**Cement**

The cement industry is experiencing a boom on account of the overall growth of the Indian economy. The demand for cement, being a derived demand, depends primarily on the industrial activity, real estate business, construction activity and investment in the infrastructure sector. India is experiencing growth on all these fronts and hence the cement market is flourishing like never before. Indian cement industry is globally competitive because the industry has witnessed healthy trends such as cost control and continuous technology upgradation. Global rating agency, Fitch Ratings, has commented that cement demand in India is expected to grow at 10% annually in the medium term buoyed by housing, infrastructure and corporate capital expenditures.

The Indian cement industry is the second largest producer of quality cement, which meets global standards. The cement industry comprises 130 large cement plants and more than 300 mini cement plants. The industry's capacity at the beginning of the year 2008-09 was 198.30 million tonnes.

(http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/Cement.htm)

**Pharmaceuticals**

The Indian Pharmaceutical industry has been witnessing phenomenal growth in recent years, driven by rising consumption levels in the country and strong demand from export markets. This segment of industry has shown tremendous progress in terms of infrastructure development, technology base and wide range of products. The industry now produces bulk drugs belonging to all major therapeutic groups requiring complicated manufacturing processes and has also developed excellent GMP (Good Manufacturing Practices) compliant facilities for the production of different dosage forms. The strength of the industry is in developing cost effective technologies in the shortest possible time for drug intermediates and bulk activities without compromising on quality. This is realized through the country's strengths in organic
chemicals' synthesis and process engineering. India is today recognized as one of the leading global players in pharmaceuticals. Europe accounts for the highest share of over 23% of Indian pharma exports followed by North America and Asia. Exports to USA have crossed the landmark figure of US $1 billion during 2006-07. Recognized as amongst the lowest-cost-producers of drugs, India holds fourth position in terms of volume and thirteenth position in terms of value of production in pharmaceuticals. It is estimated that by the year 2010, the Indian pharmaceutical industry has the potential to achieve over Rs.1,00,000 crore production of formulations and bulk drugs.

Many Indian companies maintain highest standards in Purity, Stability and International Safety, Health and Environmental protection in production and supply of bulk drugs even to some innovator companies. This speaks of the high quality standards maintained by a large number of Indian pharma companies as these bulk actives are used by the buyer companies in manufacture of dosage forms which are again subjected to stringent assessment by various regulatory authorities in the importing countries. The Indian pharma industry has grown from a mere Rs. 1,500 crore turnover in 1980 to over Rs. 78,000 crore in 2008 with about 10 per cent of share volume of global production. High growth has been achieved through; the creation of required infrastructure, capacity building in complex manufacturing technologies of active ingredients and formulations, entering into drug discovery through original and contract research and manufacturing (CRAM) and clinical trials and product specific strategies of acquisition and mergers. The domestic sector had a production turnover of Rs. 47,241 crore from about 10,000 small-scale and 300 large and medium manufacturing units in 2008. (APIs) and formulations, entering into drug discovery through original and contract research and manufacturing (CRAM) and clinical trials and product specific strategies of acquisition and mergers. The domestic sector had a production turnover of Rs. 47,241 crore from about 10,000 small-scale and 300 large and medium manufacturing units in 2008. Pharmaceutical exports have grown from Rs. 6,256 crore in 1998-99 to Rs. 30,759 crore in 2008. Exports of pharmaceuticals have been consistently outstripping the value of corresponding Imports in the period 1996-97 up to 2007-08. Exports registered a growth rate of 25 per cent in 2007-08 over 2006-07. The sector attracted FDI amounting to US$
1,401.60 million during 2000-01 to September 2008, of which, US$ 125.30 million occurred during April-September 2008. Investments in pharmaceutical sector are now expanding into areas of innovative R&D focused outsourcing opportunities like clinical trials, data management services, pharmaceutical informatics, lead discovery and optimization, pharmaco-kinetics and pharmaco-dynamics and pre-clinical drug discovery in combinatorial chemistry, chiral chemistry, new drug delivery systems, bioinformatics and phyto-medicines. The Indian pharma industry is taking leaping strides in innovative drug discovery with clinical trials underway in 34 molecules. Consequently, the Indian drug discovery market has grown from US$ 470 million in 2005 to US$ 800 million in 2007. Increasing number of Indian pharmaceutical companies have been getting international regulatory approvals for their plants from agencies like USFDA (USA), MHRA (UK), TGA (Australia), MCC (South Africa), Health Canada etc. India has the largest number of USFDA- approved plants for generic manufacture.

