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Corporation

Human Resource and Skill Requirements in the Capital Goods Sector (2012-17, 2017-22)

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1 Executive Summary

This final report presents a detailed analysis of manpower related issues prevalent in the capital goods sector covering its major identified sub-sectors. Relevant insights based on primary research and existing secondary literature on the sector have been used to prepare this report. The report also recommends the key priority areas of action for the capital goods sector skill council.

The capital goods sector is large and diverse sector comprising of many sub-sectors. Identification and a basic understanding of these sub-sectors is a pre-requisite for a skill gap study covering the entire sector. For this context, a suitable methodology has been developed to identify the following nine sub-sectors within the capital goods sector:

1. Machine tools
2. Power and electrical equipments
3. Earthmoving, mining and construction equipment,
4. Material handling and lifting equipment
5. Process & plant machinery
6. Light engineering goods
7. Textile machinery
8. Plastic, paper & rubber machinery
9. Agricultural machinery.

Analysis of sub-sectors in terms of business segments, performance, key player etc helps understanding the ecosystems surrounding the respective subsectors. This understanding across sub-sectors further strengthens the analysis of skill gap issues. From the above nine sub-sectors, the following six were identified in consultation with the Capital Goods Sector Skill Council, as priority sectors to be covered in this report: Machine tools, Power and electrical equipments, Process and plant machinery, Textile machinery, Plastic Paper and Rubber Machinery, Light Engineering Goods. Furthermore, key foundational segments- tool, dies & moulds, and automation & control- have been specifically positioned and discussed to emphasize their importance in the value chain across sub-sectors.

A section on demand side skill gap assessment analyzes the manpower insights from the perspective of industry players. The section presents a comprehensive analysis of the present and future manpower requirements along with the key insights gathered from primary interviews and secondary research. A section on supply side presents an assessment of skills gaps origination from a training institution perspective.

The sections on recommendations discuss the future course of action for the capital goods sector skill council and other policy makers

2 Report Structure

The report is structured in the following manner

- Part I includes Acknowledgement, overview of Capital Goods sector, analysis of subsectors, study of skill ecosystem to understand the origination of skill gaps, industry workforce profile, institutional assessment and skill gap perspectives

- Part II consists of actionable recommendations to address the identified issues with specific timelines

- Part III includes appendix, lists of figures and tables

PART- I

3 Acknowledgement

We are grateful for the guidance and support extended by NSDC, FICCI and Department of Heavy Industry and members of the Capital Goods SSC on this engagement.

We are also thankful to all the industry stakeholders, Training Institutions, and Industry Associations (Listed in Appendix 11.13-11.15) who participated in the primary survey conducted by us, and helped us assimilate rich insights with regard to manpower profile and skills development perspectives within the Capital Goods Sector in India.

4 Capital Goods Sector

4.1 Strategic Importance

"Capital Goods" sector comprises of plant and machinery, equipment / accessories required for manufacture / production, either directly or indirectly, of goods or for rendering services, including those required for replacement, modernization, technological up gradation and expansion. It also includes packaging machinery and equipment, refrigeration equipment, power generating sets, equipment and instruments for testing, research and development, quality and pollution control. Capital Goods sector has multiplier effect and has bearing on the growth of the user industries as it provides critical input, i.e., machinery and equipment to the remaining sectors covered under the manufacturing activity. The capital goods industry contributes 12% to the total manufacturing activity which translates to about 1.8% of GDP[1]. If the goal of achieving 9% growth in GDP during the 12th Five Year Plan has to be realized, then it is important for the manufacturing industry to grow at least by 11-13% per annum. This further requires that the Capital Goods sector, which is considered to be the core of manufacturing, should grow at around 17-19%.

4.2 Major Sub-sectors

Given the various form of capital goods being manufactured, the sector is normally divided into 8-10 major sub-sector categorized based on end-usage. In this regard, the detailed methodology adopted to arrive at 9 major sub-sectors can be referred in Appendix section 8.1
The main sub-sectors thus identified as sub-sectors of the capital goods sector are:

Table 1: Brief Description of Key Sub-Sectors

S. No.	Sub-Sector	Brief Description
1	Machine Tools	Constitutes machines related to metal cutting and forming
2	Power & Electrical equipments	Constitutes machines related to power generation, transmission, and distribution.
3	Process plant machinery	Constitutes machines such as pressure vessels, evaporators, stirrers, heat exchangers etc. are used in energy, metallurgy, oil and gas, industry etc.
4	Textile machinery	Constitutes machines used in various steps of textile fabrication such as spinning, weaving, processing, testing etc.
5	Earthmoving, mining & construction equipment	Constitutes machines such as graders, dozers, excavators etc for mining and mixers, tippers, road millers etc for constructions.
6	Material Handling & lifting equipment	Constitutes primarily of forklifts and cranes.

[1] *Capital Goods in India- A report*

7	Light Engineering goods	Constitutes machines related to roller bearing, process control instruments, castings, steel forgings, and pipes etc used in oil & gas, power, automotive etc. industries
8	Agricultural machinery	Constitutes machines used in various steps of agriculture such as land development, sowing, weeding, harvesting etc.
9	Plastic, Paper & Rubber machinery	Constitutes machinery used in various fabrication steps of paper, plastic and rubber manufacturing

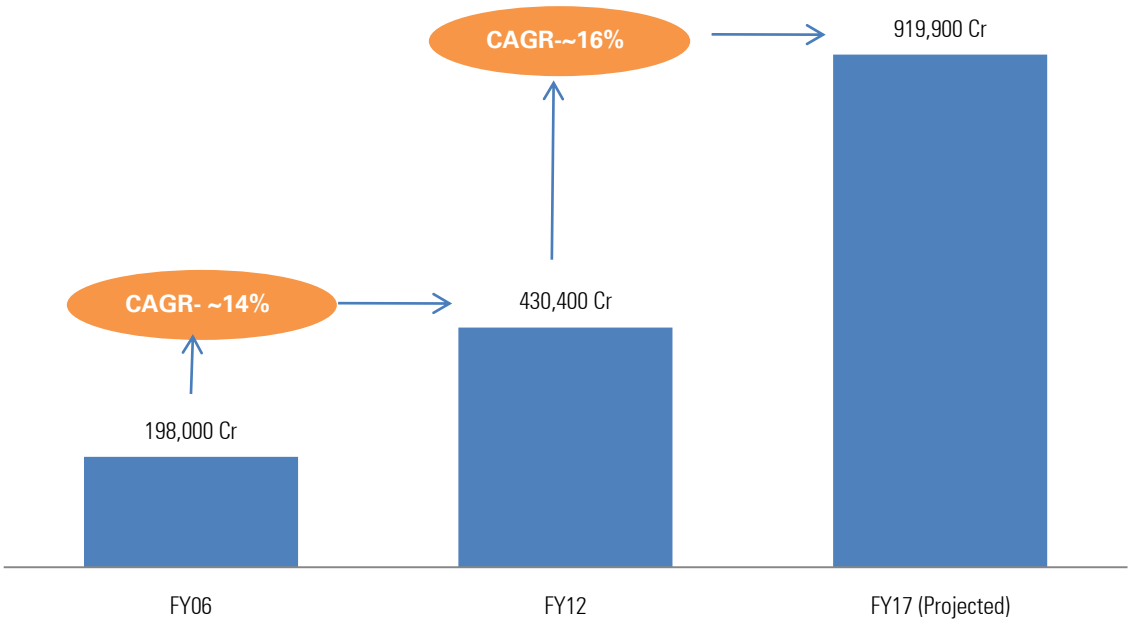
4.3 Characteristics of the Industry

- Economic performance of the sector is linked with that of manufacturing industry which is the key end-user of the Capital Goods industry.
- Capability to manufacture most of the major capital goods exists indigenously. However, given the superior technology competitiveness and competitive pricing of foreign players, the sector faces a stiff competition from imported machineries.
- The output of the sector is concentrated with a top few companies in most product groups, followed by a section of companies comprising medium to small scale players
- Indian companies lack export thrust as the focus is largely on the domestic market. However, some of the larger players are exploring export market growth targeted especially towards the Middle East and Asian markets. The sector is expected to rely on government support on areas like export financing and promotion to tap vast global capital goods market opportunity.

4.4 Economic Performance

Given the various form of capital goods being manufactured, the sector is normally divided into 8-10 major sub-sector categorized based on end-usage. In this regard, the detailed methodology adopted to arrive at 9 major sub-sectors can be referred in Appendix section 8.1

Figure 1: Market Size of Capital Goods Sector (Rs. Crores)[2]



However, a current trend of concern is the increasing dependence on imports in the sector. Imports are gaining market share across all sub-sectors, with 30% of domestic demand met through imports and the proportion being higher in the "critical components' segment for each sub-sector. Metallurgical machinery, machine tools & textile machinery are relatively weak in self reliance as more than 50% of demand is being met through imports. Import content across the sub-sectors of capital goods varies from 10% to 78% due to absence of technology of critical assemblies and subsystems. During the 11th plan period, imports grew their share in meeting the domestic demand over time. On an average import grew faster than the market for every capital goods sub-sector, barring metallurgical machinery and dies, moulds & tools, for the period 2005-11. Also the Indian share in global exports of capital goods is low, ranging between 0.1% and 0.6% across various sub-sectors. In contrast, share of global exports for China ranges between 7.7% and 16.3% depending on the sub-sector. Overall, Indian exports grew at a rate of 13% that may be mainly due to the lower base. Amongst the sub-sectors, heavy electrical equipment drove exports, recording export growth rates of 18% per annum.

[2] *Industry sources, KPMG Analysis*

Table 2: Estimated market size and CAGR of key sub-sectors		
Sub-Sector	**Estimated Market Size (FY12) [3] (figures in Rs Crores)**	**CAGR**
Machine Tools	14,000	16%
Power & Electrical Equipments	1,65,000	16.7%
Light Engineering Goods	1,54,000	15%
Process plant machinery	20,000	12%
Earthmoving, mining & construction equipments	18,500	19%
Material Handling & lifting equipments	3,000	15.6%
Textile Machinery	12,400	0.2%
Agricultural Machinery	37,000	12.3%
Plastic, paper & rubber machinery	6,500	30%
Total	**4,30,400**	**~14%**

From the above sub-sectors, the following six were identified in consultation with the Capital Goods Sector Skill Council, as priority sectors to be covered in this report:

1 Machine tools

2 Power and electrical equipments

3 Process and plant machinery

4 Textile machinery

5 Plastic Paper and Rubber Machinery

6 Light Engineering Goods

The subsequent sections of the report cover in detail each of the above six sub-sectors in terms of overview, major segments, sector performance, key players, upcoming trends, opportunities and challenges.

[3] *Industry sources, KPMG Analysis*

4.5 Policy Environment [4]

The salient features of the policy environment in respect of capital goods and engineering sectors are as follows:

- As the capital goods & engineering sector falls under de-licensed category there is no requirement of industrial license. Industrial Entrepreneur Memoranda (IEM) is required to be filed to undertake the manufacturing activity.
- FDI up to 100 percent permitted on automatic route through RBI.
- There is no limit to quantum of payment for technology transfer, design & drawing, royalty etc. to the foreign collaborator
- Import and export of capital goods & engineering items including import of second hand capital goods is allowed freely.

4.6 Concerns and Challenges

- On the output side, four to five large players form 70-80 percent of the market. However, in terms of number of players the sector can be termed as highly fragmented with majority of operative units present in the SME sector. Due to absence of economies of scale, easy accessibility of capital or equity, SMEs face challenge to grow and compete on technological front with foreign competitors.
- Due to lower appetite for capital investment in R&D and lower know-how of process technologies the technology profile of domestic products ranges from basic to intermediate.
- Support facilities, technology development institutions and skilled man-power lag behind global standards.
- Inverted duty structure and other economic parameters favor imports as source of supply.
- Higher cost of production and other impediments make the market tougher for local players

The above mentioned challenges place the sector at disadvantage while competing with companies from China. Factors like better infrastructure leading to lower cost of power and transportation, lower interest rate, government subsidies, depreciated Chinese currency and simpler labor laws enable the Chinese companies to manufacture better technological machines at lower costs. This along with liberal import policy at home shifts the balance in favor of imported machinery from many foreign countries including China.

[4] *Report of the working group on Capital goods sector for 12th five year plan*

5 Analysis of Capital Goods sub-sectors

5.1 Machine Tools

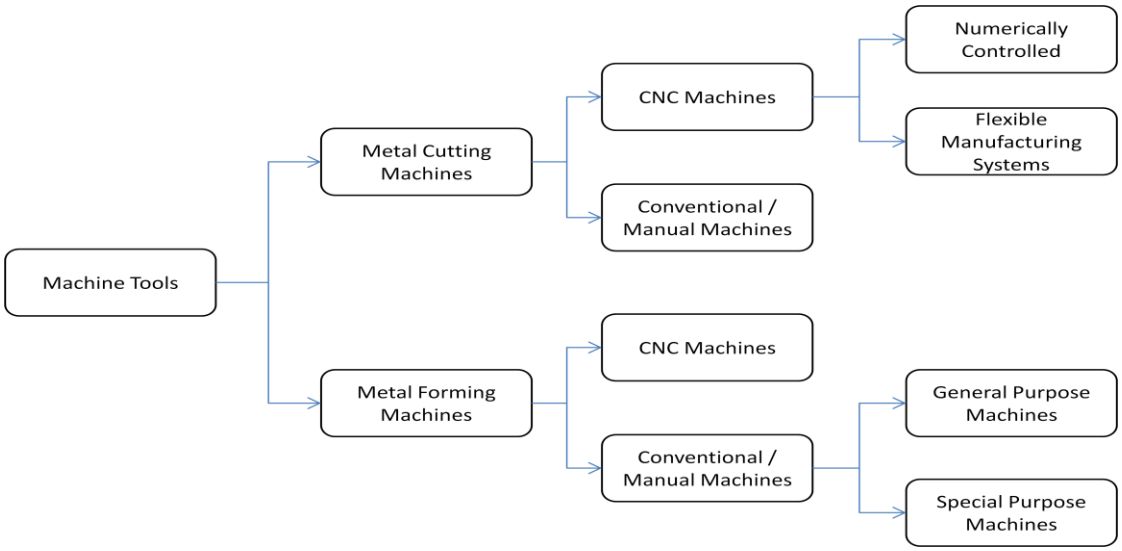
Overview

Machine Tools sector is one of the key sectors for the development of the manufacturing sector in India. The growth of many industries like automobile, auto ancillaries, textile, heavy electrical etc. are dependent on the growth of this industry. The machine tools industry is also a major contributor for various strategically important sectors like defense, railways, energy, and infrastructure etc[5] .This industry is also important for the growth prospects of small and medium scaled enterprises (SMEs).

Major Segments

Machine tool industry can be classified into two types according to the way the metal is shaped or cut - metal cutting machines and metal forming machines. Metal cutting accounts for a majority of the total machine tools output.

Figure 2: Major sub-segments of machine tools

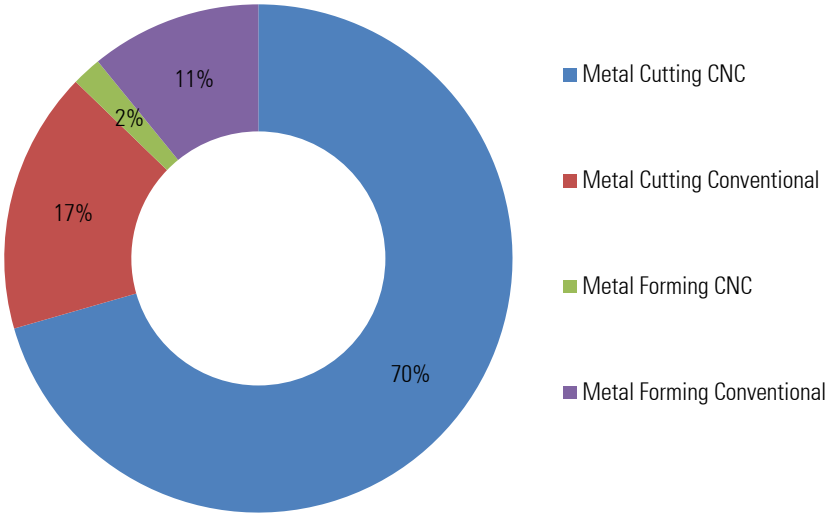


Both metal cutting and forming machines can be classified into Computer Numerically Controlled (CNC) machines and conventional machines based on how the tool selection and movement is controlled, the level of automation, and programming involved. CNC machine tools have become quite popular over the years owing to their high productivity, cost efficiency and high quality finishing. Since 2008, CNC machines have constituted to around 60% of the total machine tools produced.

[5] *Industry News, KPMG analysis*

CNC machines can be further classified into numerically controlled and flexible manufacturing systems. The conventional manual machines are classified as general purpose and special purpose machines. The CNC metal cutting machine tools the highest revenue contributor[6]. In metal forming segment, conventional machines are normally preferred.

Figure 3: Percentage contribution of different metal cutting/forming machines towards Revenue [7]

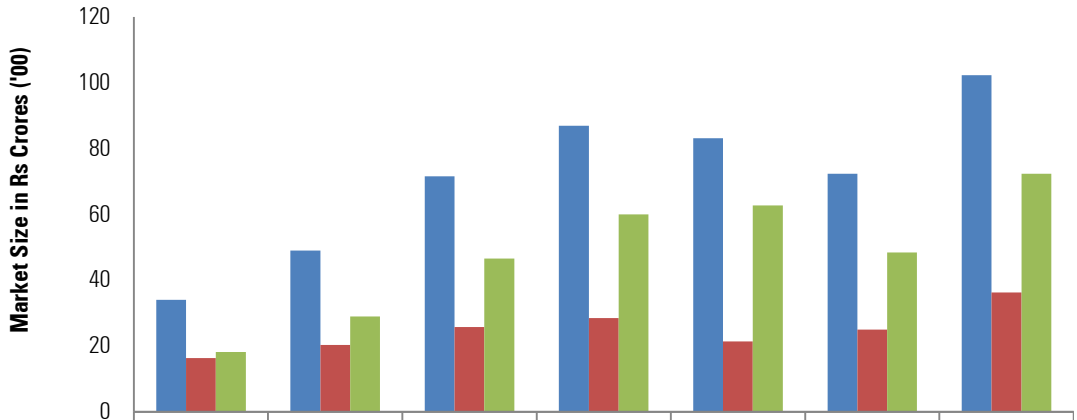


Economic Performance [8]

The total market size for machine tools in India was estimated at Rs 10,236 crores and Rs 14,000 crores for 2010 -11 and 2011-12 respectively. The production of machine tools in India was valued at Rs 3,624 crores (2011), while the rest of the requirements were met through imports. Machine tools imports have been gaining momentum over the past few years due to the lack of competence amongst the Indian firms. The machine tools industry has seen healthy growth over the last couple of years. A CAGR of 16% and 12% in market size and domestic production respectively depicts the growth rate of the industry. Imports have seen a CAGR of 20% from 2004 to 2011. The industry in 2012 provided employment to nearly 30,000 people.

[6] *Annual Report 2010 -11, Indian Machine Tools Manufacturers' Association*
[7] *IMTMA annual report*
[8] *Working Group Report on Capital Goods and Engineering Sector for the 12th five year plan (2012 -17)*

Figure 4: Machine Tools Economic Performance



	2004 - 05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Market Size	34	49	71.6	87	83.2	72.4	102.36
Production	16.3	20.3	25.8	28.5	21.4	25	36.24
Imports	18.2	29	46.6	60	62.7	48.4	72.4

Key Players

A large proportion of the machine tool players in India are small and medium sized enterprises and are unorganized in nature. More than 150 players are estimated to be in the organized sector and approximately 400 – 450 units are small and medium enterprises (SMEs)[9]. Around 70% of the total machine tool production in India is constituted by the top 10 companies.

Some examples of the key players in the industry include Hindustan Machine Tools Limited (HMT), Lakshmi Machine Works Limited, Ace Micromatic Group, Kennametal India Limited, Bharat Fritz Werner Limited (BFW), TAL Manufacturing Solutions Limited and Electronica Machine Tool Limited. A majority of machine tools manufacturers are based out of Karnataka and Maharashtra. Bangalore is considered as the main hub for most of the machine tool players. Other clusters include Mumbai, Pune, Coimbatore, Chennai, Jalandhar, Ludhiana, Ahmedabad, Rajkot, Baroda, Surendranagar and Jamnagar (Gujarat).

Key Trends

- **Increasing use of CNC machines:** In the machine tools sectors, CNC machines form the bulk of machines being used in India and contributed to the highest revenue among all categories in 2011. With the consumer demanding advanced machine tools to enhance productivity and quality, CNC machines are the need of the hour.

[9] *KPMG industry research*

- **High End user demands:** Key consumers for machine tools industry like automobiles, consumer durables, auto ancillaries etc. are more competitive and demanding owing to stiff competition. This has resulted in increasing demand for sophisticated CNC machine tools which would help them reduce costs and enhance efficiency.

- **Imports outstripping domestic production:** The domestic demand for machine tools is much higher than supply. This has resulted in heavy dependence on imports by the user industries. The demand for sophisticated machine tools is expected to increase further, as many players from the user industries are looking to diversify as well as increase production and capacity.

Opportunities

- **High growth of user industries:** The high growth rate of user industries like automobile, defense, infrastructure etc. have a direct effect on the demand of machine tools. Increasing living standards, rising incomes, rapid urbanization etc. have been fuelling the growth of many sectors like consumer durables, textiles etc. thereby providing an ample opportunity for machine tool manufacturers.

- **Strong support base:** Manufacturing of machine tools requires high quality castings which can be supported by the casting and foundry industry. The highly developed foundry industry for producing ferrous, non ferrous, steel etc. in India provides an excellent support base.

Concerns and Challenges

- **Funding Issues[10]:** Constraint of proper funding has resulted in the slow growth of the domestic machine tool industry. This industry is capital intensive and has very long gestation period which proves to be an area of concern for the financial institutions. The high prevailing interest rates over the last few years are also a deterrent for the industry and affects cost competitiveness.
- **Low domestic production and reliance on imports:** With the booming Indian economy, demand for advanced machine tools has also increased. However, the domestic production has not been able to meet the rising demand, thereby forcing industry players to rely on imports. Improper resource utilization of the organized players, coupled with funding issues for small and medium enterprises (SMEs) has made the companies which use machine tools rely increasingly on imports.
- **Technology Gaps:** There is a serious mismatch between the customer demands and technology capabilities of the Indian machine tool players. This is mainly due to the lack of research and development (R&D) investments into the sector by the domestic players (Lack of financial resources is one of the reasons for low R&D budget). The shortage of academic research institutions and unavailability of proper infrastructural facilities for proper research activities are also responsible for technology gaps in the industry.
- **High Global Competition:** Machine tool imports constituted more than 70% of the total market share in 2011. Foreign players with deep pockets, large R&D budgets are bringing in more advanced technological products into the country.

[10] *Indian Machine Tools Manufacturers Association*

- **Government Regulations:** The Indian government during the recent years has signed a number of Free Trade Agreements (FTAs) and Preferential Trade Agreements (PTAs) with foreign countries. This has resulted in zero duty on imports from these countries. This has placed the domestic players at a disadvantage due to systemic issues affecting their cost competitiveness.

5.2 Power and Electrical equipments

5.2.1 Overview

The Indian electrical equipment industry primarily caters to the power sector. Owing to the Government of India's thrust, growth and reforms in the power sector, the electrical equipment industry is poised to see tremendous growth in the coming years. The capacity addition planned in the 12th plan (2012 – 2017) and 13th plan (2017-2022) are around 88.5 GW (Gigawatts) and 100 GW[11] respectively. This would in turn attract higher investments in the power sector, a significant portion of which would be towards electrical equipment industry.

5.2.2 Major Segments

The electrical equipment industry broadly consists of four categories:

- Generation Equipments – The segment consists of power generating equipments such as boilers, turbines and generators etc.
- Transmission Equipments – The segment consists of transformers and transmission towers used for the transmission of electricity.
- Distribution Equipments – The segment consists of circuit breakers, switch gears and control gears
- Miscellaneous – The segment consists of electric motors, wires, cables etc.

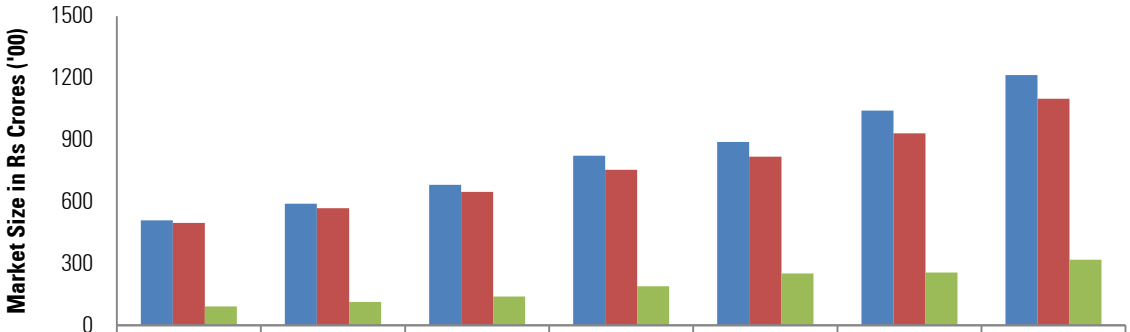
5.2.3 Economic Performance[12]

The industry has seen a CAGR of 16.7%[13] from 2004 to 2011 in terms of total market size. The total market size of this sector was estimated at Rs 1, 21,400 crores and Rs 1, 65,000 crores for 2010 -11 and 2011-12 respectively. The domestic production capacity of around Rs 110,000 crores (in terms of market value) has been able to keep pace with the demand.

The imports have also seen an increase over the years, mainly in the super critical technology for generation equipments and high tech equipments. Imports in 2011 (Rs ~31,700 Crore) constituted almost 26% of the total electrical equipment market in India.

[11] *Indian Electrical Equipment Industry Mission Plan 2012 – 2022*
[12] *Indian Electrical and Electronics Manufacturers Association*
[13] *Report of the Working Group on Capital Goods and Engineering Sector, 12th Five Year Plan*

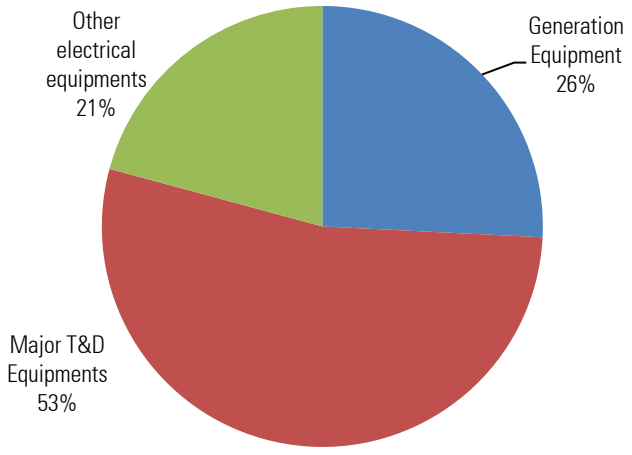
Figure 5: Power & Electrical Equipments Economic Performance



	2004 - 05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Market Size	510	589.4	681	823	890.4	1042	1214
Production	497.5	567.8	648	754	818	932	1100
Imports	92.3	113.4	139.4	189.4	252	255.6	317.7

The domestic electrical equipment industry is estimated to be more than Rs 1.20 lakh crores for 2011-12. The industry can be classified into two broad segments – generation equipments and transmission and distribution (T&D) equipments. The generation equipments (boilers, turbines and generators - BTG) contributed around Rs 30,000 crores, whereas the major T&D equipments like transformers, switchgears, transmission cables and lines contributed around Rs 64,000 crores.

