



asia eco - design electronics

Country report on the Indian electronics sector

Issues and capacity building needs in relation to international and national product-related environmental regulations and other requirements

By ELCINA Electronic Industries Association of India

Supported by European Commission and coordinated by The Centre for Sustainable Design (UK)



Key contributors

Somnath Chatterjee, Consultant, India

Ritu Kumar, TERI Europe, UK

Rajoo Goel, ELCINA, Electronic Industries Association of India, India

Martin Charter, The Centre for Sustainable Design, UK

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Asia Eco-Design Electronics (www.cfsd.org.uk/aede) aims to raise awareness of product-related environmental issues and develop eco-design tools for the Chinese, Indian and Thai electronics industries

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Foreword

Today, there is a pressing need for the Indian electronics industry to persistently track and unravel the complexities of the global supply chain, which is now being reshaped by a gamut of environmental compliance norms that have come into force. Without an actionable 'India Strategy' relying on a set of appropriately benchmarked environment management policies and implementation programmes, the competitiveness and growth of the electronics and information technology (IT) industry are bound to be hamstrung. It is, therefore, absolutely essential for companies to develop robust practices to avoid high non-compliance costs. Action in the global market place for cleaner technology processes and recycling programmes has already gathered significant momentum. In this context, this report, as part of the Asia Eco-Design Electronics (AEDE) project, is indeed timely.

In 2001, ELCINA supported Mohammed Saqib, Yashika Singh and Ritu Kumar in completing the report 'Stimulating Sustainable Trade in Electronics: Challenges, Realities and Strategies for the Indian Components Sector' which was published by the Rajiv Gandhi Institute of Contemporary Studies. This study took stock of awareness levels and the environmental management status of Indian electronics sector prior to compliance measures coming into force. The study found that some global electronics giants had already started working with their supply chain partners on compliance measures. Then, the shadow of WEEE Directive (Waste Electrical and Electronics Equipment) and RoHS Directive (Restriction on Hazardous Substances) had began looming over the world electronics manufacturing industry.

Things are now very different. By 2007, most EU Member States had implemented WEEE and the deadline for RoHS was achieved in July 2006. Other countries are now building

their environment compliance approaches similar to the EU directives, eg. some states in the USA, Korea, etc have put in place their own regulations. China, Chile, Brazil and Columbia also now have some environment management Directives in place. Japanese laws had been in place even earlier and many Japanese companies are well ahead in implementing cleaner technologies and in greening their supply chain. While the larger companies in most countries have started their compliance measures, most small and medium sized enterprises (SMEs) including those in Korea and Taiwan have fallen behind.

The story is no different in India, where government has failed to supplement the modest efforts initiated by Indian corporates and industry associations. India's total waste electrical and electronic equipment (WEEE) generated has already reached alarming proportions of about 146,000 tonnes per annum and is projected to rise sharply to 1,600,000 tonnes by 2012. What is worrying is that global compliance norms are bound to get even stricter and this obviously implies that the gaps that exist amongst large and small companies need to be bridged as quickly as possible. The time available for companies to catch up is clearly running out. A survey undertaken as part of this report also confirms this. But the mood in India's high growth electronics industry is upbeat and some companies have set impressive benchmarks for others to follow. If Indian industry avoids the pitfalls and addresses the ensuing challenges in a concerted manner and if these efforts are backed by government support, the future roadmap could be promising. Besides unravelling global environmental compliance related complexities, this report also offers the Indian electronics industry some strategic insights and innovative solutions at this extremely crucial juncture in its development.

1.0 Introduction

1.1 Overview of Indian electronics sector

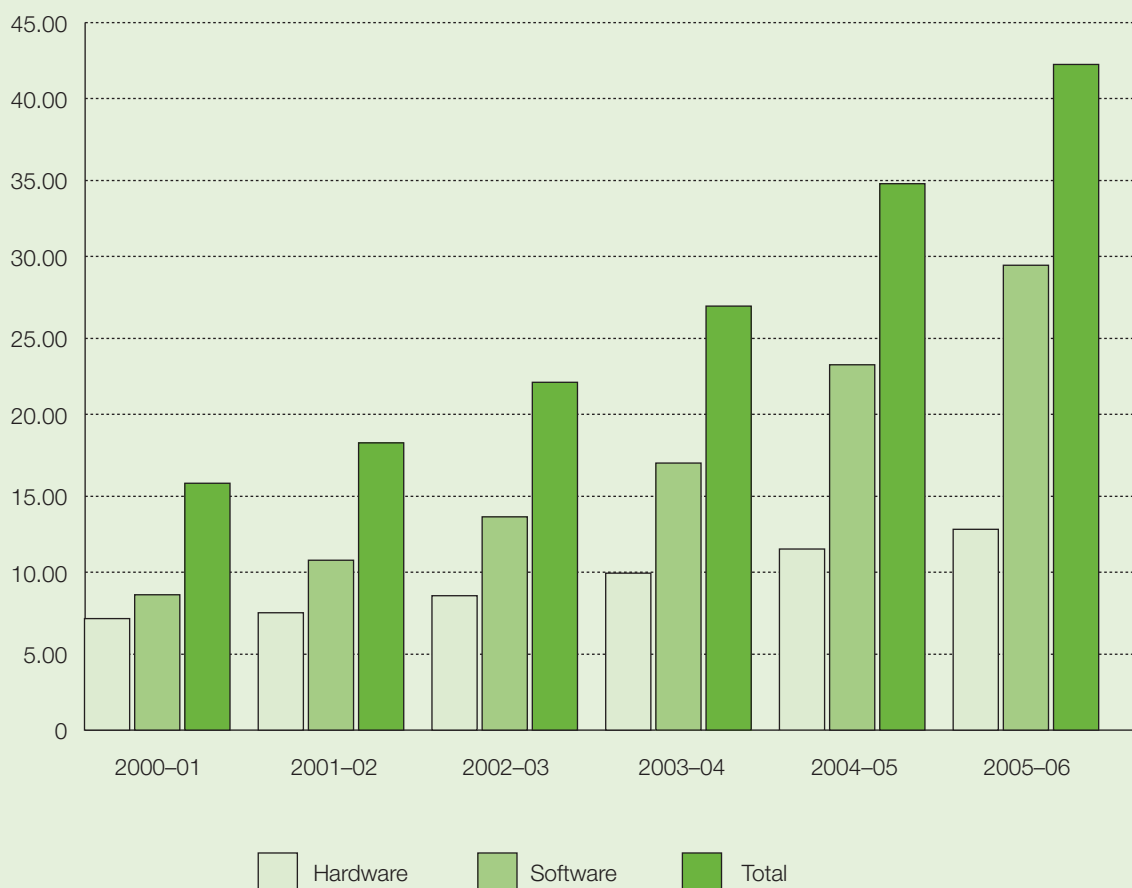
Industry size and sectoral composition

Electronics and IT hardware manufacturing in India grew by 15.6% in 2004–05 against an 8.5% growth in overall manufacturing. Total hardware production was Rs 56,000 crore (around \$12.73 billion) in 2005–06 registering an annual growth of around 12%. But this growth rate may not be adequate to

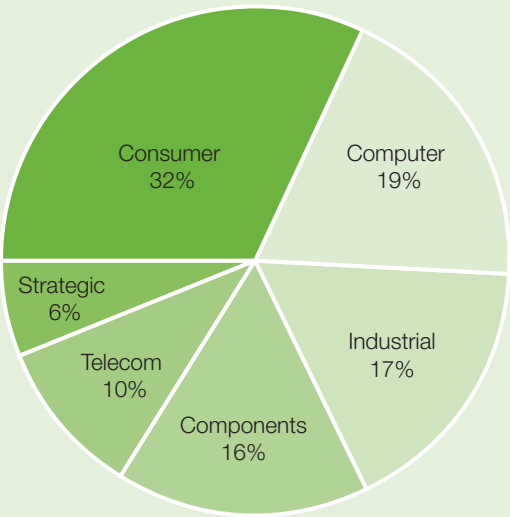
meet the increasing demand-supply gap and opportunities that lie ahead. Despite being amongst India's fastest growing industry sectors, integration with the global manufacturing chain has been sluggish.