(http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/drug-pharma.htm), http://indiabudget.nic.in

Machinery

Heavy industry in India comprises of the heavy engineering industry, machine tool industry, heavy electrical industry, industrial machinery and auto-industry. These industries provide goods and services for almost all sectors of the economy, including power, rail and road transport. The machine building industry caters to the requirements of equipment for basic industries such as steel, non-ferrous metals, fertilizers, refineries, petrochemicals, shipping, paper, cement, sugar, etc.

This industrial sector recorded a growth of 9.2% (measured in terms of the Index of Industrial Production) during the period April- Nov. 2007-08 over and above the growth of 11.6% achieved in 2006-07. Capital goods sector, which posted a robust growth of 17.4% in April-Nov. 2006-07, has maintained its growth momentum during the current year as well. According to the Index of Industrial Production, capital goods sector posted a growth of 20.8% during April–Nov. 2007-08.
Heavy electrical industry encompasses important industrial sectors including power generation, transmission and distribution equipments. This also covers turbo generators, boilers, turbines, transformers, switchgears and relays. The performance of this industry is closely linked to the power programme of the country. The Government of India has an ambitious mission of ‘Power for All 2012’. As per working group on Power for 11th plan, a capacity addition of 72000 MW is required. To reach wheel power, an expansion of the regional transmission network and inter regional capacity to transmit power would be essential. This will stimulate substantial demand for heavy electrical equipment. There is a strong manufacturing base for the manufacture of heavy electrical equipment in the country. The technology available in India is almost at par with that in the International market barring few areas of high voltage lines. However, items like CRGO steel and amorphous cores for low loss transformers are being imported.

The present buoyancy in the Indian economy would create demand for electrical products through industrial growth and general economic development. The power sector reforms will create large business for power sector equipment manufacturers and service providers. In the current favorable market scenario, the electrical industry can certainly look forward to growth.

(http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/heavy.htm)
http://indiabudget.nic.in

Steel

Steel is vital to the development of any modern economy and is considered to be the backbone of human civilization. The level of per capita consumption of steel is treated as one of the important indicators of socio-economic development and living standard of the people in any country. It is a product of a large and technologically complex industry having strong forward and backward linkages in terms of material flow and income generation. All major industrial economies are characterized by the existence of a strong steel industry and the growth of many of these economies has been largely shaped by the strength of their steel industries in their initial stages of development.
India emerged as the fifth largest crude steel producing country in the world in the year 2006 as against eighth position three years back. India is expected to become the second largest producer of steel in the world by the year 2015. India also maintained its lead position as the world’s largest producer of direct reduced iron or sponge iron. The country is likely to achieve a steel production capacity of nearly 124 million tonnes by the year 2011-12. 194 Memoranda of Understanding (MoU’s) have been signed in various states with a total planned capacity of around 243 million tonnes, and a total proposed investment of over Rs. 5.15 lakh crore. The crude steel production grew at an annual rate of 9.2 per cent during 2003-04 to 2007-08. The increase in production came on the back of capacity expansion, mainly in the private sector plants, and higher utilization rates. The Indian steel industry has diversified its product mix to include sophisticated value-added steel used in the automotive sector, heavy machinery and physical infrastructure. The industry, however, suffers from the high ash content of locally available metallurgical coal and growing dependence on imported coal and delays in getting iron ore mining lease has created uncertainties and constraints in the areas of land acquisition and transport infrastructure. The three years, 2005-06 through 2007-08, witnessed double-digit steel consumption growth. As consumption grew at almost double the rate of growth in domestic steel production during 2007-08, import of steel rose sharply while exports stagnated. Domestic steel prices started rising steeply from December 2007 and reached a peak in March/April 2008 on account of rising international price of steel led by increased global demand, mismatch between the rate of growth in domestic demand and supply and steep increase in raw material prices in the domestic and global markets. The rising domestic prices were sought to be countered with measures like imposition of export duty, reduction of customs duty from 5 per cent to “Nil” on iron and steel products, met coke, ferroalloys and zinc, reduction in countervailing excise duty from 14 per cent to “Nil” on imported TMT bars & structural steel used for construction of houses and ad valorem export tax of 15 per cent on iron ore in place of earlier specific lump-sum tax. The year 2008-09 has been a watershed year for the Indian iron and steel industry. The industry has been hit hard by the spiraling cost of imported coking coal/met coke. The first half 2008-09 witnessed rapid rise in consumption, prices and profits of steel producers. Spurred by the high growth in steel demand and the availability of key factors of production within India, huge investments were planned.
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for capacity expansion. The onset of the global economic crisis since September 2008 led to stagnation and subsequent fall in the international steel prices. Domestic demand for steel was adversely impacted by economic sluggishness and, in particular, by the sharp reduction in demand in some of the leading end-user segments of steel which depend on credit financing. As a result, steel prices started moving down sharply from September 2008. On the supply side, the liquidity crunch has negatively impacted steel investors’ sentiments.

