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Human Resource and Skill Requirements in the Electronics & IT Hardware Sector (2022) – A Report

Human Resource and Skill Requirements in the Electronics and IT Hardware Industry

Study on mapping of human resource skill gaps in India till 2022

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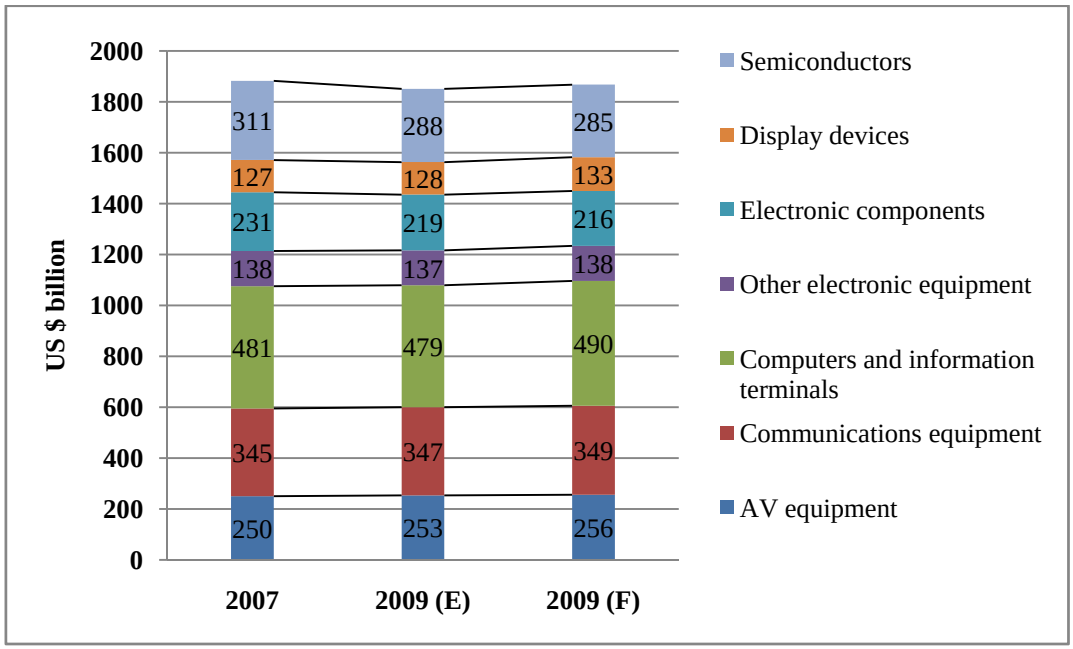
1. Environment Scanning and Competitiveness of Electronics and IT Hardware Industry

1.1. Overview of the Global Electronics Industry

The global Electronics Hardware and Information Technology (IT) industry is valued at US $ 2.5 billion. Out of this, the global Electronics Hardware industry[1] had a production of US $ 1.85 trillion in 2008. This is expected to reach US $ 1.86 trillion in 2009[2]. While the industry was on a growth path, the recent rapid growth in industry production which was the result of strong consumer spending backed by economic expansion in emerging economies came to a sudden halt in 2008. It is expected that 2009 would see a single digit growth unlike the double digit growth witnessed in the past.

The global market size and major segments are indicated below.

Figure 1: World electronics hardware production and major segments (in US $ billion)



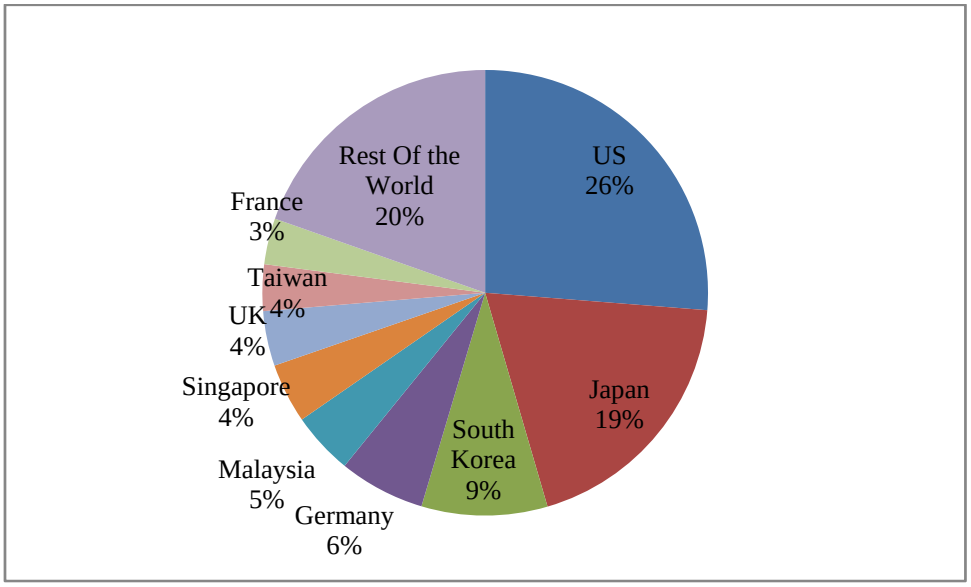
Source: Japan Electronics and Information Technology Industries Association (JETIA) and IMaCS analysis

However, despite the current downturn, it is expected that the global Electronics Hardware industry has a potential to clock US $ 3.2 trillion[3] in revenues in the next five years growing at a CAGR of about 9.5% once the economy recovers.

[1] Net of IT solution services
[2] Japan Electronics and Information Technology Industries Association (JETIA)
[3] BCC Research

The US is the market leader with a share of 26 % followed by Japan with a share of 19%.

Figure 2: Share of major producers of Electronics Hardware



With 5 out of top 10 countries, Asia dominates the electronics market. India has a share of mere 0.7% of the total production.

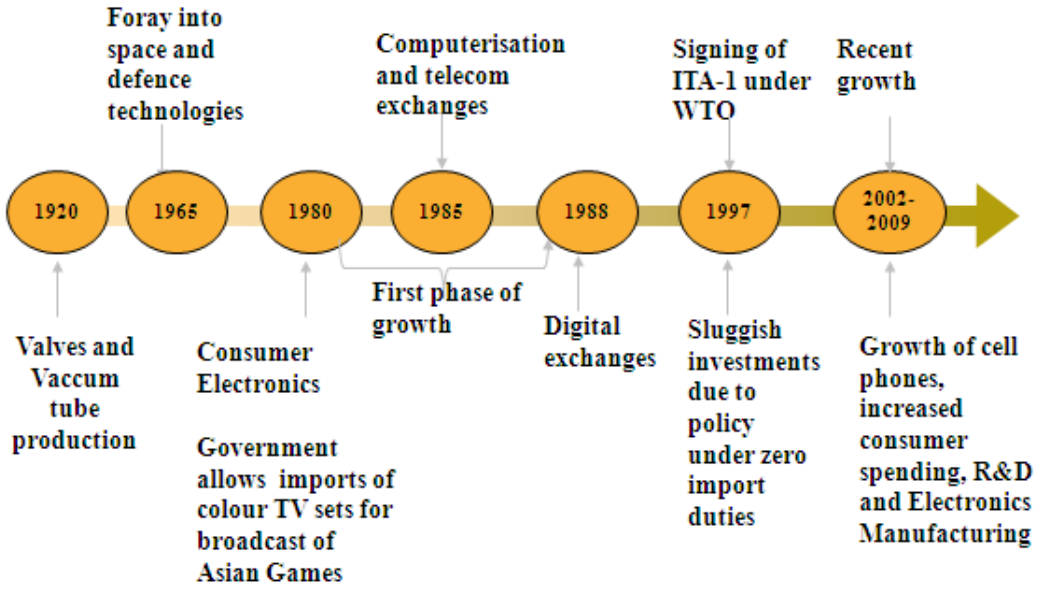
1.2. Overview of Indian Electronics and IT Hardware sector

The evolution of India's Electronics Industry from its initial forays into production of valves and space technologies, till date, is presented below.

The consumption of Electronics was US $ 28 billion in 2005. It is estimated that the demand for electronics (consumption) in India will be US $ 126 billion in 2010 and US $ 363 billion in 2015.[4] Out of this, the Indian Electronics and IT Hardware[5] sector production amounted to Rs. 947 billion in 2009[6] and has grown at a CAGR of 16.4% since 2002.

[4] Council of Electronics Hardware Associations (CEHA)
[5] Henceforth, the use of the terms 'Electronics' and/or 'IT Hardware Industry' in the Indian context refers to 'production' in India during the course of this report, i.e., domestic production for local consumption and exports.
[6] Annual Report 2008-09 of Department of Information Technology, Government of India

Figure 3: Evolution of Indian Electronics and IT Hardware Industry



Source: IMaCS analysis

The high growth rate has been supported by healthy Foreign Direct Investment (FDI) inflows. FDI in Electrical Equipments (which includes Electronics) has varied between 17% to 22% of total inflows and is estimated to be US $ 4.2 billion in 2007.