The graphs below capture the production, export and growth trends in the Indian electronics and IT industry over the past 6 years (i.e. 2000–01 to 2005–06):

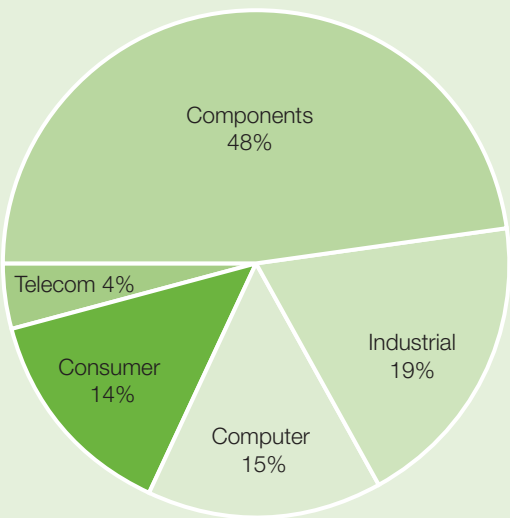
Hardware, software and aggregate production trends in Indian industry (In billion US dollars)



Breakdown of 2005–06 production of \$ 12,727.27 million by major segments



Breakdown of 2005–06 exports \$ 1,818.18 million by major segments



Indian production subject to global competition

Information technology (IT) manufacturing is the first industry sector in India to face a zero customs tariff regime. Between 65–70% of the products are covered by ITA (Information Technology Agreement) of the World Trade Organisation (WTO) with zero customs tariffs. The list of products slated for nil protection is gradually on the rise with FTAs (Free Trade Agreement) becoming part of several bilateral and regional trade pacts. Peak tariff levels for other remaining products (especially consumer electronics) were brought down to 12.5% in the 2006–07 Union Budget of the government. Against a total global electronics and IT hardware production of about \$1.4 trillion, India contributes just over \$12 billion.

Since March 2005, over 800 products covering 217 tariff lines are being imported duty free with the first phase of World Trade Organisation (WTO) Information Technology Agreement (ITA-1) coming into full force. It is anticipated that very soon, almost every IT and electronic product manufacturer in India will have no tariff protection and will need to compete with overseas manufacturers. Products that will no longer enjoy tariff protection range from telecom, personal computers (PCs), networking, strategic defence, industrial as well as some consumer electronic equipment.

Industry structure, market dynamics and the emerging scenario

At present there are more than 3500 manufacturing units of all sizes directly related to electronics value chain (employing 10 persons or more) and assorted clusters of manufacturers covering nearly 250,000 small and tiny units spread across the country which are directly or indirectly related to electronics and electrical manufacturing industry. These units employ over 3.5 million people and if we include persons indirectly supporting IT and electronics manufacturers by providing logistics, post sales, maintenance and related support services, this number increases by further 2.5 million. The emerging scenario of technology trends and consumption clearly suggest that the share of IT and electronics in India's output and employment is likely to go up significantly, subject to this industry finding a place in the global manufacturing value chain. This will bolster the growth of India's software, ITeS (IT Enabled Services), defence preparedness and other emerging industries like automobiles, precision engineering as well as biotechnology, which are now increasingly being driven by IT applications. At present, the asymmetry between hardware and software growth is clear. How the IT hardware industry combats the challenges of global competition will have a bearing on future policies and strategies for the manufacturing sector and the growth trajectory of the Indian economy.

Industry players are trying to carve out a niche in a market that has just witnessed unprecedented expansion. Sales of personal computers (PCs), mobile phones, telecom accessories and a

wide range of consumer products including colour televisions (TVs) have been increasing. In the telecom sector, the two leading companies – BSNL (Bharat Sanchar Nigam Ltd) and MTNL (Mahanagar Telecom Nigam Ltd) are planning to buy Rs 90,000 crore (US \$20 Billion) worth of equipment. The PC market in India is projected to see a massive boom with an estimated addition of over 50 million new PC users by 2010 with the future market being driven by low cost players. The diverse range of new genre digital products that combine embedded software, Radio Frequency Identification (RFID) technologies and manage data, voice as well as video signals offer huge manufacturing opportunities. The fastest growing segment is telecom with an estimated capital expenditure of \$ 50 billion. India is set to become the world's second largest mobile telecom market by 2007, when the projected mobile phone subscribers will increase to 250 million from the present range of just below 100 million. Investments in hi-tech manufacturing are gradually increasing and announcements to set up global-size plants in India also include facilities for mobile phone handsets and accessories.

Discernible shifts and emerging players with global operations

There has also been a pronounced capital flight from IT hardware to software and services. India's pioneering IT and electronics companies virtually abandoned operations in hardware and shifted resources elsewhere. Unlike the Chaebols of Korea or the giant conglomerates of Japan, who shaped the evolution of national electronics sector, Indian manufacturing has been almost devoid of large business houses. Instead, some of the existing big names like Wipro, HCL, TVS and the Tata's have engaged in low-key manufacturing of IT products and shifted focus towards software and services. Expanding operations of the newly emerging software design and application companies are not yet integrated with hardware, resulting in a 'lopsided' growth of the IT industry.

On the other hand, a group of new generation and lesser known entrepreneurs has moved in to dominate the IT and electronics hardware area, eg. Videocon, Onida group, Moser Baer, Celetron (now acquired by Jabil Circuit), Samtel, Tejas Networks, BPL etc. Recently, some multinational corporations (MNCs) have successfully joined the hardware manufacturing bandwagon. While software, services and hardware production have together grown to over \$40 billion, substantial resources are yet to be invested into semiconductors or chip manufacturing despite some modest government effort since the 1980s (eg. Semiconductor Complex Ltd., BEL, ECIL, ITI, etc.) catering for defence and communications. Thus, after five decades of IT and electronics manufacturing in India, the road to the future, presents a complex but intriguing story. At the same time, the recent success stories of a few IT manufacturing companies (including their worldwide acquisitions), offer strategic lessons for others in the industry. Embedded

technologies, design, and manufacturing along with a host of other activities are shaping the structure of the Indian electronics and IT industry. Annex 1 gives a list of global and Indian companies in the electronics sector who have carved out a niche for themselves in the Indian market due to excellence in product design, development and manufacturing.