Figure 6: Electrical Equipment Industry Size by Category (2011-12)



The industry is directly employing around 5 lakh persons and providing indirect employment to about 10 lakhs persons. Contributing around 1.5% to the national Gross Domestic product (GDP) in 2012, this industry assumes significant importance for the country's growth.

5.2.4 Key Players[14]

The major players in this industry include Bharat Heavy Electrical Limited (BHEL), Alstom India Limited, ABB India Limited etc. State run BHEL is the largest manufacturer of boilers in the country. It is estimated to hold a market share of more than 60% in the boiler segment, ranging from industrial boilers to super critical boilers.

In the distribution segment, switchgear and control gear are the two main equipments. The switchgear segment can be classified into two main segments – LT (Low Tension Switchgear – Low Technology driven) and HT (High Tension Switchgear – High Technology driven). The LT segment in India is mainly dominated by Siemens, L&T and Datar Switchgear Limited. The HT segment, being more technology intensive has better margins and higher price realization. Major players in this segment are multinationals like GEC Alstom India Limited, Crompton Greaves and ABB.

5.2.5 Key Trends

- **High Voltage Transmission:** As of now, most of the power transmission takes place through 220Kv and 400Kv lines. It is expected to move to higher voltage transmission lines of 765 Kv or more as it helps in reducing transmission losses. This further reiterates the fact that in order to handle high voltage transmission, advanced ancillary equipments in terms of circuit breakers, control gears have to be developed by the manufacturers. Thus, product development and investment in R&D would be very crucial for the players.

- **Imports of High Tech Equipments:** In 2011, 37% of the super critical technology generation equipments (B-T-G) were met through imports. This trend is supposed to continue in the next couple of years as well due to better technology and lower costs of the foreign players.

5.2.6 Opportunities

- **Domestic Demand:** In order to sustain an annual GDP growth rate of around 7% – 8% over the next couple of years, the electricity requirement is bound to go up by almost 4-5 times. Rapid industrialization, higher living standards, growing middle class etc. would increase the per capita consumption of power over the next couple of years. Thus, it provides ample opportunities for the equipment manufacturers to meet the demand of expansion plans for the power producers.

- **Infrastructure Development:** The government's priorities in infrastructure development would provide a big boost to this industry. Growth in airports, metro rail, malls, roads, highways and other infrastructure projects indicate a sustained demand in growth for power and hence electrical equipments as well.

[14] *News Articles – KPMG Analysis*

- **Rural Electrification:** The Government's initiative of increasing the penetration of electricity in villages and "Power for All" policy by 2012 is also an indication of increasing demand for domestic power.

- **Export Opportunities:** The African countries suffer from inadequate infrastructure facilities such as railways, power, roads, power distribution systems etc. At present, India's exports of electrical equipments to African countries are less than $500 million. Countries from Africa as well as from Latin America, Caribbean and Central Asia provide tremendous scope for the export of BTG (Boiler – Turbine – Generator) and T&D (Transmission and Distribution) equipments.

5.2.7 Concerns and Challenges[15]

- **Low Cost Imports:** In 2011, imports constituted around 26% of the total market value of the electrical equipment industry. Tough competition from the global players, coupled with lower costs and better technology is a matter of concern for the domestic manufacturers.

- **Low Domestic Capacity Utilization:** The domestic electrical equipment industry is supposed to have surplus manufacturing capacities across generation and T&D segments. Coupled with high global competition, the challenge of utilizing existing domestic capacities is compounded.

- **Low Growth of the Power Sector in the near term:** Prevailing coal shortages in the country, problems with Fuel Supply Agreements (FSAs), land acquisition, clearances from the Ministry of Environment and Forests, people protests etc. are impeding the growth of power sector in India in the near term. This could result in lower than anticipated growth of the sector.

- **Manpower Shortage and Lower Productivity:** The industry is facing acute shortages in quality skilled personnel and employable manpower. The productivity has also been low due to outdated curriculum of the training institutes like Industrial Training Institutes (ITI), polytechnics etc.

- **Low investments in R&D:** The investments in product development and new technologies have not been up to the mark by the domestic players. This has resulted in the global players with deep pockets bringing in latest technology to the Indian market. Lack of proper linkages and relationships with the industry and research institutions (both domestic and abroad) is another concern area.

- **Poor Financial Health of Electricity Boards:** The poor financial condition of the various state electricity boards is also hampering the growth of power sector in the country. The accumulated losses of state electricity boards for March'2010 amounted to around Rs 1 Lakh crores as per the Shunglu Committee report in 2011[16]. Electricity boards of Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh etc. are running in losses for years.

[15] *News Articles, KPMG Analysis*
[16] *http://www.indiaspend.com/investigations/indias-most-bankrupt-electricity-boards*

5.3 Process Plant Machinery

5.3.1 Overview

The industry caters to a wide variety of process industries like oil & gas, petroleum refining, petrochemicals, chemicals, fertilizer, pharmaceuticals, metal industry, cement, paper, sugar, cryogenics, distilleries etc. The industry designs and manufactures a very wide range of equipment and systems such as: pressure vessels, columns, towers, heat exchangers, multi-tubular reactors, evaporators, crystallizers, dryers, road/rail tankers, most modern storage equipment, loading and unloading systems, cooling towers, cryogenic systems, equipment for dairy and food processing, mineral beneficiation equipment, rotary kilns, equipment for power plants, equipment for offshore projects, thermal and combustion systems etc. An impressive array of equipment for solid-liquid separation, equipment for water and waste water treatment, systems for environmental engineering and pollution control, large material handling equipment, marine equipment and special purpose equipment for critical services such as reformers, multiwall ammonia converters, urea reactors, urea strippers, transfer line exchangers, process gas waste heat boilers, hydrocracker reactors, fired heaters etc. are also being manufactured and exported by the industry.

It is a highly capital as well as labour intensive sector with a strong engineering orientation where the products are mostly custom built. Hence economies of scale have less relevance in this sector except for the machine, or labour utilization factor if work load is not uniform.

5.3.2 Major Segments

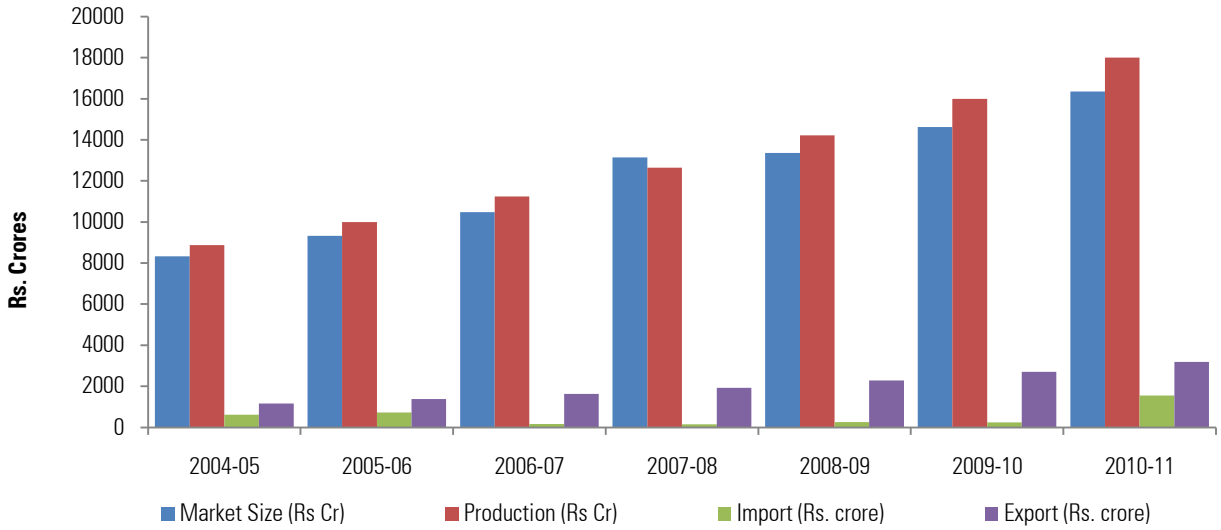
Major process plant machineries include tanks, pressure vessels, evaporators, stirrers, heat exchangers, towers & columns, crystallizer, furnace, etc. are used in energy sector, gas, oil, refinery, chemical & petrochemical, fertilizer, paper & pulp, sugar, cement, dairy industry, etc.

5.3.3Economic Performance

The total market size of this sector was estimated at Rs 16,000 crores and Rs 20,000 crores for 2010 -11 and 2011-12 respectively. Process Plant machinery sector has grown at a CAGR of 12 % in last five years. Exports to the tune of Rs.3,194 crore during 2010-11 have been realized for major equipments covering Fertilizers, Refinery, Petrochemicals, Oil and gas sectors etc. and growing at a CAGR of 18.3% whereas imports stood at Rs.1,548 crore during 2010-11 and growing at a CAGR of 16.5%.

The exports are expected to touch the figure of Rs.8, 750 crore by 2016-17. The import level is expected to be at Rs.3, 868 crore by 2016-17.

Figure 7: Process Plant Machinery Economic Performance[17]



5.3.4 Key Players

There are over 200 units engaged in the manufacturer of process plant machinery in the country out of which 65% are small & medium manufacturers. The major players of this sector are as follows: Larsen & Toubro, Godrej & Boyce Mfg. Co., Ingersoll Rand (India), Ondeo Degremont, Saraswati Industrial Syndicate, Alfa Laval (India), F L Smidth, Walchandnagar Industries, Alstom Projects India, K C P, Swetha Engineering.

5.3.5 Key Trends

Increasing Globalization: Lately, there has been a trend of global equipment manufacturers shifting their bases to Asia with India being one of the favored destinations. These players have brought with them the latest technologies, made significant investments in order to improve the quality of Indian made equipment to be on par with their global competitors. This has led to resurgence in Indian manufacturing, which can be observed in many examples of Indian companies now going global. While competing in the global market place with players that are several times larger than them, Indian PPE (Process Plant Equipment) industry has recognized the significance of innovation and modern techniques across different dimensions. Concepts like TQM (Total Quality Management), Lean Manufacturing, Six Sigma and Business Process Mapping have swept most of the organizations – as they pursue the promise of dramatically improved competitiveness through quality, service, productivity and profitability.

5.3.6 Concerns and Challenges[18]

[17] *Report of the working group on capital goods and engineering sector for 12th five year plan*
[18] *KPMG analysis & News articles*

- **Import of second hand machinery:** As per the present policy, old machinery can be imported without any restriction of age, resulting in huge import of second hand machinery into India. Old machinery is also being imported to various SEZs without payment of tax and duties. This machinery is refurbished later for use. This is adversely affecting the domestic process plant machinery industry.

- **Lack of Mass manufacturing:** As per industry reports, many of the companies are not able to scale up due to unavailability of mass manufacturing and restrictive labor laws.

- **Financial cost:** Typical lead time for supply of Process plant equipment is 12-18 months. The differential interest charged between LIBOR and Indian prime lending rate is around 10% which is itself higher than the import duty. Considering the fact that many of Indian manufacturers are SMEs, this by itself can dramatically reduce our competitiveness and hence, the market share. Further, this interest differential inhibits stocking of material and thereby further increases the delivery cycle time.

5.4 Textile Machinery[19]

5.4.1 Overview

The Textile machinery sector in India is one of the key engineering sectors responsible for the growth of the Indian economy. In its early years, the sector was producing machines mainly for the cotton textile sector. However, subsequently, the textile industry diversified the production line to take up the production of machinery required by the man-made fiber sector, the woolen sector and even the jute sector. Today, the entire range of equipment required for forming lint and man-made fibers up to finished fabrics are produced in India. Side by side, the ancillary and textile testing and monitoring equipment sectors too developed appreciably. The sector generally categorizes these equipments into ginning, spinning, weaving, processing, and testing machinery.

5.4.2 Major Segments

The sector is major divided into following seven major segments:

1. Ginning and spinning
2. Weaving
3. Synthetic machinery
4. Processing machinery
5. Testing and instrumentation machinery
6. Jute machinery
7. Components and accessories.

Ginning & Spinning

The entire range of Spinning machinery is manufactured in India, including ginning machinery, blow room machinery, cards, draw frame, combers, speed frame, ring frame, ancillary machinery, two for one twisting and auto-cone winding machines and parts and accessories, in general, are at par with international standards.

In ginning there are innovations to control the contamination in cotton by reducing human handling, maintaining humidity in pala houses and bins, auto feeding etc. There are five to six manufacturers in ginning. Capacity of ginning machinery is adequate and there are exports and practically no imports.

The total capacity of Ginning and Spinning is Rs. 4,561 crores. It meets over 75% of domestic requirement. In the coming years, it is likely to meet 90% of the requirement. There are domestic as well as foreign players. The technological gap is minimal.

Weaving

The total capacity is Rs. 703 crores. The weaving segment is mainly classified into weaving preparatory, weaving-shuttle looms, weaving- shuttle-less looms. The technology, capacity and production for weaving preparatory are adequate in India. Some of the reputed manufacturers for weaving preparatory are Prashant Gamatex Pvt. Ltd., Ahmedabad, Jupiter Comtex Pvt. Ltd., Ahmedabad, etc. For weaving-shuttle & shuttle-less looms, there exist many

[19] *TMMA, Industry Research articles, KPMG Analysis*

manufacturers which supply almost 40,000 to 50,000 power looms per annum. However, there are few manufacturers of automatic shuttle looms or new technology shuttle-less looms. For shuttle-less looms present installed capacity is almost 16,500 per annum, though production has not reached beyond 2,000 per annum. However demand is increasing, it is believed that the capacity utilization should increase in the coming time.

Synthetic Machinery

The capacity for synthetic machinery is approximately Rs. 1,000.00 crores. All kinds of synthetic machines such as Draw Texturising, TFO Twister, and H. S. Winder etc. (except fiber/filament manufacturing chemical plant) are produced in India. Surat, Rajkot, Surendranagar are the main centers for the manufacture of spindles, spindle pots, spindle inserts, etc. Only critical electronic equipment like PLC controls, servo motors etc. are imported. India is self sufficient in such machinery and also exports to different countries. There is practically no import as there is no technology gap.

Processing machinery

The total capacity for processing machinery is approximately Rs. 900 crores and existing capacity meets over 50% of the requirement.

There are more than 50 manufacturers of processing machinery in the country. Almost the entire range of processing machinery is now being manufactured in the country, with continuous scouring, bleaching, mercerizing, washing, dyeing plants, preshrinking ranges and more, being produced by domestic manufacturers. The indigenous machinery available now competes on an even footing with their European counterparts with low material to liquor ratio, and is capable of processing fabric with comparable results at a very reasonable cost. All critical electronic components and equipments are imported. All other types of parts and accessories are also made in India.

Quality of textiles processing in Indian machines is at par with international standards. Many hi- tech machinery are being manufactured in the country for e.g. Continuous Bleaching Plant, Dyeing Plant, Washing range, Preshrinking Range, Indigo dyeing Plant etc. For batch processes India has one of the best quality machines when compared with other countries. Technology gaps exist only in case of special purpose processing and finishing machinery and continuous plants which is also getting narrowed with time.

Testing and machinery equipments

The total capacity is Rs. 220.17 crores and almost 80% of the requirement is met by the domestic manufacturers. And mainly the critical components and electronic controls are being imported in this segment

The Indian textile engineering industry started developing testing and monitoring equipment in the 60s and today a wide range of high quality latest generation testing and monitoring equipment is being manufactured in the country.

Jute machinery

The total capacity is approximately 70 crores and more than 60 percent of demand is met through domestic production.

There are half a dozen good manufacturers of jute machinery in the eastern sector. Lagan Engineering Co. Ltd., Kolkata is the major manufacturer of jute machinery and its parts, components and accessories. There are some small engineering units also manufacturing jute machinery parts and accessories in Kolkata, West Bengal.

Parts/components and accessories

The capacity for this segment is almost Rs. 1,000 crores. The parts/components and accessories also play a major role in manufacturing and maintenance of the textile machineries. Major examples of such parts and accessories are: Bearings, Beams, Bobbins, Bobbin Holders, Bushes, Card Gauges, Ceramic Guides, Cone and Tubes, Cops-Aluminum/Steel, Drums, Filters, Flat Tops, Motors, Needles, Pins, Belts, Rollers, Humidifiers, Over Head Traveling Cleaners, Shuttles, Healds, Reeds, Spindle Tapes, Trolleys, etc.

The segment produces all the parts and accessories indigenously except for some critical parts and high speed cam dobby, electronic dobby and jacquard.

5.4.3 Economic Performance

The sector consists of approximately 1446 units, with a total investment of approximately Rs.7, 800 crore. Of the ~1446 units, more than 80% of the units are SMEs and approximately 40 percent of units are involved in manufacturing complete machinery while the rest manufactures spare parts and accessories. The total installed capacity is approximately Rs. 9,100 crore. The sector provides direct/indirect employment to more than 250,000 people and this figure is expected to grow to over 4, 00,000 lakhs during 12th Plan

The Textile machinery production is projected to grow from Rs 6,150 Crore in 2010-11 to Rs 14,300 Crore in 2016-17 at a CAGR of 15% based on commensurate growth of Indian textile industry and expected policy interventions. The sector contributes greatly to the competitiveness of the Indian Textile Industry (TI) by meeting 45-50% of its demand. Of the current imports made by this sub-sector, 12% is towards to Standardized Equipment while 27% is towards High-tech Equipment while the rest is towards Accessories and Spare parts.

The trend and projection of textile machinery in terms of size, production, imports, and exports are summarized in following graphs:

Figure 8: Textile Machinery Economic Performance

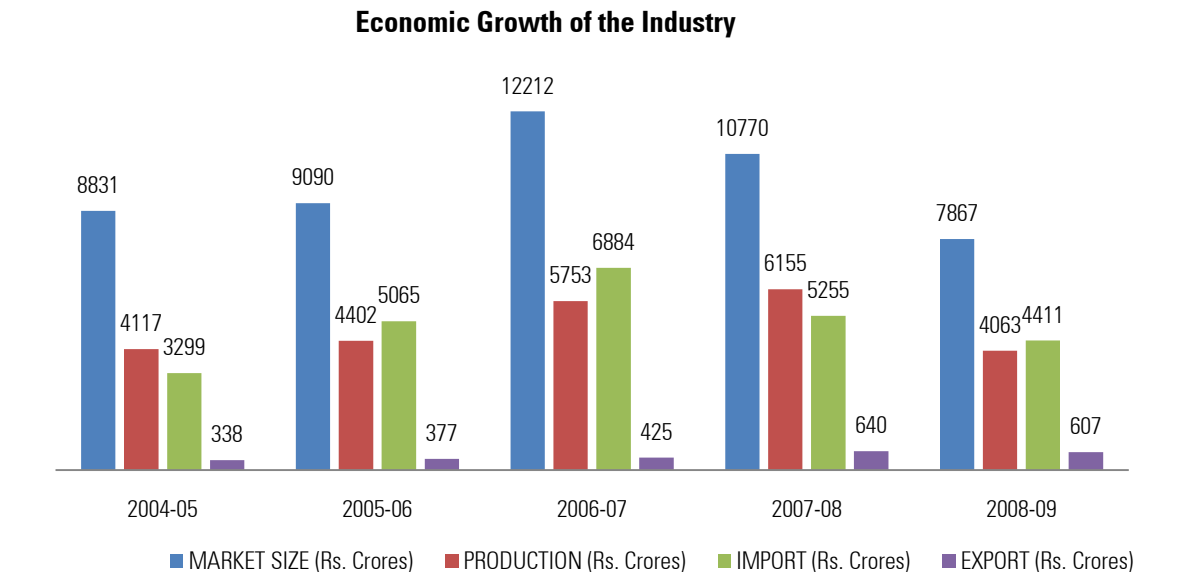
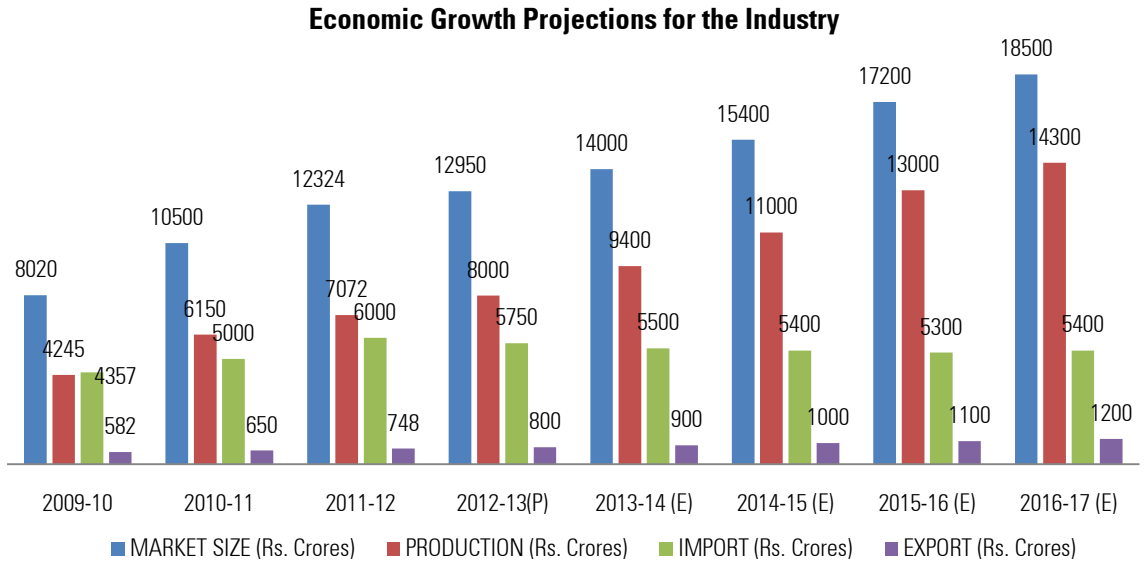


Figure 9: Textile Machinery Economic Performance



5.4.4 Key Players

The machinery manufacturing operation takes place both in the organized and the unorganized sectors. In the organized sector, in addition to the public limited companies, machinery manufacturing is done in independent units, which have collaborative joint ventures with the foreign entities. In the decentralized sector, there are small-scale industrial units as well as tiny units engaged in the production of accessories pertaining to the textile machinery. The key players of these sectors are: Lakshmi Machine Works, Veejay Lakshmi, Ttuetzschler India, Rieter India, Stovec India, InspirOn, Himson Engineering Industries, Harish textile engineers etc. The major geographic regions of operations for this sector are as follows: Large- Rajkot, Surat and Ahmedabad in Gujarat, Coimbatore, Tamilnadu, Mumbai; Medium- Nagpur; Small- Panipat, Amritsar, Ludhiana.

5.4.5 Opportunities

Increased usage of Electronics and robotics

One of the new trends in textile machinery production is the increasing use of electronics and development of automation and robotics. In India textile machinery manufacturing started with many foreign technical collaboration during 1960s to 1980s. Lakshmi Machine Works (LMW) in the past had entered into technical collaboration with Swiss based textile machinery manufacturer Rieter for textile machineries and German based Steel and Ammunitions major Krupp for technology transfer tie-ups. During and after 1990s foreign technology flow to India practically stopped due to opening of markets by the Government. For markets such as India and China which are currently labor intensive in nature, the requirement for cutting-edge technology is slated to increase in the coming years.

Growth in Non-woven disposable textile

There is a considerable rise in the demand for nonwoven disposable textile products like filters and tissues particularly in the emerging economies such as China and India, where nonwovens are seeing great business opportunities due to the growing prosperity in these countries. Non woven composites have many applications in many sectors specifically the automotive sector. The demand for other technical textile products is also increasing rapidly.

Increasing popularity of eco-friendly fibers

With immensely growing popularity of eco- friendly fibers, textile machinery that help in the production of eco friendly products, for example, cold pad-batch dyeing machine that uses a more environmental friendly technique for coloring knit fabric, will see a good growth.

Growing recognition of sourcing indigenously

Since sourcing of the most of the textile machinery today is done from the Europe which is relatively costlier and requires specialized technicians to maintain the machinery, the Indian machinery have become a better substitute to those in addition to the comfort levels of the domestic manufacturers.

In a way, newer opportunities are knocking at the doors of textile engineering industry in terms of growing demand of textile machinery in the domestic market and also exports to the neighboring countries which are emerging as significant textile producers.

5.4.6 Concerns and Challenges

Stiff competition from European manufacturers

Stiff competition from well designed and engineered machinery from Europe and cost effective solutions from China still remains a challenge for this sector. In some cases, competition is in the form of refurbished European machinery which is high on performance and is also available at cheaper rates. In such a scenario, it is imperative to look for solutions that can help growth.

Rising sensitization towards aesthetics

Mostly, the MSME sector is aware and has risen to the task of technology up gradation, both in their machinery as well as in the production techniques of these machines.

But technology is a great leveler. When almost all manufacturers offer equal performance the differentiating factors are price and aesthetics.

Import of second hand machinery

As per the present policy, old machinery can be imported without any restriction of age, resulting in huge import of second hand machinery into India. Old machinery is also being imported to various SEZs without payment of tax and duties. This machinery is refurbished later for use. The subsidy on such used machinery for modernisation is also a retrograde step. These are adversely affecting the domestic textile machinery industry.

5.5 Light Engineering Goods

5.5.1 Overview

Light engineering goods industry is one of the largest segments of the capital goods sector. Its demand depends on a variety of end-user industries such as power, mining, oil and gas, consumer goods, automotive and the general manufacturing sector. In other words, the products covered under this industry are largely used as inputs to the capital goods / heavy engineering industries. This segment constitutes machines related to roller bearing, instruments for the medical and surgical sector, process control instruments, castings, steel forgings, and pipes, among others.

Being highly labour intensive, the light engineering sector generates ample employment opportunities in the economy, especially into the areas where there is an abundant supply of skilled and semi-skilled labour.

India has a strong engineering and capital goods base. It is a major exporter of light engineering goods which include a wide range of items, such as forgings, fasteners, bearings, steel pipes and tubes, diagnostic medical instruments, etc. The presence of well-developed and sound 'light engineering' sector is of high importance to the Indian economy and is the basis of almost all productive and business activities in the country. The major suppliers to this industry are the companies supplying them with raw materials like steel, aluminium etc.

Light Engineering is a diverse industry with the number of distinctive sub-sectors. Some of them are:-

Roller Bearing Industry

Bearings are used to minimize friction between moving parts and find application in rotating parts of virtually all machines and across all sectors such as automobiles, electric motors, diesel engines, industrial machinery and machine tools, etc. They generally consist of inner ring, outer ring, rolling elements, cage and seals and come in two general shapes, that is, ball or roller. The ball bearing is the biggest segment of the industry and contributes to approximately half of the total market size in volume terms. Rollers come in four basic styles, namely, cylindrical, needle, tapered and spherical. The automobile sector accounts for bulk of the total demand of this industry with estimated share of 35 per cent, electrical industry share is 12 per cent, after market (replacement) share is 40 per cent and the remaining 13 per cent consumption is by other industries.

Welding Equipment and Consumables

Traditionally, welding has been used as a means of fabrication. But, over the years, it is effectively used for cladding, hard-surfacing, cutting and a number of other applications for maintaining and reclaiming old machinery and equipments. The demand of the industry depends on the automobile, steel and heavy engineering sectors. The organized sector has a dominating presence in the automatic and semiautomatic welding equipment and higher end electrodes, while the unorganized sector mainly serves manual metal arc welding equipment and low-end electrode segments.