(http://indiainbusiness.nic.in/industry-infrastructure/industrial-sectors/steel.htm)

http://indiabudget.nic.in

Chemical

Chemical industry is one of the oldest industries in India. It not only plays a crucial role in meeting the daily needs of the common man, but also contributes significantly towards industrial and economic growth of the nation. It is highly science based and provides valuable chemicals for various end products such as textiles, paper, paints and varnishes, leather etc., which are required in almost all walks of life. The Indian Chemical Industry forms the backbone of the industrial and agricultural development of India and provides building blocks for downstream industries.

Chemical industry is an important constituent of the Indian economy. Its size is estimated at around US$ 35 billion approx., which is equivalent to about 3% of India's GDP. The total investment in Indian chemical sector is approx. US$ 60 billion and total employment generated is about 1 million. The Indian chemical sector accounts for 13-14% of total exports and 8-9% of total imports of the country. In terms of volume, it is 12th largest in the world and 3rd largest in Asia. Currently, per capita consumption of products of chemical industry in India is about 1/10th of the world average. Over the last decade, the Indian chemical industry has evolved from being a basic chemical producer to becoming an innovative industry. With investments in R&D, the industry is registering significant growth in the knowledge sector comprising of specialty chemicals, fine chemicals and pharmaceuticals.

The Indian chemicals Industry comprises both small and largescale units. The fiscal concessions granted to small sector in mid-eighties led to the establishment of large number of units in the Small Scale Industries (SSI) sector. Currently, the Indian
Chemical industry is in the midst of a major restructuring and consolidation phase. With the shift in emphasis on product innovation, branch building and environmental friendliness, this industry is increasingly moving towards greater customer orientation. Even though India enjoys an abundant supply of basic raw materials, it will have to build upon technical services and marketing capabilities to face global competition and increase its share of exports. The production of polymers accounted for almost 62 per cent of the total production of major petrochemicals during 2008-09. The domestic capacity of polymers was 5.72 million MT during 2008-09. With 88.5 per cent capacity utilization, production of polymers during 2008-09 at the level of 5.06 million MT was attained. The domestic production capacity of synthetic fibres was 3.46 million MT during 2008-09. With capacity utilization of about 73 per cent, production at the level of 2.52 million MT was achieved. The share of imports of chemicals and petrochemicals in the total national imports ebbed from 9.0 per cent to 6.7 per cent during the period 2002-03 to 2008-09 (upto February) whereas the share of exports declined marginally from 11.2 per cent to 10.0 per cent during the corresponding period.