Table 1: Production and growth of Indian Electronics and IT Hardware Industry (in Rs. billion)

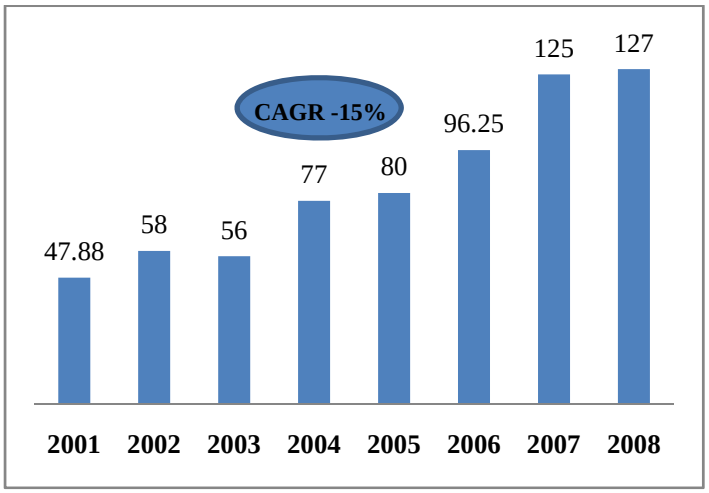
	2002	2003	2004	2005	2006	2007	2008	2009	CAGR
Consumer Electronics	127	138	152	168	180	200	226	260	10.8%
Computers[7]	36	43	68	88	108	128	159	135	20.8%
Telecom Equipment	45	48	54	48	70	95	187	260	28.5%
Strategic Electronics	18	25	28	30	32	45	57	68	20.9%
Components	57	66	76	88	88	88	96	96	7.7%
Others[8]	45	56	61	83	88	104	119	128	16.1%
TOTAL	328	375	438	505	566	660	844	947	16.4%

Source: Annual Report 2008-09 of Department of Information Technology, Government of India

[7] Also referred to as IT Hardware
[8] Mainly consists of the Industrial Electronics'

India exports around 17% of its total electronics hardware production. Exports in FY2008 were Rs.127 billion[9]. Indian Electronics Hardware exports have shown steady growth rates of 15% (CAGR, between FY 2001 to 2008), yet India remains a net importer with electronics imports of over Rs.700 billion in FY 2008.

Figure 4: Electronics hardware exports in Rs. billion



Source: ELCINA

1.3. Key segments in the Indian electronics hardware sector

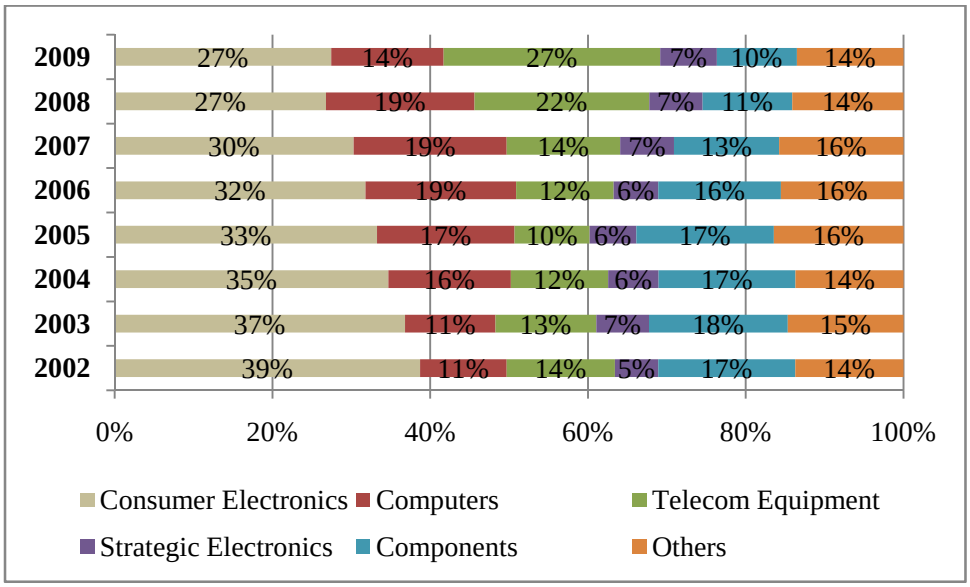
The Indian Electronics and IT Hardware sector has 6 key segments, namely Consumer Electronics, Industrial Electronics, IT Hardware, Telecommunication Equipment, Electronic Components, and Strategic Electronics. Consumer Electronics and Telecom Equipments are the largest segments with about 27% share each in total production.

The table in the previous section gives the size and growth rates of individual segments.

As can be seen from the figure below, while Consumer Electronics has traditionally been the largest segment, Computers and Telecommunication Equipment have increased their share in the industry in recent times.

[9] ELCINA, Annual Report 2007-08, Department of IT, Government of India

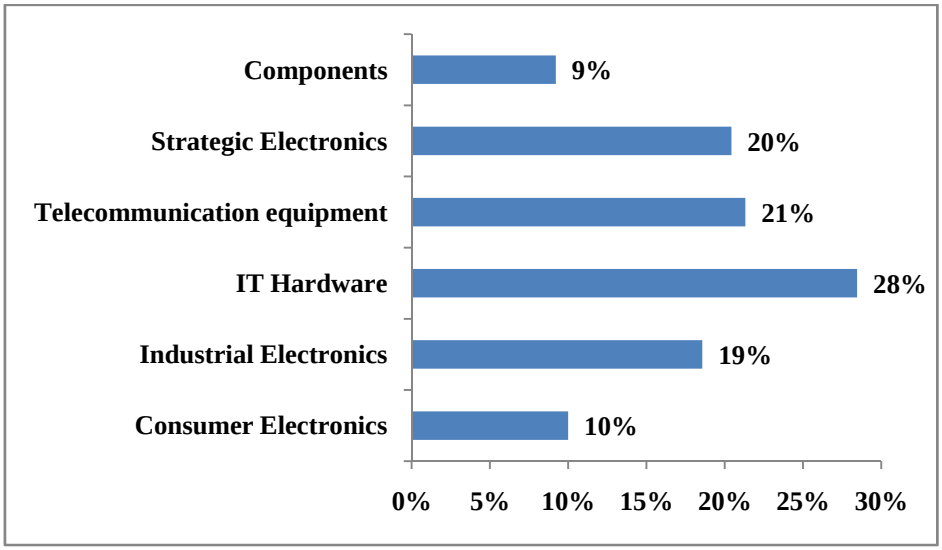
Figure 5: Changing structure of the Indian Electronics and IT Hardware Industry



Source: Department of IT and IMaCS analysis

Telecommunication Equipment and IT Hardware are the *fast growing segments* with CAGR (FY 2002 to 2008) of 21% and 29% respectively. These segments have witnessed high growth rates due to the advent of IT and growth in the Indian Telecom Industry.

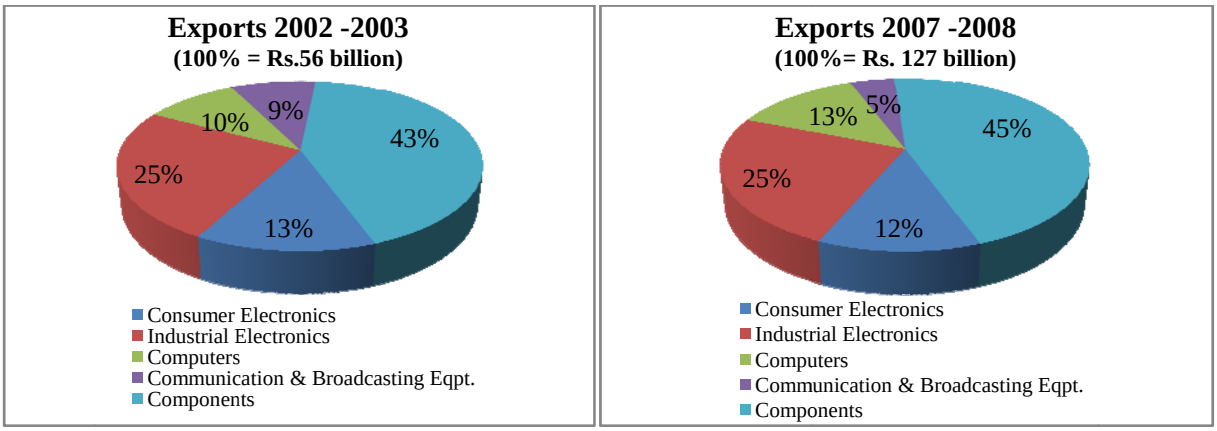
Figure 6: Growth rates of key segments CAGR (FY 2002 to FY 2008)



Source: IMaCS analysis

The share of the segments in exports has remained largely unchanged from 2003. Electronic components constitute the major proportion of exports with a share of 45% in FY 2008.

Figure 7: Export contribution from various segments



Source: ELCINA

In the following sections, we shall understand the profile of various segments introduced above.

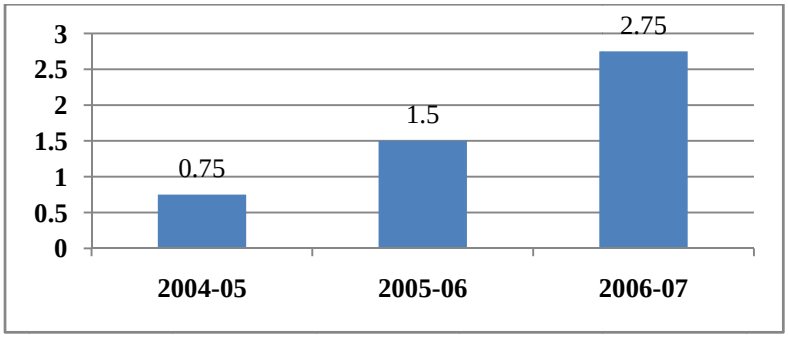
1.4. Consumer Electronics

Consumer Electronics has traditionally been largest segment in the Electronics and IT Hardware industry. It contributes to roughly 28% of the industry production of Electronics in the country. The segment had an estimated turnover of Rs. 260 billion in 2009.

Consumer electronics comprises of products like televisions, audio and video systems, set top boxes (STB), washing machines, air conditioners and mixers amongst others.

The colour television (CTV) segment is the largest contributor to the Consumer Electronics segment with estimated sales of over 15 million units in FY 2008. While Flat TV accounts for 55% of domestic TV production, hi-end products, particularly LCD TV and Plasma TV are gaining popularity. Sales of STB have increased at over 85% in the recent past.

Figure 8: Sale of STB (million units)



Source: CEHA and IMaCS analysis

The air conditioner (AC) market has seen steady growth with a strong preference for split AC units over window AC units. Split ACs account for about 64% of sales of ACs (in value terms).

DVD players segment continued to grow with sales of 7 million units in FY 2007 to 2008. Introduction of CAS and expansion of DTH has fuelled demand in STB and home theatre segments.

Apart from manufacturing, the functions of marketing, sales and distribution are major components in the value chain in Consumer Electronics. After-sales support and spare parts sales are continuous sources of revenue in consumer durables such as washing machines, water purifiers, lifts, and ACs. Most manufacturers offer annual maintenance contracts to consumers.