Ferrous Castings

The Indian foundry industry is the fifth largest in the world. It is vital for the growth and development of engineering industries as it constitutes essential intermediates for automobiles, industrial machines, power plants, chemicals and fertilizer, cement plants, etc. Considering the wide range of engineering applications of these castings and high

potential for exports, there is considerable scope for establishing additional capacity particularly for high end applications.

Process Control Instruments

This industry covers a wide range of instruments and systems required for monitoring and measuring of physical, chemical and biological properties. Their importance is significant in high cost, large and sophisticated process industries like fertilizer, steel, power plant, refineries, petrochemicals, cement and other process industries. They are required for measurement and control of process parameters like pressure, temperature, humidity, level, flow, etc. in the process industry. The technology tie-ups with internationally reputed manufacturers have brought in technological breakthrough in various areas of industry. Present technology of process control system is microprocessor based centralized control system. Future technology is for decrease in the sensing and response time of the equipment and greater automation control, i.e., without manual interference.

Seamless Steel Pipes and Tubes

They come in all kinds of sizes including thin, small, precise, slender and other special pipes as well as in different forms such as hot rolled cold drawn, turned, rotorolled, etc. They have applications in aircraft, missile, and nuclear power plants and anti friction bearing, etc. Ultra high strength and corrosion-resistant properties make these perfect for oil and gas industry, steam boilers, chemical and other processing industries, pipelines, installation with high and supercritical steam conditions, etc. Oil sector accounts for around 60 per cent of total requirement of seamless pipes. Bearings and boiler sector contribute around 30 per cent of demand. The industry is able to manufacture tubes up to 14" outer diameter. With upcoming substantial growth in the power sector and increase in demand of bearings from automobile sectors, the demand pattern may change in favor of these two sectors.

Electrical Resistance Welded (ERW) Steel Pipes and Tubes

Based on the end-user customers' requirement, ERW steel pipes and tubes are available in various qualities, wall thickness and diameters of the finished pipes. While manufacturing ERW steel pipes, high quality continuous-cast, fully-kilned, control-rolled, fine-grain and low-carbon steel is used. High performance ERW steel pipes and tubes possess high corrosion resistance, high deformability, high strength and high toughness. These pipes are used in fencing, lining pipes, oil country tubular, scaffolding, water and gas conveyance, structural, engineering purposes, etc. There has been tremendous increase in the production of ERW steel pipes due to higher demand in oil and gas industry, infrastructure and automobile uses. There are large numbers of units in the SSI sector. The industry has been de-licensed and is eligible for automatic approval up to 100 per cent FDI.

Submerged-Arc Welded (SAW) Pipes

There are two types of SAW pipes namely longitudinal and helical welded SAW pipes. Longitudinal SAW pipes are preferred where thickness of pipe is more than 25 mm and in high pressure gas pipe line. While, helical welded SAW pipes are used for low pressure applications. The cost of helical SAW pipes is less than longitudinal pipes. Total installed capacity of SAW pipes in the country is around 6.5 lakh tones. There is huge demand of SAW pipes in the country due to transportation of oil and gas and transmission of water.

Industrial Fasteners

The fastener industry in India may be classified into two segments, namely, high tensile and mild steel fasteners, which broadly include nuts, bolts, studs, rivets and screws. All types of fasteners except high tensile and special type

of fasteners are reserved for SSI Sector. Mild steel fasteners are primarily manufactured by the unorganized sector, while high tensile fasteners require superior technology and are dominated by companies in the organized sector. Fasteners are used in almost all engineering and chemical industries. Automobile industry accounts for bulk of the total demand. Consumer durables and railways are the other primary users of the high tensile fasteners.

Steel Forging Industry

Forging is the product of work on plastic state of metal to a desired shape by application of pressure. The working of metal into the shape by means of modern forging methods refines the grain structure, develops its inherent strength, improves the mechanical properties and produces the structural uniformity free from hidden internal defects. Forgings are produced through various methods which include open die forging, closed die forging and near net shape/precision forging. The Indian forging industry has emerged as a major contributor to the manufacturing sector of the Indian economy. The key driver of demand of forging is the automobile industry. About 65 per cent of the total forging production is used in this sector. The other Industries that use forgings include Railways, Defence, Oil Exploration, Cement, Steel Industry and other Engineering Industries. India's forging industry not only meets almost the entire domestic demand of forgings but is also a large exporter and is making a significant contribution to India's exports. The indigenous industry constitutes of about 10 large units followed by large number of medium, small and tiny units.

5.5.2 Economic Performance

The performance of the sector in term of its key segments is summarized in the following table:

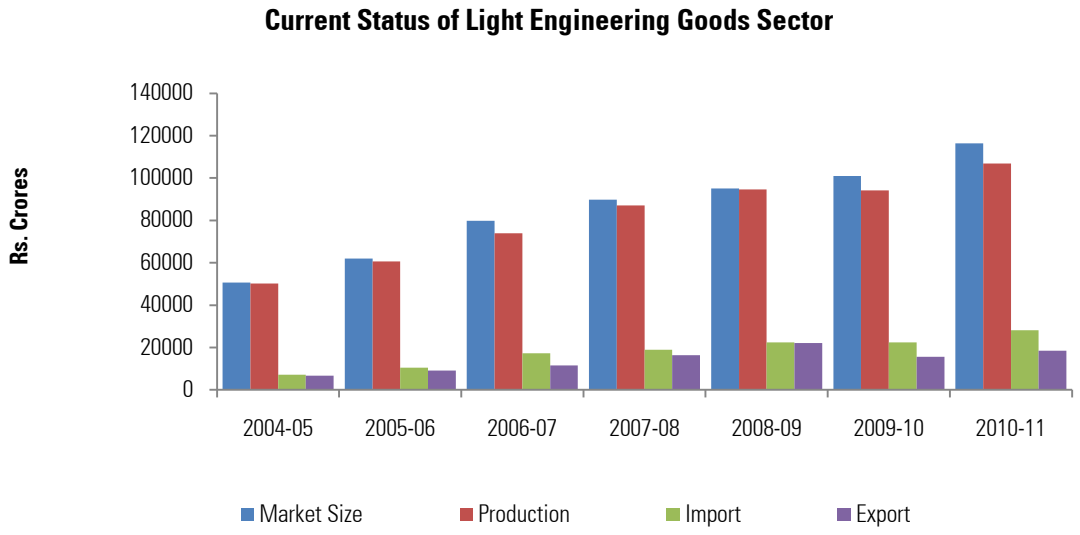
Table 3: Key Segments in Light Engineering sector[20]

Key light industries	Unit	Production (Apr'11 - Jan'12)	YoY Growth (in %)
Bearings (ball/roller)	Units	669,636,600	5.72
CI castings	Tonnes	192,009	5.48
Steel castings	Tonnes	215,752	35.93
Hose pipes	INR billion	2.72	-24.59
Fasteners (high tensile)/bolts & nuts	Tonnes	93,300	5.79
Aluminum tubes/pipes	INR billion	0.19	14.29
Spun pipes	Tonnes	360,649.69	0.12
Stampings and forgings	Tonnes	401,300.13	13.23
Bearings (ball/roller)	Units	669,636,600	5.72
CI castings	Tonnes	192,009	5.48

[20] *Department of Industrial Policy & Promotion*

The total market size of this sector was estimated at Rs 1,16,449 crores and Rs 1,54,000 crores for 2010 -11 and 2011-12 respectively. The production of Engineering Goods sector is Rs 1,06,820 Cr during the year 2010-11 and has shown a healthy growth of 13.4% CAGR in the last 6 years. The export for the sector is around Rs 18,526 Crore during the year 2010-11. Overall, 18.5% of the domestic production is exported. The imports for the sector are estimated to be around Rs 28,155 Crore and they meet 25.5% of domestic demand.

Figure 10: Economic performance of light engineering goods sector[21]



5.5.3 Key Players

The key players of this sector are as follows: SKF Bearings India, National Engineering Inds, FAG Bearings India, Timken India, NRB Bearings TISCO, ABC Bearings Ltd., Mahindra Sintered Products, Sujana Industries, Kirloskar Oil Engines, Bimetal Bearings, HMT Bearings Harsha Engineers Gabriel India, Welspun Corp, Maharashtra Seamless, PSL, Man Industries, APL Apollo Tubes, Ratnamani, Zenith Birla, Bharat Forge, Ahmednagar Forg, Mahindra Forg, Alicon Castallo, Electrosteel.

5.5.4 Key Trends

Shift to small bearings

With changing trend in favour of light weight and high performance automobiles demand for small bearings is expected to increase.

Increase in operation efficiency

[21] *Report of the working group on capital goods and engineering sector for 12th five year plan*

Improved operational efficiency rather than mere capacity addition is expected to become more important to remain compliant with global standards. Therefore, a certain percentage of capital investments will have to be invested in technology upgradation with emphasis on IT, CAD etc.

5.5.5 Opportunities[22]

The key growth drivers of the engineering goods market in India are as follows:

Growth in infrastructure sectors: The development of infrastructure remains the basis for the development of the engineering goods sector. Infrastructure growth is greatly driving the development of the engineering goods industry. Infrastructure listed a growth rate of 4.6 percent. Infrastructure index increased to 261.8 in FY2011

Growth in number of SEZs: The government has sanctioned a number of Special Economic Zones (SEZs) across the country for the engineering industry, which is accelerating the growth of the industry

Huge replacement market: There is a huge replacement and maintenance market in India, wherein light engineering goods are of huge importance. This is due to the fact that the light engineering goods undergo wear and tear and require constant replacement of small parts

5.5.6 Concerns and Challenges

High cost of industrial inputs: The Engineering industry mainly uses raw materials of domestic origin. The raw materials price index has risen faster than the machinery price index. It is difficult for engineering manufacturers to pass on the rise in prices to the consumers thereby impacting their profitability. Sometimes, the quality of raw materials is also not up to the international standards and which in turn affects the quality of final products. Steel in China is much cheaper for the domestic Chinese industry than steel for the domestic Indian industry. The difference is over 10 to 15%. In such a scenario, MSMEs cannot compete with Chinese engineering industry where bulk orders are concerned. The fact that domestic manufacturers are uncompetitive prevents building large scale manufacturing base which creates a chain reaction.

High cost of credit: The credit cost is rather high in India. One of the rationales behind financial liberalization was that interest rates would come down for investment purposes. At present, export credit is available at about 12-14%, which exporters have to factor into the price of their products.

[22] *Opportunities in India's engineering goods market- 2012 by Gyan Research and Analytics*

5.6 Plastic, Paper and Rubber Machinery

5.7.1 Overview

Plastic Processing Machinery entails the processing, design, development, and manufacture of plastics products. There are 11 major manufacturers of machinery in the organized Sector and nearly 200 small & medium manufacturers. Major plastic machineries include Injection Molding Machine, Blow Molding Machine and Extrusion Molding Machine. This Sub-sector is highly labour-intensive and with an emerging trends of increasing imports in this sector.

The rubber machinery industry in India manufactures inters-mixer, tyre curing presses, tyre moulds, tyre building machines, turnet servicer, bias cutters, rubber injection molding machine, bead wires, etc. According to the Ministry of Heavy Industries, currently there are 19 units in the organized sector for the manufacture of rubber machinery mainly required for tyre/tube industry. The Indian rubber machinery manufacturing industry is a net exporter.

Domestic manufacturers meet 95% of processing industry needs on technology and product range. Product technologies are at par with leading brands of developed world. Moreover, Domestic manufacturers offer technology products to the processors at great cost advantage. World leading technologies have manufacturing presence in the country through wholly owned subsidiaries or technology license arrangements.

5.7.2 Major Segments

Plastic Machinery primarily constitutes of following types of machines:

- **Extrusion Machines:** Films and Sheets, Fiber and Filaments Pipes, Conduits and profiles, Miscellaneous applications
- **Blow Molding :** Bottles, containers, Toys and House wares
- **Roto Molding:** Large circular tanks such as water tanks
- **Injection molding Machines:** Industrial Injection Molding, Household Injection Molding and Thermo-ware/ Molded luggage

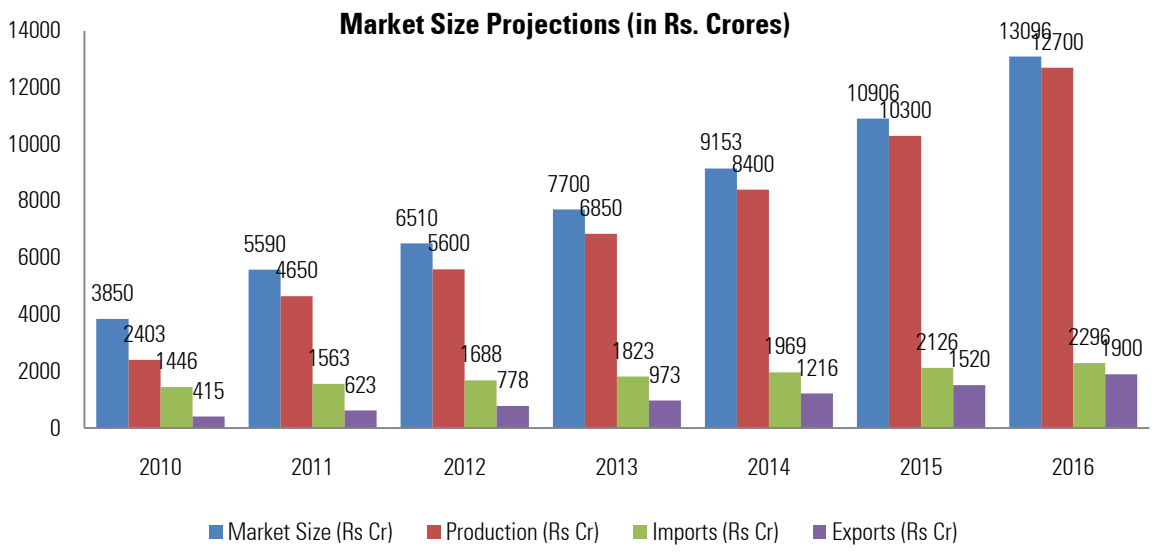
Rubber machinery primarily constitutes of following types of machines:

- **Compounding Machinery:** Compounding adds chemicals for vulcanization
- **Mixing Machinery:** Mixing of chemicals with the base rubber to achieve uniform dispersion of ingredients
- **Shaping Machinery:** Involves Extrusion, Calendaring, Coating, Molding and casting
- **Vulcanizing Machinery:** Cross-linking of elastomeric molecules

5.7.3 Economic Performance

The sector's demand is targeted to grow at a CAGR of 18.5% to Rs 13096 Crores in 2016-17. The total market size of this sector was estimated at Rs 6,510 crores for 2011-12. Import is estimated to be Rs 1447 Crores and constitute 37.5% of total domestic demand. Comparatively the exports have grown at slower pace with a CAGR of 9.4%.

Figure 11: Plastic, Paper, & Rubber Machinery Economic Performance



5.7.4 Key Players

- **Finolex Industries Ltd:** Finolex Industries Limited is India's largest PVC pipe manufacturer. The company manufactures PVC pipes and fittings for housing, agriculture, industrial, construction and telecommunication applications. The company can produce 90,000 metric tons of pipes each year.

- **Plastiblends India Limited:** Plastiblends India Limited is renowned as India's pioneer Master-batches manufacturer. The company is the largest exporter and producer of stabilizer compounds and Master-batches for the plastic processing industry in India.

- **AGA Group International:** One of the most prominent plastic companies in India is the AGA Group International, established in 2004 in Ambala City, Haryana, India. The company supplies, manufactures and exports laboratory plastic wares.

- **Corporate Resource Group:** The Corporate Resource Group is one of the leading suppliers, exporters and manufacturers of plastic instruments and pipettes in India. The company export products in the USA and Africa. The company was founded in Burari, India, in 2004.

- **Apar Industries Ltd:** Established in the year 1958, Apar Industries is among the best established companies in India operating in the diverse fields of electrical, metallurgical and chemical engineering. Over the ensuing years it has evolved to be a 500 million US Dollar diversified company offering value added products and services in Power Transmission Conductors and Petroleum Specialties.

5.7.5 Opportunities

Growing opportunities in automotive sector

As the Plastic and Rubber industry is heavily dependent on automotive sector, launching of new cars in the small segments are expected to drive the demand for plastics.

Lower level of polymer usage

As of now the Indian Plastic and Rubber industry has enormous potential for growth as polymer use in India is far below the world level. With increasing competition in the global market and the constant drive to improve our living standards, the scope for use of plastics is bound to increase manifold and make the production double in the coming years

5.7.6 Concerns and Challenges

Lack of skilled manpower

Skilled manpower is in short supply in associate & supervisory category for processing industry as well as in machinery manufacturing. The education system in current form and curriculum prevalent at institutes and universities does not create industry employable manpower, with exception of diploma and degree in plastics stream conducted by some of the institutions.

Lack of efficient supply chain

Quality and reliability of the product is decided by the quality of components put into its construction. Moreover, cost of the product is dependent on cost of parts from supplier. Industry need to pay attention to develop efficient supply chain for cost-quality–delivery using the Cluster development programs offered under UNIDO program.

Financial assistance for further expansion

Industry has seen sizeable growth in past 5 years in tandem with our growing economy. Domestic manufacturers have 62% share in the machinery market. Share of imports is 38%. Imports are mainly from Far East on account of low price and shorter delivery. To serve the growing demand for machinery all the major machinery manufacturers have undertaken capacity expansion with near Rs. 400 Cr investment in plant & machinery and up gradation in technology. Further investments are necessary to raise the production volumes and technology to global scale. Volumes will give price competitiveness.

High cost of capital

The cost of capital remaining high, processors in Small scale sectors tend to decide on machinery selection primarily based on price. They end up choosing low to medium technology machines and sometimes opting for used machinery. Soon it proves to be a bad investment as these processors incur high operating cost as well as lose on productivity and also consume higher energy.

Used machinery imports

Advancement in processing machinery for enhancing the energy efficiency and productivity has happened in recent past. Under the compulsions to reduce the carbon footprint, processors in the developed world are replacing the older machines with new technology machines. Thus used machinery from developed world is finding a way to developing

world with an attractive price tag. Used machinery population if allowed to increase will render the domestic processing industry inefficient in the long run.

High Input Costs

In order to enable processors to compete with the global manufacturers, the most technologically advance components are imported from Europe, USA and Japan. These imports attract 7.5% customs duty leading to increase in prices of finished goods, which in turns makes the domestic products uncompetitive in comparison to global manufacturers.

Need of automation equipment

Certain automation equipments are required in the machinery for improving productivity, reducing wastage and improving quality levels. These automation equipments currently covered under Tariff Heading 9031, are not manufactured in the country and attract an import duty of 7.5%. Unavailability of critical components indigenously necessitates need to establish clusters for manufacturing critical components of common use across the industry. With increased volumes the resultant economy of scale will reduce the input costs.

5.7 Foundational Segments of Capital Goods Sector

In addition to the sub-sectors covered above, there are certain foundational segments which occupy a central position in the manufacturing value chain across sub-sectors. These segments are relevant to manpower and skills development perspective since a possession of sound knowledge and skills on the various tools required for manufacturing and their usability is seen as essential for improved productivity and quality in the overall capital goods sector. The important foundation segments identified for the capital goods sector are as follows:

5.7.1 Tools, Dies and Mould Making

Definition

Tools, Dies and Moulds represent three essential requirements of a modern machine shop. They are considered to be the lifeline of the capital goods sector since they are necessary for various industries to run their production. Typically, these are used for a variety of applications such as cutting dies, or punches, and shaping and stamping mechanisms. Tool manufacturers craft precision tools that are used to cut, form, and shape metal and other materials. They produce jigs and fixtures, devices that hold metal while it is stamped or drilled. Die makers construct metal forms (dies) that are used to shape metal in stamping and forging operations.

Importance for capital goods sector

The Tool and Die segment remains a central part of the manufacturing value chain. Various sub-sectors of capital goods are dependent on the availability of a good tool, die and mould making industry since this segment directly contributes to manufacturing capacity, quality and pricing of the output.

An understanding of how various jigs, fixtures, dies, molds, machine tools and other tools are made and operated is essential to correctly and precisely use the various machines to work metals to close tolerances. The whole production process eventually operates through various machines which in turn are built upon the basic precision tools and moulds provided by the tools and die making function. A lapse in understanding the working of such essential precision tools and moulds may lead arise from a weak technical aptitude and curb productivity, increase error rates when operating machines.

Influence on Skills requirements

The tools, dies and mould makers are among the most highly skilled production workers in the manufacturing industry. The work of a tool, die, and mould maker comprise the production of mechanical items such as jigs, fixture, form tools, dies, moulds, cutting tools, metal pressing and drawing dies used in the manufacturing process. These items need to be functional, cost-effective, safe and easy to operate. Given the rapid technological advancement in manufacturing, the skills requirements for tool, dies, and mould making is expected to become advanced further. And more computer aided design and computer manufacturing programmes are expected to be used from blueprints or instructions to seuqnce of operations needed to produce the the tool or die.

5.7.2 Automation and Control ("Embedded Electronics")

Definition

Automation and control refers to use of machines, technology, and control system to optimize productivity in the manufacturing of goods (or delivery of services). The automation can be fixed or programmable to control the various production processes. Furthermore, automation can be present at following levels of manufacturing plant:

- Machinery level- instrumentation level of machine control
- Group level- Automation at a group of machines level within a manufacturing cell
- Shop floor level – Automation of several manufacturing cells
- Plant level- Automation at which the activities of production, monitoring, scheduling, and controls are placed
- Enterprise level – Includes all management activities

Automation in the production industry has passed through numerous phases, from the early phase in with individual control devices on the shop floor to modern automation at enterprise level. The technological progress in instrumentation and computer technology has strongly shaped the embedded automation concept. This progress has given impetus to building automation systems such as computer-aided design and computer-integrated manufacturing.

Importance for capital goods sector

In the present scenario, automation and control is one of the most indispensible requirements for any company of capital goods sector. In the environment of competition and technology advancements today, automation and control is a critical mean to increase productivity of manufacturing, quality of product, consistency of the product, and to reduce turnaround time and human labor costs.

Influence on Skills requirements

Given the fast technological advancements, it is expected that the industry as a whole will make rapid progress in automation chain from machinery level to enterprise level. And in near future, modern automation and control will evolve as one of the important foundational segments of manufacturing value chain with skills required to work on embedded technology expected to become an integral part of job roles across sectors. Furthermore, the future skill requirements in automation and control will not remain limited to manufacturing's perspective. With increasing adoption of automation at enterprise level, skills requirements for new and special departments such as material handling, product development, production planning/scheduling etc will also become important.

5.7.1 Hydraulic Systems

Definition

Hydraulic system utilizes fluid power to multiply exerted force. It uses high-pressure liquids (called as hydraulic liquid) to generate and distribute energy. The hydraulic fluid is transmitted throughout the machine to various motors and cylinders which becomes pressurized as per the resistance present. The flow of the fluid is controlled directly or automatically by control valves and distributed through hoses and tubes. The advantage of using a hydraulic machine is that it can produce large amount of power that is used for controlling and moving a particular mechanism.

Importance for capital goods sector

Hydraulic system is widely used in the various sectors of capital goods manufacturing. Many items, that require significant energy and force, such as tool manufacturing, rely on the hydraulic technology and process. Furthermore, today's industry trend in design and manufacturing in capital goods sector is more and more towards sophisticated systems, tighter clearances and high pressures. These new systems are, therefore, expected to increasingly use hydraulics system system in the manufacturing technologies.

Influence on Skills requirements

With increasing adoption of hydraulic system in manufacturing, requirement for designers and assemblers for hydraulic machines is well expected to increase and become an intergral part of capital goods manufacturing. The trademan working on the hydraulic system are expected to have the knowledge of following important areas: basic physical laws of hydrostatics and hydrodynamics, symbols of hydraulic control elements and circuit diagram, and maintenance of hydraulic system. The shop floor skills requirement include identifying, inspecting and assessing hydraulic systems using fluid power principles to predetermined specifications interpreted from data sheets and circuit diagrams.

6 Skill Ecosystem and Origination of Skill Gaps

The capital goods industry sector has its associated skill ecosystem which is a self-sustaining network of workforce skills and knowledge. This eco-system is constituted by four main stakeholder groups, i.e.:

1 The individuals who invest in skills

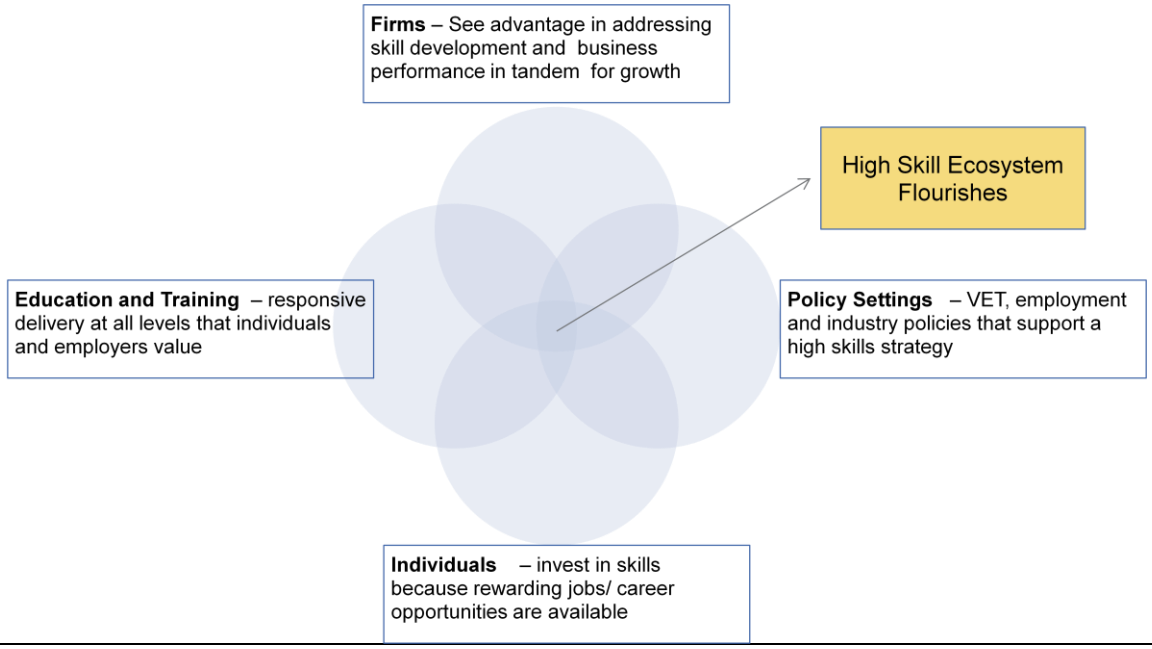
2 The education and training system which delivers the requisite education and skills development

3 The firms which leverage the skilled manpower for business outcomes

4 Policymakers who devise strategies for skills development

High skill ecosystems, as represented below are those with a competitive advantage and a strong capacity for innovation and growth. This is the essence of the all efforts in any industry sector initiative – to achieve the positioning of a high skill ecosystem where skill development and business performance are tightly related.

Figure 12: High skill ecosystem[23]



The above representation for a high-skills ecosystem underpins the importance of alignment between the four stakeholder groups' objectives and activities. At a policy level, the economic conditions, structure of the industry and labour markets are important. The business settings of a firm and its 'workforce management' practices are also important. The effective role played by the education and training system as a source of manpower and the disposition of individuals to invest in training and education are further enabling factors.