http://chemicals.nic.in/chem1.htm
http://indiabudget.nic.in

**Electrical and Electronic Industry**

Like every other industrial sector in India, the Indian Electrical/Electronics Industry too is slowly emerging out of its "protective cover". For far too long has Indian industry remained shackled and consequently inward looking. Over the past fifty years there was no exposure to global players and competition, with the result that the industry grew up in a sheltered environment, dependent on the Government for everything, from licenses to protection to tariffs. Each one of these interventions was aimed at securing protection for oneself and ensuring growth of one's own organization at the cost of industry and the nation at large. Lack of global competition encouraged a "cost plus" approach, where every conceivable cost increase was passed on to the customer. There was thus no motivation to reduce costs.

With delicensing, decontrol and deregulation, Indian industry has suddenly been exposed to global competition. Since last decade, India has witnessed what global players have achieved and what they are capable of achieving. We are
becoming aware of competition on our turf. In this scenario, every company complains of increased competition, lower order books and shrinking margins. The Indian Electrical/Electronics Industry is of course further besieged by the fact that there is a dearth of business on account of lack of investment in the power infrastructure. Many organizations in this industry are looking overseas to develop the export markets owing to reduced demand at home. At the outset, it must be stated that the reduced domestic demand is at best a temporary phenomenon. The power sector in India is bound to grow and this will undoubtedly boost demand from the utilities, quite apart from the industrial demand which will continue to grow with increased industrial output. The poor financial health of the SEBs is however a damper that cannot be wished away in the short term. This will continue to plague corporate in the Electrical Industry, until the SEB restructuring and unbundling brings a turnaround in the medium term.

Electronic industry is engaged in designing, manufacturing, marketing, supporting, selling and distribution of a broad range of electronic components such as bolts, clamps, fasteners, lighting, semi conductors, integrated circuits, microprocessors, cables and wires, switches, sensors, keyboards, sockets, sonar devices, test and inspection equipment etc. Worldwide market leaders of electronic components are United States of America, European, Asian countries like Japan, China, India, Taiwan, and Hong Kong The year 2007-08 was marked by substantial growth in the revenue of IT-ITeS industry, BPO, software and services exports and software and services employment. However, the expected growth in 2008-09 is significantly lower when compared to 2007-08. Growth in IT-ITeS industries By December 2007, over 498 India-based centres (both Indian firms as well as MNC-owned captives) had acquired quality certifications, with 85 companies certified SEI CMM Level-5. Production of electronic items such as consumer, industrial electronics, computers, communication and broadcasting equipment, strategic electronics and components registered steady growth over a period of three years, from 2005-06 to 2007-08. Similarly export earnings of the electronics hardware and computer.

http://indiabudget.nic.in
http://www.allelectricalproducts.com/indian-electrical-industry.html
Plastic Industry

The Plastics Industry in India has made significant advancements ever since it made a modest but promising beginning by commencing production of polystyrene in 1957. The potential Indian market has motivated Indian entrepreneurs to acquire technical expertise, achieve high quality standards and build capacities in various facets of the booming plastic industry. Phenomenal developments in the plastic machinery sector coupled with matching developments in the petrochemical sector, both of which support the plastic processing sector, have facilitated the plastic processors to build capacities to service both the domestic market and the markets in the overseas.

The plastic processing sector comprises of over 30,000 units involved in producing a variety of items through injection moulding, blow moulding, extrusion and calendaring. The capacities built in most segments of this industry coupled with inherent capabilities have made us capable of servicing the overseas markets.

(http://www.indianplasticportal.com/plastic-industry-overview/)

http://indiabudget.nic.in

Rubber

India is one of the leading producers of rubber in the world. The rubber industry is one of the most important contributors to the growth of the Indian economy. The growth in the rubber industry of India is set to follow an upward spiral considering the improved standard of living, a boom in the automobile industry and the support provided by the government to the rubber manufacturing companies of India. The rubber directory provides vast information related to the leading manufacturers, suppliers and exporters of rubber and rubber based products in India.