Despite the recent economic downturn, the Consumer Electronics Industry has been on a growth path and is expected to achieve sales growth of 15% over the previous year and clock Rs. 260 billion in revenues in 2009[10].

1.5. IT Hardware

IT Hardware is one of the fastest growing segments with CAGR of 21% (FY 2002 to 2009). The production of this sector in FY 2008 was Rs. 159 billion. In FY 2009, this came down to Rs. 135 billion on account of the economic slowdown.

IT Hardware segment includes personal storage devices, printers, servers, Personal Computers (PCs), supercomputers, data processing equipment and peripherals such as monitors, keyboards, disk drives, plotters, SMPS, modems, networking products and add-on cards.

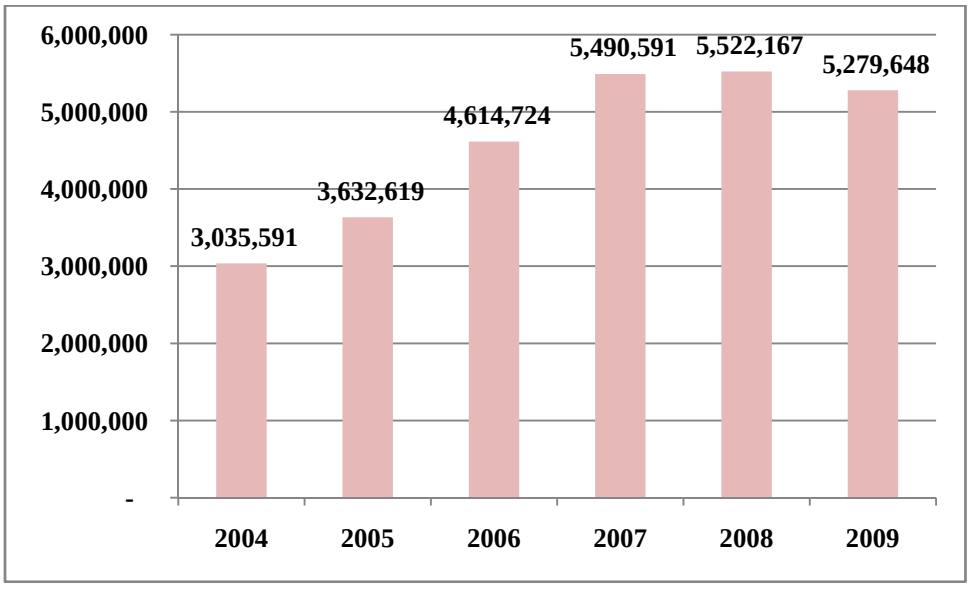
1.5.1. Personal Computers

PCs consist of desktops and laptops/notebooks. Total PC sales are expected to be about 7.2 million in FY2009. About 70% of PCs demand is from office segment and 30% from home segment. In half-year terms, PC sales recorded a 12% growth over H1-2007-08 but declined by 9% over H2-2007-08.

Desktop sales are expected to dip to 5.3 million in 2009. Sales in desktops are recording much lesser growth (6%) as compared to laptops (growing at well over 100%) in the last three years.

[10] Outlook India, March 26, 2009

Figure 9: Number of desktops sold

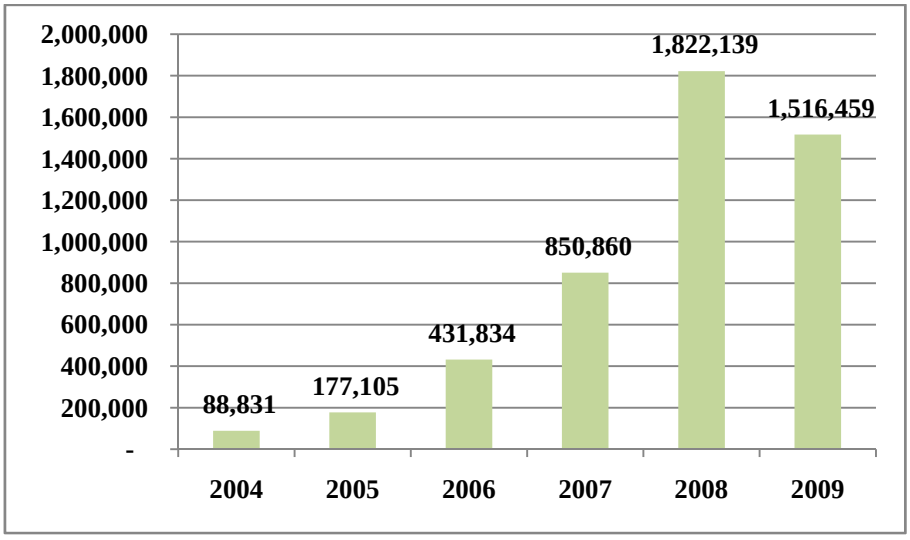


Source: MAIT

In half-year terms, the sale of laptops increased 13% in H12008-09 to touch 0.77 million units. However, this was 32% lower as compared to H2-2007-08. In the long term, notebooks will grow at a much faster pace than desktops.

Till recently, this segment was dominated by local assemblers and some branded Indian companies. A number of MNCs (such as Compaq, HP, IBM, and ACER) are now assembling PCs locally and have started focusing on satellite towns and cities for sales. Wipro and Zenith are the domestic market leaders.

Figure 10: Number of laptops sold



Source: MAIT

Increasing incomes, education requirements, e-Governance initiatives, Common Service Centre (CSC) schemes, and the penetration of internet and broadband services have fuelled the demand in this sector. This segment was dominated by local assemblers and some branded Indian companies until recently. A number of MNCs (such as Compaq, HP, IBM, DELL and ACER) have entered the Indian space.

However, it should be noted that much of the production of IT Hardware in India is still largely dominated by assembly and packaging, and not production of high end IT sub-assemblies.

1.5.2. Other IT Hardware Equipment

The following table presents the market size and growth for various other products in the IT Hardware sector in 2007.

Table 2: Market size and growth of other IT Hardware Equipment in 2007

Product	Market Size	Growth
Servers	90,000 units	About 1%
Routers and Switches	US $ 320 million and US $ 440 million respectively	36% and 25% respectively
Networking Products		
Hubs	192,000 units	33%
Network Interface Cards	4.2 million units	15%
Modems	0.85 million units	43%

Source: MAIT

1.6. Telecommunication Equipment

Telecommunication equipment is the second fastest growing segment after IT hardware. The estimated production of this segment in FY2009 was Rs. 260 billion.

The segment includes digital exchanges (EPABX, RAX, TAX and MAX), transmission equipment (HF/VHF/Microwave trans-receivers), satellite communication terminals, optical fibre communication equipment, two-way radio communication equipment.

Communication technology has taken a big leap forward and received national recognition as a key driver for development and growth. India has taken a leading position in the mobile handsets market.

Mobile subscriber base has crossed 300 million and is expected to touch 500 million by 2010. The number of active internet entities[11] is expected to be 8.6 million in March 2009.

Some of the world renowned mobile set manufacturers, like Motorola, Samsung, Sony Ericsson and LG have set up production bases for mobile handsets in the country.

Recently, the segment has seen a number of service providers such as MTS, Swan, and Virgin entering the segment, increasing the demand for telecommunication infrastructure products and services.

1.7. Electronic Components

The electronics components segment primarily supplies to consumer electronics, telecom, defence, and information technology sectors. The components produced in India at present include TV picture tubes, monitor tubes, diodes and transistors, power devices, ICs, hybrid microcircuits, resistors, capacitors, connectors, switches, relays, magnetic heads, DC micro motors and tape deck mechanism, Printer Circuit Boards (PCB), crystals, loudspeakers and hard and soft ferrites. The growth of electronic components depends on the growth of the other constituents of IT Hardware and Electronics sector to which it supplies.

The world's top five mobile handset makers - Nokia, Motorola, Samsung, Sony-Ericsson and LG have their manufacturing bases in India. Presence of global majors like Flextronics, Jabil and Elcoteq is creating potential for a quantum jump in hardware manufacturing in India and should have a downstream impact by stimulating demand for components and assemblies.

Most of the top global semiconductor companies have set up their chip design centres in India. The semiconductor products that are expected to drive the revenues are:

- Microprocessor driven by desktops, notebooks and telecom equipment
- Analog driven by mobile phone, monitors and UPS
- Memory driven by desktops, notebooks, servers and telecom infrastructure
- Discrete driven by TV and audio systems, energy meters and converters, mobile and telecom infrastructure.

While India's presence as a base for manufacture of high end components is still underway, by nature of its growth in the IT/ITES industry, India has already established a presence in the R&D for components with global electronics majors such as Texas Instruments, Intel and others having their research facilities in India.

[11] Entities are establishments/Households with internet connection; an entity may house multiple user/s or connections

Adoption of semiconductor technology/manufacturing, nanotechnology, Surface Mounted Technology (SMT), and increasing miniaturisation will be key to industry competitiveness in the medium term.

1.8. Strategic Electronics

The strategic electronics segment consists of satellite base communications, navigation and surveillance, underwater electronics and infra-red based detection, disaster management and GPS based vehicle tracking systems.

The Government feels that it is desirable to focus on production in the strategic electronics sector to ensure acquisition of the state-of-the-art technology. The sector is increasingly facing problems in attracting and retaining talent. There is also a trend towards outsourcing/sub contracting and privatisation. At the national level, various research institutions are developing strategic systems and public sector undertakings and some private agencies are contributing towards production. Estimated production of this sector in 2008-09 was Rs. 68 billion.

1.9. Overview of Industrial Electronics and other products

Industrial electronics is the second major export segment after electronic components with a significant share of 25% in total Electronic Hardware exports in FY 2008.

The segment includes products that are used by other industries, such as process control instrumentation, electro-mechanical systems, test and measuring (T&M) instruments.

Electro-mechanical systems is a major product group driving sales in this sector with a share of more than 30% of total industrial electronics sales. Products include industrial electronics equipment and systems, automation technologies, networking systems and other stand-alone instrumentations used in manufacturing industries like Steel, Textiles, Cement, Power, Chemicals and Refineries etc.