The above representation of an alignment in various stakeholder positions leading to a high skill ecosystem also provides insights into possible fault lines that may lead to skill gaps when such alignment is missing between one or

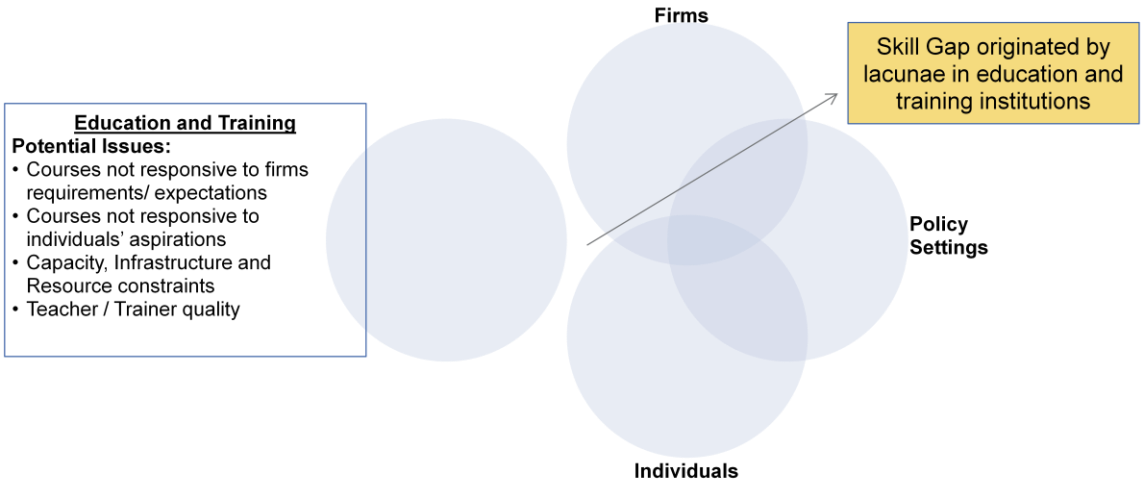
[23] *Skill Ecosystem National Project: Government of Australia*

more stakeholder groups. The same is discussed briefly below. The skill ecosystem approach in combination with 'workforce development' is critical to address the issues of manpower requirements of industry, by looking beyond just training.

6.1 Type I Skill Gap

Type I skill gap arises when the education and training system is not responsive to the changing needs of the industry requirements or expectations and is slow to adopt training curricula, courses or delivery methodologies that are required for current and future manpower profile of the industry. Another lacuna can be the lack of responsiveness to the individual's needs and aspirations on the aspect of investing in skills which can lead to the erosion in the value of training perceived by individuals and hence the emergence of non-formal channels for the manpower to enter the industry without going through the education and training system. More often, such an education and training system suffers from poor industry linkages and associated issues such as lack of infrastructure and resource constraints and poor teacher quality.

Figure 13: Type I Skill Gap

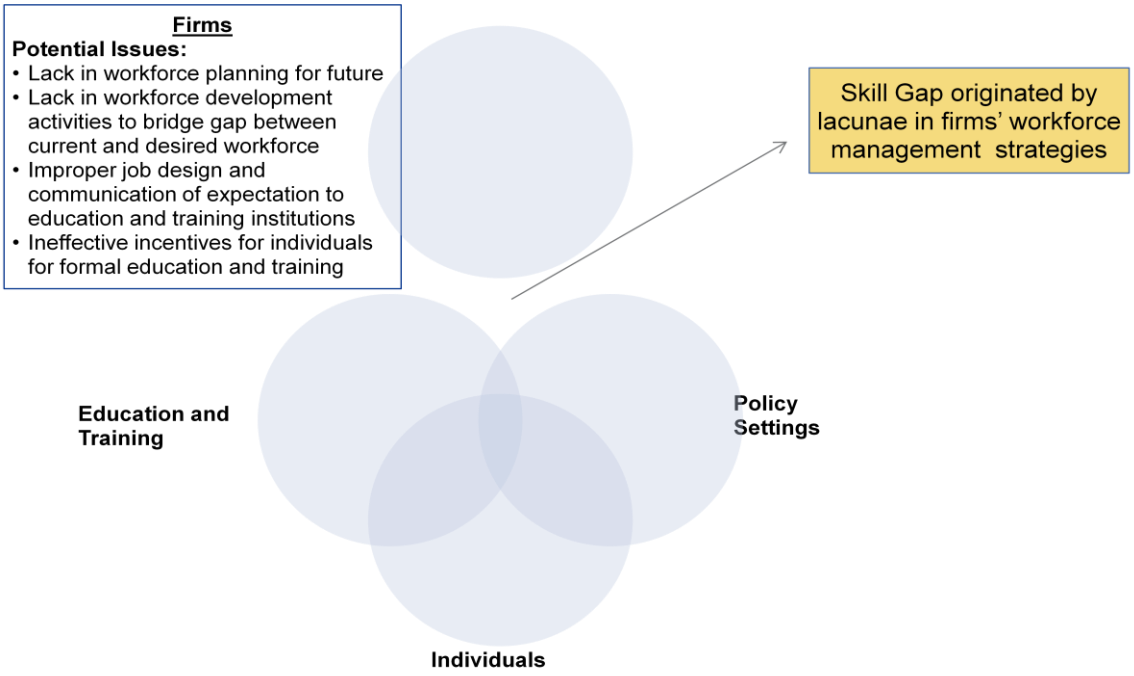


6.2 Type II Skill Gap

Type II skill gap arises from lacunae in the workforce management strategies adopted by firms in the industry sector. Workforce management includes both workforce development, or the activities related to improving the workforce to bridge the gap between current workforce and desired workforce and workforce planning, or activities that are future focused to manage the supply and demand of labour. Workforce development activities include job design recruitment, performance management, skill development, retention strategies etc. Workforce planning activities include forecasting of staffing needs, succession planning and industry / technology developments which impact workforce.

Key issues leading to type II skill gap include improper job design which mismatches the education skills required with those available from formal education and training channels, insufficient interaction with education and training system leading to inadequate communication of the industry expectations on skills required. Another issue could also be the ineffective structuring of incentives towards individuals who have invested in skills development

Figure 14: Type II Skill Gap

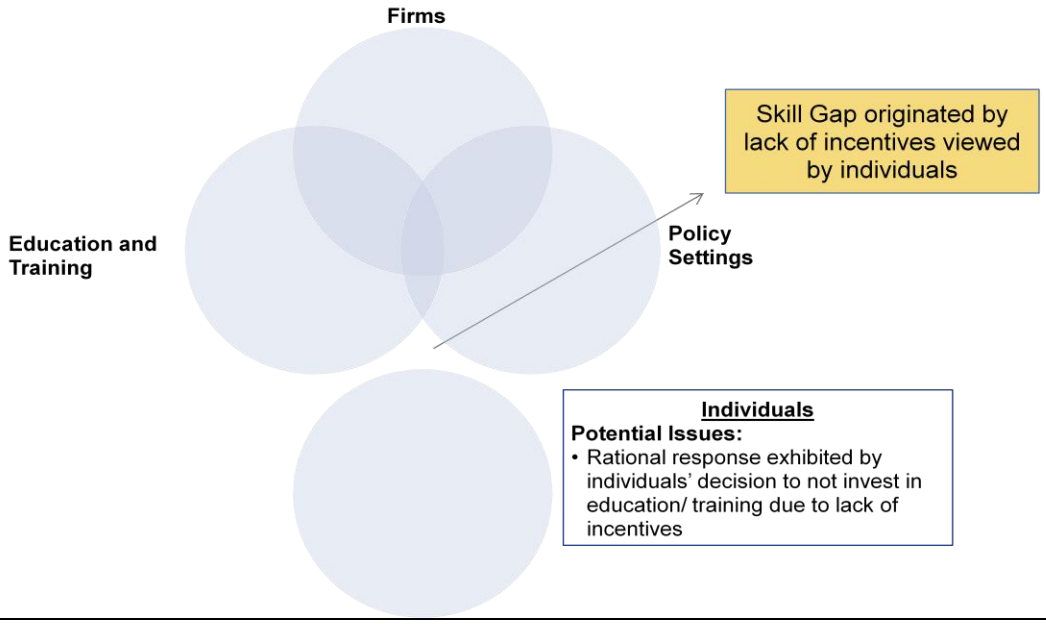


6.3 Type III Skill Gap

Type III skill gap is closely correlated with the Type I and Type II skill gaps, since it is the rational response chosen by individuals to either a education and training system that makes the training investment unattractive, or firms' workforce management policies which dilute the requirement for education and training.

The following sections present insights on the above skill gaps as observed in the Capital Goods industry and the recommendations for the Capital Goods Sector Skill Council on policy responses that can facilitate the alignment between the three stakeholder groups of firm, individual and the education and training system

Figure 15: Type III Skill Gap



7 Industry Workforce Profile and Skill Gap Perspectives

In subsequent sub-sections the following demand side areas will be analyzed to identify the present and future skill related issues for each sub-sector:

- **Present workforce requirement:** To appreciate the skill related issues prevalent in the capital goods sector, an understanding of the present workforce requirement is essential. This would help to identify the need gaps as well as the root causes of their existence.

- **Future manpower requirement:** A consideration of future workforce landscape is essential to make a complete and updated view. And more so in the context of capital goods sector which is expected to grow at least by 15 percent growth in the next decade. With such a high targeted growth in domestic production it is well expected that the companies will be requiring higher number of manpower across trade roles and hence the need to understand manpower requirement.

- **Current Skill Gaps & Future Expectations:** The section would summarize the key manpower insights, prevalent issues and expected future challenges for each sub-sector.

The analysis in subsequent sections covers the following major sub-sectors of capital goods sector: Machine Tools, Power & Electrical Equipments, Process Plant machinery, Textile machinery, Plastic, paper and rubber machineries, and Light Engineering Goods.

7.1 Industry Profile

As indicated earlier, across sub-sectors, the industry structure tends to be consisting of a few large players followed by distinct layers of medium and small scale companies. This leads to diversities in the manpower requirement of individual organizations in each segment, though the overall requirement for entire sub-sector and sector may be relatively more stable. While large companies responded by indicating a larger share of core job roles as direct labor needs of the organization, smaller to medium companies typically had a lesser number of core job roles. For example, the requirement of a paint shop operator/ painter could typically be found in larger companies where economies of scale may support the case for a dedicated paint shop. On the contrary, smaller companies typically outsource or sub-contract the painting work and hence the painter role is not within the direct labor requirement of the company, but is transferred to a paint shop that may be serving customers within the capital goods sectors, as well as other manufacturing sectors.

7.2 Current Manpower Employment & Distribution

For the purpose this study, production-labor intensity coefficient methodology has been suitably adopted to estimate the current manpower requirement. The details of the methodology can be referred in Appendix- Manpower Estimation Methodology.

The estimated current manpower employment across the six sub-sectors is approximately 1,300,000. The distribution of the same across subsectors and functions are as follows:

Table 4: Estimated Current Employment in Capital Goods Sector[24]

Function	Machine Tools	Power & Electrical	Process Plant machinery	Textile Machinery	Plastic, Paper & Rubber	Light Engineering Goods	Total
Production	139,000	428,400	153,000	92,600	42,800	349,200	1,205,000
Support Functions	10,500	32,200	11,500	7,000	3,200	26,300	90,700
Total	**149,500**	**460,600**	**164,500**	**99,600**	**46,000**	**375,500**	**1,295,700**

Key Insights

1. From the above table it can be observed that the power & electrical and light engineering goods sub-sectors hire maximum number of manpower with total requirement greater than all other four key sub-sectors put together. Machine tools and Process plant machinery sub-sectors are next two major employers of skilled workforce.
2. The comparison of estimated number of manpower employed in above key sub-sectors vis-à-vis estimation in the report of the working group on Capital Goods and Engineering Sector for the 12th Five Year Plan is as follows:

Table 5: Current manpower estimation- KPMG & Planning commission report

Sub-Sector	KPMG Estimation	Planning Commission Estimation
Machine Tools	149,500	160,000
Power & Electrical	460,600	500,000
Process Plant Machinery	164,500	150,000
Textile Machinery	99,600	95,000
Plastic, Paper & Rubber	46,000	50,000
Light Engineering Goods	375,500	370,000

Over and above direct manpower, these sub-sectors also create a high number of indirect jobs (including suppliers and service providers' jobs). In this context, the total employment figures in table-6 indicate the total of direct and indirect jobs created across subs-sectors:

Table 6: Total Estimated Employment across sectors

Sub-Sector	Total Estimated Employment (including direct, indirect, suppliers, service providers)
Machine Tools	300,000
Power & Electrical Equipments	1,500,000
Process Plant Machinery	252,000

[24] *Source: KPMG estimates based on metrics gathered from primary research*

Plastic, paper & rubber machinery	120,000
Textile Machinery	250,000
Light Engineering Goods	640,000

Referring the figures of direct manpower in table-4 (Current manpower estimation), the ratio of indirect to direct job is estimated to vary across various sub-sectors. Furthermore, various industry players in primary interview opined that the ratio of indirect to direct jobs is expected to rise further in future. This will be primarily driven by more and more medium to large size companies outsourcing processes which require basic levels of skills and focusing only on core processes requiring advanced levels of skill.

On the functional distribution front, 90-95 percent of total direct manpower is employed in the production and operations while the rest 5-10 percent being in support functions such as finance, sales HR etc. Production and operations occupy a greater share of the employer requirements, and the critical roles and skill gaps expressed by employers during discussions also tended to be in the production/ operations functions.

7.3 Thematic Job Roles

The table below profiles the core job roles validated by industry as critical to their manpower needs across levels of operator, supervisor and manager.

Table 7: Thematic job roles of various sub-sectors

		Criticality of job roles across sub-sectors and levels					
Job Roles[25]	**Machine Tools**	**Power & Electrical M/C**	**Process Plant M/C**	**Textile M/C**	**Plastic, paper & rubber M/C**	**Light Engineering Goods**	**Comments**
Machinist	Operator[26]						Common requirement
Machinist for large size machining	Supervisor	-	-	-	Supervisor	-	Experienced machinist with specific training
Machinist for precision machining	Supervisor						Experienced machinist with specific training

[25] *The description of the job roles can be referred in the Appendix-Description of major trade roles in Capital Goods Sector*
[26] *Indicates the level at which the role is typically considered critical from a manpower perspective, by industry*

Welder	Operator						Specialized welding depending on product requirement
Electrician	Supervisor						Deployed in QC and assembly
Instrument Technician	Supervisor						Assembly and integration
Cable Operator	-	-	-	-	-	-	Not stated critical
Operator for robotic material handling	Operator						Requirement for companies with line automation
CNC Programmer	Supervisor	-	-	-	-	Supervisor	For
Tool and Die Maker	Supervisor						
Machine Builder/Assembler	Supervisor						
Inspector	Supervisor						
Designer	Across levels (typically engineers)						From entry level to experienced
Heat Treatment	Operator, Supervisor						
Expert (Foundry)	Operator						Higher propensity for sub-contracting operation

Specialist (E&C Engineer)	Supervisor	Oversight of sub-contracted operators
Paintbooth Operator	Operator, Supervisor	Higher propensity for sub-contracting operation at SME
Draughtsman	Operator, Supervisor	Also referred to as CADD operator due to extensive use of computers in technical design
Fabricator	Operator, Supervisor	Need to understand assembly drawings, handle machine and perform assembly operation
Quality controller	Operator (Checker), Supervisor	Reviews the quality of all factors involved in production and commissioning of equipment
Maintenance staff	Supervisor	
Middle level managers	Manager (Project Management, Quality Control, Shop Floor / Line Managers)	

7.4 Operator-Supervisor-Manager Distribution

The typical skill and profile requirements at three main levels- operator, supervisor, and manager- of various production roles are summarized below:

Table 8: Operator-Supervisor-Manager matrix

Level	Percentage Requirement	Current Profile Requirements • Education • Experience	Skill Requirements
Operator	85-90%	• ITIs and below • 1-3 years of experience	• In-depth trade knowledge and skill • Professional skills and work attitude • On the job learning
Supervisor	8-9%	• Diploma and above • 3-5 years of experience	• Understanding of latest technologies • Ability to meet daily production targets • Troubleshooting skills and understanding business implications of errors in operations • Good team management and communication skills
Manager	1-2%	• Diploma/ Engineering degree or above • >5-10 years of experience	• End-to-end business implications of operations • Ability to map business requirements into production process • Project and team management • Provide inputs to training needs of supervisors/ operators

7.5 Key Qualitative Aspects of Trade Roles

To further analyze the qualitative requirements of relevant trade roles, it is important to comprehensively understand the skill related requirements of the sub-sector for various trade roles. In this context, following important areas would be analyzed to understand the various demand side requirements:

- Desired Skill
- Preferred skill recruitment channels
- Employees up-skilling practices

7.5.1 Desired Skills

While on quantitative front, different sub-sectors and companies would have different requirements; on qualitative front, the key expectations from a particular trade role across sectors remain similar. The key qualitative expectations of company from its manpower are as follows:

Technical competency

On this part, companies expect employees to be skillful on following key aspects:

Technical knowledge of trade: Employee is expected to have a sound practical knowledge of the trade. And this requirement of practical knowledge is even more important in case of small to medium size companies. SMEs are typically more constrained than large players to allocate capital and time for manpower training and hence they have a tendency to rely more on manpower that is readily skilled and fully productive in operations.

Sensitivity to quality assurance and High Productivity: With a rapid growth in manufacturing and competition from imported machineries, sensitivity to quality assurance and higher productivity has become all the more important. Capital goods manufacturers are expected to deliver products not only of high quality but also under very tight timelines. And given the competition from foreign counterparts, capital goods maker cannot afford any batch rejection or delay in project execution. This scenario has increased the importance of quality techniques such as JIT, six-sigma etc and employees are expected to be well-versed in such techniques.

Good technical aptitude: Good technical aptitude among employees is primarily sought for two reasons: easy up-skilling and reduction of downtime. With rapid advancements in manufacturing, capital goods maker are also required to adopt newer technologies. And with such technological advancements, re-skilling/up-skilling the existing employees has become all the more important. However, to be able to quickly learn new technologies employees should have good technical aptitude to quickly grasp the learning. If not so, the partially trained employees remain a bottleneck in quickly expanding on new technology. Secondly, an employee with good technical aptitude is able to understand and resolve day-to-day technical glitches relatively quickly. This helps companies in reducing downtime and thereby increasing productivity.

Soft Skills

Good communication skills: A part of the trade job roles includes understanding and communicating the machine related instructions. Hence, a good communication skill is one of the important requirements of the various trade roles.

Professional attitude: The manufacturing process requires an employee to demonstrate important professional traits such good team worker, adherence to guidelines, disciplined etc to ensure quality and productive production process.

7.5.2 Preferred Recruitment Channels

The recruitment channels employed by the companies have a large bearing on its skill related competitiveness. The companies taking more methodological approach to hiring new manpower are able to access better trained employees as compare to companies following unstructured approach. In this context, there are three key channels of recruitments employed by companies across the sectors:

- **Formal Training programs:** The large companies primarily rely on hiring manpower from training programs either running in-house or in good institutions. The hiring percentage of large companies from such programs is close to 70-80 percent. However, for SMEs this channel constitutes only a minor source of new hiring. The primary reason being that typically SMEs are more constrained in their approach to manpower planning since they rely on more immediate project wins and have to accordingly upscale or downscale manpower count.
- **From competition:** The other major source of hiring a trade worker is from competitors from within or outside the sector. This mode of sourcing new employment constitutes approximately 60-70 percent in SMEs hiring. However, for large companies the percentage remains low in 10-20 percent range.
- **Internal job rotations or promotions:** This mode of new skill sourcing constitutes minority percentage among both large companies and SMEs.

The reliance on channels of recruitment other than fresher recruitment from education and training institutions indicates the existence of type I and type II skill gaps. This is discussed in more detail in the following sections.

7.5.3 Employee up-skilling practices

Medium to large companies follow more methodological approach in managing the skills of employees on rolls. And from time to time relevant training programs are facilitated to employees to up-kill. However, small companies largely remain unstructured in their approach to train the employees. And a very minimal capital and time is earmarked to provide employees an exposure to essential training programs.

As far as the preferred mode is concerned, on-the-job training remains the unanimous choice for the shop floor roles. On-the-job training has been attributed to maximum learning adoption as compare to classroom based or computer based training programs

7.6 Other Insights

7.6.1 Important Regions of Employment Concentration

Based upon the primary interviews with industry players and sub-sector associations, following clusters have been identified as the key regions of employer concentration:

Table 9: Location and Geographic Clusters

Sub-sector	Location Clusters	Geographic Regions in India
Machine Tools	Rajkot, Pune, Mumbai, Chennai, Bangalore, Hyderabad, Ludhiana	South ,West and North
Power and Electrical Equipment	Ahmedabad, Bangalore, Gurgaon, Delhi, Jaipur, Noida	South, West and North
Textile Machinery	Rajkot, Surat, Vapi, Ahmedabad, Mumbai, Tarapur, Nagpur, Coimbatore, Panipat, Amritsar, Ludhiana	South, West and North
Process Plant Machinery	Pune, Mumbai, Bangalore, Chennai, Coimbatore	South and West
Plastic, Paper and Rubber Machinery	Ahmedabad, Mumbai, Pune, Bangalore	South and West

Light EngineeringGoods	Mumbai, Pune, Nagpur, Chennai,Delhi	South, West and North

7.6.2 Manpower projection techniques used

The manpower projection techniques used by human resource teams in this sector has a relation to the company size and maturity of other workforce development practices. Large size companies typically assess future manpower needs based on their business needs and strategic goals (the planning horizon may itself vary between 1-3 years). Medium and small companies normally focus on upsizing / downsizing manpower based on their order book and hence are likely to typically employ a higher share of temporary manpower. Companies with a clearer vision for the future and better manpower forecasting techniques may be more likely to have a better workforce management strategy which enables them to work closely with the education and training systems for better recruitment, retention and continuous training interventions for the employed manpower

7.6.3 Key Expansion Strategies

The industry participants of the study expected following two expansion strategies to be adopted in future:

1 Increase the production capacity

2 Set-up new plants at other locations

Other notable strategies for expansion included upstream/ downstream/ related diversification, as well as pursuit of export geographies in Asia and Middle East, though these strategies were not as common as the first two strategies

This indicates that the majority of the expansion in the sub-sector in next decade is expected to come mainly through capacity expansion at existing or new locations. And probably understandably so, when there remains a large pie of imported machineries which can be replaced by indigenous production. On skill front, it can be inferred that the demand for manpower will primarily increase for existing job-roles.

7.6.4 Potential Sources of Manpower

New talent acquisition has been deemed to be one of the top priorities by companies of all sizes and sectors. The potential sources of manpower play an important role in determining the availability of adequate skill in requisite 9quantity. The most important recruitment channels employed by companies in various sectors are as follows:

- **Industrial Training Institutions:** The industrial training institutions (ITIs/ ITCs) facilitate the major percentage of new manpower requirement. This channel has been observed to be accessed more by medium to large companies as against smaller size companies. One of the reasons for such a trend is low employability of new trainees on shop floors. Large companies further train new joinees for typically three to six months before employing them on shop floors, even as smaller companies find that such a practice of further training fresh recruits from training institutions is often difficult given their business visibility is more short to medium term and also because investing in such training is often found to increase attrition in the experience of SMEs.
- **In-house training centres:** This channel of manpower is primarily employed by large size companies such L&T, BHEL etc which are able to invest and construct a quality training infrastructure on their own. Given the amount of capital required, in-house training centres are not typically setup by small to medium sized companies.

- **Experienced hires from competitors:** This involves hiring from competitors within subsector or companies in other sectors. This is a very important source of manpower for small companies as against large companies. The preference of lateral hiring among the small companies is, as already discussed, due to the paucity of time and capital to train its new manpower. SMEs generally prefer to hire manpower which is readily employable and can start giving shop floor output from day one without much additional training.
- **Others:** Other channels of new manpower include internal hiring through promotions and rotations. Job rotations are more frequently employed by SMEs which tend to prefer multi-skill employees who can be seamlessly employed across functions/ roles depending on project requirements. In some cases, companies also promote contractual employees to permanent role based upon performance to not only fill the vacancies but also to incentivize contract workers for good performance. However, on a whole, this mode has been relatively less utilized by small and large companies alike.

7.6.5 Training Requirements of Employees

Constant up-skilling of the employees has been deemed as a critical area of workforce management by participating employers. The important insights on the training requirements of existing employees as gathered from the primary interviews are as follows:

- **Most preferred mode:** For most of the trades, on-the-job training has been a preferred mode over classroom or computer based training. Industry players prefer on-the-job training for its high learning adoption in minimal time. However, classroom based training or offline training through simulation also play an important complementary role in imparting the requisite knowledge. And in most cases, considering factors such as material cost, safety etc brief offline training precedes on-the-job training.
- **Training content:** Apart from training on the core activities of the work trade, following areas have been indicated by employers to be the important areas of training: quality control aspects including concepts like six sigma, JIT etc; personal safety on the job; environmental aspects of production operations etc.
- **Training expenditure and hours:** Expected training expenditure required to up-skill the existing employees was indicated to typically lie in the range of ten to fifteen percent of annual salary of workforce. While on duration front, the training requirement varies from as high as three/four months for new joinees to a week-month for up-skilling the existing employees.

7.7 Projected Manpower requirement- 2017 & 2022

For the purpose this study, production-labor intensity coefficient methodology has been suitably adopted to estimate the future manpower requirement. The details of the methodology can be referred in Appendix- Manpower Estimation Methodology.

The projected manpower requirement in 2017 across the six sub-sectors is approximately 2,085,000. The distribution of the same across subsectors and functions are as follows:

Table 10: Projected Manpower Requirement-2017[27]

Function	Machine Tools	Power & Electrical	Process Plant machinery	Textile Machinery	Plastic, Paper & Rubber	Light Engineering Goods	Total
Production	237,200	679,000	227,500	131,800	90,700	573,300	**1,939,400**
Support Functions	17,900	51,100	17,100	9,900	6,800	43,100	**146,000**
Total	**255,000**	**730,100**	**244,600**	**141,700**	**97,500**	**616,400**	**2,085,400**

The projected manpower requirement in 2022 across the six sub-sectors is approximately 3,941,000. The distribution of the same across subsectors and functions are as follows:

Table 11: Projected Manpower Requirement-2022[28]

Function	Machine Tools	Power & Electrical	Process Plant machinery	Textile Machinery	Plastic, Paper & Rubber	Light Engineering Goods	Total
Production	477,500	1,240,000	385,400	226,300	215,600	1,120,300	**3,665,100**
Support Functions	35,900	93,300	29,000	17,000	16,200	84,300	**275,700**
Total	**513,400**	**1,333,300**	**414,400**	**243,300**	**231,800**	**1,204,600**	**3,940,800**

[27] Manpower projections are based on market growth of the sectors (refer Table 2 of this report) and a view on labor elasticity expressed by employers during discussions. These have been further validated through secondary sources of information. These projections may vary from actual results in the future if the underlying assumptions (e.g. sector growth) are realized differently

[28] Same as above

7.8 Current Skill Gaps, Future Industry requirements - Insights from survey

7.8.1 Current Skill Gaps and underlying issues

As per the skills ecosystem approach outlined earlier, the following are skill gaps and their originating issues:

- **Low employability due to technical incompetency (Type I/ II Skill Gap):** Industry participants highlighted the concern of low employability of new entrants into the workforce due to technical incompetency. The situation becomes more burdensome for small to medium sized players which have to invest capital and time to train the employees to desirable level. The originating points for this skill gap are twofold.
    - The ITIs from which the industries source this category of manpower suffer from a curriculum and content that is not relevant to the current or future industry needs. While this is being partly addressed by the scheme for company adoption of ITIs, not all companies can afford the resources and bandwidth to follow this approach. Hence the ITIs which are not responsive to the employer needs give rise to the Type 1 skill gap
    - For a large number of small to medium industries whose workforce management strategies are not evolved or absent, investing in capacity building initiatives for education and training is not a rational response. This leads to poor communication of requirements and collaboration with ITIs. Further lack of tight inter-firm linkages in similar sectors makes factors such as attrition a significant deterrent to employee skill development. These are causal factors symptomatic of Type II skill gap
- **Lack of employee attitude/ inclination for a career in engineering (Type II/ III skill gap):** The tough competition from imported machineries requires the Indian manufacturers to adopt newer technology to remain competitive. However employees with a little experience do not possess the right attitude / inclination to stay invested in a career in engineering through up-skilling themselves which can support those business needs of technology up gradation. The key reason for this issue is many of the manpower pursuing entry level jobs in the sector live on subsistence level. And therefore, to earn a salary to live is understandably the primary objective of such people. An attitude to make a conscious effort to train oneself in latest technology is lost to the need for receiving a better salary on a more immediate term basis. While this is a type III skill gap on one side, the lack of proper incentivization of job roles associated with the new technology (type II skill gap) are also likely be underlying factors
- **Dependence on informal channels for manpower sourcing and temporary manpower (Type II skill gap):** An Ad hoc workforce management approach is typical of many small and mid size manufacturers. Majority of SMEs participants did not cite any formal method of manpower planning – which is mostly the basis of orders inflow and leads to reliance on informal channels for recruitment of semi-skilled manpower and increased share of temporary labour. This type II skill gap adds complexities to the skills ecosystem and the labor market information as it is difficult to categorize and plan interventions for temporary manpower whose future availability and contribution to the sector are not reliable.