With around 6000 units comprising 30 large scale, 300 medium scale and around 5600 SSI/tiny sector units, manufacturing 35000 rubber products, employing 400 hundred thousand people, including around 22000 technically qualified support personnel, with a turnover of Rs.200 billions and contributing Rs.40 billions to the National Exchequer through taxes, duties and other levies, the Indian Rubber Industry plays a core sector role. India is the third largest producer, fourth largest consumer of natural rubber and fifth largest consumer of natural rubber and synthetic rubber.
together in the world. Besides, India is the world's largest manufacturer of reclaim rubber. In fact, India and China are the only two countries in the world which have the capacity to consume the entire indigenous production of natural rubber and thereby obviate the compulsion and over dependence on exports of surplus quantity of natural rubber. This product group declined by 1.5 per cent during 2008-09, compared to their growth of 8.9 per cent during 2007-08. The growth of tyre industry is linked to the growth of the auto industry and the replacement market. Two-wheeler production had a modest growth during 2008-09, so did the two-wheeler tyres. The production of rubber footwear grew by 3.9 per cent while sheets (PVC/rubber) fell by 4.7 per cent. PVC pipes and tubes, which have the highest weight in the product group, witnessed a decline of 7.2 per cent during 2008-09, on top of an impressive growth during the previous two years.


(http://www.surfindia.com/rubber/)

Data Collection

For data collection, the manufacturing companies from the above said manufacturing sectors, who have won some awards like MBNQA, Rajiv Gandhi National Quality awards, Golden Peacock National Quality awards, Best Management Practices awards etc. have been targeted. The manufacturing companies whose names have appeared in the world’s best business newsletter – The Forbes (2005 edition) – were also targeted for data collection. In the 2005 edition, The Forbes (2005 edition) has listed thirty Indian companies like Reliance, NTPC, HPCL, BHEL etc. The award winning companies were targeted for the data collection for the simple reason that they are doing the green practices. It is fair to say that a sample drawn from the firms following green practices could be considered a reasonably representative measure of the environmentally conscious manufacturing. Apart from this, like Saraph et al. (1989), for the reasons of practicality and convenience, samples from various firms located in different regions of India have been targeted for the survey.

4.3.2. Sampling Method

The purpose of sampling is to enable one to estimate some unknown characteristics of population. There are nine methods, which could be used for sampling (Metri, 2001):
Convenience sampling, Judgment sampling, Snowball sampling, Quota sampling, Simple Random sampling, Systematic sampling, Stratified sampling, Cluster sampling and Multistage sampling.

All the methods have some advantages and disadvantages. Of these nine methods, snowball sampling is useful in locating members of rare populations by referrals. According to Goodman (1961), the snowball sample is a judgment sample that is used to sample special population. Reduced sample sizes and costs are clear cut advantages of snowball sampling. In snowball sampling, initial respondents are selected by probability methods and additional respondents are obtained from information provided by the initial respondents. This method is therefore very appropriate for experts’ data collection in which researcher is interested in the views of articulate individuals on a particular subject rather than taking a representative probability sample (Metri, 2001). Furthermore, random sampling is representative only when its size is large. In case of small number of sample unit, it may not give representative set of units (Saraph et al., 1989). Also, attempting to get a random sample on a relatively new area may increase the chance of non-response. Hence, snowball sampling method has been considered appropriate and used in this study. The limitation of snowball sampling is that bias may enter into the study because a person who is known to someone (also in sample) has a higher probability of being similar to the first person. If there are differences between those who are widely known by others and those who are not, may be problem with snowball sampling. To reduce the bias, initially 30 respondents were selected by probability method from various sources (such as directory of ISO 14001 certified industry, Industrial Directory, companies like public, private and government organizations). Then additional respondents were obtained from information provided by the initial respondents. This process was continued till the sample reached the targeted sample size. Descriptive analysis (discussed later) revealed that samples covered micro, small, medium and large organizations and also various positions and sectors. Therefore, snowball sampling for the present study is not biased and has given an adequate representative set of samples. Along with snowball sampling method, in-person survey was considered appropriate for investigation.
4.3.3. Sample Size