This segment continues to be an important constituent from the perspective of applications for electronics and IT. Manufacturing of related hardware in technology areas like PLC, distributed control systems, UPS, varied power electronic equipment and systems has been increasing in the country. Newer technologies involving wireless sensors and sensor networking are rapidly emerging as potential application in the field of industrial electronics on account of ease of installation and cost competitiveness.

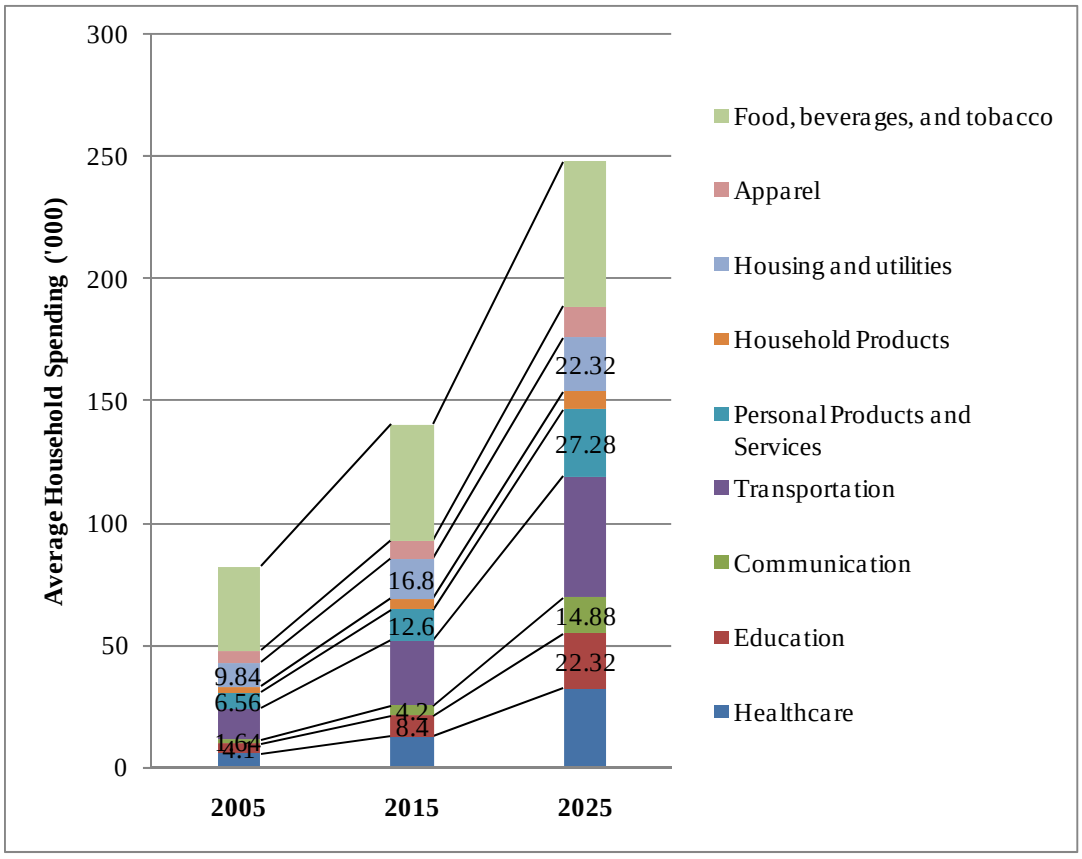
Heating, ventilation and cooling solutions/products another major growing product group has seen a boost in demand with the establishment of SEZ and government focus on infrastructure development like airports, metro rail projects, medical tourism and the upcoming Commonwealth games to be held at New Delhi in 2010. Medical equipments are also likely to drive growth of this sector.

1.10. Demand Drivers for the Electronics and IT Hardware industry

The major demand drivers for the Electronics and IT Hardware industry are outlined below:

- ***Consumer Electronics*** would be predominantly driven by growth in household spending, especially in areas such as Education (growth of 9%), Communication (12%), Housing and utilities (4.7%) between 2005 and 2025[12] [13]. This would have spin off effects in Telecommunications and IT Hardware as well and is evidenced by the current growth trends in Private Final Consumption Expenditure (PFCE) in these areas.

Figure 11: Changing nature of household spending



Source: McKinsey Global Institute

- ***Telecommunication Equipment*** would be mainly driven by increasing mobile penetration to B and C circles with mobile connections expected to touch 500 million by 2010. Further, increasing number of wireline and wireless broadband (Broadband Wireless

[12] McKinsey Global Institute
[13] Figures in brackets indicate growth rates in real terms

Access/WiMAX), as well as demand for Customer Premises Equipment (CPE) and Fibre to the Home (FTTH) are likely to drive demand in the long term.

- ***IT Hardware*** would be driven by increasing household spend on IT, Education, as well as domestic IT demand by Indian companies, e-Governance initiatives under the National e-Governance Programme (NEGP), IT based education in schools (also part of Sarva Siksha Abhiyan), as well as growth of IT and ITES industry.
- ***Strategic Electronics*** would be driven by sustained GDP growth and increasing defence spending in an uncertain world. Major private participation from the likes of Tata Group and Mahindra Group in defence is underway.

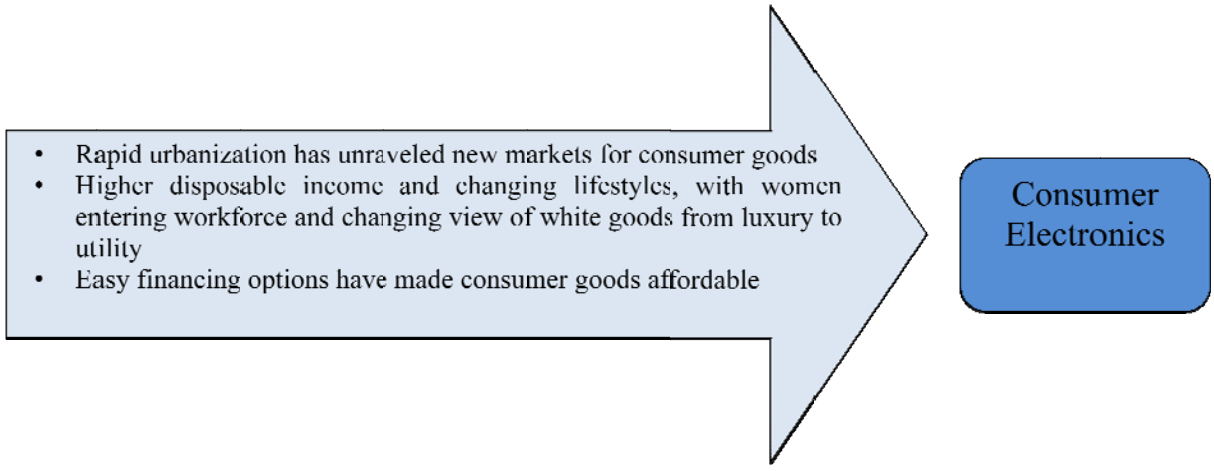
The above sectors would also have downstream effect on Industrial Electronics (driven by GDP and Industrial Growth) and Components.

Electronic Manufacturing Services (EMS) and R&D based exports will also be a major driver of growth in the industry. Increased value-addition in these areas will further drive demand for production as well as sales, services, and after-sales support, which will have major implications on the demand for skilled human resources.

A number of global companies would also use India as a base to cater to domestic and export markets as is the trend currently.

A summary of major demand drivers is presented below.

Figure 12: Demand Drivers in the Electronics and IT Hardware industry



Source: IMaCS analysis

1.11. Key Players and Major Production Clusters

Electronic Hardware sector has large number of players who operate across their respective value chains. A number of large MNCs operate are in the Consumer Electronics, IT Hardware and Telecommunication Equipment segments. Electronic Components and Strategic Electronics segments are still relatively in the nascent stage consist of a number of small players or large PSUs.

Table 3: Key players in the Electronics Hardware sector (illustrative)

Segments	Key players[14]
Consumers Electronics	Videocon, LG Electronics, Blue Star, Philips, MIRC, Samsung
IT hardware	HCL Infosystems, WIPRO Infotech, D-Link (India)
Telecommunication equipment	Avaya Global, Bharathi Teletech, Himachal Futuristics Communications Ltd., Reliance InfraTel
Electronic components	Samtel, Flextronics India Ltd., AT&S India Ltd., Jabil
Strategic components	Bharat Electronics Ltd
Industrial electronics and others	Siemens, Voltas, Tektronix, Philips

The production clusters in India are fairly well spread out. The oldest clusters are the ones in Maharashtra, Gujarat and the National Capital Region (NCR – Delhi). The clusters in Karnataka and Andhra Pradesh have come up mainly due to the success of the IT/ ITES industry, to meet the demand for electronics from this sector. Other clusters have come up due to planned interventions, i.e., the Government granting facilities and benefits to producers/exporters.

Table 4: Major production clusters

City	State
Ahmedabad	Gujarat
Bengaluru	Karnataka
Gurgaon	Haryana
Hyderabad	Andhra Pradesh
Mumbai	Maharashtra
Noida	Uttar Pradesh
Pune	Maharashtra
Chennai	Tamil Nadu

Source: UNIDO cluster database

[14] A player can have presence in multiple segments as well

1.12. Key Success Factors and Risk Factors

The major success factors and risk factors[15] for some of the Electronics and IT Hardware industry are detailed below.