7.8.2 Future Industry Requirements

Participants of the study indicated following manpower requirements to become important in order to remain competitive in future. These will have an impact for the overall workforce management strategies of the sector:

- **Demand for Innovation and design roles to increase:** For Indian companies to remain competitive against imported machineries, a strong foothold on innovation and design is critical. More so when the manufacturing sector itself is expected to embrace quickly many technological advancements in near future. To match up with such a rapid pace growth and requirements of manufacturing sector, Indian machine makers will be required to not only invest capital but also build a strong innovation & design manpower pool.
- **Demand for competent managers to increase:** The sector is expected to see a double digit growth in the next decade. And it is expected that all industry players ranging from small to large will strive to grow and capture best possible portion of the pie. However, as small to medium sized companies expand; demand for effective managers will increase. In such a phase of expansion, a manager's role is expected to become important to not only ensure strict adherence to quality guidelines but also keep motivated the manpower to ensure high productivity.
- **Demand for computer skills based job-roles to increase:** With technological advancement application of IT in various roles will start taking considerable importance. And the traditional way of performing the trades will be replaced by more computers or IT driven system and technologies. For example, in future the demand of CNC programmer is expected to surpass those of machinists.
- **Demand for multi-skilled employees:** Convergence in technologies – electronics hardware, firmware, software, communications technologies – will require candidates with greater conceptual knowledge on these technologies and be able to deploy such equipment/devices as well. Due to convergence of these technologies the requirement of technicians with multi-disciplinary technical knowledge and skill will become important. In this context, the multi-skilling training becomes very important especially for SMEs employers who require their employees to perform more multi-tasking. Multi-skilling includes training the employees across the traditional trade roles. The primary benefit from multi-skilling is that a particular job which would have required more than single trade- however not more than one person – can now be performed by just one person. This could be further understood with an example of changing out a motor. Typically, changing a motor would require an electrician to disconnect the motor leads and a millwright or mechanic to disconnect the coupling, physically replace the motor, and perform the alignment. The electrician would then return to the job, reconnect the motor leads, check and possibly change rotation. The mechanic or millwright would, at this point, be able to connect the coupling halves to complete the job. However, a multi-skilled trade worker would have replaced electrician and mechanic. Such a trade worker would have been trained in the proper disconnecting and reconnecting of the motor leads, as well as how to change motor rotation.

Availability of cross-trained employees helps increasing the productivity and reduces labor costs through following benefits:

- **Flexibility:** Cross-trained employees are flexible to play multiple roles and are able to fill in for absent employees and work in any area of the business that requires increased manpower at any time, and for any

duration. This allows the business owner to maintain production levels under many circumstance that would otherwise leave workers idled or profits left on the table

- **Decrease labor costs:** A company with multi-skilled labor can operate with a reduced number of employees. A multi-skilled workforce moves with the workload instead of waiting for the work to come to them. This results in fewer idle work hours, which reduces the cost to the business owner.
- **Flexible and motivated Employees:** Multi-skilled workers are more flexible to learning new skills and to consistently adapt to changes in production. Employee satisfaction improves morale in a business, which leads to increases in productivity and employee retention rates.

The productive areas which can be identified for multi-skilling would be those which require two or more crafts to complete the job, but only one or two individuals to do the work. In the context of capital goods sector following areas could be considered for cross-training of the employees:

- Jobs which can combine electrical and mechanical skills
- Jobs which require electrical/mechanical and simple welding skills

8 Training Institutions – Skill Gap Perspectives

A survey of training institutions (refer 11.15) in conjunction with an industry survey of effectiveness of the training institutions revealed the following skill gaps and their originating causes. The training institutions profiled were ITIs and Polytechnics and their equivalents (both private and government managed) offering skills training on specific trades. The issues identified with the education and training institutions' resulting in skill gaps are as follows:

1. **Poor placements (Type I/ II Skill Gap):** One of the key reasons acknowledged by both training institutions and firms is that the placements are an indicator of the quality of training provided. Both stakeholders felt that poor quality of training was arising from the fact that the training provided was not responsive to the needs of the industry. Apart from citing outdated technology on which training was provided, lack of effective communication and other professional skills training were vital missing links typical of training institutions with low placement records

2. **Problem of drop-outs (Type III Skill Gap):** Various training institutions experience the cases of student drop-out. Such incidents actually lead to a sub-optimal usage of institution's capacity. While the percentage of such drop outs may vary, an understanding of primary reasons behind the student's discontinuation of training invariable pointed to the factors

   - Financial issues
   - Some quick job opportunity elsewhere
   - Admission in some poly technical course or engineering course
   - Difficulty in understanding the course
   - Disinterest in the trade

   Amongst the above, financial issues and pursuit of job opportunities mid-way through the course are typical of a Type III skill gap arising from the individual seeing a lack of incentive in undergoing the training.

3. **Under utilization of capacity due to poor perception of trades (Type III skill gap):** Growing inclination towards other sector jobs such as this in malls, financial services, and IT which are financially more lucrative, have better working environment or have better social standing have made it difficult to fully utilize the existing seat capacity for some of the trades. This is seen to be a very strong factor leading to the quantitative skills gaps in this sector.

4. **Unavailability of sufficient funds constraints to increase capacity (Type I skill gap):** Availability of funds has been cited as another major hindrance in planning aggressively for the capacity expansion. Training infrastructure for engineering trades is asset intensive and requires significant capital allocation compared to most other sectors' training. On an operating cost basis also, good private training institutions are forced to innovate on delivery methods that will lower costs, in order to maintain profitability in a market that does not typically allow them pricing power

5. **Unavailability of adequate number of trainers of good quality (Type I skill gap):** Poor trainers' quality or lack of an adequate number of good trainers, has been felt to be one of the key reasons for poor quality of training leading to poor employment outcomes. And it has been strongly recommended by various participants to start the "Train the trainer" course on full scale to meet the demand of different institutions

8.1 Quantitative Assessment of Training infrastructure

When it comes to facilitating trained employees, ITI/ITCs and ATS have a decisive role to facilitate required number of manpower. And given that capital goods sector is expected to grow at 15-18 percent in next decade, high growth in manpower requirement is expected year after year. In this context, a view on the current supply and expected future requirements becomes critical for the stakeholders concerned. The estimated capacity of ITIs/ITCs and ATS in trades relevant to the Capital Goods Sector has been tabulated below. The details of the methodology adopted for the capacity estimation can be referred in the Appendix- Quantitative Assessment of Industrial Training Capacity.

Table 12: Quantitative Assessment of Industrial Training Capacity[29]

	ITI s				ATS
Trade Roles	**Government**	**Private**	**Total**	**Estimated Trainees available***	**Estimated Trainees available***
Machinist Machinist for large size machining Machinist for precision machining CNC Programmer	552	102	654	1526	6375
Welder	1,309	1,242	2,551	3875	7416
Electrician	1,685	9,524	11,209	34412	13285
Instrument Technician	178	56	234	375	1060
Cable Operator	1,021	589	1,610	3328	3274
Tool and Die Maker	88	23	111	228	842
Machine Builder/Assembler Specialist	1,722	8,442	10,164	28485	22217
Heat Treatment Operator & Forman Expert	47	3	50	91	516
Maintenance staff	91	12	103	204	1467
Draughtsman	285	337	622	1312	925
Fabricator (Sheet Metal Worker)	235	49	284	480	1581
Total			**27,592**	**74,316**	**59,009**
Total Trainees available				**133,325**	

** Number of trainees expected to be available to six sub-sectors under study*

From the above table, the estimated supply of 133,325 trainees might appear to meet the approximate annualized demand of 126,000[30] for above mentioned trades in the six sub-sectors. However, due to existent structural

[29] *Seat capacity from DGET website*
[30] *KPMG Analysis manpower projection*

constraints in the present ecosystem this capacity fails to translate into actual surplus. Firstly, at students' level factors such as unwillingness to geographically relocate, aspirations for a specific sector only, higher salary aspirations, inclination for self employment commonly leads to the lot of new trainees being weaned away from the Capital Goods sector. While at industry and institute level, weak local market labor intelligence, poor perception of quality of trainees, industry-institute disconnects leads to under utilization of existing capacity. Hence, over and above the seat capacity expansion suitable measures at various levels are also required to address the structural constraints which lead to an artificial skill shortage in the system. In this context, it is important to note that the average incremental capacity to be added in 2017-22 for the above mentioned trades in six-subsectors is expected to be around 1-1.2 lac seats[31]. And unless actions are undertaken to overcome the structural constraints in the current training system, this future annual demand cannot be met adequately.

8.2 Trainer Assessment

On qualitative front, the most important expectations from trainers, in order to ensure an effective training delivery are as follows: Qualification, Knowledge of subject matter, industry experience, commitment to learning, teaching ability and interpersonal skills. It has been observed from the primary discussions that while the trainers have an adequate knowledge of subject matter they relatively lack on two critical softer aspects- teaching ability and commitment to learning. While the weaker teaching skill reduces the effectiveness of knowledge transfer, weakness on further learning has its impact on keeping one's technical knowledge abreast with industry. On the profile part, access to trainers with good amount of industry experience has been felt to be a challenging area. Experienced trainers are sought after for their better ability to bring the requisite the practical perspective to the training and to motivate the trainees to pursue a long term career in manufacturing.

Over and above the qualitative aspect, availability of sufficient number of trainers is critical to achieve the targeted growth in training capacity. This is of specific importance, when the requirement of trainers increases in proportion with number of trainees trained. Due to practical component of the training, the Student: Trainer ratio should be ideally around 15:1. Accordingly, the estimated trainers' requirement in the current scenario is approximately 67,700. However, it is estimated that the staff vacancy level in the industrial training institutions varies from 14 to 32 percent[32] and therefore, a shortage of 9,500 to 22,000 exists in trainers' space currently. Further, over and above the current trainer deficit, a minimum of 8,000[33] trainers will be additionally required for augmenting seat capacity by 1-1.2 lacs to meet the industry's skilled manpower needs in 2017-22.

31 KPMG manpower projection analysis
[32] FICCI Survey on state of ITIs and KPMG Analysis
[33] Assuming 1:15 trainer:students ratio

PART- II

9 Recommendations

In the earlier sections, the critical issues afflicting the manpower development of the capital goods industry were identified and categorized according to their associated skill gap types in the skills ecosystem. Further, the recommended solutions can also be identified actionable items for the relevant stakeholders in the skills ecosystem as discussed below:

9.1 Action Points to tackle Type I skill gap

1 **Strengthening the industry-training system linkages –** Critical to the success of developing an industry responsive training program is the clarity of inputs and information exchanged between the training system and industry. The SSC as a platform should function as the gateway of information exchange that will form the basis for all skill development initiatives

2 **Developing certified training programs that help trainees 'earn while they learn' –** It will be important to devise the training programs structure that include an active practical learning component for trainees at a real work location within industry. This has to be supported with a remuneration equivalent to an unskilled/ semi-skilled worker by the industry. Apart from providing a financial basis for the individual to invest in training, the firm also stands to benefit by obtaining access to a large pool of apprentices who can subsequently and selectively be mentored to become employees

3 **Strengthening the teacher training framework –** One of the key tasks of the SSC will be to develop teacher training programs and run pilots of these programs to test the potential for cultivating a large pool of current and past employees of the sector with significant experience into certified trainers

4 **Developing a trainer network –** The SSC could develop a database of retired and current employees of the capital goods industries who could be developed to conduct accredited training programs. When combined with periodic feedback, trainer training and mentoring of these industry veterans based on their performance, an teacher training certification may also be given to such trainers to increase their marketability as a trainer

5 **Exploring fiscal/ policy initiatives to setup a capital infrastructure fund for accredited training institutions –** The SSC with larger representation from industry and NSDC may pursue options to develop a capital infrastructure fund to be setup by the government for funding capex required to setup training institutions

6 **Developing an accreditation framework for training institutions –** An important task for the SSC would be to develop a training institution and training program accreditation process that will be endorsed to be of a quality that is responsive of industry needs. Such an accreditation may be time bound with option for renewal upon validation that the institution/ training program remains relevant to industry requirements. International best practices in quality assurance and accreditation (Refer 11.13) can be evaluated by the SSC and customized to the Indian context for effective adoption

7 **Developing a labor market information system that reflects the dynamic status of industry's manpower profile and needs –** A labor market information system is critical at various levels and definitely so for policy makers who need to plan for skills development needs which are reflecting the industry's workforce priorities

8 **Developing industry responsive national occupational standards for developing standardized training curricula –** National occupation standards hold the key to defining training curricula that are relevant to changing industry needs. The SSC's core task would be to develop these standards and setup a mechanism where these can be periodically reviewed and updated for industry relevance.

9.2 Action Points to tackle Type II skill gap

1 **Enlisting support of industry associations to increase membership and participation in the SSC activities –** Given the nature of the industry where there a few dominant large players and a number of medium to small players, the SSC could try to enlist the support of all the large players and key players in the medium to small segment represented in their respective associations and are active in pursuing the cause of skill development for their industry. This will be critical to evolve a representative industry platform that will be a channel for clear communication with the education and training system

2 **Exploring regulatory support through labor and wage standards (for various certification levels) related to training programs offered by SSC accredited training providers –** The SSC could help in marking the value of training programs and certifications by supporting the implementation of national labor and wage standards to each certification. This could help provide clarity on the value an individual would attach to the training programs before deciding to invest in one

3 **Fiscal and government procurement policy incentives for firms to adopt progressive workforce management techniques such as employee skill development, periodic contributions to labor market information, employment of certified trainers with a periodic contribution to industry training needs –** The importance of improved workforce management needs to further established among firms to encourage them to actively participate and provide support that benefits the industry as a whole. For which, obtaining inputs for labor market information, or supporting industry training needs by extending trainer resources etc. need incentivization by government either in fiscal measures (regulatory approach) or in its procurement from capital goods companies (market approach)

9.3 Action Points to tackle Type III skill gap

1 **Identification of target manpower (e.g. rural population) sources to whom a career in engineering / capital goods sector is aspirational –** Many parts of eastern India and mainly rural areas have been observed by training providers and firms to be a source of manpower who could be trained and developed into skilled manpower. The SSC, as part of its labor market information system could identify typical demographic profile of people who are likely to enter the capital goods industry and support the development training programs suited to these profiles

2 **Spread awareness and market the benefits of investing in training leading to a certification –** All stakeholders in the skills ecosystem need to be able to spread awareness and market the benefits of a career in capital goods sector and the benefits of certification in order to induce a rational response from the individual

that favors an investment in training. These could be attempted by sustained and large scale marketing campaigns to reach out to the potential converts

10 Key Action Items for SSC- 1st Year of operation

Subsequent sections cover the recommended action plan for the capital goods sector skill council in its first year of operation on following important dimensions:

1. Product selection and development
2. Product rollout, testing and validation
3. Marketing identified trades for trainee mobilization
4. Initiating efforts to support and implement policy changes
5. Building support for organizational capabilities required

10.1 Product Selection and development

- **Shortlist priority areas (Important Trades and Regions):** Five priority trades - machine builder (fitter), electrician, machinist (including large & precision machining), welder, fabricator (sheet metal worker), which have maximum impact and skill requirement can be initially targeted in the pilot phase before scaling up to cover all the trades. These five trades constitute more than 80 percent of workers employed across various trades (Refer 11.10). On geographical front, West and South region employs the majority of manpower. Therefore, the pilot in first year of operation can be started with one major city per region (e.g. Mumbai Region and Coimbatore).
- **Develop National Occupations Standards:** A clear identification of job roles and skills required is essential to ensure that various stakeholders of the industry are able to communicate the skill requirements and gaps in a standardized language. In this context, national occupation standards based upon the inputs of companies across sub-sectors and sizes should be developed to standardize the requirement of various job roles and corresponding skills.
- **Emulate role-model institutions:** Training institutions known for their distinguished programs and models should be emulated to replicate the success stories across regions. For instance, the distinct training approach of Bosch Training Institute which ensures periodic assessment of industry requirements, skill gaps analysis, and continuous monitoring of training output coupled with strong infrastructure has evolved as one of the preferred training institutions by employers and employees. Similarly, Germany MSME model on the back of its constant focus on young talent and 'dual' system of vocational training whereby young people both attend school and acquire the necessary practical skills in a company has been a successful model. This dual system of training ensures that Germany produces skilled professional with need oriented skills.. Other successful examples include sandwich courses in Indian institutions (e.g.: IGTR) or on-site delivery of training (e.g.: NTTF). These examples can be used as models to design and develop a model curriculum and to develop institute accreditation framework as well. In the first year of operation, SSC could target to accredit 20 training institutions, and train 25 trainers & 2000 trainees through these accredited training institutions. Case studies of a few notable institutions has been provided in 11.12
- **Design teachers' training programs:** Identify successful institutions in India and abroad (e.g.: Australian TAFEs) having expertise in design of teachers' training programs to develop the training of trainers curriculum for identified trades.

- **Develop** Recognition of Prior Learning **(RPL) framework and certification for industry practitioner:** The vast pool of retired (or near retirement) industry people should be tapped to build a strong trainers' network across institutions in various regions. For which, a RPL (Recognition of Prior Learning) framework and a certification program for existing industry practitioners should be developed to upgrade the industry practitioner to trainers.
- **Develop LMIS and an online platform to share inputs:** Developing a labour market information system that reflects the dynamic status of industry's manpower profile and needs is critical at various levels. And more so at policy makers' level that need to plan for skills development needs reflecting the industry's needs. Furthermore, a technology enabled platform which enables access to relevant stakeholders to upload their concerns, requirements and observations in real time. (e.g. : Ministry of labor and employment (MOLE), Department of Heavy Industry (DHI), FICCI, Industry associations, Industry players)

10.2 Product rollout, testing and validation

- **Audit the training institutions on developed accreditation:** Apply developed accreditation mechanisms to evaluate performance and accredit successful institutions across ITIs/ ITCs, Captive Institutions and new institutions setup with NSDC funding (currently less than 5% focus amongst NSDC funded players in this space). In this context, an independent agency could be invited to audit affiliated institutes based upon inputs, process and output qualities. Such an auditing agency will validate that the training programme is able to provide a learner with adequate opportunity to achieve a specific award. Furthermore, institutions which are able to maintain the desired rating on all input, process and output parameters for stipulated time may be incentivize through government funding
- **Targeting Existing Capacity for up gradation:** Select key clusters where existing industry-training institution linkages can be upgraded and accelerate the same with support from MoLE / DHI (government sector) and FICCI/ Industry Associations (private sector/ PPP). The model curriculum identified should be shared with these institutions to adopt content and deliver.
- **Ramp up Training of Trainer (TOT) program:** Identify and shortlist key industry players with representative senior workforce profile, for participation in TOT pilot. Identify and cultivate teacher training centres of excellence amongst network of accredited institutions and rollout pilot, measure results and refine structure for wider rollout.
- **Build Trainers' network:** Work with industry associations, and industry network to develop database of potential candidates for RPL and ToT training and conduct ToT certification programs. Provide trainer to industries and training institutions who need services of certified or to-be-certified trainers. Identify and shortlist key industry players with representative senior workforce profile, for participation in Training of Trainers' pilot.
- **Test and validate the results:** Monitor the training results from the modeled training institutions and incorporate any changed required in the training process, curriculum and NOS. Facilitate content best practices amongst training institutions by identifying and rewarding top institutions.

10.3 Marketing identified trades for trainee mobilization

Some of the key action steps to improve the perception of manufacturing career in capital goods sector and to mobile trainee are as follows:

- **Tap new manpower segments:** Identify and target new manpower segments such as rural workforce, trained non-worker, woman etc in collaboration with top training institutions (e.g.: NTTF) and manpower sourcing businesses
- **Market identified trades:** Work with NSDC and other industry stakeholders to design appropriate marketing campaigns that can be funded and launched to attract potential aspirants to accredited training institutions including initiatives such as World Skills competitions. Other initiative in this context would be to ensure successful placement of first 2000 candidates at premium salary and use them as marketing testimonials
- **Incentivize and support potential trainees:** Arrange funds for extending incentives linked to SSC certifications of Rs. 10,000 (recent budget announcement) to the students. Setup career advise portal/ toll free hotline / call centre to counsel people with enquiries on options for training and employment

10.4 Initiate efforts to implement supporting policy changes

The efforts on other fronts need to be accompanied with supporting policy changes to encourage industry stakeholders and training institutions to actively participate and adopt the initiatives being undertaken the skill council. In this context, some of the encouraging policy changes to support the initiatives are as follows:

- Design the fund exploring PPP structures and multi-lateral funding agency (WB/ADB) support for creation/ up gradation of capital infrastructure. Pursue with MoLE policy responses to decentralize planning / budgeting and allow infrastructure sharing by ITIs
- Incentivize industry players to invest in training set-ups that are SSC accredited and higher weighted consideration for 2% CSR funding for investments in skills development in this sector
- Adopt and implement systemic best practices from international models such as the Germany MSME model (Refer 1.1.11.11.4) to encourage Indian SMEs to increase focus on new trainees and participate in building a strong pool of available new talent.
- Design incentives scheme (e.g.: UK construction industry incentives in the form of tax refunds) for industry contribution to LMIS, ToT and subscription to SSC accredited trainings

10.5 Building organizational capabilities required

Following critical organization capabilities needs to be adopted by sector council to ensure long term success of the skill development action plan:

- **Build Strong partnership with stakeholders:** Build strong partnerships with industry, model training institutions, manpower staffing solutions providers, industry associations to facilitate a strong central point of contact. Leverage partnerships to raise funds from avenues like CSR budgets to supplement NSDC grants.

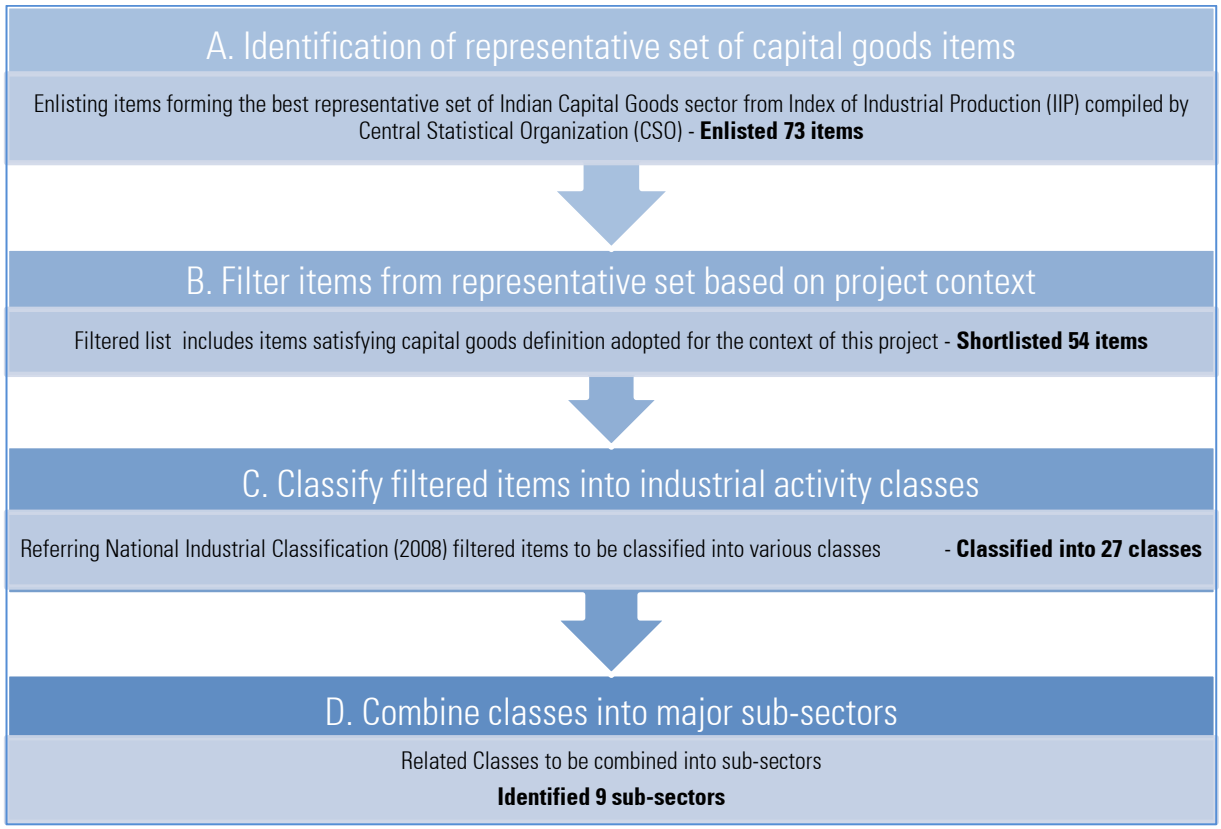
- **Build requisite in-house expertise:** Capabilities in important relevant areas such as vendor management for activities such as NOS development, occupational mapping, LMIS development etc, marketing campaigns design and execution, management of trainers' database etc needs to be developed.

PART- III

11 Appendix

11.1 Methodology

The following four stage filter methodology has been adopted to identify the major sub-sectors of capital goods sector:



A. Identification of representative set of capital goods items

For a comprehensive analysis of capital goods sector, it is imperative to first identify capital goods items which form the best representation of this sector. For which, the Index of Industrial Production (IIP) compiled by the Central Statistical Organization (CSO) has been used as the initial reference point. The use based classification of this index includes 73 items and have a total weight of 8.82% in IIP. The list of these 73 items can be referred in Annexure- 1.