The e-waste problem

Rapid diffusion of electronic products in India with rising consumption and product obsolescence has created a severe e-waste crisis. This is further aggravated by the large volumes of e-waste that are legally permitted to be imported. The total waste generated from electrical and electronic equipment (WEEE) in India amounts to about 146,000 tonnes per annum and this is projected to rise to 1,600,000 tonnes by 2012.

A majority of the recycling processes are carried out in backyard open smelters, inflicting severe damage to environment and human health. However, some non-governmental organisations (NGOs) and local firms have started organised training programmes on recycling and more recently modern facilities for recycling have been established. For instance, E-Parisaraa has implemented a non-incineration methodology for e-waste management.

In India, the e-waste problem is not properly addressed in the Hazardous Waste (Management and Handling) Rules, 1989 (as amended in 2003). Schedule 3 of the Rules contain Serial No A:A A1180 defining waste from electrical and electronics assemblies not eligible for direct reuse but for recycling. This is the only existing provision for managing and handling e-wastes in India. A national WEEE Task Force was constituted in July 2004 and it was expected that WEEE legislation would be enacted in 2006. However this has still to be finalised.

Although it is not possible to trace the impact that the EU Directives (WEEE, RoHS, EuP) and the forthcoming national WEEE legislation may have on the volumes of e-waste in India, it is possible to infer that pressures on producers to take back obsolete items as well as to re-design products to meet the requirements of the Directives may well have a positive impact on the e-waste problem in India in the long run. However this hypothesis remains to be tested.

1.2 Key industry associations and dissemination routes

The electronics hardware industry is governed by the Department of Information Technology (DIT) within the Ministry of Communications and Information Technology (MCIT). The DIT is the nodal organisation which overlooks developments and policies for electronics hardware and recommends policies for future direction.

The DIT also operates a number of institutes and autonomous societies which undertake research, testing and training on technical subjects pertaining to electronic products. Standardisation, Testing and Quality Certification (STQC) and Directorate of National Informatics Centre (NIC) are two organisations which operate as offices for DIT and oversee the entire activity related to Research, Quality, Testing, Education and Information Management.

Some of the important societies of DIT serving the electronics hardware industry are:

- 1 Centre for Materials for Electronics Technology (C-MET) – materials research
- 2 DOEACC Society – education
- 3 Society for Applied Microwave Electronics Engineering and Research (SAMEER) – EMC & EMI testing and compliance
- 4 Software Technology Parks of India (STPI) – software and hardware export oriented units
- 5 Electronics and Computer Software Export Promotion Council (ESC) – promotion of exports

Details about the above organisations are available at **www.mit.gov.in**

The key national associations serving the electronic hardware industry are:

- ELCINA Electronic Industries of India: focussing on electronic materials, components, Electronic Manufacturing Services, Industrial and Defence Electronics as well as other emerging areas such as medical electronics, auto electronics and so on. **www.elcina.com**
- MAIT: Manufacturers Association of Information Technology – which focuses on IT products, computers and peripherals. **www.mait.com**
- CETMA: Consumer Electronics and TV manufacturers Association – focussing on Consumer Electronic Goods and Household Appliances. **www.cetmaindia.org**
- TEMA: Telecom Equipment Manufacturers Association – for all telecom products. **www.tematelecom.org**

The above associations represent, by and large, the entire electronics hardware industry and provide a comprehensive platform for interacting with the industry and disseminating information. The websites of these associations provide information about their activities.

2.0 Legislation and industry initiatives

2.1 International legislation

Developments in Europe

There have been four major environmental legislative developments in Europe which impact the Electronics industry and all its stakeholders:

- The Directive on the Restriction of Certain Hazardous Substances (RoHS) [March 2003]
- The Directive on Waste from Electrical & Electronic Equipment (WEEE) Directive [March 2003]
- The proposed Directive on Eco Design and Energy Using Products (EuP) [2005]
- The proposed Directive on Registration, Evaluation and Authorisation of Chemicals (REACH).

The first two, RoHS and WEEE have more severe and immediate implications and have been transposed into national legislation in nearly all EU member states. The other two relate to environmental issues but are not limited to the Electronics industry. However, in due course they will have significant implications for EEE suppliers.

RoHS Directive restricts use of Certain Hazardous Substances in Electrical and Electronic Equipment and bans entry of goods into the EU market if they contain more than the permitted levels of lead, cadmium, mercury, hexavalent chromium and both polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. RoHS came into force on 1 July 2006.

The WEEE Directive on Waste Electrical and Electronic Equipment (2002/96/EC) aims to prevent WEEE arising, to encourage re-use, recycling and recovery of WEEE and to improve the environmental performance of all operators involved in the lifecycle of electrical and electronic equipment, especially those dealing with WEEE. The Directive sets requirements relating to criteria for the collection, treatment, recycling and recovery of WEEE. It makes producers responsible for financing most of these activities; retailers/distributors also have responsibilities in terms of the take-back of WEEE and the provision of certain information. Private householders are to be able to return complete WEEE without charge.

The **EuP Framework Directive** relates to Eco-design of Energy-using Products (EuP). The EuP Directive defines conditions and criteria for establishing requirements for environmentally relevant product characteristics (such as energy consumption) and facilitate their improvement. The target date for implementation into Member States laws is 11 August 2007. The EC is likely to set eco-design requirements for specific energy-using products which have a significant impact on the environment. This Directive covers a broader range of products than RoHS

and WEEE. Energy conservation and climate change are two of the main drivers for the Directive but not the only ones since eco-design considers all impacts. The Directive is unlikely to come into force generally within the EU before 2009. Producers will be expected to establish management systems and supply technical documentation on life cycle assessment and compliance.

REACH was adopted on 29 October 2003 by the EC to establish a new regulatory framework for chemicals. The new system called REACH (Registration, Evaluation and Authorisation of Chemicals) requires manufacturers or importers of more than one tonne of a chemical substance per year to register it in a central database. REACH imposes greater responsibility on industry to manage the risks from chemicals, provide safety information and pass information down the chain of production. Failure to register will mean that the chemical would not be allowed to be imported into the EU.

REACH would have major implications for electronics companies manufacturing within the EU as this industry uses significant quantities of chemicals in its processes. The objective is to control the use of hazardous chemicals in the EU and not to ban them. REACH does not apply outside the EU and only applies to process chemicals and not to manufactured products.

The key drivers for environmental legislation in Europe have been concerns regarding hazardous materials, environmental and health risks, growing volume of waste EEE, need to reduce greenhouse emissions and improve energy efficiency. There has also been recognition of the need for an integrated approach to product policy so that policy and regulation in one area does not have adverse effects in another and also the need for international standardisation.

Developments in Japan

Main developments in environmental legislation in Japan are:

- Fundamental Law for Establishing a Sound Material-Cycle Society [2001]
- Law for the Promotion of Effective Utilisation of Resources (LPEUR) [2001]
- Home Appliances Recycling Law (HARL) [2001]
- Green Purchasing Law (GPL) was passed [2001]
- Waste Management Law [2003]
- Japanese RoHS [2006].