Table 5: Key Success Factors and Risk Factors

Segment	Key Success Factors	Key Risk Factors
Consumer Electronics	▪ Ability to offer innovative products ▪ Keeping abreast with technological changes ▪ Local and efficient manufacturing to reduce cost ▪ Effective regional distribution model	▪ Competition ▪ Large number of well established Indian and MNC companies ▪ Overcapacities in China, Taiwan, Malaysia, etc.
IT Hardware	▪ Newer and sleeker products ▪ Effective distribution model ▪ Competitive pricing	▪ Easy replicability ▪ Large number of fakes ▪ Grey market ▪ Excess capacities in Taiwan, Malaysia, etc.
Others common to the industry	▪ Design capabilities and R&D ▪ Addressing export markets through EMS ▪ Quick adoption of high tech manufacturing (SMT, nanotechnology, etc.) ▪ Developing capabilities beyond low end manufacturing and assembly, moving up the value chain	▪ Regulatory risks (especially telecom) ▪ Managing electronic waste and consequent environmental hazards

Source: IMaCS analysis

1.13. Industry Outlook

Near Term: The near term is likely to see a softening of demand due to recessionary trends (as was observed while describing the segments earlier). As an illustrative case, the demand expected in the IT Hardware sector is shown below.

[15] Illustrative

Table 6: Estimates for FY 2008-09

Product	FY 2007-08	FY 2008-09 Estimates	Expected Growth
Dot Matrix	374,700	475,000	27%
Inkjet	590,479	575,000	~ Flat
Laser	387,000	275,000	- 29%
UPS	1,620,738	1,550,000	~ Flat

Source: MAIT

Table 7: Estimates for FY 2009-10

Product	FY 2008-09	FY 2009-10 Projections	Expected Growth
Desktops	5,279,648	5,400,000	2%
Notebooks	1,516,459	1,900,000	25%
Total	6,796,107	7,300,000	7%

Source: MAIT

It is expected that increased demand for Notebooks would mark the end of the economic slowdown in the PC segment. Other segments such as ***Consumer Electronics*** have demonstrated a double digit growth of about 15% and is likely to do in the future too due to buoyant demand. This trend is likely to result in further improvement after the next 3 to 4 quarters for the industry.

Long Term: The long term growth outlook for the Electronics and IT Hardware industry remains positive. It is expected that the Indian Electronics and IT Hardware manufacturing industry can target upto US $ 155 billion in revenues in the next 8 to 10 years. A growth rate of about 20%[16] would be possible subject to sustained action by stakeholders for the development of this sector.

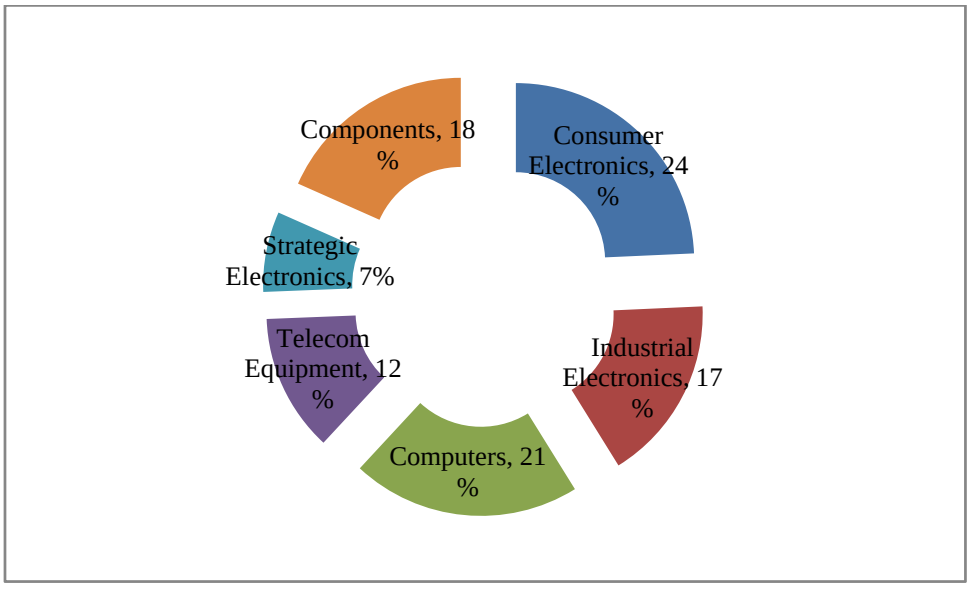
[16] IMaCS analysis

2. Human Resource and Skill Requirement in the Electronics and IT Hardware Industry

2.1. Current employment pattern

The human resource directly employed in the industry is estimated to be approximately 770,000[17] in 2007. This is expected to be about 0.9 million currently[18].

Figure 13: Distribution of human resource in the Electronics and IT Hardware industry



Source: IMaCS analysis

The profile of persons employed in the industry across various education levels is shown below.

[17] CEHA
[18] In FY2009, IMaCS analysis

Table 8: Profile of human resource across various educational qualifications

	Ph. D/ Research	Engineers	Diploma or equivalent certification by other agencies	ITI and other vocational courses	Other graduates	CA/MBA/etc.	12th/10th standard
Consumer Electronics	3%	9%	10%	7%	27%	22%	22%
IT related hardware	4%	20%	25%	10%	19%	6%	16%
Telecom Equipment	5%	40%	20%	7%	15%	6%	8%
Strategic Electronics	6%	37%	22%	10%	10%	5%	10%
Components	6%	28%	13%	16%	3%	2%	32%
Manufacturing	*1%*	*20%*	*15%*	*20%*	*2%*	*2%*	*40%*
Design	*25%*	*60%*	*5%*	*0%*	*8%*	*1%*	*1%*

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

The profile of persons employed at various functional levels is shown below.

Table 9: Profile of persons across various functional levels

	R&D	Manufacturing	Sales	After-sales support	Administration
Consumer Electronics	4%	50%	27%	14%	5%
IT related hardware	3%	21%	25%	41%	10%
Telecom Equipment	4%	30%	30%	30%	6%
Strategic Electronics	12%	46%	8%	20%	13%
Components	16%	62%	8%	6%	8%
- Manufacturing	0%	78%	8%	7%	7%
- Design	81%	0%	8%	0%	11%

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.2. Value chain of activities across various segments of the Electronics and IT Hardware Industry

The following figures depict the value chain of activities across different segments in the Electronics and IT Hardware industry.

Figure 14: Value chain in Consumer Electronics

Figure 15: Value chain in IT Hardware

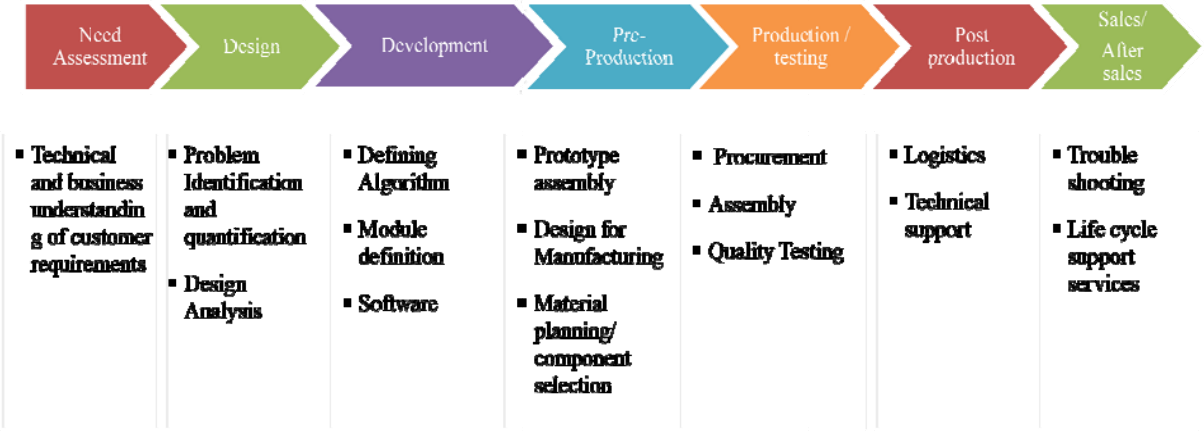


Figure 16: Value chain in Telecommunication Equipment

Figure 17: Value chain in Electronic Components

Note: Narrative highlighted in blue for the above figure is applicable on for passive components

2.3. Profile of people employed and Skill Requirements

We shall review the skill requirements from the perspective of the following functions in the Electronics and IT Hardware Industry.

- Production
- Sales
- Design and Development
- Quality assurance
- After-sales service.

2.3.1. Skill requirements in the Production function in the Electronics and IT Hardware Industry

Figure 18: Profile of persons employed in the Production function

Production Manager	***Key Role:*** Overall management of employees/processes, planning high level targets and ensuring smooth operations ***Qualification:*** BE & MBA, BE/B. Tech & M. Tech/ MS from electronics, ECE, mechanical, instrumentation streams with 8-10 years of experience in manufacturing
Shift Engineer	***Key Role:*** Managing production-shifts/ monitoring technicians and supervisors, quality checks, on job training, process improvements through time and motion studies ***Qualification:*** BE/ B. Tech / M Tech (Electronics, ECE, Mechanical, Instrumentation) with 6-8 years experience on shop floor
Line Supervisor	***Key Role:*** Ability to maintain low downtime on machines, line balancing to ensure the production targets are met by operators ***Qualification:*** Diploma Engineers (Mechanical, Electronics, and Instrumentation) with 4-5 years experience
Operator/ Technician	***Key Role:*** Ensuring production as per production planning and targets, regular and preventive maintenance of manufacturing equipments, operating fork lift trucks/ conveyor belts, CNC machines and robots ***Qualification:*** Diploma Engineers, ITI pass-outs specialising in electrical/mechanical
Worker/ Helper	***Key Role:*** Materials and machine handling, loading/unloading, packaging, store keeping ***Qualification:*** 10th Pass and above with basic equipment handling know-how

The skill requirements in the Production function are illustrated below.