B. Filter items from representative set based on project context

In a study commissioned by Government of India[34], capital good items have been defined as follows:

"Product/ equipment of high value, durable (economic asset life 3 years), used as plant and machinery for agricultural, industrial and commercial purpose in production/ service delivery process"

In accordance with the definition adopted by the Government of India stated above, and for the purpose of this study, product/equipment used for commercial purpose in service delivery process or any other products which are not

[34] *Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Government of India.*

equipments or machines that can be used in production have been kept outside the project context and stakeholders,. On this basis, following capital items have been excluded from the initial reference set prepared by the Central Statistical Organization (CSO):

Items Excluded		
Transport Equipments: 1. Commercial Vehicles 2. Utility/Multi-Purpose Vehicles 3. Ship Building & Repairs 4. Locomotives all types 5. Coach, railway 6. Railway wagons 7. Three-Wheelers(including passenger & goods carrier), Tractors (complete)	**Electronic Components:** 1. EPABX / PABX Systems 2. X-ray equipment 3. Medical and Surgical Equipment (except x-ray) 4. Computers 5. Computer Peripherals 6. Printers	**Non-metallic mineral products** 1. Magnesite, Dead Burnt 2. Refractory Bricks 3. Grinding Wheels **Manufacture of lifts, escalators and moving walkways** 4. Lifts/Elevators & Components thereof **Manufacture of air-conditioning machines** 5. Air Conditioner (Packaged)

C. Classify filtered items into industrial activity classes

The filtered items were then mapped to various industrial activity classes using National Industrial Classification (NIC-2008) as a reference[35]. For example, earth moving machinery and loaders belong to same class of economic activity "Manufacture of machinery for mining, quarrying and construction" (NIC-2008 Code- 2824). Similarly, cranes and material handling equipments belong to same class of economic activity "Manufacture of lifting and handling equipment" (NIC-2008 Code- 2816). Following this methodology, the 54 items were mapped to following various classes of activities.

S. No.	Sub-Class (Ref. NIC-2008)	Items Covered
1	Manufacture of agricultural and forestry machinery	1. Agricultural Implements 2. Agricultural Machinery
2	Manufacture of electric power distribution transformers, arc-welding transformers, fluorescent ballasts, transmission and distribution voltage regulators	3. Transformers (Small) 4. Transformers (P.D.T & Special Type) 5. UPS/Inverter/Converter
3	Manufacture of electric motors (except internal combustion engine starting motors)	6. DC Motors 7. Electric Motors Phase-I 8. Electric Motors(Excl.Phase-I)
4	Manufacture of electricity distribution and control apparatus	9. Relays, Fuses And Switchgears 10. Air Break Switches / Circuit Breakers 11. Aluminum, Conductor 12. Insulated Cables/Wires all Kind

[35] *The National Industrial Classification (NIC) is an essential Statistical Standard for developing and maintaining comparable data base according to economic activities. Such classifications are frequently used in classifying the economically active population, statistics of industrial production and distribution, the different fields of labor statistics and other economic data such as national income*

		13. Electrical Switchboard
5	Manufacture of insulated wire and cable	14. Cable, Jelly Filled 15. XLPE Cable 16. Cable, Rubber Insulated 17. H.T. Insulators
6	Manufacture of other electrical equipment	18. Generator/Alternator 19. Stabilizers
7	Manufacture of fiber optic cables for data transmission or live transmission of images	20. Fibre Optic Cable
8	Manufacture of other lifting and handling equipment and parts thereof	21. Cranes 22. Material Handling Equip. 23. Forklift
9	Manufacture of earth-moving machinery (bulldozers, angle-dozers, graders, scrapers, levellers, mechanical shovels, shovel loaders, off-road dumping trucks etc.)	24. Earth Moving Machinery 25. Loaders
10	Manufacture of other machinery for mining, quarrying and construction n.e.c.	26. Mining Equipment
11	Manufacture of boring, cutting, sinking and tunneling machinery	27. Drilling Equipment
12	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	28. Engines Incl. Internal Combustion and Diesel Engine 29. Construction Machine/Equipment 30. Turbines & Accessories
13	Manufacture of machinery for preparation of textile fibers, spinning machines, machines for preparing textile yarns, weaving machines (looms), including hand looms, knitting machines, textile fabric processing & finishing, synthetic machinery excluding extrusion, garment & nonwoven machinery	31. Textile Machinery
14	Manufacture of machine tools for turning, drilling, milling, shaping, planning, boring, grinding etc.	32. Machine Tools
15	Manufacture of other pumps, compressors, taps and valves etc.	33. Air & Gas Compressors 34. Pumps (including power driven pumps)

16	Manufacture of machinery for working soft rubber or plastics or for the manufacture of products of these materials	35. Plastic Machinery Incl. Moulding Machinery 36. Rubber Transmission And V Belts
17	Manufacture of printing and bookbinding machines and machines for activities supporting printing on a variety of materials (other than textiles)	37. Printing Machinery
18	Manufacture of ovens, furnaces and furnace burners	38. Furnaces 39. Solar Power Systems
19	Manufacture of auxiliary plant for use with steam generators (condensers, economizers, superheaters, steam collectors and accumulators)	40. Boilers
20	Manufacture of metal containers for compressed or liquefied gas	41. Cylinders
21	Manufacture of other machinery for the industrial preparation or manufacture of food or drink n.e.c. (including tea or coffee making machines)	42. Food Processing Machinery
22	Manufacture of machinery for the dairy industry	43. Dairy Machinery
23	Manufacture of other special-purpose machinery n.e.c.	44. Cement Machinery 45. Driers 46. Sugar Machinery 47. Packaging Machinery
24	Manufacture of bearings, gears, gearing and driving elements	48. Industrial Chains
25	Manufacture of refrigerating or freezing equipment f industrial use, including assemblies of major components	49. Chillers
26	Manufacture of other general purpose machinery n.e.c.	50. Electric Welding Machines
27	Manufacture of industrial process control equipment	51. Cooling Towers 52. Industrial Blowers 53. Heat Exchangers

		54. Chemical Equipment And Systems

D. Combine classes into major sub-sectors

It was further observed that there exist many companies which operate in multiple classes due to related nature of value chain, end usage or technical competency required. For example, BHEL manufactures equipments pertaining to power generation, power transmission, & other electrical activities. These three classes, therefore, have been grouped into single sub-sector "Power & Electrical Equipments" for the purpose of analysis. Similarly, BEML manufactures equipments pertaining to construction (Hydraulic excavators) and mining (Dozers & Dumpers). Therefore, earthmoving & mining related classes have been grouped into "Earthmoving, Mining & Construction Machinery" sub-sector.

Based on this methodology, the 27 classes have been, grouped into following major sub-sectors:

S. No.	Sub-Sector	Sub-Class
1.	Agricultural & Forestry Machinery	1. Manufacture of agricultural and forestry machinery
2.	Earthmoving, Mining & Construction Machinery	2. Manufacture of earth-moving machinery (bulldozers, angle-dozers, graders, scrapers, levelers, mechanical shovels, shovel loaders, off-road dumping trucks etc.) 3. Manufacture of other machinery for mining, quarrying and construction n.e.c. 4. Manufacture of boring, cutting, sinking and tunneling machinery
3.	Process & Plant Machinery	5. Manufacture of machinery for the dairy industry 6. Manufacture of other machinery for the industrial preparation or manufacture of food or drink n.e.c. (including tea or coffee making machines) 7. Manufacture of other general purpose machinery n.e.c. & special Machineries (cement, sugar, metallurgy etc) 8. Manufacture of ovens, furnaces and furnace burners 9. Manufacture of refrigerating or freezing equipment of industrial use, including assemblies of major components 10. Manufacture of metal containers for compressed or liquefied gas
4.	Light Engineering Goods	11. Manufacture of bearings, gears, gearing and driving elements 12. Manufacture of industrial process control equipment
5.	Machine Tools	13. Manufacture of machine tools for turning, drilling, milling, shaping, planning, boring, grinding etc.
6.	Lifting & Handling Equipment	14. Manufacture of other lifting and handling equipment and parts thereof 15. Manufacture of lifts, escalators and moving walkways
7.	Plastic, Paper & Rubber Machinery	16. Manufacture of machinery for working soft rubber or plastics or for the manufacture of products of these materials 17. Manufacture of printing and bookbinding machines and machines for activities supporting printing on a variety of materials (other than textiles)
8.	Power & Electrical	18. Manufacture of auxiliary plant for use with steam generators

	Equipment	(condensers, economizers, super heaters, steam collectors and accumulators) 19. Manufacture of engines and turbines, except aircraft, vehicle and cycle engines 20. Manufacture of fiber optic cables for data transmission or live transmission of images 21. Manufacture of electricity distribution and control apparatus 22. Manufacture of electric power distribution transformers, arc-welding transformers, fluorescent ballasts, transmission and distribution voltage regulators 23. Manufacture of insulated wire and cable 24. Manufacture of other electrical equipment 25. Manufacture of electric motors (except internal combustion engine starting motors) 26. Manufacture of other pumps, compressors, taps and valves etc.
9.	Textile Machinery	27. Manufacture of machinery for preparation of textile fibers, spinning machines, machines for preparing textile yarns, weaving machines (looms), including hand looms, knitting machines

11.2 List of key capital goods items

S. No.	Capital Good Item	S. No.	Capital God Item
1.	Rubber Transmission And V Belts	2.	Printing Machinery
3.	H.T.Insulators	4.	Cement Machinery
5.	Refractory Bricks	6.	Driers
7.	Magnesite, Dead Burnt	8.	Industrial Blowers
9.	Grinding Wheels	10.	Solar Power Systems
11.	Cylinders	12.	Chillers
13.	Boilers	14.	Computers
15.	Engines Incl. Internal Combustion and Diesel Engine	16.	Computer Peripherals
17.	Turbines & Accessories	18.	Printers
19.	Construction Machine/Equipment	20.	Transformers (Small)
21.	Air & Gas Compressors	22.	Transformers (P.D.T & Special Type)
23.	Pumps (incl. power driven pumps)	24.	Relays, Fuses And Switchgears
25.	Industrial Chains	26.	Electric Motors Phase-I
27.	Furnaces	28.	Electric Motors(Excl.Phase-I)
29.	Cranes	30.	DC Motors
31.	Material Handling Equip.	32.	UPS/Inverter/Converter
33.	Lifts/Elevators & Components thereof	34.	Conductor, Aluminium
35.	Forklift	36.	Air Break Switches / Circuit Breakers
37.	Air Conditioner (Packaged)	38.	Insulated Cables/Wires all Kind
39.	Packaging Machinery	40.	Electrical Switchboard
41.	Heat Exchangers	42.	Cable, Rubber Insulated
43.	Chemical Equipment And Systems	44.	Cable, Jelly Filled
45.	Electric Welding Machines	46.	XLPE Cable
47.	Tractors (complete)	48.	Fibre Optic Cable
49.	Agricultural Machinery	50.	Generator/Alternator
51.	Agricultural Implements	52.	Stabilisers
53.	Machine Tools	54.	EPABX / PABX Systems
55.	Drilling Equipment	56.	X-ray equipment
57.	Earth Moving Machinery	58.	Medical & Surgical Equipment (except x-ray)
59.	Loaders	60.	Cooling Towers
61.	Mining Equipment	62.	Commercial Vehicles
63.	Dairy Machinery	64.	Utility/Multi-Purpose Vehicles
65.	Sugar Machinery	66.	Ship Building & Repairs
67.	Food Processing Machinery	68.	Locomotives all types
69.	Textile Machinery	70.	Coach, railway
71.	Plastic Machinery Incl. Moulding Machinery	72.	Railway wagons
73.	Three-Wheelers(passenger & goods)		

11.3 Description of Major trade roles in capital goods sector

S.No.	Core jobs in respect of all sub sectors of capital goods
1	Machinists include the operations such as turning, milling, drilling, grinding, tool sharpening, tool setting, gear hobbing, etc.
2	Machinist for large size machining application such as Boring/Slide way Grinding/Plano-milling
3	Machinist for precision machining for tool room applications, Precision Grinding, Jig boring, etc.
4	Welder for joining or welding operation
5	Electrician to assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
6	Instrument Technician performs specific job duties such as inspecting and adjusting mechanical and pneumatic instruments and systems. also maintain metering and recording instruments in order to regulate the flow and water pressure of various types of manufacturing equipment.
7	Cable Operator for Wire drawing, Stranding operator, Extruder operator, Laying-up, Armour jointer, etc.
8	Operator for robotic material handling
9	CNC Programmer
10	Crane Operator for handling the raw materials and goods
11	Tool and Die Maker
12	Machine Builder/Assembler for performing the following jobs: Fitting / Filing /Scraping, Hydraulic Assembly, Electrical Assembly, Pneumatic Assembly, Lead screw / Ball screw, fixturing & tooling assembly and whole machine assembly
13	Inspector for Adjustment test / Alignment test /Measurement & inspection
14	Designer for tool, fixture and machine tool, plastic machinery, earthmoving machinery, process plant machinery, textile machinery and its assemblies
15	Heat Treatment Operator and Forman
16	Expert in operating furnace and handling/fixing molten metal, ladles, etc. pattern making, sand mixing & casting, fettling, etc.
17	Specialist for Erection and commissioning
18	Paintbooth Operator for surface coating, painting, shot blasting, surface preparation etc.
19	Draughtsman to draft and design metal fabrication and material handling equipments
20	Sheet metal fabricator to perform welding, cutting, bending, drilling operations on metal sheets.
21	Quality controller to ensure to ensure that products and processes comply with the relevant requirements of the quality management system
22	Maintenance staff for Tooling maintenance, Preventive maintenance Service /Maintenance at customers' end
23	Middle level Managers with managerial skill for Shop Management, Marketing Management, vendor development, inventory management, Materials Management, Finance Management, Human Resources Management, IT Management like ERP etc.

11.4 Questionnaire- Industry Association

Q) Who are the key players of your sub-sector?

Q) What are the key characteristics of the sub-sector in terms of: competition concentration - monopoly / oligopoly/perfect competition, organized players vs. unorganized etc.

Q) What is the labor intensiveness in machine tool sub-sector? (Total revenue per total employee)

< Rs. 5 lakhs	Rs. 5-10 lakhs	Rs. 10-50 lakhs	Rs. 50 lakh – 1 crore	>Rs. 1 crore

Q) Is the labor intensity expected to increase / decrease in the future?

>20% increase	5-20% increase	+/- 5% change	5-20% decrease	>20% decrease

Q) What is the typical ratio of contract employees to total number of employees for your sub-sector?

Q) Are there any labor related issues like - union problems etc. in your sub-sector?

Q) What are the demand drivers of employment?

Which of the following factors impact manpower demand in your sub-sector?	Applicability (Yes / No)	Strength of factor (1 – very strong to 5 – very weak)
Changing technology		
Increasing import of components		
Favorable Govt. policy		
Growth in downstream sector		
Any other (please specify) 1. 2.		

Q) What are the barriers to manpower supply?

Which of the following factors impact manpower supply in your sub-sector?	Applicability (Yes / No)	Strength of factor (1 – very strong to 5 – very weak)
Inadequate number of institutions /candidates		
Poor perception of the sector among the candidates		
Inadequate training infrastructure in institutions		
Growing attractiveness of other sectors		
Any other (please specify) 1. 2.		

Q) What are direct & indirect manpower being employed in this particular sub-sector?

Up to 10 indirect jobs per direct job	10-50 indirect jobs per direct job	50-100 indirect jobs per direct job	100-500 indirect jobs per direct job	>500 indirect jobs per direct

				job

Q) How is the proportion of direct to indirect jobs likely to change in the future?

Q) Which of the following factors are likely to impact the change in the proportion of indirect to direct jobs?

Factor	Applicable	Impact on indirect jobs (If yes)		
	(Yes / No)	Increase indirect jobs	No impact	Decrease indirect jobs
Outsourcing				
Technology change				
Greater import of components				
Any other (please specify) 1. 2.				

Q) How does the job creation/job vacancy cycle in your sub-sector depends on the lead times for manufacturing the machinery pertaining to that sector

Q) Is there any seasonality in the nature of job creation in your sub-sector? If yes, please specify the variation in demand across quarters in the table below.

Q) What proportion of vacancies is due to attrition, creation of new jobs due to added capacity etc.?

Q) What are the major cities of operations?

Q) Which of these clusters can be classified as large, medium, and small?

Q) What are the new emerging clusters?

Q) Why has those cities evolved as preferred choice of cluster presence?(1- Very important 2- Important, 3-Not important)

Factor	Importance (1-Most Important 5-Least important)
Proximity to raw material	
Proximity to customers	
Presence of infrastructure like ports, roads etc.	
Favorable local Govt. policies like incentives, subsidies	
Presence of skilled manpower	

Q) What are the primary reasons for skill gap?

Skill Gaps	
Reason for skill gap	**Importance of Factor (1 – Very High 5 – Very Low)**
Frequent technology changes	
Lower salary compared to industry	
Poor quality of supply (institutions)	
Lack of training	

Q) What are the measured taken to synchronize the expectations & capacity of Industry-Institute?

Q) Name some initiatives taken for skill development by the industries in yesteryears?

Q) Which of these initiatives succeed/failed?

Q) What were the reasons behind the success of these models? (Large scale or specific industry training programs or shared set-up for infra or shared funding)

Q) What were the reasons behind failure?

Q) What are best practices prevalent in India/Other Countries that can be followed for skill development?

11.5 Questionnaire- Demand Side

Research Objectives – The objective of this study is to to ascertain the human resource requirement in the capital goods sector. In this regard, the sub sector has been identified as a key sub-sector of the capital goods sector. 20 core job roles have also been identified within the capital goods sector as stated below. This questionnaire seeks information and perspectives from employers on similar core job roles applicable to their organization/ industry. The information provided by employers will be consolidated and validated at an industry level to help the Capital Goods Sector Skill Council plan skill interventions as per the industry needs

Proposed List of 20 Core job roles in the Capital Goods Sector

S.No.	Core jobs in respect of all sub sectors of capital goods
1	**Machinists** include the operations such as turning, milling, drilling, grinding, tool sharpening, tool setting, gear hobbing, etc.
2	**Machinist for large size machining** application such as Boring/Slide way Grinding/Plano-milling
3	**Machinist for precision machining** for tool room applications, Precision Grinding, Jig boring, etc.
4	**Welder** for joining or welding operation
5	**Electrician** to assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
6	**Instrument Technician** performs specific job duties such as inspecting and adjusting mechanical and pneumatic instruments and systems. also maintain metering and recording instruments in order to regulate the flow and water pressure of various types of manufacturing equipment.
7	**Cable Operator for** Wire drawing, Stranding operator, Extruder operator, Laying-up, Armour jointer, etc.
8	**Operator for robotic material handling**
9	**CNC Programmer**
10	**Crane Operator** for handling the raw materials and goods
11	**Tool and Die Maker**
12	**Machine Builder/Assembler** for performing the following jobs: Fitting / Filing /Scraping, Hydraulic Assembly, Electrical Assembly, Pneumatic Assembly, Lead screw / Ball screw, fixturing & tooling assembly and whole machine assembly
13	**Inspector** for Adjustment test / Alignment test /Measurement & inspection
14	**Designer** for tool, fixture and machine tool, plastic machinery, earthmoving machinery, process plant machinery, textile machinery and its assemblies
15	**Heat Treatment Operator and Forman**
16	**Expert** in operating furnace and handling/fixing molten metal, ladles, etc. pattern making, sand mixing & casting, fettling, etc.
17	**specialist** for Erection and commissioning
18	**Paintbooth Operator** for surface coating, painting, shot blasting, surface preparation etc.
19	**Draughtsman** to draft and design metal fabrication and material handling equipments
20	**Sheet metal fabricator** to perform welding, cutting, bending, drilling operations on metal sheets.

21	**Quality controller** to ensure to ensure that products and processes comply with the relevant requirements of the quality management system
19	**Maintenance staff** for Tooling maintenance, Preventive maintenance Service /Maintenance at customers' end
20	**Middle level Managers with managerial skill for** Shop Management, Marketing Management, vendor development, inventory management, Materials Management, Finance Management, Human Resources Management, IT Management like ERP etc.

Industry Questionnaire

Company details & labor intensiveness				
In which of the following Sub-Sectors your company/business vertical operate in?[36]				
Machine Tools Process Plant Machinery Power & Electrical Equipment Textile Machinery Plastic, Paper & Rubber Machinery Construction, Mining, Earthmoving Equipments Material handling/lifting Equipments Agricultural Machinery				
How Would you classify your company in this Sub-Sector ?(Small/Medium/Large)				
How would you rate Labor Intensity in your Sub-Sector? (High/Medium/Low)				
What is the labor intensiveness in your sub-sector? (revenue per employee)				
< Rs. 5 lakhs	Rs. 5-10 lakhs	Rs. 10-50 lakhs	Rs. 50 lakhs – 1 crore	>Rs. 1 crore
Is the labor intensity expected to increase / decrease in the future?				
>20% increase	5-20% increase	+/- 5% change	5-20% decrease	>20% decrease
Drivers of manpower demand				
Which of the following factors impact manpower demand in your sub-sector?			Strength of factor(1 – very strong to 5 – No Impact)	
Changing technology				
Increasing import of components				
Growth in downstream sector				
Any other (please specify)				
Barriers to manpower supply				
Which of the following factors impact manpower supply in your sub-sector?			Strength of factor (1 – very strong to 5 – No Impact)	
Inadequate number of institutions /candidates				

[36] *If your company is into different sub-sectors, please respond to questionnaire separately for each sub-sector.*

Poor perception of the sector among the candidates	
Inadequate training infrastructure in institutions	
Growing attractiveness of other sectors	
Any other (please specify)	

Nature of job creation (Direct vs. Indirect[37])				
What is the current proportion of direct to indirect jobs?				
Up to 10 indirect jobs per direct job	10-50 indirect jobs per direct job	50-100 indirect jobs per direct job	100-500 indirect jobs per direct job	>500 indirect jobs per direct job
How is the proportion of direct to indirect jobs likely to change in the future?				
>20% more indirect jobs per direct job	5-20% more indirect jobs per direct job	+/-5% change in indirect jobs per direct job	5-20% less indirect jobs per direct job	>20% less indirect jobs per direct job

Which of the following factors are likely to impact the change in the proportion of indirect to direct jobs?			
Factor	Impact on indirect jobs (If yes)		
	Increase indirect jobs	No impact	Decrease indirect jobs
Outsourcing			
Technology change			
Greater import of components			
Any other (please specify) 1. 2.			

Expansion Strategies					
Which of the following expansion strategies are being explored by companies in your sub-sector?					
Increase production capacity at existing location	Set-up new plants in other locations	Upward integration (manufacture of components and raw materials)	Downward integration (manufacture end-use products)	Related diversification (enter new product / sector)	Any other (please specify)

Current Employment Needs of Organization (Direct)						
Role[38]	Brief Job description/ operations[39]	Skills required	Temporary (% of employees)	Permanent (% of employees)	No. of people employed	
					Current (2013)	Projected (2017/2022)
Machinist						
Welder						

[37] *Indirect employment refers to jobs created by a company other than directly employed by the company eg. jobs created at suppliers and other associates*

[38] *Please list the roles that are applicable to your company / sub-sector*

[39] *Please refer to the 20 job roles mentioned in page 1 for the job description of each role.*

Supervisor						
…						

What are the forecasting techniques being used by players like you in this Sub-Sector?

Manpower Supply Systems

Role	Channels for filling up job vacancies (% of total recruitment)				
	From Institutions	From direct-competitors within sub-sector	From competitors in other sub-sectors	From within company - through job rotation/ promotion	Others
Machinist					
Welder					
Supervisor					
…					

Employee Profile (Current Status & Desired profile)

Role	Education (Diploma / Degree/ ITI. etc)		Experience (no. of years (1-10yrs)		Any other (Gender, Age criteria etc.)	
	Present	Desired	Present	Desired	Present	Desired
Machinist						
Welder						
Supervisor						
…						

What are the reasons for not being able to hire ideal profile of manpower in terms of parameters listed above? How could these reasons be addressed?

Training Needs

Role	No. of training hours per	Training spend per	Modes of training (classroom, CBT,

	employee p.a.		employee p.a.		on the job etc.)	
	Present	Desired	Present	Desired	Present	Desired
Machinist						
Welder						
Supervisor						
…						

What are the hiring triggers for your company? (Factor like attrition, new order etc?)
What new job roles you envisage shall become relevant to your sub-sector in next decade?
What will be the quantitative and skill requirements of these new job roles?

Manpower Gaps

Role	Shortage / Surplus (% of total workforce)	Attrition rate range (%)	Skill gaps (High / Medium / Low)	Skill gap issues (Qualitative)	Suggested actions / recommendation
Machinist					
Welder					
Supervisor					
…					

Skill Gaps

Reason for skill gap	Importance of Factor (1 – Very High 5 – Very Low)
Frequent technology changes	

Lower salary compared to industry	
Poor quality of supply (institutions)	
Lack of training	
Other reasons	
Please indicate some best practices that can be emulated to meet quantitative/qualitative requirements of manpower?	

11.6 Questionnaire- Supply Side

Training Institution Questionnaire

Current Capacity

Please share the following details about the courses being offered by your institution presently?

Trades	Course Offered (Yes/No)	Course Tenure	Entry Qualification	Sanctioned no. of seats	Seat Utilization
Machinist					
Welder					
Supervisor					
…					

What reasons would you attribute for the under utilization of seats for some of the above cases? (If applicable) (1-Relevant, 2- Irrelevant)

Not enough demand from industry

Higher Entry Qualification

Higher Course fee

Long course tenure

Disinterest in trade

Competition from other institutions (please specify competitors)Any other

What steps are taken to address the relevant factors?

Future Capacity

What is the future capacity planning for various trade courses?

(Please capture details of any new trade courses as well planned to be introduced in future)

Trades	Expected Sanctioned Capacity-(2017/2022)	Expected Changes in Course Tenure	Expected Changes in Entry Qualification	Expected Changes in course curriculum
Machinist				
Supervisor				
…				

What major constraints need to be addressed to achieve the future capacity expansion?

Unavailability of trainers

Unavailability of funds

Unavailability of prospective students

Uncertain future demand from industry

Any other factor

How could those constraints be addressed?

Institute-Industry Interface

How do you plan to introduce new trade courses?

What is the lag/lead time between demand expressed by industry for a course and introduction of course from your institute?

How do you plan seat allocations across various trade courses?

How do you design curriculum from various trade courses?
How does facility and faculty of the institute ramp-up with the changing demands of industry?
What is the present interface between your institution and industry to synchronize the companies' requirements and supply?
What changes are required in this interface/decision making process to make the future supply relevant?

Training Quality

How do recruiters rate your students on following: (1- Needs improvement, 2- Meets expectations, 3- Exceeds expectations)
Technical knowledge- Theory
Technical knowledge- Practical
Broad based technical knowledge
Trade focused Specialized knowledge
Problem solving aptitude
Communication skill
Why do you think recruiters rate your students as described above?

How would you rate your training institution on following parameters? (1- Needs improvement, 2- Meets Expectations, 3- Exceeds expectations)

Parameter	Rating
Building & Class-rooms	
Power Supply	
Machinery, tools, Equipment and furniture	
Provision to use NC/CNC/Automated machine	
Qualification of trainer	
Training facility for trainers	
Industry-Institution interface for trainers	
Course structure- Proportion of theoretical & practical training	
Industry training facility for students	
Placement programs	

How do you plan to address the parameters rated '1 – Needs expectations' to improve the quality of training

Trainer Quality

What are the qualification criteria for trainers in terms of educational and professional experience?
How would you rate your trainers on following parameters? (1- Needs improvement, 2- Meets Expectations, 3- Exceeds expectations)

Parameter	Rating
Knowledge in the subject matter	
Work Experience	
Commitment to learning	
Teaching ability	
Interpersonal skills	

What are the current programs undertaken to train the trainers on above parameters?

What steps can be taken to address the parameters rated "1- Need Improvement"?

What are the various platforms available for trainers for industry interaction?

Placement Program

Do you facilitate students with placement programs? If Yes:

Trade	Placement Ratio	Feedback received from recruiter
Machinist		
Welder		
…		

What are the reasons for less than 100 percent placement ratio for some cases? (If applicable)

If No placement program is facilitated:

Challenges faced to facilitate a placement program.