'Reduce, Reuse and Recycle' (3Rs) is the basic principle on which Japanese environmental legislation is founded. The first three laws including Fundamental Law for Establishing a Sound Material-Cycle Society, LPEUR, and HARL and based on these

3Rs. The GPL applies to government purchasing and aims to create a green market for a number of publicly procured products. The Waste Management Law applies to responsible and appropriate methods of disposal of waste. Japan has emphasised creation of a recycling economy to minimise the use of materials and energy.

The Fundamental Law was enforced from January 2001 and establishes the principles under which other environmental legislation is expected to operate. This law outlines the responsibilities of the different sectors.

The Waste Management Law and LPEUR are subject to the Fundamental Law and govern the practical application and details of these regulations. The Waste Management Law basically deals with disposal whilst the LPEUR deals with the 3Rs through specific product-related regulation.

Hazardous substances in EEE and WEEE are not specifically covered within this framework of waste legislation but Japan has drafted its own version of RoHS and this was implemented in 2006. However, from the late 90s voluntary agreements were in place.

Although LPEUR and HARL are stated to be based on 'producer responsibility' there is a major element of 'consumer responsibility' since consumers pay for the schemes. In this sense they differ from WEEE, which is wholly paid for by producers.

The Green Purchasing Law was passed in 2001 to establish green purchasing as a national policy. This law mandates that all governmental bodies must conduct green purchasing, must create and publicise its purchasing policy each year and report purchasing records. There are over 150 items on the list which includes office equipment, lighting and electrical goods. This Law complements and supports voluntary purchasing initiatives such as the Green Purchasing Network, established in 1996.

The HARL legislation was passed in 2001 and gives the producers – manufacturers and importers – of four domestic appliance types, the responsibility of providing a national take-back scheme and the objective of achieving recycling targets. It includes air conditioners, washing machines, televisions and fridges/freezers as the items where the greatest environmental benefit could be achieved by responsible recycling. Some new categories are under consideration and may be added soon.

Sustainable waste management has been one of the key drivers for environmental initiatives and legislation in Japan for the last 20 years with its enormous manufacturing base and limited natural disposal options. Existing landfill space is due to run out in 2008 and the government has been following a planned strategy since the early 90s under the basic 3Rs – Reduce, Reuse, Recycle.

With huge generation of electronic waste (and other types of waste) the country has been seeking to reduce dependency on both natural resources and land disposal, and to mitigate society's environmental impact. Japan has been successful in making sustainable environmental development an essential part of economic progress. It has been able to disperse this culture into the Japanese industry which has in turn integrated sustainable development into its R&D and design policies.

2.2 Indian legislation

The Ministry of Environment and Forests (MoEF) is the national authority responsible for legislation regarding waste management and environmental protection. However, as of date, hazardous waste management laws do not regulate e-waste and local governments who are responsible for the collection and disposal of municipal solid waste, play no role in the collection or disposal of e-waste.

Hazardous waste in India is managed under the Hazardous Wastes (Management and Handling) Amendment Rules, 2003 which amends the original rules, namely the Hazardous Wastes (Management and Handling) Rules, 1989. These rules cover all types of hazardous wastes and gives a comprehensive list of industries and products covered. The amendment in 2003 added lead acid batteries to these rules which are also covered under the Batteries (Management and Handling) Rules, 2001 made under the Environment (Protection) Act, 1986.

Schedule 2 of these rules lists the Wastes Constituents with concentration limits based on BAGA (the Netherlands Protection Agency) List of Hazardous Substances. Schedule 3 Part A on List of Waste Applicable for Import and Export which includes List A1: Metal and Metal Bearing Waste lists out items related to electrical and electronic products, lead acid batteries, cathode ray tubes, PCB's, capacitors etc.

Pollution control is a subject under the MoEF and all such rules governed by MoEF are enforced by State Pollution Control Boards. The Central Pollution Control Board (CPCB) is the nodal authority under the MoEF responsible for enforcement of environment protection laws and is assisted by the State Pollution Control Boards (SPCBs). The CPCB is also formulating a Charter on Corporate Responsibility for Environmental Protection (CREP).

All industrial units with potential for causing pollution of any kind need a No Objection Certificate from the Pollution Control Board. These certificates are issued after conducting an environment impact study of the proposed unit.

A WEEE legislation called The WEEE (Management and Handling) Rules, 2006, is being drafted and was presented for deliberations at the National E-Waste Legislation Workshop on

3–4 May 2006, organised by the Ministry of Environment and Forests (MOEF), Government of India and German Technical Cooperation (GTZ). This draft is compiled by ASEM-GTZ (Advisory Services for Environment Management) for MOEF.

Other important legislation with respect to Labour and governance of factories are listed below. The Directorate General, Factory Advice Service and Labour Institutes (formerly the Chief Adviser of factories), attached to the Ministry of Labour of the Government of India was set up with the objective of administering the Factories Act. This Act defines the duties and responsibilities of manufacturers and service providers in provisioning certain minimum facilities for the labour employed, their conditions of employment, and basic amenities to be provided by the Factory employing them.

Model Rules framed under the Factories Act also define the scope and process for handling trade waste and effluents, public health requirements and requirement of basic facilities for the employed workforce. The Factories Act also defines Requirements in Respect of Dangerous Processes and Operations. Other laws relating to handling, storage and disposal of hazardous substances are the Environment Protection Act, and the Hazardous Waste (Management & Handling) Rules (referred above).

There are also separate labour laws that address social security issues/measures (The Wages Act, Payment of Bonus Act, Employees' State Insurance Act and Provident Fund Act), rules for employing women (Labour Act) and restrictions on employment of child labour (Child Labour (Prohibition and Regulations) Act).

2.3 Voluntary initiatives in India

E-waste is a recent 'discovery' in India and has received attention only during the last 5–6 years with a realisation of its adverse impact on the environment. Earlier, focus was more on toxic wastes in general and metal scrap. Interestingly, more work has been done in India in this field by international organisations rather than local ones. The Indo-German-Swiss e-waste initiative aims to document current e-waste handling in major cities and develop a database to mitigate their health and environmental hazards. Similarly the United Nations Environmental Programme (UNEP) project was established in 2005 to reduce environmental and health hazards in the city of Mumbai.

The environmental NGOs in India play an important informational role, being quite active in creating awareness regarding environmental issues and vocal about unacceptably high external costs of polluting industries. A few, like Toxics Links, have brought the issue into focus and are forcing manufacturers/importers and the government to come up with feasible solutions.

A Greenpeace initiative was started in 2005 to provide information on workplace and environmental contamination due to electronics recycling in India. There has been direct action by Greenpeace and demonstrations at Wipro Infotech, Bangalore, a huge electronics and software services/business process outsourcing company. This resulted in Wipro launching an e-waste disposal service to end customers from September 2006.

A major electronics manufacturer in India, Bharat Electronics Limited, has set up environmental management system to eliminate the use of poisonous and toxic chemicals in crystal processing. They have also successfully reduced resource and material consumption and have replaced hazardous materials like tri-chloroethylene and isopropyl alcohol.