Table 10: Skill requirements in the Production function

Level	Skills Required
Production Manager	▪ Project management skills, including excellent organisational and planning skills in order to plan, monitor and alter production schedules when necessary ▪ Ability to identify and encourage innovative and productive activities among workers/methods of production ▪ Strong knowledge of the production process and ability to oversee all parts of the production process including logistics and quality control ▪ Ability to liaison with suppliers regarding quality, price, delivery times and ethical standards, including finding new

Level	Skills Required
	sources of supply ▪ Ability to overcome production-related issues, such as machine faults by overseeing the work of maintenance technicians, and liaising with in-house design and sales teams ▪ Ability to work under pressure, multi-task and meet deadlines ▪ Ability to overcome problems and handle conflict ▪ Knowledge of budgeting and cost management techniques ▪ Strong communication skills.
Shift Engineer	▪ Ensuring achievement of targets as per production plan drawn by the Production Manager ▪ Developing the maintenance schedule for upkeep of plant and equipment and communicating the same to the line supervisors for adherence ▪ Problem solving skills to minimise the downtime and optimise the production of shift with minimum defects and re-working ▪ In-depth technical knowledge of assembly line process and procedures for preparing the Standard Operating Manuals in liaison with Production Manager to be followed by technicians/operators ▪ Strong understanding of and focus on cost reduction and productivity improvement with the aid of time and motion studies ▪ Ensuring compliance with on–the job training schedule and conducting workshop for skill enhancement of technicians and operators.
Line Supervisor	▪ Ability to meet the production target of a particular line, while ensuring adequate supply of material, adherence to quality parameters and maintenance schedule ▪ Material management skills to eliminate wastages and strong knowledge of process to followed to eliminate defective production/re-working ▪ Ability to fix production targets for workmen, clearly communicate instructions to operators and workers and measure

Level	Skills Required
	their performance against these targets ▪ Problem solving ability ▪ Providing on–the job training and mentoring of the operators/technicians.
Operator/Technician	▪ Practical skills for using technical equipment and machinery ▪ Ability to follow instructions and understand operating manuals for strict adherence ▪ Ability to identify defects and rectify them ▪ Ability to ensure minimum wastage ▪ Ability to work in a team as well as on an individual basis ▪ Awareness of health and safety standards ▪ Knowledge of quality standards ▪ Adaptability to new processes/production lines.
Helpers	▪ Ability to understand instructions ▪ Symbol comprehension and basic reading skills ▪ Ability to identify deviations in material and inform the operators/supervisor ▪ Awareness of health and safety standards ▪ Punctuality at work.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.3.2. Skill requirements in the Sales function in the Electronics and IT Hardware Industry

The profile of persons employed in the Sales function and the typical skill requirements are illustrated as follows.

Figure 19: Profile of persons employed in the Sales function

Sales Manager	***Key Role:*** Target setting and planning, Key account management, marketing planning and sales promotion in liaison with trade partners ***Qualification:*** B Tech (IT, Electronics)/B Com/B Sc and MBA with 6-8 years experience
Area Manager/ Territory Manager	***Key Role:*** Consultative sales to corporate clients and managing distributors in a specific geographical area under purview ***Qualification:*** B Sc/B Tech (IT, Electronics) and MBA with above 4 years experience
Senior Sales Executive	***Key Role:*** Customer identification and acquisition, Account management ***Qualification:*** B Sc/BA/B Com/B Tech (IT, Electronics) with 2 years experience, MBA preferred, and even Diploma and ITI pass outs
Sales Executive	***Key Role:*** Cold calling and initiation of sales process, field sales, ensuring delivery and documentation ***Qualification:*** Fresh B Com, B Sc, B Tech, MBA, and even Diploma and ITI pass

Table 11: Skill requirements in the Sales function

Level	Skills Required
Sales Manager	▪ Negotiation skills to settle favourable commercial terms with channel partners in various territories ▪ Knowledge about industry trends and competition ▪ Knowledge of own product features and functionalities ▪ Knowledge of budgeting and cost management techniques ▪ Strong understanding of commercial aspects of transaction and pricing techniques ▪ Strong communication skills ▪ Ability to manage teams and get the sales force to achieve its target

Level	Skills Required
	▪ Performance measurement through daily and weekly reports and devise the strategy to meet shortfalls, if any.
Area Manager/Territory Manager	▪ Strong networking skills to maintain relationship with clients and distributors ▪ Strong communication skills ▪ Knowledge about industry, competition, own product, product innovations and emerging trends ▪ Ability to manage and monitor leads generated and referred, tracking follow-up and closure ▪ Knowledge about commercial aspects of transactions such as pricing and promotional schemes to ensure adequate profits and achievement of sales targets ▪ Manage daily sales plans for market development and performance measurement using key metrics like daily sales-out, width, depth and reach ▪ Ability to co-ordinate channel activities like training Sales Executives in products and applications, sales techniques, route planning for sales calls, competitive counters, etc.
Senior Sales Executive	▪ Ability to identify customer requirements and making the sales pitch accordingly ▪ Thorough knowledge of the products and ability to cross-sell/up-sell ▪ Ability to train junior people and productively utilise them for achieving sales target ▪ Good relationship management skills ▪ Liaisoning skills with trade partners/channel management ▪ Awareness about trends in the industry and competitors offerings ▪ Good communication skills ▪ Ability to undertake database management, record keeping

Level	Skills Required
	and MIS.
Sales Executive	▪ High degree of aggression and energy required ▪ Good communication skills ▪ Ability to follow up properly and perseverance required ▪ Thorough knowledge of the product being sold and ability to draw comparisons with competing products ▪ Ability to undertake cold calling and prospecting ▪ Good relationship management skills.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.3.3. Skill requirements in the Design and Development function in the Electronics and IT Hardware Industry

The profile of persons employed in the Design and Development function and the skills required is presented below.

Figure 20: Profile of persons employed in the Design and Development function

Chief Technical Officer	***Key Role:*** Identifying area for product and service innovation, liaisoning with global technology partners for knowledge acquisition and in-house customisation ***Qualification:*** Ph D/M Tech in electronics, ECE, IT, Systems Designing with 12-15 years of experience
Project Lead	***Key Role:*** Driving applied research initiatives through product and service innovations, managing the team of design/architect engineers, supervising customer specified product design activities ***Qualification:*** B Tech/M Tech/PhD (IT/Electronics) with 8-10 years experience
Design Engineer	***Key Role:*** Product exploration, chip level design, sub-system level design, Proofs of Concept, detailed hard models designing ***Qualification:*** B Tech/Diploma Engineers with 2 years of experience

Table 12: Skills required in the Design and Development function

Level	Skills Required
Chief Technical Officer	▪ Knowledge about the latest technology and industry trends, sound technical background, understanding of and ability to identify research opportunities ▪ Networking skills and strong contacts with researchers/academicians worldwide ▪ Knowledge of applicable quality standards and ability to improve/devise the standards in co-ordination with Quality Department ▪ Ability to develop a team, proactively identify training needs of team and develop them ▪ Ability to supervise and guide the research team regarding the research activities ▪ Strong goal orientation.
Project Lead	▪ Knowledge about the latest technology and industry trends, sound technical background, understanding of and ability to manage research activities – new trends in VLSI and embedded ▪ Ability to co-ordinate characterisation and test efforts with an objective of commercialisation of the product/service innovation ▪ Ability to lead a team of Design/Architect Engineers by providing clear cut instructions ▪ Project management skills ▪ Strong communication and trouble shooting skills.
Design Engineer	▪ Ability to update technical knowledge about latest technology and applied research innovations proficiency in prototype designing/testing for IT Hardware – VLSI and embedded technologies ▪ Database Management and record keeping skills ▪ Ability to handle unstructured and repetitive work due to large number of iterations involved in the process ▪ Problem solving attitude and flair for innovation keeping in mind the desired outcome ▪ Knowledge of quality certifications (such as six sigma, ISO, etc) so that the new product/prototype complies with safety standards and specifications.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.3.4. Skill requirements in the Quality Assurance function

The profile of persons employed in the Quality Assurance function and the skills required is presented below.

Figure 21: Profile of persons employed in the Quality Assurance function

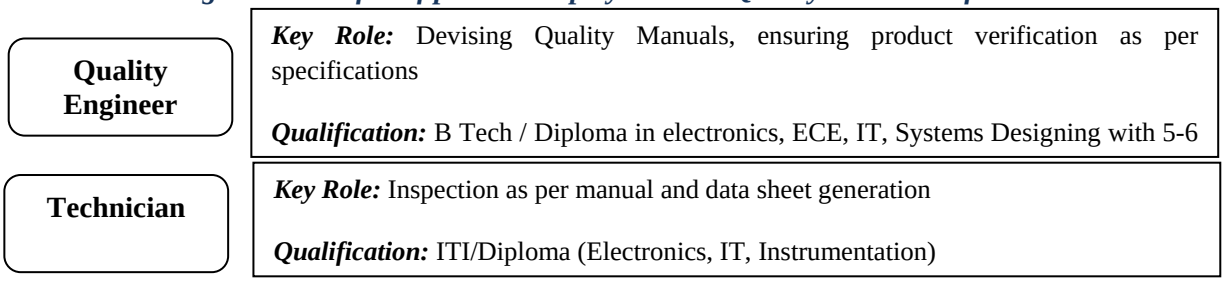


Table 13: Skills required in the Quality Assurance function

Level	Skills Required
Quality Engineers	▪ Awareness about latest developments in quality and process improvements areas and preparing quality manuals in accordance ▪ Ability to supervise and lead inspection process ▪ Ability to understand the quality requirement of the clients and train the technicians as per own quality standards or those of OEM (in case of contract manufacturers) ▪ Strong goal orientation.
Technicians	• Understanding of the quality assurance process and ability to follow the inspection manual properly • High level of diligence and aptitude for repetitive and monotonous jobs • Ability to identify the deviations • Meticulous in record-keeping and data management • Analytical skills to analyse the data and identify the trends in inspection results.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.3.5. Skill requirements in the After Sales Service (Service Support) function

This section illustrates the skills required in the Service Support function.

Table 14: Skills required in the Service Support function

Level	Skills Required
Service Support Executives	▪ Technical knowledge about product and technologies ▪ Ability to motivate and train repair mechanics ▪ Ability to address customer complaints in the most effective and efficient way ▪ Good communication skills.
Repair Mechanics	▪ Ability to follow the instructions manual ▪ Trouble shooting skills ▪ Ability to handle tools and equipments ▪ Knowledge about product and its configuration.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.4. Skill Gaps in the Electronics and IT Hardware Industry

There are certain skill gaps generic to each function, while some are sector specific. This section highlights the ***generic*** and ***sector specific skill gaps*** in the Electronics and IT Hardware Industry.