How could these constraints be addressed from due support from industry/associations?

What are your key expectations from Industry associations/government/companies?

11.7 Manpower Estimation Methodology

For the purpose of study, production coefficient methodology has been adopted to estimate future manpower requirement. This methodology is based upon the assumption that there remains a "time-period" based relationship between labor inputs and production of a good or service. The term time-period has been used to highlight the fact that the relationship between labor input and production output keeps changing from time to time with advancement in technology and increase in productivity. Furthermore, longevity of such a time period would vary across sectors and countries depending upon the exposure and adoption of newer technologies.

The key variables used as an in this methodology are: current production capacity, expected growth rate in production over estimation period, current labor intensity, expected future labor intensity.

Furthermore, in the context of capital goods sector, it is important to note that the sector itself comprises multiple major sub-sectors. And these sub-sectors are expected to grow at different rates in future, with different labor intensity and changes therein. Hence, it is essential that the manpower is first estimated at representative sub-sectors level and then summed-up to arrive at the total demand for the whole sector.

The variables to be used in the above formula are described in following table along with the estimation techniques used for them:

Current Production Capacity	
Definition	Total installed capex or production capacity of a sector. The output of this capacity will be either used indigenously or exported to other countries
Data Source	Secondary Reports
Application	To be used a base number to determine the future production capacity of the sector
Expected Growth Rate	
Definition	Expected growth rate in installed capex or production capacity in next 5/10 years
Data Source	Secondary Reports and Primary interviews
Application	To be used to arrive at the future production capacity of the sector by using the current production capacity as the base number
Current Labor Intensity	
Definition	Present Ratio of Total employee/Total Revenue (Employees/ Rs Lacs)
Data Source	Secondary Reports & Primary interview
Application	One key variable to estimate the future employees' requirement is future labor intensity. In this context, current labor intensity would be used a base number to estimate the future labor intensity. Incorporating changes in current labor intensity for factors such as technology advancements, productivity increase etc shall help to arrive at the best possible estimate of future labor intensity.
Future Production Capacity	
Definition	Expected future installed capex or production capacity of a sector.
Source	To be derived from current production capacity and expected growth rate.
Application	To be used in conjunction with future labor intensity to estimate the future manpower requirement.

Future Labor intensity	
Definition	Expected Ratio of Total employee/Total Revenue (Employees/Rs Lacs)
Data Source	To be derived from current labor intensity with due changes to be incorporated based upon primary and secondary research.
Application	To be used in conjunction with future labor intensity to estimate the future manpower requirement
Average Annual Demand	
Definition	Average annual industry demand expected in 2013-17 and 2017-22
Data Source	To be derived from future manpower requirement and current manpower requirements incorporating correction for attrition rate.
Application	To be used in in conjuction with training infrastructure capacity to determine present demand-supply gap and the future training capacity required to meet industry demand

11.8 Quantitative Assessment of Industrial Training Capacity

The details of the key metrics used for the estimation of the current training infrastructure capacity are as follows:

1 **Source of Manpower**: For the purpose of this study, external training sources ITI/ITC and ATS have been considered for supply estimation. Currently, existing ITI and ATS training system facilitate the major percentage of trainee requirement. The training infrastructure being built-up by NSDC in collaboration with various training providers currently forms a minor percentage of total capacity and has been kept out of purview.

2 **Training Programs**: The relevant training programs have been identified based upon the training course description[40] and job description and inputs from primary research.

3 **Key Data Source**: The current capacity of ITI/ITC for various training courses has been referred from the data available on DGET website (http://www.dget.nic.in/). Whereas the ATS capacity has been referred from Ministry of Labor & Employment report on Trade apprenticeship training in India.

4 **Percentage of trainees available**: Of the total capacity, total trainees available to join the six sub- sectors under study has been estimated after incorporating following parameters based upon the primary feedback and secondary research: approximate capacity utilization, number of trainees expected to join capital goods sector, number of trainees expected to join the six-subsector under study.

[40] www.dget.nic.in

11.9 Information on Industrial Training Institutions

State Wise Number of Affiliated ITIs[41]

S.No.	State	Total	Government			Private		
			General	Women	Others	General	Women	Others
1	Andaman and Nicobar Island	2	2	0	0	0	0	0
2	Andhra Pradesh	788	101	21	4	653	4	5
3	Arunachal Pradesh	4	3	0	0	1	0	0
4	Assam	31	24	3	1	3	0	0
5	Bihar	575	23	7	1	541	0	3
6	Chandigarh	2	1	1	0	0	0	0
7	Chhatisgarh	171	70	8	4	89	0	0
8	Daman and Diu	2	2	0	0	0	0	0
9	Delhi	77	5	3	7	36	23	3
10	Dadra and Nagar Haweli	1	1	0	0	0	0	0
11	Goa	18	12	0	0	6	0	0
12	Gujarat	417	158	5	3	248	2	1
13	Himachal Pradesh	204	59	17	1	126	0	1
14	Haryana	197	55	45	1	85	10	0
15	Jharkhand	174	13	2	0	157	0	2
16	Jammu and Kashmir	39	33	1	4	1	0	0
17	Kerala	613	58	9	9	527	2	8
18	Karnataka	1470	123	13	13	1294	7	20
19	Lakshadweep	1	1	0	0	0	0	0
20	Meghalaya	7	4	1	0	2	0	0
21	Maharashtra	884	375	14	2	484	9	0
22	Manipur	7	6	1	0	0	0	0
23	Madhya Pradesh	291	108	12	1	169	1	0
24	Mizoram	2	2	0	0	0	0	0
25	Nagaland	2	2	0	0	0	0	0
26	Orissa	627	20	8	4	557	3	35
27	Punjab	342	61	50	3	217	10	1
28	Pondicherry	18	6	2	0	10	0	0
29	Rajasthan	826	94	8	7	711	2	4
30	Sikkim	3	2	0	0	1	0	0
31	Tamil Nadu	733	62	8	5	649	6	3
32	Tripura	8	6	1	0	1	0	0
33	Uttranchal	114	54	4	5	50	0	1
34	Uttar Pradesh	1554	109	40	4	1391	10	0
35	West Bengal	110	41	2	2	63	2	0

[41] *http://www.dget.nic.in*

Total	**10315**	**1696**	**286**	**81**	**8072**	**91**	**87**

Trade Units and No. of ITIs (All India)[42]

S. No.	Trade	No. of Units*	No. of I.T.I.'s	
			Government	Private
1	Attendant Operator (Chemical Plant)	72	42	10
2	Attendant Operator (Chemical Plant)	7	4	0
3	Mechanic Communication Equipment Maintenance	4	1	2
4	Carpenter	563	379	91
5	Driver Cum Mechanic (Light Motor Vehicle)	238	111	76
6	Draughtsman (Mechanical)	976	285	337
7	Draughtsman (Civil)	2443	504	882
8	Electrician	25609	1686	9526
9	Electroplater	30	22	1
10	Foundaryman	180	117	6
11	Farm Mech. Agri. Mechanic	5	4	0
12	Fitter	21196	1722	8443
13	Instrument Mechanic (Chemical Plant)	41	16	6
14	Instrument Mechanic (Chemical Plant)	15	10	2
15	Instrument Mechanic	372	178	56
16	Information Technology & Electronics System Maint.	573	281	126
17	Mechanic Repair & Maintenance of Light Vehicle	21	8	7
18	Mechanic Auto Electrical & Electronics	61	18	29
19	Mechanic Agricultural Machinery	25	21	1
20	Machinist (Grinder)	251	110	18
21	Machinist	1263	442	84
22	MCP	134	33	59
23	Mechanic-cum-Operator Electronic Communication System	22	5	7
24	Mechanic (General Electronics)	15	4	3
25	Moulder	87	54	2
26	Mechanic Maintenance (Chemical Plant)	38	21	6
27	Mechanic (Marine Diesel)	11	2	2
28	Mechanic (Motor Vehicle)	3224	888	945
29	Mechanic Mechatronics	9	4	0
30	Mechanic Machine Tool Maintenance	114	70	6
31	Operator Advanced Machine Tool	5	4	1
32	Pump Operator-Cum-Mechanic	115	95	10
33	Painter (General)	272	166	69
34	Plastic Processing Operator	159	117	10

[42] http://www.dget.nic.in

35	Pattern Maker	71	55	1
36	Sheet Metal Worker	357	235	49
37	Tool & Die Maker (Dies & Moulds)	32	18	6
38	Tool & Die Maker (Press Tools, Jig & Fixture)	66	35	7
39	Tool & Die Maker	72	35	10
40	Turner	1925	586	236
41	Welder (Gas & Electric)	1749	662	421
42	Welder	2097	647	823
43	Wireless Mechanic cum Ope	20	14	1
44	Wireman	2476	1021	589

**One Unit may have multiple trades*

11.10 Top Job Roles with a Quantitative Demand

Ascertaining the top job roles from a industry demand perspective (quantitative) is vital to help the Sector Skill Council identify top job roles and trades which will need to be prioritized and to form these roles as the basis for the first year activities of the Sector Skill Council. To estimate the share and dentify the top 5-6 job roles, the data provided by (DGET) Directorate General of Employment and Training under the Apprenticeship Training Scheme has been used[43]. The number of workers ascertained by other than unskilled workers across various trades was used as a starting point, and the trades relevant to the Capital Goods Sector and applicable to the 20 job roles were identified to prepare a statement of total number of workers. This provides a microcosmic view of the relative importance of the identified job roles in the Capital Goods and Engineering Sectors. Based on this, the top job roles and their share to total employment are stated as under:

S. No.	Core Job Role	% of total employment in relevant roles[44]
1	Machine Builder / Assembler	39%
2	Electrician	21%
3	Machinist	18%
4	Welder	12%
5	Fabricator (Sheet Metal Worker)	2%
6	Draughtsman	2%
7	Others	6%
	Total	**100%**

[43] Annexure-IX, Trade Apprenticeship Training in India (As on 31.12.2011) under Apprenticeship Training Scheme, December 2012 published by DGET, Ministy of Labour and Employment

[44] The above percentages should be used for the limited purpose of judging the quantitative priorities amongst the 6 roles. Subsequent intelligence in terms of 'core' vs. 'non-core' job roles may be required to further shortlist top job roles suited to the SSC's context

11.11 Notable Industry Practices

11.11.1 The Bosh Training Training Centre

The Bosch Training Centre is equipped with state of the art facilities/equipments and was established in the year 2005. It possesses facilities for training, development and testing various automotive products and vehicles besides diagnostics on vehicles fitted with Electronic Control Unit. Built over an area of 800 square meters, it has a separate Vehicle Area, Diesel Workshop, Auto Electrical Workshop, Technical Library and two modern Lecture Halls with state of the art audio/video equipment and projection system. A variety of training films, cut-away and transparent models make learning interesting and enjoyable.

Manned by qualified and experienced staff, the Bosch Training Centre conducts a variety of training programs to meet different customer requirements. The level of participants ranges from Mechanics to Managers/Proprietors and from Engineers to Senior Executives drawn from BOSCH Authorized Representatives, OE customers and their dealers, Defense Establishments, State Transport Undertakings, Fleet Operators as well as Educational Institutions

Joint certification training center at SRM University:

Joint Certification Training Centre established at SRMU. It will act as a bridge to address the technological gap and focus on various technical training programs. SRMU have given a dedicated space of 4000 sq ft area in their campus for Bosch training.

Various training modules have been implemented along with Bosch Diagnostics products FSA 500, BAT 121, Battery charger, Auto-electrical test bench, CR diagnostics kit, and other training aids in the first phase. The course modules were designed jointly to create better employability of students and also improve the maintenance culture of the CAR repair workshops.

The Bosch Approach:

1 Creating Awareness:

- Creating Awareness among school finishers through summer training.
- Encouraging students from technical courses to visit the plant.
- Industrial Exposure for Engineering students as part of their curriculum

2 Establishing Training Centers: Establishment of various training centers in Delhi, Jaipur, Bangalore etc

3 Standardized Training Model: This system employs recognized, globally accepted and standardized training approaches to ensure effective training and internalization of knowledge.

4 Skill Development & Training:

- On the Job Training: To bridge the gap between institute and industry
- Fresh Graduates Training: To develop a pool of competent engineers for future responsibilities

5 Ensuring effective Training to the Trainers:

6 Partner with NGO's:

- Partnering with NGOs to bring underprivileged & rural population into the talent pool

7 Sharing Expertise

- Sharing the expertise with industry bodies to formulate short term programs

Training Approach:

The BOSCH training approach involves the following steps:

- Periodic Assessment of Industry Requirements: This process looks as changing Industry trends, requirements and attempts to modify the curriculum, pedagogy and tools used with a view of the changing requirements
- Gap Analysis: Involves Required Skill mapping with present level of skill. Gaps are analyzed and recommendations in the form of effective training are employed.
- Course Curriculum, Pedagogy, Tools are reviewed on a semi-annual or an annual basis to modify, Enhance to ensure its effectiveness
- Implementation and continuous monitoring to ensure desired output

11.11.2 AUSTRALIAN TAFE INSTITUTIONS

In Australia, technical and further education or TAFE institutions provide vocational tertiary education courses, mostly qualifying courses under the National Training System/Australian Qualifications Framework &Australian Quality Training Framework. Fields covered include business, finance, hospitality, tourism, construction, engineering, visual arts, information technology and community work.

TAFE institutions are known as colleges or institutes, depending on the state or territory. TAFE colleges are owned, operated and financed by the state and territorial governments. This is in contrast to the other universities, whose funding and management is predominantly the domain of the Commonwealth government.

Structure of TAFE institutions

- TAFE colleges generally award qualifications up to the level of advanced diploma, which is one notch lower than that of the Bachelor degree within the Australian Qualifications Framework. In many instances TAFE study can be used as partial credit course towards Bachelor degree-level university programs.
- From 2002 the TAFE education sector has been able to offer Bachelor degrees and post-graduate diploma courses to fill the existing void in niche areas, particularly vocationally focused areas of study based on industry needs.
- Universities have the ability and power to design and structure their own degree courses. However, Each TAFE degree course must be assessed and approved by the Higher Education Accreditation Committee of Australia

- Some private institutions also offer courses from TAFE's; however they more commonly offer other vocational education and training courses. TAFE courses provide students an opportunity for certificate, diploma, and advanced diploma qualifications in a wide range of areas

Funding

- Students who enroll in these undergraduate degree courses at TAFE are required to pay full fees and are not entitled to Commonwealth Government supported student fee loans, known as HECS loans, but have eligibility in the FEE-HELP loan scheme.
- TAFEs in some states can also teach senior high school qualifications, like the VCE and the Higher School Certificate. Some universities, e.g. Charles Darwin University and Royal Melbourne Institute of Technology, offer TAFE courses; these are funded by the local state and territory governments.

Reasons for Success

- Practical study programs that is hands-on to give participants the skills to become 'job ready'.
- These institutions provide Government-endorsed and industry-recognized Advanced Diplomas, Diplomas and Certificates.
- Large array of courses to chose from including in study in computing, information technology, business and management, hospitality and tourism, as well as in fast-growing new industries such as e-commerce. Over 1,000 courses to choose from including other areas such as art and design, community services and engineering.

11.11.3 Skill development for MSMEs- Philippines

The technical vocational education and training system:

Technical vocational education and training (TVET) is one of the key measures to equip workers with employable and productive skills needed by the industry and the economy in the Philippines. The technical Education and Skills Development Authority (TESDA) is the lead government agency that is responsible for managing this sector

The Philippine technical vocational education and training (TVET) system can be characterized as competency based, accessible and open, flexible and responsive to industry requirements and quality-assured.

The network of public and private TVET institutions provides massive training opportunities, particularly in the light of local and global demand for qualified and highly skilled workers for enhancing productivity and global competitiveness of industries as well as in addressing displacements of workers.

TVET provision is delivered by the network of public and private institutions through the following modes: school-based; centre-based, enterprise-based, and community based technology training programs.

- School-based programs: This refers to the direct delivery or provision of TVET programs by public and private providers, including TESDA administered schools. These school-based programs include post-secondary course offerings of varying duration depending on the Training Regulation.
- Centre-based programs: This refers to training programs being undertaken in the 16 TESDA regional training centers (RTC), 45 provincial training centers (PTC) and specialized centers such as the TESDA Women's Center,

TESDA Training Center Taguig Campus Enterprise (TTCTCE), Korea-Philippines Training Centers as well as private training centers. Program offerings in the centers are also qualification- or TR-based similar to the TVET schools.

- Enterprise-based programs: these programs are implemented within companies/firms and can be any of the following:
    - Learnership Program: practical on-the-job training for approved learnable occupations for a period not exceeding three months. Only companies with TESDA approved and registered learnership programs can hire learners. Learners are absorbed by the companies after training.
    - Dual Training System (DTS): an instructional delivery system that involves two venues of learning – 30% in the school/training centre and 70% in the company/establishment. The training is based on a training plan collaboratively designed and implemented by an accredited dual-system educational institution/training centre and accredited dual system of agricultural, industrial and business establishments.
    - Apprenticeship Program: enterprise-based training undertaken within the company which involves a contract between a trainee and an enterprise on an approved apprentice able occupation. The program serves as a bridging mechanism to enhance the government's skills development and employment facilitation programs and provides new entrants to the labor force with the opportunity to acquire basic skills and work experience, which are of prime importance to employers in hiring new employees.
- Community-based training: these are TVET programs conducted in the communities, mostly in partnership with local government units (LGUs) and NGOs. Programs are usually based on the local skills requirements and resources available in the area.

11.11.4 The German MSME Model

The German Mittelstand refer to small and medium-sized enterprises (SMEs) , either according to the German definition (up to 500 employees andup to €50m annual turnover) or according to the European definition (up to 250 employees or up €50m turnover).

Key Highlights of German "Mittelstand"

- More than 99% of all German firms belong to the "German Mittelstand".
- German MSME's contributes almost 52% of total economic output.
- These companies account for around 39% of the overall turnover of German companies; in 2010 that was approx. €1.91tr.
- It employs roughly 14 million people. That equates to approx. 61% of all employees subject to social security contributions.
- The training provided by the "German Mittelstand" makes a major contribution towards reducing levels of youth employment to 7.9%.
- The international top-line of the German MSME's has been growing for years, and stood at €186.1bn in the year 2010.

Employment and Skill Development

The MSME' ensure that youth unemployment is much lower in Germany than in many European countries. The employment policy of German is also characterized by sustainability. German SMEs make the training of their own pool of young talent a constant focus. In doing so, they benefit from the "dual" system of vocational training, whereby young people both attend school and acquire the necessary practical skills in a company. This dual system of training ensures that Germany produces skilled professionals with need oriented skills. It is also one of the main reasons as to why youth unemployment levels in Germany – currently standing at 7.9% -are the lowest in Europe. As of 2010 end, four-fifths of all trainees amounting to more than 1.35 million of the 1.62 million trainees in Germany received their vocational/on-the-job training in the "German Mittesland".

Important Lessons

- The German model facilitates access to skilled jobs at different levels and facilitates inter-firm mobility. In Germany, young workers are more qualified than the average employee and are therefore able to shift companies, roles.
- Further technical training is only generally provided after initial training in order to reinforce qualifications gained by experience, and to validate promotions based on other required criteria.
- The stability of the apprentice intake during times of lackluster/negative economic growth has also ensured efficiency in vocational training and skill development

11.12 Notable Training Institutions in India

11.11.5 Indo-German Tool Room, Indore[45]

The Indo-German Tool Room is an ISO 9001:2008 certified organization, established in 1995 by GOI with the assistance from Government of Federal Republic of Germany. Land, building and infrastructural assistance, for the institute, has been provided by the state government of Madhya Pradesh. The institute is engaged in the design and manufacture of Plastics Injection Moulds, Press Tools, Die Casting dies, Fixtures & Gauges, Jigs along with other precision job work on CNC machining center, CNC EDM and Wire-cut etc. The Institute also conduct recognized Long, Medium as well as Short-term Technical Training courses for all types of Industries.

Key Objectives

- Develop competitive edge over national and International players.
- Establish internationally acclaimed Centre of excellence in Tool Engineering along with product development and Allied fields.
- Nurture socially relevant skill development program me for improving employment potential.
- Adopt E-teaching including computer based training.

Infrastructure

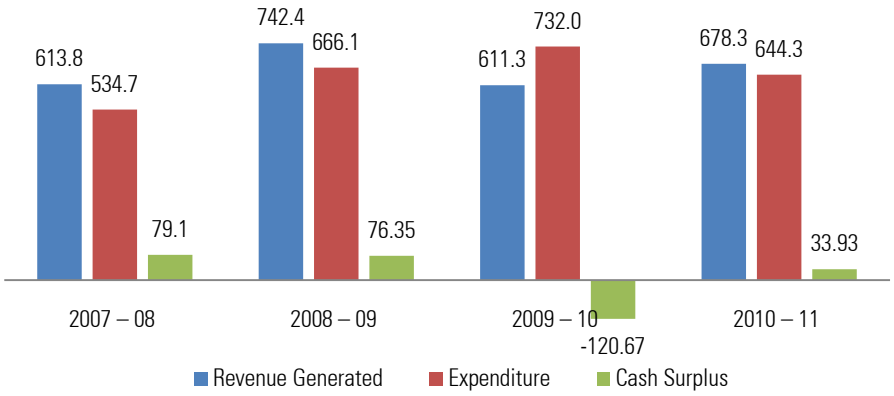
The institute is well known for its well furnished classrooms, modern training workshops, CAD/CAM laboratories with latest software, machine Shops (Conventional & CNC machines), seminar hall and library

Key Details (for the year 2010-11)

- Number of Trainees trained in long term courses – 882
- Number of Trainees trained in short & medium term courses – 3300
- Number of female candidates trained – 258
- Long Term Courses conducted – 7
- Short & Medium Term Courses conducted – 223

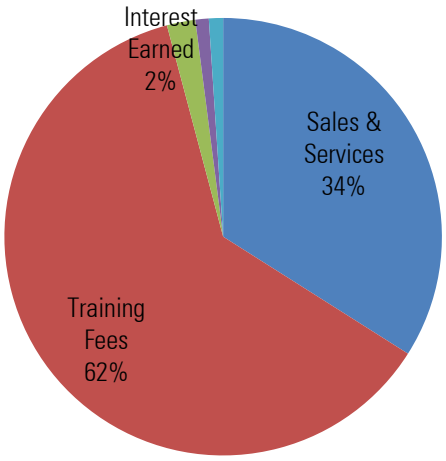
[45] *IGTC Indore, Website*

Financials (in INR lakhs)[46]



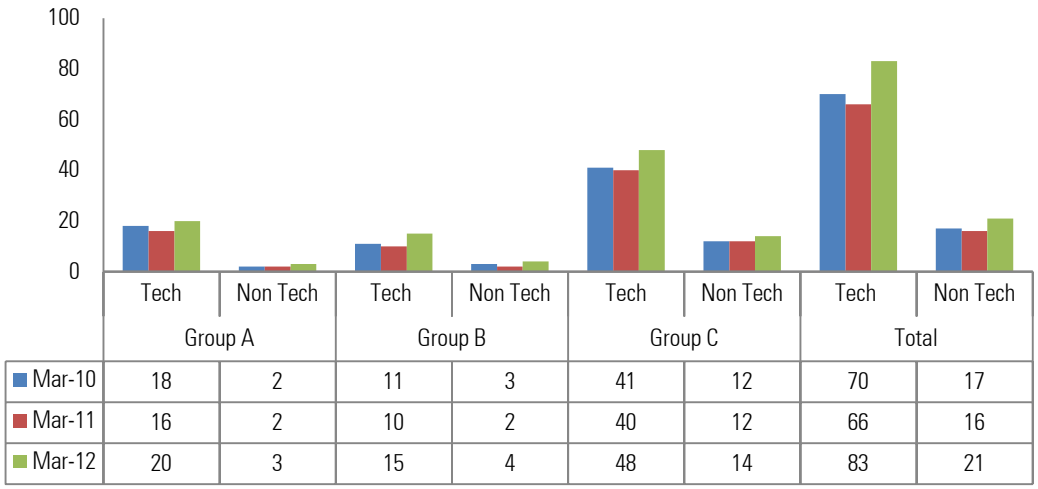
- Revenue Generated per student (considering long, short & medium term courses)– Rs 16218.00
- Expenditure per student – Rs 15407.00
- Revenue generation showing increasing trends

Revenue Mix[47]



[46] *KPMG Analysis*
[47] *KPMG Analysis*

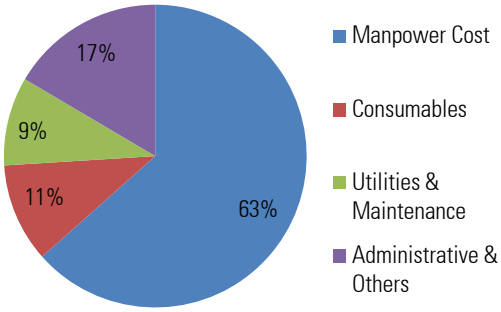
Employee Strength[48]



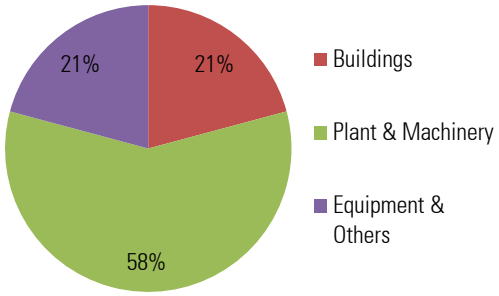
	Group A		Group B		Group C		Total	
	Tech	Non Tech	Tech	Non Tech	Tech	Non Tech	Tech	Non Tech
Mar-10	18	2	11	3	41	12	70	17
Mar-11	16	2	10	2	40	12	66	16
Mar-12	20	3	15	4	48	14	83	21

Operating and Capital Expenditure (2010-2011)[49]

Operating Expenditure



Capital Expenditure



11.11.6 Indo German Tool Room – Aurangabad[50]

The Indo German Tools room was established by the government of India in its endeavor to provide right stimulus for the growth of industry in the country – particularly with an objective of helping MSMEs. It is a combined initiative of

[50] *IGTO Aurangabad Website, KPMG Analysis*

the of Government on India, Government of Federal Republic of Germany & Government of Maharashtra, Indo German Tool Room (IGTR) an ISO 9001:2000, ISO 14001:2004 is a centre which nurtures excellence and provides total tooling & training solutions. IGTR is concentrating on an integrated development of the related segments of the industry by way of providing International Quality Tools, Trained Personnel and Consultancy in Tooling & Related Areas.

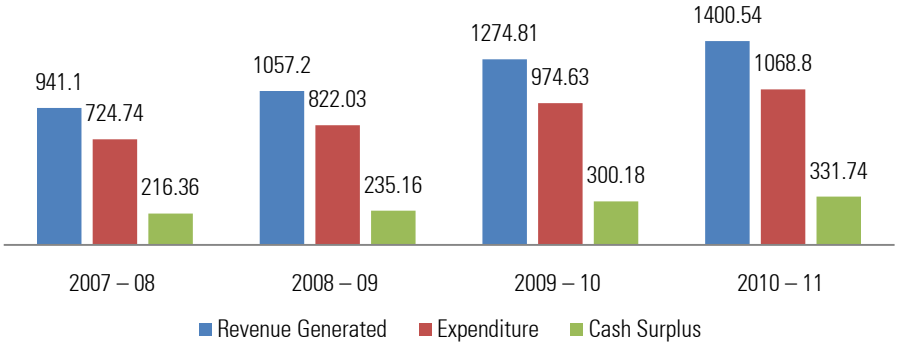
Objectives

- Design and Manufacturing of Quality Press Tools, Die Casting Dies, Moulds, Jigs, Fixtures and Gauges and components as per customer requirements conforming to International Standards.
- Train man-power to the industry through Long Term, Medium Term and Short Term Courses in CAD/CAM/CAE/CNC Machining and Tool & Die Technology.
- Provide Consultancy for Total Tooling Solutions for product development, productivity enhancement and quality improvement.