HP, has taken the initiative to offer collection programmes for its printers, especially for large corporate clients who generate reasonable volumes. The cartridge take back is motivated more by commercial reasons, than from an environmental point of view, because HP wants to discourage the proliferation of cartridge re-use which is substantially cheaper than its own original supplies.

Two e-waste recyclers in Bangalore, one of the largest generators of e-waste, have been authorised to set up commercial ventures to recycle e-waste. These two are E-Parisaraa and Ash Recyclers.

EMPA, Swiss Federal Laboratories for Materials Testing and Research, a major research organisation in Switzerland, has been conducting studies and doing research in New Delhi and Bangalore along with the German organisation, GTZ, to understand the generation and management of e-waste in India. M/s IRG Systems South Asia Pvt. Ltd (IRGSSA) carried out a pilot study in the Delhi region under guidance from EMPA, Central Pollution Control Board (CPCB), Delhi Pollution Control Committee (DPCC), and MAIT, an industry association. Their field study revealed that the e-waste, particularly computers, coming into the market for recycling is much older than in Switzerland. This is likely because the life-time of a computer is longer in India. An EMPA pilot study in New Delhi (EMPA, 2004) indicated that the entire industry is based on a series of networked relationships between collectors, traders and recyclers, each adding value, and creating jobs, at every point in the chain. The main incentive for the players is financial profit, not environmental awareness. However, these trade and recycling alliances, which exist outside the legal framework, provide employment to many groups of people.

Recognising the seriousness of the problem, the Indian government has recently constituted a workgroup involving manufacturers, importers, NGO and experts to draft an e-waste management strategy, which was scheduled to be launched in 2005. This workgroup comprises representatives of the pollution control board, manufacturers, NGOs and international

experts, first met in August 2004 and is trying to set the course for future actions.

Industry Associations in India are now collaborating actively to formulate a policy to manage e-waste and also to spread the culture of sustainable trade and eco-design. ELCINA and MAIT are working actively with the Department of IT to formulate a policy for RoHS and WEEE and have set up an e-waste working group. An eco-design club has also been floated by ELCINA with the aim to support the eco-design tool development initiative undertaken under the AEDE Project (www.cfds.org.uk/aede).

3.0 Implications for suppliers

3.1 Implications of EU Directives and voluntary initiatives

WEEE, RoHS and EuP as well as voluntary initiatives in the EU and elsewhere have an impact on the Indian electronics industry through the supply chain. The nature and extent of the impact varies depending on the type of product and the position of the manufacturer in the supply chain. The present section summarises some of the most important implications emerging from a survey of 16 Indian companies covering a range of products including cathode ray tubes, semiconductors, printed circuit boards (PCBs), resistors, switches, relays, connectors, electronic parts, materials and environment management services. Companies surveyed included multinational corporations (MNCs), large Indian companies and small and medium-sized enterprises (SMEs). For a more detailed description of survey results see Annex 2.

a: Awareness and preparedness

The general awareness levels regarding the WEEE and RoHS Directives were found to be quite high. However the level of preparedness to implement the requirements remains a matter of concern, especially amongst SMEs manufacturing capacitors, resistors and other passives. Larger companies producing PCBs and connectors were the most advanced in terms of readiness to meet international norms.

b: Technology and process changes

The lead imbroglio

Replication of the successful transition to lead free processes in Japanese companies may prove difficult for Indian companies without active collaboration with other players in the supply chain. Perfecting technology transformation and reaching satisfactory volumes of production with lead free processes to achieve economies of scale can take a lot of time with the possibility of several cases of performance failure.

Indian industry will have to learn from the successes and failures of switching to lead-free processes. For over 50 years, soldering processes throughout the world used lead in the electronics industry to fix components to printed circuit boards (PCBs). The most preferred alternate choice now is the tin-silver-copper mixture. But it is argued that there is still no superior alternative to the traditional tin-lead solder in terms of reliability and cost. These substitutes to lead are found to have varying melting temperatures and many producers are still exploring alternative assembly processes. Credible reports based on actual experience of manufacturers raise doubts about the robustness and efficacy of lead-free alternatives. Apart from higher cost, lead free processes can harm components. Not only can passives and PCBs be damaged by lead free processes that require 30–40 degrees higher temperature and longer heating time, their reliability is also in question. Manufacturers will have

to be far more cautious about quality aspects. It is expected that the initial transitional phase for India to lead free processes will be potentially quite difficult, with improvements taking place as volumes pick up and processes stabilise.

Restrictions on copper

Large quantities of copper are used in manufacturing laminates and PCBs. Aluminium could be a viable alternative when produced in foil form and laminated to all common materials, such as epoxy glass, with acceptable peel strengths. It is felt that aluminium PCBs will be easier to recycle than copper ones. The process of plating through holes using copper is polluting. Efforts are underway to replace this forty year process technology by other cleaner alternatives such as gold plating. An Indian PCB company has successfully refined this process of gold plating to bring down costs. Gold (as well as Nickel) is regularly recovered from spent solutions and is also recovered from rejected boards.

c: Costs of compliance

The WEEE Directive places the onus of covering recycling costs on the equipment 'producers' based in Europe, typically brand vendors, distributors or importers. The producer is defined as one who manufactures and sells electronic equipment under his own name, or resells under own brand equipment produced elsewhere, or imports/exports electronic equipment into the EU. Although the WEEE Directive does not cover components or sub-assemblies and the accountability rests with the final producer, component and sub-assembly makers will be affected through the supply chain. Much would depend on their ability to secure a firm place in the supply chain by producing goods that meet the specifications of the final equipment producer. The direct impact of the WEEE Directive on Indian companies is negligible as very few export finished equipment to Europe. The exceptions may be very large Indian companies such as Videocon and Onida who have capability to deal with European WEEE. RoHS has a much greater impact on Indian companies as a large number export components and electronic sub-assemblies to Europe.

The precise recycling cost to producers varies significantly across countries. Greenpeace estimates that the recycling costs of a PC will be \$20 in the US and \$2 in India. The lowest compliance cost is that of cell phones, estimated at little over \$1. Costs will decline as competition picks up and economies of scale come into full swing in the recycling processes. It is expected that all players in the supply chain will end up paying some share of the final recycling cost, and that a portion of this cost will be passed on to consumers.

Given practical difficulties and cost implications, recycling programmes deserve more attention. The Indian industry and government should, therefore, closely track these global trends to evolve their strategies and action plans. It is desirable for

the material suppliers to consider exploring e-waste streams as a raw materials source. The focus of original equipment manufacturers (OEMs) should be on design for disassembly and finding ways to fund this.

Costs of compliance with RoHS depend mainly on the costs associated with substituting lead free components, capital equipment, and materials. A Prismark study estimates the following cost increases for RoHS compliant products. These may be used as a benchmark by Indian industry.