Despite the widespread use of non-probability samples, there is no available theoretical basis for determining the sampling error or sample size. Observations suggest that non-probability sample size decisions are made by calculating the size either as if it were a probability sample or else on an “all-you-can afford” basis. Uhlik and Lores (1998) determined the sample size using the formula applicable to probability sampling, even though, they used both probability and non-probability sampling methods for data collection on constructability practices among general professionals. Flynn et al (1994) suggested that a sample size of 30 or more is statistically sufficient for calculating Cronbach’s alpha. However they even used a sample size of 12 also in subsamples. From the literature it is clear that, in a survey, not all participants return the questionnaire. After considering the expected response rate, data collection method, the requirements for performing statistical analysis, and the survey cost, a sample size of 300 was initially targeted. This size of sample compares favorably with those reported in the literature for similar studies (Saraph et al, 1989, Flynn et al., 1994, Metri, 2001).

4.3.4. The Survey

The survey was administered from September 2008 to November 2008. The questionnaires were mainly targeted to middle or top level management as explained in previous section. The sample group was contacted either by phone or by e-mail to seek agreement to participate in the survey. Prior appointments were taken from participants to visit their offices/plants for the survey. The questionnaires were sent through e-mail and at some places questionnaires were handed over to the respondents in person. Mostly the survey was conducted by face-to-face interview with the experts. Every interview was preceded by a brief introduction pertaining to the objectives of the study and its methodology and then respondent used to fill the questionnaire. Each of these interviews lasted one to one and half-hours. In some of the cases where experts were extremely busy, after briefing about the survey, they promised to return the questionnaire as per their convenience within a week or two. These respondents were reminded by phone/e-mail if they had not returned the questionnaires within the period they promised. A total of 325 questionnaires were delivered to the participants of whom 115 participants returned the questionnaire.
without any follow-ups. Total 230 phone calls and 105 e-mails were made to non-respondents for follow up process. This vigorous follow up resulted in the return of 173 additional responses for a total of 288. Out of these 288 questionnaires, 228 questionnaires were personally collected from their offices/plants and 60 questionnaires were received through mail or e-mail. This represents overall 89% response rate. Out of these 288 questionnaires, one was answered partially by the respondent and two responses came either from other than selected manufacturing sector or from respondents other than mentioned in the sample. As a result, valid returns suitable for analysis totaled 285, yielding an acceptable response rate of 87%. Respondents were also given an opportunity to add to the list of variables presented, but no further significant items have been identified.

The response rate was high compared with other surveys, such as those by Shah and Murphy (1995), Saraph et al. (1989), Black and Porter (1996). It is pointed out that the expected response rate for industry is of the order of 25–30%. Given the nature of study and length of the questionnaire, it is considered to be high/very high return rate. The higher response rate is primarily the result of the snowball sampling along with personal contact approach used. Although this method is time-intensive and impracticable in many cases, it proved effective for this study. The level of response rate exceeded the normal expected for survey research in manufacturing industries and also yielded a sample size suitable for the subsequent statistical analysis.

Non-response analysis was conducted to clarify the reasons for not returning completed questionnaire. The method used was direct telephone contact of randomly selected sub-sample of 15 non-respondents to determine why they did not respond. The chief reason for non-response by the respondents was lack of time to fill up a four pages (A4 paper size) questionnaire. All the non-respondents have given this reason. Non-respondents did not differ from respondents in terms of organizational demographics. Therefore, the actual replies received can be assumed to constitute the valid responses of the original sample.
4.3.5. Data Preparation

Proper data analysis requires effective data preparation and management. The length of the questionnaire, the number of completed surveys anticipated and data analysis software all had to be considered in selecting a database-management system. A rational database-management program, Microsoft Excel®, was chosen for this purpose. Survey responses were coded in the database. Both quantitative and non-quantitative, open-ended responses were recorded for possible future analysis. This also helped to clarify quantitative responses.