2.4.1. Skill gaps in the Production function

Table 15: Generic Skill Gaps in the Production function

Level	Skill Gaps
Helper level	The helper level personnel generally lack the industrial culture to work on the shop floor. They are to be provided with short duration training on behavioural aspects as their job does not involve any technical skills, but still gaps remain. Key skill gaps are: ▪ High absenteeism, lack of punctuality ▪ Lack of discipline at workplace for adhering to production norms ▪ Inability to identify deviations in material and inform the

Level	Skill Gaps
	operators/supervisors ▪ Insufficient awareness of health and safety standards, despite being educated about the same.
Operator/Technician	▪ Inability to understand material variation and take corrective action or escalate the issue so that wastages can be minimised ▪ Incapable of identifying defects at any particular point in the production line and rectifying the same on time ▪ Lack of machine handling ability and knowledge of latest technologies ▪ Insufficient orientation to learn - Operators do not make an attempt to understand new processes and need handholding for a much longer period than required ▪ Inability to understand instructions and product designs completely ▪ Quality technicians lack the computer proficiency and data management skills, the quality manual is not referred to diligently in few cases. Most of the people lack understanding of latest quality concepts and techniques.
Supervisor	▪ Inability to keep the team motivated and manage their expectations ▪ Inability to involve subordinates or take their feedback in decision making process ▪ Poor capability to prepare inspection manuals and supervise the inspection process ▪ Lack the enthusiasm to organise quality/system improvement training and inculcate a culture of quality consciousness among workers.
Across the Production function	Across the Production function, there are skill gaps in the following areas: ▪ Soldering – manual and automatic ▪ Shop floor concepts, clean room

Level	Skill Gaps
	▪ Equipment identification and handling ▪ Quality and safety issues.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.4.2. Sector specific skill gaps in the Production function

Sector specific skill gaps in the Production function are illustrated below.

Consumer Electronics: In this sector, roughly 50% of the workforce is engaged in the production function. Specific skill gaps are:

- Insufficient knowledge about the manufacturing of new products in the sector (Flat TVs, LCD TVs, Plasma TVs), insufficient knowledge of PCB assembly/population
- Insufficient understanding of components being used in the latest products in the sector, material management and reduction of rejection in the production of these new products
- Shortage of technically qualified people for quality audit function as well as machine operators and maintenance technicians of Surface Mounted Technology (SMT)/Auto Insertion. Skilled manpower for handling SMT/auto insertion machines are expected to be a severe shortage.

Components: In the case of manufacturing of components, more than 80% of the workforce is involved in the production process, including quality inspection. The key skill gaps related to manufacturing of components are as follows:

- At operator level, current manpower faces issues in understanding process charts, material variation and machine operations
- Lack of knowledge of PLC programming and Robotic machinery maintenance
- Operators involved in the inspection process lack the capability to carry out this function as per the manual
- Insufficient computer proficiency and data management training
- There is in general a shortage of maintenance technicians/ electricians/ fitters for handling boiler, machine panels and air conditioning systems
- At Line in-charge/Supervisor level, key skill gaps are lack of understanding of concepts of productivity improvement, line balancing, time and motion studies, knowledge of production metrics like hourly production rate variation, inventory management.

IT related hardware: Key skill gaps in this sector are in the case of Engineers employed and to some extent in ITI pass-outs who are hired as Assemblers. The skill gaps are as follows:

- In case of Engineers, lack of latest product and technology knowledge, insufficient skills for execution of product development, insufficient knowledge of production line processes like optimal kitting of components for assembly and mass production practices, including line error minimisation
- In case of ITI pass outs (mainly those specialising in the Electronics trade), who take up assembly based on circuit charts and diagrams, ability to understand processes in assembly is a major skill gap.

2.4.3. Skill gaps in the Sales function

Table 16: Generic skill gaps in the Sales function

Level	Skill Gaps
Sales Executive	The sales executive generally lacks the understanding of consumer behaviour and buying decision making process. They are provided short term trainings on improving inter-personal skills, communication abilities and products of the company. The key skill gaps in the industry are as follows: ▪ Lack of understanding of the products being sold (own as well as those of competitors), which results in targeting the wrong customers or not being able to fully convince the customers about product features and functionalities ▪ Inadequate communication skills, especially those people who only have an engineering background ▪ Inability to keep proper MIS records.
Senior Sales Executive	▪ Inability to prepare/make an effective sales pitch by matching the product functionalities with customer requirements ▪ Lack of understanding of customer needs and trends in the industry ▪ Inadequate negotiation skills and proactive attitude to actively pursue and close deals.

Level	Skill Gaps
Area/Territory Manager	▪ Inability to mentor/train the field staff in terms of generating and closing the deals ▪ Lack the enthusiasm to assist the field staff for marketing calls ▪ Lack of leadership skills and relationship management skills ▪ Inadequate planning skills for event-based marketing in association with channel partners ▪ Lack of focus on product profitability as people put more emphasis on meeting the sales target with little or no attention on the profitability aspect which impacts the overall performance.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.4.4. Sector specific skill gaps in the Sales function

Consumer Electronics: This sector has more than 25% of its workforce involved in the Sales function as it requires high level of customer interaction with the end user. Key skill gaps for Sales personnel employed in this sector are:

- Insufficient understanding of the financial aspects of business - cost structure of the trade channels, margins involved along the value chain and the consequent discounting strategy to be used
- Ineffective sales force management
- Insufficient coordination with service team to fulfil service commitments and annual maintenance contracts
- Insufficient exposure to understanding customer requirements.

IT related hardware: This sector has roughly 25% of its workforce employed in the Sales function. Key skill gaps in sales personnel are:

- Insufficient understanding of the dynamics of the customer organisation's functioning and their business requirements for IT related hardware (relating business requirements to technology)

- Inability to interact confidently with the higher echelons of the customer's organization about their needs and how to fulfil them.

2.4.5. Skill gaps in the Design and Development function

Table 17: Generic skill gaps in the Design and Development function

Level	Skill Gaps
Design Engineer	These personnel require highly specialised skill sets and an orientation towards research. The key skill gaps in the industry are as follows: ▪ Lack of understanding of latest technologies in product proto-typing and inability to upgrade the technical knowledge ▪ Theoretical concepts of Electronics/Embedded Software weak ▪ Insufficient exposure to practical training ▪ Testing and validation skills are not in line with industry requirements ▪ Lack of problem solving attitude, innovation and creativity.
Project Lead	These personnel are well experienced professionals with good-track record and aptitude for research. In general there is a shortage of scientists and research heads as there is limited infrastructure for training and development of research people. The key skill gaps are: ▪ Lack of ability to communicate effectively with concept development team ▪ Insufficient project management and integration skills ▪ Insufficient exposure to cost optimisation, resource management and productivity improvement.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.4.6. Sector specific skill gaps in the Design and Development function

Semi conductors: There is expected to be a huge shortage of people having theoretical knowledge of Electronics - Embedded Software and people qualified for VLSI design. At senior levels, the skill gaps are mainly related to insufficient project management and integration skills, productivity improvement, team building and people management.

IT Hardware: A key skill gap is the lack of interest in Application Research.

2.4.7. Skill gaps in the Service Support function

Table 18: Generic skill gaps in the Service Support function

Level	Skill Gaps
Senior Service Technician	There is expected to be a shortage of people in the area of maintenance and repair of consumer electronics (mainly new products like Flat TVs, LCD), communication equipment (mainly mobile handsets) and home computers. The key skill gaps are: ▪ Lack of ability to handle complex issues, especially related to customer complaints and expectations ▪ Inability to train mechanics for repair jobs ▪ Product knowledge is not upto the required level ▪ Diagnostic skills are a gap ▪ In the case of computers, knowledge of sub-assembly is a major gap ▪ Knowledge of system integration, mainly for Government and Enterprises, including Network Design, is a major skill gap. .
Repair Mechanics	The key skill gaps in the industry are as follows: ▪ Lack of practical orientation and equipment handling ability, hence a lot of time has to be spent on in-house training to handle newer operating tools and equipment ▪ Great deal of handholding is needed as they lack logical thinking and problem solving attitude ▪ Insufficient skills to handle customer grievances and assure customer satisfaction, inability to take up reporting in an effective manner.

Source: MAIT Report on mapping the manpower skills in the IT Hardware and Electronics Manufacturing Industry

2.4.8. Sector specific skill gaps in the Service Support function

IT Hardware: The key skill gaps are in the areas of:

- Understanding control circuitry and power supply
- Trouble shooting
- LCD Panels
- Modular units
- Customer interaction
- L1 and L2 level repairs.

Telecom Equipment: The key skill gaps, especially in servicing mobile handsets, are:

- Fault identification
- Customer interaction
- Board level repair
- Signal testing and signature reading
- L1 and L2 repairs.

2.5. Projected Industry Size and Human Resource Requirements

2.5.1. Projected Size and Human Resource Requirement of the Electronics and IT Hardware Industry

Our analysis reveals that the Electronics and IT Hardware industry has the potential to grow at a Compounded Annual Growth Rate (CAGR) of about 17% till 2022 and even thereafter considering the fact that the GDP is expected to grow at a rate of 7.5% to 8% over this period[19]. Therefore, we expect the production of Electronics and IT Hardware to increase from Rs. 844 billion in 2008 to Rs. 7,520 billion by 2022. Consumer Electronics, Computers, Telecom Equipment, and Industrial Electronics would contribute to a large portion of the size of the industry.

[19] Our overall approach to macro-economic modeling and forecasting is explained in a separate annexure

Table 19: Production in the Electronics and IT Hardware Industry in India

Size of Electronics and IT Hardware Industry (Rs. billion)	2008	2012	2018	2022	CAGR
Electronics and IT Hardware Industry in India	**844**	**1,636**	**4,300**	**7,521**	**17%**
Consumer Electronics	226	399	946	1,474	14%
Others (Industrial Electronics)	119	234	650	1,380	19%
Computers	159	260	852	1,546	18%
Telecom Equipment	187	478	1,338	1,354	15%
Strategic Electronics	57	125	344	714	20%
Components	96	140	171	1,053	19%

Source: IMaCS analysis

This would translate to the overall employment in the industry increasing from the current level of 0.9 million to over 4 million by 2022. This would translate to an incremental human resource requirement of about 3 million to 3.2 million.