Lead free solder paste cost factors

Cost factors	Percentage increase in paste cost
Metal cost premium (more tin and silver)	7%
Patent royalty payment	5–9%
Higher energy costs to make alloy	3–8%
More complex process (three component alloy)	1–3%
NRE-Research (flux, stencil properties, aging, etc.)	10–20%
Total initial cost increase (at the current stage)	36% average
Total steady state high volume cost adder (future)	20%

Source: Prismark Partners LLC (www.prismark.com)

In the case of PCBs, shifting to lead-free processes may not be costly and price variance is expected to be unlikely at least in the medium term. But these lead-free PCBs warp or crack under the required high temperatures for lead-free solder. Not all are able to resolve this problem quickly. This might translate to higher costs.

For substrates that contain lead, e.g. flip-chip ball grid array (BGA) packaging, the cost hike is anticipated to be 10% for the substrate to be RoHS compliant. This cost is likely to be passed on to their customers who are chipset makers and can finally be passed on to motherboard manufacturers.

Passive components like capacitors and chip resistors are particularly susceptible to damage from the hotter lead-free process calling for greater caution and expertise in adapting to alternate substances. Japanese players dominate the passives market with Murata, TDK, Taiyo Yuden having long experience in supplying similar parts to the branded Japanese giants. Conversion to lead-free by Semco and Yageo was reported to be complete with negligible cost implications. Indian companies can use them as benchmarks.

Other expenses and risks include testing. Costs associated with testing include high priced testing equipment, labour and associated administrative expenses.

Since most companies will offer both RoHS compliant and non-RoHS compliant products for some time to come, inventory risk management will become an important and additional task. Initially, assemblers and distributors will have to keep track of twice as many parts. A thorough evaluation and planning of the assembly process would be necessary for Indian companies to overcome these hurdles to lead-free assembly.

It is clear that compliance measures will require substantive investment from Indian companies covering costs of product-redesign, re-tooling of production lines, new materials, new processes, product testing facilities (in-house and third parties), personnel training, consulting expenses and the writing-off of discarded hazardous products and materials. As compliance standards keep rising, investment costs are bound to increase. In some cases costs have been reduced, although marginally, such as in the case of a medium sized company manufacturing Semiconductors. Historically, they used potassium dichromate solution as pre cleaners in axial diodes prior to lead finish. A non hazardous chemical MICROPREP 18 was tried and found to be a substitute which resulted in the elimination of chrome from the process, and costs were reduced both in manufacturing and effluent treatment by approx Rs.100,000 (US\$ 2300 approx.) per year. The company also substantially reduced the consumption of power per microchip manufactured and similarly reduced the consumption of water.

d: Penalties

Penalties for non-compliance with the WEEE Directive differ across European countries and come under two headings: failure to register and non-compliance. Those failing to register need to pay €100,000 in Italy and a staggering €1.5 million fine and two years in prison for Estonia. France imposes €7500 and Spain €1.2 million for non-compliance. Germany and Ireland ensure that non-compliant products are either blocked or taken off the market. EU authorities will conduct spot-checking of electronic imports for compliance and any RoHS failures will result in producers having to pay fines. Typically, non-compliant goods have to be shipped back to the country of origin. In such situations, the producer can divert the product to another country, which could possibly accept it. Or else, it has to dismantle the product to remove hazardous substances and rebuild it. Whatever the case may be, this could ultimately translate into higher costs.

e: Marginalisation of smaller suppliers

Suppliers failing to meet compliance requirements risk being marginalised. SMEs not closely associated with the OEMs and ODMs are more vulnerable than others. The problem is further aggravated for SMEs by the prevalence of a multitude of requirements, lack of transparency in communicating these requirements, and, short deadlines for meeting them.

Failure to comply by SMEs will result in loss of international sales and possibly a portion of domestic sales. Besides, non-compliance would imply huge penalty costs and/or take back of product, leading to higher operational cost of higher inventory as well as redirecting the item to other acceptable destinations. All this would imply significant cost escalation with negative impacts on overall business operations.

f: Socio-economic impacts

Under some circumstances of non-compliance, rising costs or loss of business, SME units may close down or downsize operations. In either case, there will be loss of jobs and income generation opportunities. ELCINA has reported the loss of about 60 companies from its membership over the last 4 years due to company closure or shifting business out of electronics hardware resulting from an inability to compete.

The magnitude of unemployment following lay-offs by non-compliant companies will depend on how fast the released employees can find work elsewhere and also the economic base of the location. In depressed economic regions, the negative impact of lay offs will be significant. Employees in regions close to large manufacturing hubs like Bangalore, Delhi, Mumbai Hyderabad, Pune and Chennai are likely to find new jobs and rehabilitation prospects as compared to others. In India, particularly near large metropolitan areas and urban

centres, alternative employment has been provided by the service sector, especially call centres and software companies.

With significant SME domination in the Indian electronics industry, the net impact on employees in terms of job losses in the short term is most likely to be negative.

Impact on women employees is also expected to be negative as there is a high percentage of the work force is female.

Finally, if the government comes out with clear-cut legislation on e-waste, all those involved in dubious recycling in backyards will need to look for alternate sources of occupation and income. There is also an opportunity for India to learn from the problems associated with the implementation of the WEEE Directive in Europe. An element to be considered is the incorporation of 'individual producer responsibility' (IPR) requirements to stimulate eco-design and e-waste reduction, something that has been neglected by Member States in the EC.

3.2 Competitiveness of Indian industry versus other Asian countries

Despite some highly competent companies in India, the industry average level remains low when benchmarked with other emerging economies including Thailand, Taiwan and China. The situation may get worse if there is further delay in government support to industry. On the whole, it must be concluded that in the case of any lack of investment and preparedness across the industry with minimal government support, it is quite possible that Indian industry and the national economy shall be competitively disadvantaged relative to other countries. This would also imply job losses, factory closures, operational losses of companies and depressed incomes impacting the entire economy.

Indian electronics and Japanese initiatives – some benchmarks and lessons

An attempt has been made here to benchmark the status of Japanese companies (based on a recent AEDE survey – see www.cfsd.org.uk/aede) with Indian electronics. The Japanese have some useful lessons to offer.

- Like India, the larger Japanese companies appear to have responded positively to the new policy, legislative, and business framework. Smaller Japanese companies are ahead of Indian SMEs.
- Unlike India, there has been substantial investment in cleaner technology and also in developing the infrastructure for recycling home appliances as well as office equipment.
- The initiatives by the top Japanese OEMs like Toshiba, Sony, Matsushita, NEC and others towards greening supply chain by working closely with their vendor is an important lesson for Indian industry.

- The move by Japanese companies to place greater focus on green product development with highly challenging goals for the next 5–10 years offers useful lessons for Indian companies.
- Japanese initiatives on green procurement initiatives need to be adapted and implemented in India
- India companies should adopt the Japanese system of broader product-related environmental information systems incorporating data on materials, chemical, energy and packaging.
- Like Japan, a standardised approach to environmental accounting can be evolved in India. Importantly, a clear definition of environmental cost categories was developed by Ministry of Environment in Japan during late 1990s.

4.0 Gaps and future needs

The following gaps and needs were identified during the course of the industry survey mentioned above and summarised in Annex 2.