Key Course details

- Long Term Courses conducted – 8
- Medium Term Courses conducted – 66
- Short Term Courses conducted - 300
- Number of Trainees trained in long term courses – 346
- Number of Trainees trained in medium term courses – 888
- Number of Trainees trained in short term courses - 4434
- Number of females candidates trained – 201

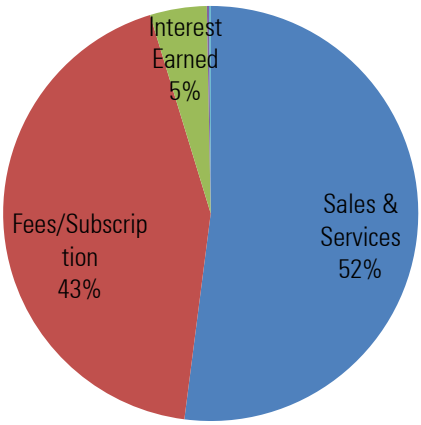
Financials (in INR lakhs)[51]



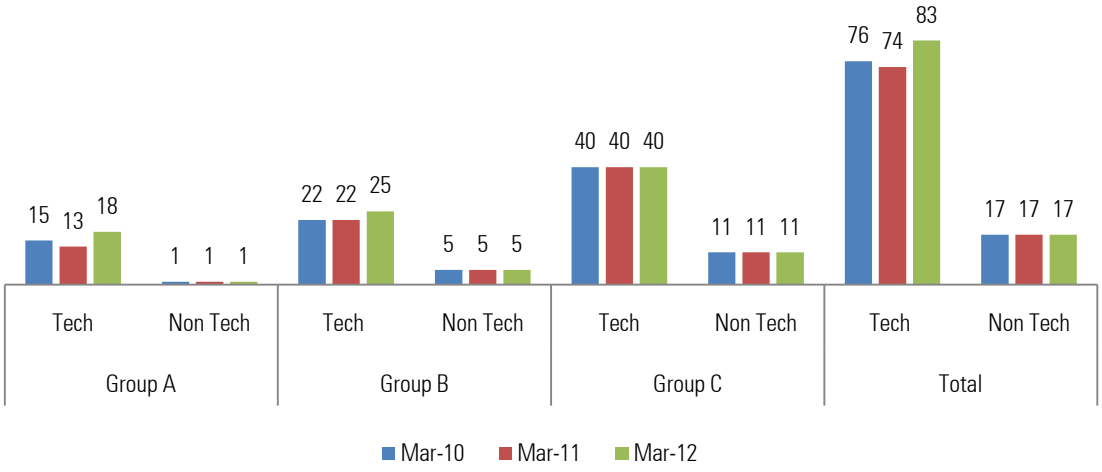
- Revenue Generated per student (considering long, short & medium term courses)– Rs 24709.00
- Expenditure per student – Rs 18857.00
- Profit Per student – Rs 5852.00
- Net Profit Margin - 23.68%

[51] *KPMG Analysis*

Revenue Mix[52]

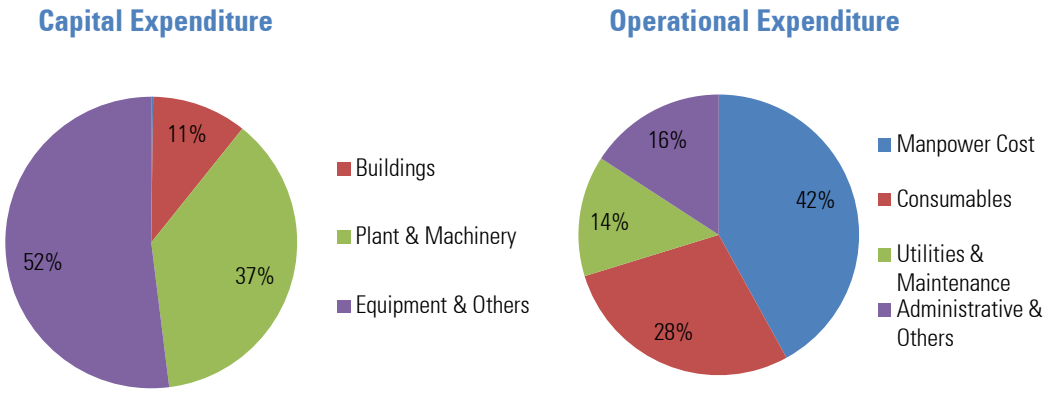


Employee Strength[53]



[52] *KPMG Analysis*

Capital and Operating Expenditure (2010-2011)[54]:



11.11.7 Nettur Technical Training Foundation (NTTF)[55]

The NTTF was established in 1963 with technical support & knowledge transfer from Swiss industries and trainings institutions. The first NTTF Technical Training Center started in Tellicherry, Tamil Nadu in 1959. The NTTF has industrial tie-ups with many corporate such as Tata Steel, Lakshmi Machine Works Limited, SPIC, HBL Power Systems Limited, OEN and AISIN (Japan)

Key Highlights

Number of Training Centers	15
Number of Students	10000 +
Full Time Faculty	Around 600
Organizations covered	Around 320
Industries recruiting annually	400+

Courses Offered

NTTF offers courses under different Engineering verticals such as Mechanical, Electrical, Information Technology and Computer Engineering. NTTF offer Technical Training programs at Certificate, Diploma, Post diploma & Postgraduate levels. The Institute also offers courses under Distance Education, Short Term Courses and CCNA Certification

Infrastructure

- Training programs are operated out of building and land owned by the parent trust
- The Institute possesses a well equipped Electronics laboratory, Computer Laboratory with latest software's & internet facility, Mechanical workshop, Machine and Welding Shop and Well equipped Digital Library
- It also has a Tool & die making sophisticated machines & Design Lab

[55] *KPMG Analysis, NTTF Website*

Financials[56]

- Gross Turnover – Rs 36,46,33,754
- Profit (After Depreciation) – Rs 6,90,19,101
- Net Profit margin of 19%

Operating Expenditure:

Opex Head	Value (INR Crores)
Consumables	1.1
Utilities and Maintenance	3.03
Manpower costs	12.7
Admin expenses	7.4
Financial Charges	0.78

11.11.8 Welding Research Institute, Tiruchirappalli (BHEL)[57]

Welding Research Institute (WRI) was established in November 1975 by Government of India with UNIDO and UNDP assistance under the management of Bharat Heavy Electricals Limited in Tiruchirappalli, India. The institute, on a regular basis, interacts with world renowned institutions for updating the knowledge base on latest technologies and assimilating experience. This Institute has been established to cater to the welding needs of the Indian welding industries and for contributing to the growth of welding and allied technologies.

Main Activities

- Research and Development of various welding processes
- Metallurgical Investigations and dissemination of its research findings
- Consultancy Services

Highlights

Personal Trained	17400 +
Consultancy Services	Around 3500
Organizations covered	Around 320
Number of Patents sealed	105
Awards Won	70
Technical Papers published	1060

Recognitions

- The institute is authorized by Indian Boiler regulations (IBR) for training and certification of welders
- It is also recognized by Bureau of Indian Standards (BIS) and National Hydro Power Corporation (NHPC) for testing of welding electrodes
- The organization's Centre for Doctoral research has been recognized by various institutes such as the IIT's, IISc, NITT, Anna University etc

[56] *KPMG Analysis and Insights*
[57] *Welding Research Institute Website*

Revenue Source[58]:

- The revenue mix mainly consists of fees from the comprehensive regular courses, tailor made programs for sponsoring organizations and consultancy services.
- The Welding & Inspection (W&I) and Certified Welding Inspectors (CWI) are the most popular regular courses at WRI. For 2012-13, The Welding & Inspection program has been scheduled seven times, Certified Welding Inspectors course for six times and the rest of the three programs are scheduled only once.
- WRI provides consultancy services in equipment development, consumable & power source testing, Process & technology development, Metallurgical Investigation, Repair & Reclamation, Distortion Control, Structural Integrity analysis , Remnant life estimation, condition assessment etc.

11.11.9 ESAB Welding Institute, Kolkata[59]

The ESAB Welding Institute is managed by ESAB India, the Indian subsidiary firm of ESAB Global, a leading player in welding & cutting technology. The Institute offers training in welding & allied activities. The institute differentiates itself with state of the art infrastructure and affiliations that it has with national & international bodies.

Courses Offered:

- Welding Course for Engineers and Supervisors
- Reclamation Welding Technology for Engineers and Supervisors
- Productivity through Mig/Mag process for Engineers and Supervisors
- Welding technology for Marine engineers
- Technical Service programs
- Customized Programs

Special Features:

- Authorized AWS Test Centre
- Approved IIW – ATI for Welder Certification (NWTCS)
- Witness Certification of Welders by ABS-IV
- IBR quality welder's training by qualified instructors
- 6GMIG/MAG Welding Training &Trade Test Facility
- SS welding training imparted to RDSO, Railway Ministry

Revenue Mix:

- The revenue mix consists of fees from regular courses, tailor made programs for organizations, consultancy services and various technical services programs
- Larger number of courses and the weekly admission cycle indicate high demand for welding programs

11.11.10 IL&FS Skill Development Corporation Limited (ISDC)[60]

[58] *KPMG Analysis*
[59] *ESAB Welding Institute Website*
[60] *ISDC Website*

ISDC is a Joint Venture between IL&FS and NSDC (National Skills Development Corporation) incorporated in 2011. Largest PPP (Public Private Partnership) programs to set up in skill training and vocational education arena in India. The key mandate of ISDC is to bridge the skill gap by building and managing 100 multi skill schools across India in 4 years and to train & skill around 2 million persons by 2021

Facilities

Location	Training Block Area (in sq ft)	Hostel Capacity	Area per student (sq ft)
Palladam	11000	360	30.55
Rourkela	8000	256	31.25
Sricity	15000	N/A	N/A
Bhilwara	18000	144	125

Core Competencies

- This Institute is a preferred government partner in skills training
- The ISDC possesses more than 600 industrial partnerships
- Excellent relations & linkages with the job market
- Curriculum designed as per industry demands
- High quality, certified trainers
- Industry simulated infrastructure and training environment

Partnerships[61]

- Tie-up with IETS (Group Company) for content development and for the "Train the Trainer programs"(for consideration of 3 crores for 4 centers)
- Industry Partnership with Retailers Association of India, The Scandinavian Business Academy, Clothing Industry Training Authority, Zentralverband des Deutschen Handwerks
- Knowledge Partnership with German Chamber of Skilled Arts and UK-India Education Research Initiative

Courses Offered

2D Animation	CNC Operator	Hardware & Networking	Medical Transcription
Advanced Welding – Non BPL	Computer Operator	Hardware Maintenance	Refrigerator & AC Maintenance
Basic Welding	Electrician	Hospital Assistant	Retail Management
BPO Non Voice	Fitter	Hospitality Management	Security Personnel
BPO Voice	Food & Beverages	Financial Services Manager	Software Developer JAVA
Civil Supervisors	Garment Checker & Finisher	Leather & Rexene Goods Maker	Weaving Machine Operator

[61] *ISDC Website and KPMG Analysis*

11.13 Best Practices- Accreditation and Quality assurance[62]

11.11.11 New Zealand- Standard One

New Zealand has created the New Zealand Quality Control Association (NZQA) to ensure consistency and quality of training delivered by institutes. The NZQA's primary function is to coordinate the administration and quality assurance of national qualifications in New Zealand. This includes dealing with the quality assurance of training providers and their courses, moderation of assessment activities and processes, including:

- provide an overarching quality assurance role in the tertiary sector
- quality assure national qualifications
- quality assure qualifications offered by private training providers
- quality assure assessment procedures and processes at secondary schools

The overall role of the New Zealand Qualifications Authority is to be the independent and impartial expert organization, which can be relied upon to administer robust National Qualifications Framework assessment systems and provide reliable quality assurance systems that deliver on statutory accountabilities. With this it seeks to facilitate qualifications which are accepted as credible and robust, nationally and internationally. To achieve this, NZQA has developed "Standard One" criteria as a comprehensive framework of provider quality, which assesses the educational mission, inputs, processes, assessments and outputs. As part of this, NZQA (along with industry associations) has developed 18,000 competency-based standards to assess the skills of graduates. These standards correspond to modules of training of education which are developed with sector-based Industry Training Institutions.

11.11.12 Switzerland- Vocational Education & Training Ordinance[63]

Switzerland employs a nodal independent coordination body, which oversees and coordinates vocational education and training in the country, while involving and leveraging all key stakeholders. This body also owns the accreditation framework while delivering the other broader roles as well. In Switzerland context, it has set of Vocational Education Training (VET) ordinances which are prepared jointly prepared by the government and professional organizations, and are issued by the Federal Office for Professional Education and Training (OPET). The VET ordinances govern following aspect related to an occupation and training:

- Content of the training
- Occupational profile and the technical, social, and personal skills criteria that workers must meet in that profile
- Qualification and assessment procedures
- Roles of the vocational institute, host company and industry training institutes

[62] *Accreditation and quality assurance in vocational education and training- ECDVT report*
[63] *Transforming India's skill development landscape- FICCI sponsored*

However, the need to balance the flexibility in the curriculum and standardization is met through Commissions for Quality and Development. Each commission has representation from government and industry players. These commissions are responsible for adapting the training plans to current labor market needs. And any changes required could be submitted as a request to federal office for professional education and training.

11.11.13 Ireland- Further Education and Training Accreditation Council (FETAC)

In Ireland, the Qualifications (Education and Training) Act of 1999 created a new legislative framework for a more coherent high quality VET system. In 2001, the Further Education and Training Awards Council (FETAC) was established as the single national awarding body for further education and training.

The awards are publicly recognized qualifications of the national qualification framework (NQF). FETAC makes awards to learners on a broad range of programmes offered by different types of VET providers and has a comprehensive strategy to assure the quality of the programmes leading to its awards. This strategy involves three coordinated separate functions, including elements of quality assurance, formal accreditation and continuous monitoring.

Quality Assurance: All VET providers offering FETAC awards are required to have a quality assurance system agreed by FETAC. A provider must be able to demonstrate its capacity to monitor, evaluate and improve the quality of programmes and services it offers to learners. Providers who demonstrate this capacity are registered with FETAC and may offer awards from the national framework of qualifications

Quality Validation: FETAC validates programmes submitted by VET providers whose quality assurance procedures have been agreed. Validation is seen as the process by which a programme is evaluated, before it is delivered, and to ensure that the programme can provide a learner with the opportunity to achieve a specific award;

Quality Monitoring: FETAC monitors and evaluates programmes along and after their delivery by providers. Monitoring consists of multifaceted information on providers' programmes, services and the quality assurance systems which support them. If the evaluation of this information indicates it is necessary, either validation of the programme or agreement on the quality assurance procedures can be reviewed.

11.11.14 Sweden- Swedish Agency for Advanced Vocational Education

The Swedish Agency for Advanced Vocational Education is responsible for approving and accrediting continuing training courses according to quality standards. The agency, which is independent but steered by the Swedish government, operates nationwide and supports recognized training courses with its financial grants. It must also ensure that every curriculum maintains the proper level of quality at all times.

The accreditation consists of several steps taken in sequence within a given time frame:

- Formal approval of the course;
- General quality inspection;
- Follow-up survey;
- General quality revision.

Before a new course is started formal approval has to be given so that the agency will pay grants to students and to providers. Each application is independently rated (and cross-checked) by two members of the agency according to different criteria, with the existence of a provider internal quality management system being a precondition. Further, there must be an educational board, with both external stakeholders and students represented, for each VET provider. For continuing training there is no explicit verification but an implicit mechanism which assures that the need for a certain training course is approved. Continuing training is based on cooperation between potential employers and VET providers, which quite often are the municipalities.

The advantage of this collaboration is that potential employers know what needs they are likely to have, and VET providers know about the educational requirements needed to meet those needs in the best way. The VET provider applies for grants but the content and the curricula for new training courses are developed by including the most relevant stakeholders, namely local employers, the municipalities and even representatives from higher education. Thus, courses are highly customized. Before being approved, the VET provider is screened for competence in addressing gender policies and the specific needs of socially disadvantaged groups, such as through application of adapted recruitment strategies.

After one year general quality inspection takes place which takes into consideration a self-evaluation report from the provider, with assessments from the students an integral part. Other sources for this second step of the accreditation process are a report from the education board as well as feedback and complaints from the students who might have directly contacted the agency.

In the second year, after the first course has come to an end, a follow-up survey including all students is carried out by the agency addressing their degree of satisfaction with the training, their employment situation after the course and the usefulness of the acquired skills at their workplace.

Finally, after four years of practice a general quality revision of the relevant course, its contents and curriculum is undertaken, in which all available data are reviewed and evaluated.

Approved training courses receive a label which serves as proof for potential customers that the course is quality-assured by the national agency. The reports and the ratings of the agency are made public and thus might be used by customers as additional sources of information.

To date, there are no benchmarking activities in Sweden between VET providers and training courses and no links are made between the output achieved by the VET provider and the amount of public funding.

11.11.15 Germany- Two Step Accreditation System

In Germany a two-step accreditation system has been put into practice, consisting of certification and accreditation procedures. In the regulatory framework the external assessment of VET providers and their training courses is called certification and licensing, and the bodies which do the licensing are called certification agencies or centres of expertise. To carry out their activities, these agencies or centres have to be accredited first by the Federal Agency for Labour, the former public employment service), which acts as the overall body for accreditation

VET providers have to apply for their certification and for the licensing of their courses to a private agency, which must be accredited by the national body. Certification agencies can apply for nationwide accreditation but also for accreditation that is limited to a specified economic or educational sector or regional territory. Accreditation of

certification agencies is temporary, only for a period of three years at the most. Additionally, every year the system for quality assurance and quality development has to be verified by the national accreditation body. An accreditation council has also been established to advise the national accreditation body and to draft recommendations for accreditation and certification procedures. This council has nine members: representatives from both the Federal Ministry of Economy and Labour and the Federal Ministry of Education and Research, a representative from the trade unions, employer organizations, organizations of VET providers, and three independent scientific experts.

To benefit from public funding, VET providers must be certified by an accredited certification agency and their training courses must be licensed. VET providers can apply for nationwide certification, for training activities in certain economic or educational sectors or for training activities in certain regions. To pass the certification procedure, VET providers have to prove their financial efficiency and educational capacity, and to fulfill a number of detailed requirements, including:

1. The capacity to support the integration of their trainees into employment;
2. The qualifications, professional experience and participation in further training of teachers and trainers;
3. An efficient system for quality assurance and quality development including:
    - Customer orientation;
    - Continuous evaluation of training courses based on the use of indicators and measurement;
    - Continuous improvement of training provision;
    - Cooperation with external experts for quality development

Providers have to demonstrate that they fulfill further criteria for licensing training courses to be funded with public money, having taken into consideration:

1. The preconditions of proposed training target groups;
2. Their perspectives for integration into employment;
3. Organization of learning processes preparing for a recognized graduation, or at least part of this;
4. Clearly defined time frame for the training course, including adequate practical working experience.

The certification agency determines which VET providers are to be certified and licensed. In the case of a negative decision, the VET provider can subsequently improve the criteria which had not been accepted within three months; if not, the application will be rejected. Following a positive decision, a certificate is granted by the certification agency and can be used by the VET Accreditation and quality assurance in vocational education and training: Selected European approaches provider as a label for quality in its information and marketing activities.

Certification is always limited for a maximum period of three years. Every year, however, a monitoring audit has to be carried out by the certification agency, focused on the VET providers' quality management system.

From a European perspective it is interesting to note that agencies accredited in a similar procedure in another EU Member State are of parallel status to agencies certified in Germany. In the German system the State or semi-State organizations are not involved in accreditation of VET institutions, offering opportunities for further deliberations on the education system. Together with the possibility for VET providers to choose freely the certification agency they

would like to cooperate with, the German system is quite advanced as a highly self-governed educational system. With the recognition of certification agencies accredited in foreign countries, it can be classified as being fit for a European approach.

11.11.16 Important Lessons for Indian Context

In Indian context, Quality Council of India (QCI) is the nodal body responsible for quality assurance and accreditation for educational and vocational training providers. Quality Council of India (QCI) was set up jointly by the Government of India and the Indian Industry, to establish and operate national accreditation structure and promote quality through National Quality Campaign. QCI is registered as a non-profit society with its own Memorandum of Association. QCI is governed by a Council of 38 members with equal representations of government, industry and consumers. Chairman of QCI is appointed by the Prime Minister on recommendation of the industry to the government[64].

While the Indian accreditation and quality assurances structure is similar to other countries, there are some areas which could be learnt and adopted from other practices for Indian context:

- **Equal focus on Quality Assurance on Process/Output**: As a part of quality assurance, over and above the assessment of inputs such as land, labs, infrastructure etc, process quality measures & output quality measures should also be given equal weight age. Process quality factors includes factors such curriculum design, teaching methods, examination and evaluation procedure etc. Whereas the output quality factors includes factors such as placement ratio. Feedback from employers etc. Higher accountability on these factors shall lead to a focus on achieving success on success measures which are relevant for students and companies.
- **Students' participation in Quality Validation**: Students should be actively involved in validating the quality assurance of on-going training programs. Quarterly feedback surveys with students will help to understand the gaps experienced by them during the course of training.
- **Independent agency to audit institutes:** An independent agency could be hired to audit affiliated institutes based upon inputs, process and output qualities. The institutes who are able to maintain the desired rating on all input, process and output parameters for some stipulated time may be incentivize through government funding.

[64] *http://qcin.org/about.php*

11.14 Industry players who participated in the survey

S. No.	Sub-Sector	Name	Region
1	Agricultural Machinery	Mahindra & Mahindra	West
2	Construction Equipments	Gujarat Apollo	West
3	Construction Equipments	Larsen & Toubro	West
4	Light Engineering Goods	SKF India Ltd	West
5	Light Engineering Goods	Welspun Corp	West
6	Light Engineering Goods	HYDRO PROKAV PUMPS INDIA PRIVATE LIMITED	South
7	Machine Tools	Grindwell Norton Limited	North
8	Machine Tools	HMT Machine Tools Limited	South
9	Machine Tools	Lakshmi Machine Works Ltd.	South
10	Machine Tools	Bharat Fritz Werner Ltd.	South
11	Machine Tools	Batliboi Limited	West
12	Machine Tools	Larsen & Toubro	West
13	Machine Tools	Micromatic Machine Tools	North
14	Machine Tools	Lokenath Chatterjee & Sons (Precision Tools) Pvt. Ltd.	East
15	Machine Tools	Maa Alloys Pvt. Ltd.	East
16	Machine Tools	Hariss Machines Pvt. Limited	North
17	Machine Tools	Rimaco Industries	North
18	Machine Tools	Industrial Tooling Services	South
19	Machine Tools	ELRKE INDUSTRIAL ENTERPRISES	South
20	Machine Tools	Sridevi Tool Engineers Pvt.Ltd	West
21	Machine Tools	Vora Industries Ltd.	West
22	Machine Tools	Plus-One Machinefabrik Pvt. Ltd.	South
23	Plastic, Paper Rubber	ASB International pvt Ltd.	North
24	Plastic, Paper Rubber	Ferromatik Milacron India Pvt. Ltd.	West
25	Plastic, Paper Rubber	Mamata Machinery Group	West
26	Plastic, Paper Rubber	Windsor Machines Limited	West
27	Plastic, Paper Rubber	Sidel India	North
28	Plastic, Paper Rubber	Steer Engineering Pvt. Limited	South
29	Plastic, Paper Rubber	Nypro Forbes	South
30	Plastic, Paper Rubber	Neo Plast	West
31	Plastic, Paper Rubber	KRAFTSMAN TOOLING PVT LTD	West
32	Power & Electircal Equipments	Alstom T&D India Limited (new name)	North
33	Power & Electircal Equipments	Emco Limited	West

34	Power & Electircal Equipments	Thermax India	West
35	Process Plant Machinery	BGR- Oil & Gas Equipment Division	South
36	Process Plant Machinery	EDAC Engineering Limited	South
37	Process Plant Machinery	ISGEC	North
38	Process Plant Machinery	TITANIUM TANTALUM PRODUCTS LTD	South
39	Process Plant Machinery	Chemtrols Indistries Limited	West
40	Process Plant Machinery	Kevin Enterprises Pvt Ltd	West
41	Process Plant Machinery	BOHLER Welding Group India P. Ltd.	West
42	Process Plant Machinery	Siraga India P Limited	West
43	Process Plant Machinery	Oriental Enterprise Private Limited	West
44	Process Plant Machinery	Positive Metering Pumps (I) Pvt Ltd	West
45	Process Plant Machinery	Larsen & Toubro	West
46	Textile Machinery	Lakshmi Machine Works Ltd.	South
47	Textile Machinery	Rieter India Pvt. Limited	West
48	Textile Machinery	Lagan Engineering Co. Ltd.	East
49	Textile Machinery	Dalal Engineering Pvt. Ltd.	West
50	Textile Machinery	InspirOn Engineering Pvt. Ltd.	West
51	Textile Machinery	Yamuna Machine Works	West
52	Textile Machinery	Alidhra Weavetech Pvt. Ltd.	West

11.15 Training institutions who participated in the survey

S. No.	Name	Region	Type
1	CENTRAL TOOL ROOM & TRAINING CENTRE	East	Government
2	The George Telegraph Training Institute	East	Private
3	Don Bosco Technical Institute	East	Private
4	Govt Industrial Training Institute, Tollyganj	East	Government
5	Institute of Jute Technology	East	Government
6	Govt Industrial Training Institute Gariahat	East	Government
7	Industrial Training Institute for Women	East	Government
8	Government Industrial Training Institute, Maliviya Nagar	North	Government
9	Government Industrial Training Institute, Nizambudin	North	Government
10	AMRITA SCHOOL OF ENGINEERING-Amrita Vishwa Vidyapeetham,	South	Private
11	GEDEE TECHNICAL TRAINING INSTITUTE	South	Private
12	MSME - TOOL ROOM (CENTRAL INSTITUTE OF TOOL DESIGN, HYD)	South	Government
13	MURUGAPPA POLYTECHNIC COLLEGE	South	Private
14	NETTUR TECHNICAL TRANING FOUNDATION [NTTF]	South	Private
15	INSTITUTE FOR DESIGN OF ELECTRICAL MEASURING INSTRUMENTS (IDEMI),	West	Government
16	INDO GERMAN TOOL ROOM - Indore	West	Government
17	INDO GERMAN TOOL ROOM - Aurangabad	West	Government

11.16 Industry Associations who participated in the survey

Sub-sector	Association Concerned
Machine Tools	Indian Machine Tools Manufacturers' Association (IMTMA) Tool & Gauge Manufacturers Association of India (TAGMA)
Power & Electrical Equipments	Indian Electrical and Electronics Manufacturers Association (IEEMA)
Textile Machinery	Textile Machinery Manufacturers' Association (TMMA)
Plastic, paper and rubber machinery	Plastics Machinery Manufacturers Association of India (PMMAI)
Light Engineering Goods	Engineering Export Promotion Council (EEPC)

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- A strong cross functional team with expertise of Consulting, Corporate Finance, Tax teams – focused on education sector
- Working closely with Central Govt., MoHRD, State Govts, Apex bodies and funding agencies
- Use of robust proprietary tools and methodologies assuring quality delivery to our clients

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