Table 20: Incremental human resource requirement in the Electronics and IT Hardware Industry (in '000s)

Projected human resource requirement 2008 - 2022 (in '000s)	2008	2012	2018	2022	Incremental
Electronics and IT Hardware Industry in India	**906**	**1,446**	**2,870**	**4,129**	**3,223**
Consumer Electronics	204	298	532	686	482
Others (Industrial Electronics)	107	168	334	567	461
Computers	193	273	689	810	617
Telecom Equipment	184	400	880	759	575
Strategic Electronics	69	128	271	474	405
Components	149	179	164	834	685

Source: IMaCS analysis

2.5.2. Projected profile of human resource requirement

Based on the profile of human resource employed in the industry, the following is the profile of the incremental human resource requirement, both education-wise and function-wise, between 2008 and 2022.

Table 21: Incremental human resource requirement – education-wise till 2022 (in '000s)

Incremental human resource requirement	Ph.D and Research scholars	Engineers	Diploma and other equally certified skills	ITI and other vocational courses	Other graduates such as B.Sc	MBA/ CA/ CWA	10th / 12th
Consumer Electronics	14	43	48	35	130	106	105
Others (Industrial Electronics)	14	184	46	30	14	25	147
Computers	25	123	154	62	117	37	99
Telecom Equipment	29	230	115	38	86	32	45
Strategic Electronics	24	150	89	40	41	19	42
Components	38	192	89	110	23	13	220
Total requirement in the Industry	**144**	**922**	**541**	**315**	**412**	**232**	**658**
Incremental human resource requirement				**3,223**			

Source: IMaCS analysis

Table 22: Incremental human resource requirement – function-wise till 2022 (in '000s)

Incremental human resource requirement	R&D	Manufacturing	Sales	Service Support	Administration
Consumer Electronics	19	241	130	67	24
Others (Industrial Electronics)	14	334	69	23	21
Computers	19	130	154	253	62
Telecom Equipment	23	172	172	172	34
Strategic Electronics	49	188	32	83	53
Components	111	427	55	38	53
Total requirement in the Industry	**234**	**1,492**	**613**	**637**	**248**
Incremental human resource requirement				**3,223**	

Source: IMaCS analysis

The share of various regions that would drive this human resource requirement is as follows.

Table 23: Share of various regions in human resource requirement

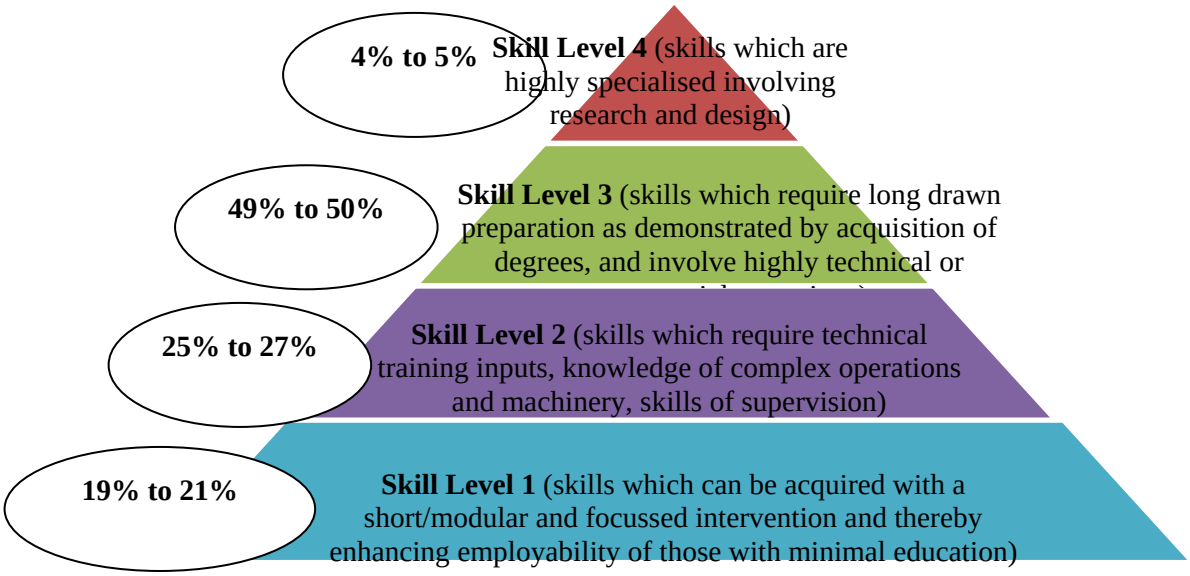
Region	% Share
Northern	37%
Western	27%
Southern	27%
Others	9%

Source: IMaCS analysis

2.5.3. Skill Pyramid for the Electronics and IT Hardware Industry

Given that the industry would required a varied profile of skill sets, the following figure presents an overview of the profile of skill requirements as derived from human resource requirements across different sectors of the Electronics and IT Hardware Industry.

Figure 22: Skill Pyramid for the Electronics and IT Hardware Industry



Source: Industry inputs, IMaCS analysis

The skill pyramid, in summary, captures where the Electronics and IT Hardware Industry stands relatively in terms of skills (a function of activity, educational requirements, and amount of 'preparatory' time required to inculcate a specific skill) as compared to all other industries.

As can be observed, ***'Skill Levels 2 and 3'***, have the highest incremental requirement of human resource. This indicates the requirement for persons trained in ***manufacturing, servicing, and sales functions*** in the Electronics and IT Hardware Industry.

2.6. Emerging Trends in Electronics and IT Hardware Industry and Implications on Human Resource and Skill Requirements

The following are some of the emerging trends in the Electronics and IT Hardware Industry:

- ***Increasing consumption and potential for production:*** The expected steady increase in the Private Final Consumption Expenditure (PFCE) on Home Appliances, Recreational and Education Services, both ranging between 13% and 15%, is expected to drive the consumption and production of Electronics and IT Hardware. This is expected to drive industry/production growth at about 17%, with major contributors being Computers, Consumer Electronics, and Telecom.
- ***Sales and Service Ecosystem as a driver of employment:*** The sales and service support functions are expected to generate an incremental employment of 1.2 million persons till

2022. This would be due to a large nation-wide footprint of tier-2 and tier-3 industry participants (dealers, franchisees, service agencies, etc.). This 'ecosystem' would contribute to a large portion of the human resource requirement.

- ***Manufacturing has potential for increasing localisation:*** While a large portion of manufacturing is actually currently a combination of sourcing and assembly, increasing content would be locally manufactured – for example, passive components, certain active components, more complex motherboards, increasing adoption of Surface Mounted Technologies and other high-tech areas. Certain components such as CRT based picture tubes may eventually see a reduction in production given the increasing adoption of LCD/Plasma displays. Incremental employment in manufacturing is likely to be 1.5 million till 2022.
- ***Increasing adoption of E-Waste Management*** (electronic waste management) driven by regulation is likely to see more 'organisation' of the industry in that space.
- ***Global trends*** such as green and energy efficient technology is likely to have increasing adoption in India too.
- ***Increasing contract manufacturing and stronger OEM-supplier relationships*** would also be a key success factor towards developing a better ecosystem. There is a strong case for cluster development in this sector.
- ***Growing segments would be major contributors to employment:*** Segments such as Consumer Electronics, IT Hardware, Telecom Equipment would be major contributors for employment. Illustrative growth categories are:
    - Set Top Boxes
    - Mobile Handsets
    - Plasma/LCD TVs
    - PC assembly
    - End to End IT solutioning - assembling, installation, support at on-site and off-site, infrastructure management, emergence of newer technologies such as cloud-computing.

2.7. Focus areas for NSDC for Skill Building

The following are the possible focus areas for NSDC for skill building in the Electronics and IT Hardware Industry.

Table 24: Focus areas for NSDC for Skill Building

Skill sets required	Incremental Employment (till 2022, in million)	Possible areas for skill building
Manufacturing	1.5	▪ Basic Manufacturing • Basic manufacturing skills • Safety norms • Meeting pollution control laws, etc. • Punctuality • Reading circuit diagrams and populating boards • Awareness of shop floor, concepts of ESD • Adherence to cleanliness norms. ▪ Advanced Manufacturing and Contract Manufacturing operations covering: • Quality certifications like Six Sigma • Productivity measurement • Process control • Assembly line scheduling • Costing and budgeting • Basic management program, effective meetings, constructive confrontation etc. ▪ High-Tech Manufacturing • Chip Mounted Technologies • Complex LCD Technologies • Semi conductor Technologies • Plasma displays • Nanotechnology.
Servicing Support	0.6 to 0.7 million	▪ L1 and L2 servicing/repair of Mobiles, Telecom Equipment, IT Hardware, Consumer Electronics ▪ Higher order servicing – L3 and L4 repairs
Other areas: E-Waste Management and Sales		

Source: IMaCS analysis

The above two skills sets account for about 70% of the incremental human resource requirement between themselves. NSDC can focus on the above mentioned areas, apart from other possible areas depending on the benefit proposition of the skill building activity.

This report has been prepared by **ICRA Management Consulting Services Limited (IMaCS).**

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- Deep understanding of policy formulation.
- Extensive and organised database on several sectors.
- Knowledge of key factors of success in different projects and programmes.
- Ability to research emerging trends in the economy, as well as in specific sectors.
- Insight into different programmes and organisational processes.
- Ability to carry out economic analysis, build quantitative and financial models to project future performance and identify imperatives.
- Ability to identify the various types of risks and suggest appropriate strategies to mitigate the same.

The Education and Skills practice at IMaCS focusses on identifying skill gaps, mapping future skill requirements, and formulating strategies to address them. Our service offerings encompass diagnosis, design and implementation of education and skill development interventions for government and private sector.

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