4.1 Management

Major gaps

- There exists a huge conceptual gap in integrating environment management and corporate responsibility into business strategy. Environment management systems (EMS) are mainly driven by compliance pressures and not yet seen as best practice benchmarks. This in turn implies that environmental considerations are not incorporated during the idea-generation phase of product development. Thus, there is a huge capacity gap in eco-design initiatives. This gap poses severe problems for SMEs in India in relation to the potential eco-design requirements of the Energy-Using-Products (EuP) Directive .
- The problems for SMEs are likely to multiply, if large companies and MNCs switch to more reliable larger suppliers. This will result in shrinking or even complete loss of business for the SMEs. As the demand for recycling and greening of supply chains increases, the SME supplier base may gradually be phased out.
- EMS practices (like eco design, recycling, etc) are not usually customer-centric with virtually no participation of marketing professionals in work on cleaner and greener products. The signals and feedback from customers (i.e., the final consumer or OEMs/ODMs, tier two companies) are often missed out. This gap in business practice has meant that companies are unable to strike a balance between consumer needs and EMS practices. As a consequence, industrial designers do not feature in the value chain of the product.
- There is a severe information gap in the Indian government (policy making as well as implementation agencies), in the area of best practices and international compliance challenges. There is no government agency which is solely responsible for tracking and benchmarking international environmental compliance measures and appropriately adapting them to the Indian economic, social and political context. Industry (especially MNCs and larger companies) on the other hand, are ahead of the government in terms of information on best practices and compliance norms.

Needs

To cope with compliance challenges and change, suppliers to electronics OEMs/end-users need to induct proper management systems. The following management related actions are required, especially for SMEs:

- Understanding and implementation of EMS through ISO 14000 certification and ISO 9001 quality systems.
- Understanding the importance and perspectives of different stakeholders in business strategy.
- Providing timely and relevant information to cope with ongoing changes and their implications. This would call for: monitoring systems, compliance evaluation and control measures, fine tuning internal communication and information systems, developing extensive external communication with customers, industry associations, national regulatory authorities and government agencies.
- Establishing effective planning systems including:
 - a. Strategies to phase out hazardous substances
 - b. Investment in new production lines, processes, materials, testing capabilities, training and other requirements.
 - c. Strategic planning for re-designing products and production processes in tune with the needs of recycling, energy efficiency or other operational upgrading that may be directed by customers, OEMs or the final end-user. These may include planning for labelling of finished products as per WEEE or other mandatory stipulations.
- Formulating plans for SA 8000 and labour standards as per national and international norms
- Planning for management and audit of quality and eco-design programmes.
- Integrating eco-design and green procurement into organisational processes
- Above all, there is a need to educate management in developing countries about the correlation between RoHS, WEEE, EuP, LPEUR and HARL and effective eco-design. If the culture of eco-design can be disseminated and understood, products will meet the requirements of environmental legislations and sustainable trade. This can be done by showcasing examples of the few companies which have successfully implemented eco-design and effectively utilised it as a tool for commercial as well as environmental success.

4.2 Technical needs

Major gaps

- While most companies focus on continuous improvement (which are more incremental in nature than substantive improvements), there is a very large gap in terms of recycling, remanufacturing, and dismantling abilities. Hence, recycling will pose a huge operational and cost burden for companies. The problem is further compounded by the virtual absence of a life cycle approach and government support for recycling.
- There is no concerted drive in Indian industry towards lead free manufacturing and the technological gap in this area could be a severe concern with the EU RoHS Directive which came into effect on 1 July 2006.
- There is also a capacity gap in recycling technologies for plastics, some metals as well as chemicals. Recycling needs to be established as an organised business in India which works within environmental norms.

Needs

- Understanding and tracking all relevant legislations and their implications
- Creating technical infrastructure and support systems (for eco-design, recycling, e-waste collection, treatment and disposal, etc.)
- Training industry on cleaner process technologies and transfer of knowledge.
- Creating new technical institutes and identifying some existing ones for leading technical aspects of the environment movement involving all stakeholders – industry, professionals, shop floor workers, researchers, NGOs, e-waste management agencies and governments. All stakeholders need to be assigned well-defined responsibilities and made accountable for actions.
- Training on operational aspects like product design, re-design, tooling and re-tooling, new materials and processes, product testing facilities and validation.
- Collecting and communicating life cycle related information including on EuP and other technical requirements such as energy management, labour standards.

5.0 Capacity building plans

This section describes a set of capacity building measures that need to be implemented by Indian industry in collaboration with the government and international agencies. The measures have been identified based on the industry survey completed by ELCINA. Annex 2 provides details of action plans identified for different products/processes. The following paragraphs highlight short, medium and long term actions to be implemented across the sector.

5.1 Short-term capacity building measures

The focus of short-term capacity building measures by the government and industry has to be on RoHS compliance and developing a well integrated information and communication system on fundamental data and operational aspects. The most prudent approach would be to target as many SMEs as possible. This has to be done within a stipulated time frame in the short term by concentrating on key suppliers who quickly transmit the learning to others in the supply chain. In this regard, the Taiwanese model of working with targeted suppliers could be followed. These capacity building measures have to be taken up at the national level with joint programmes by the government and the industry. Some of these short term capacity building measures are:

- Elaborate and implement a comprehensive government regulation on RoHS compliance focusing on rapid implementation and standards for guidance on eco-design.
- Set up a task force under the leadership of the Department of IT in collaboration with Ministry of Environment as well as Ministry of Commerce and Industry, to quantify the size and potential of the re-conditioned and re-manufactured market for electronic products. This task force should also provide a clear definition of responsibilities of recycling amongst producers, suppliers and other stakeholders, and should be done in collaboration with industry associations.
- Develop an effective information and communications process with internet and intranet support systems
- Prepare dockets in digital and hard copies on all relevant global environment management practices
- Train companies to establish and implement management systems that focus on compliance requirements and involve all decision makers and stakeholders
- Initiate highly specialist training modules in eco-design for industrial designers in companies. Redesigning products in an eco-friendly manner and involving design engineers and design institutes like NID (National Institute of Design) is strongly recommended for this purpose. Eco-design workshops across major industry clusters and hubs could be

a regular curriculum spearheaded by industry associations like ELICNA. Some of the IITs (Indian Institute of Technology) should be approached to start to actively engage in eco-design. It would also be important to learn from international experience, since most of the process technologies currently used in India are imported from the EU, Japan and the US.

- Initiate research on cost structures of cleaner processes to suggest methods for bringing down compliance costs particularly for the SMEs. Strategies for shifting to lower cost structure can also be appropriately formulated. This can be done in collaboration with business schools.
- Joint R&D and technical projects with European agencies on cleaner technologies can also be taken up by leading Universities and institutes.
- Design effective technical know how and testing programmes for target companies.
- Design and implement intensive training programmes and infrastructure development for recycling, with cost-benefit analysis models clearly defining incentives as well as penalties.
- Organise focused and high impact workshops on capacity building measures for combating specific compliance challenges.

5.2 Medium-term capacity building measures

Once the short-term capacity measures start yielding results, the medium to longer term measures will need to focus on building ongoing support programmes and initiatives to raise the level of preparedness and competencies of SMEs to respond to future regulatory challenges. While the general thrust areas for medium-term capacity building measures remain similar, the skill levels and the knowledge base will need to be further upgraded. Also, in the medium-term, the systems and competencies developed will need to be institutionalised at the national level.

Coordination between agencies in the field of research, training, testing and certification will be key to successful implementation. Industry and trade associations will have a catalytic role and ensure that the momentum of progress is not lost. Collaborative ventures amongst industry, government and academia should also play an important part at this stage.

A medium-term action might be to set up partnerships with companies like Siemens, Tyco, AT&S, Sony, Philips, Nokia, Solectron, Jabil and Flextronics who are positioned at various stages of the supply chain.

5.3 Long-term capacity building measures

As the industry and the economy moves up the learning curve, enhancing competitive advantage in the global arena through innovation would assume significance. This will be a critical element of long-term capacity building measures. Building on the achievements in the short and medium-term and extending these initiatives will also constitute the long term agenda.

In the long-term, the Indian industry has to strategically position itself to effectively respond to global environment management practices and new developments in US, Europe and Japan. Securing a firm position in the global supply chain and initiating corporate social responsibility (CSR) through improved stakeholder engagement should be a priority in the long term.

For propagating and sustaining environment management best practices in the longer-term, a group of leading companies setting industry benchmarks can make their professionals available for training and implementing clean technology processes for a fee. Part of the fee could be borne by sponsors and agencies championing the cause of environmental protection. This activity could be coordinated by industry associations like ELCINA as part of its newly created Environment Cell. All such initiatives have to be taken up at the national level with the aim of reaching out to as many companies as possible.

The Government has a key role to play in long-term capacity building. In particular, it needs to:

- Devise support systems including infrastructure development to bring down compliance costs
- Track global compliance requirements on an ongoing basis and develop appropriate policy agenda and implementation programmes. A senior officer with decision-making powers (Director or Joint Secretary) from the MOEF (Ministry of Environment and Forests) needs to be assigned to the MC&IT (Ministry of Communications and IT) to evaluate all technical issues and develop a better understanding on compliance challenges. This collaboration between the two Ministries is critical for sharing responsibilities and addressing the challenges.
- Support design, testing, tooling, training for EMS compliance targeting as many SMEs as possible. This could be done jointly with the industry, training institutions, academia and other enabling agencies.

Summarising the capacity building measures required, the primary actions required are :

- Prepare clear standards on RoHS, WEEE, EuP, LPEUR, HARL and eco-design as guidelines for the Indian industry
- Support training and information dissemination on sustainable trade and environmental issues to the industry which would encourage them to be proactive on the issue
- Active engagement of the government on all aspects critical for success ranging from creating standards, legislation, training as well as promotion of testing and recycling facilities.
- Creation of public awareness on environmental issues and the encouragement of corporates to actively participate and support programmes.

Annex 1: Global and Indian companies involved in the electronics market in India

Global companies	Hi-tech product design, development, manufacturing and other activities
Philips	DVD video code. Philips began designing 65 and 90 nanometer chips in Bangalore
Apple	iPod audio code
Texas Instruments	OMAP
Microsoft	J Sharp and others
Adobe	Reader for Palm and iPaq
Intel	Chip codenamed Whitefield for the first time to be designed from scratch in India. Chip testing to commence shortly with massive investment amounting to \$ 700 million
Cisco	IOS core components
Hewlett Packard	Manufactures computers – desktops and laptops – printers, digital cameras, PDAs, ink and toner cartridges.
Oracle	OpenView kernel and components
Tyco, Molex and Amphenol	All are leading global connector makers with competitive production base in India and exporting
Elcoteq	Electronics manufacturing and services for mobile handsets
Flextronics	Wide range of telecom networking products, accessories and services
AT&T	One of the world's largest PCB maker supplying from India to leading global telecom players
EPCOS	Siemens-Matsushita set up exporting passive components out of two factories in India
Vishay Components	US based leading player sells components across the world from its production base in India
ISMC	Plans to commission large-scale low-end chip manufacturing facility in India

Indian companies	Hi-tech product design, development, manufacturing and other activities
Moser Baer India Ltd.	Third largest optical disk manufacturer in the world
VXL Instruments	Third largest global terminal equipment manufacturer
Hical Magnetics	Supplies magnetics to world's leading mobile handset makers
Celetron	Amongst the earliest to initiate large global operations in computer peripherals from mid-1990s
Videocon	Acquired cathode tube plants of Thomson to emerge amongst the largest players in the world. Bought consumer electronics business from AB Electrolux (Sweden) and Hyundai (Korea)
Ajanta Clocks	World's largest electronic clock manufacturer and also operating from China
Glowtronics	Supplies cathode heaters to NASA, USA
Samtel Group	Acquired monitor plant in Germany. Inducting flat panel and plasma technologies. Hiked capacity Colour picture tubes and glass parts for picture tubes
Epigon Media Technologies	Designed complete innards of internet radio to be manufactured by Taiwanese OEM and being tested Japanese companies. Digital satellite radio in trial and experimenting with portable Karaoke.
Tejas Networks	Start-up making low cost corDECT wireless technology products innovated in India (IITMadras).
MobiApps	Its product Mtrack sells in 20 countries and helps track, manage and access as well as monitor all mobile assets. The product integrates GPS technology and wireless communications to provide users location relevant and time sensitive information on their mobile assets.
Ittiam Systems	Provides electronic design to clients and has 3 product lines – a) wire line and wireless, b) speech and audio, c) image and video – from which 6-8 products have emerged.
Novatium Solutions	Start-up building US \$ 100 computer using thin client architecture running on Windows and open-source platforms supporting e-mail, word processing, spread sheets, presentations and web-browsing. Uses innovative micro signal architecture that integrates functions on a single chip. Expected users include schools, colleges, hospitals, community centres and businesses in developing countries.
Xenitis and Xenitis Unitek	Launched branded sub Rs 10,000 PCs and has JV(Taiwan) for PC component manufacturing
Tata Consultancy Services (TCS)	Next-generation smart cards to be ready by 2006 with own chip design and affordable prices but cards to be manufactured in Taiwan

This table also highlights that software design and hardware manufacturing are not integrated in India.

Annex 2: Company survey results

The 16 companies covered in the survey are leaders in areas like cathode ray tubes, semiconductors, PCBs, capacitors, resistors, switches, relays, connectors, electronic parts, materials and EM services. These also represent five areas: Active, Passive and Electromechanical Components, PCBs and Electronic Manufacturing Services. However, given the possible 'producer responsibility' for e-waste management and recycling, the report also tracks OEMs and the final good manufacturers. Various players in the supply chain have also been researched.

The survey was also supplemented by factory visits and interactive sessions. Input from industry associations, technical experts and opinion makers have also been incorporated into findings. Direct and indirect interaction with SMEs made up for the poor response of SMEs to this research. To conclude, the participants in the survey included reputed MNCs, large Indian corporates and a small group of SMEs.

Analysis and action plans based on industry response

Product/processes	Current status & concerns/gaps	Action plans/capacity building
Recycling	Few private initiatives – scattered and on low scale. There exists a large informal, primitive recycling activity causing severe damage to environment and health. A national funding mechanism or pricing model for recycling does not exist.	Improve infrastructure, strict legislation and enforcement. Ban e-waste and junk imports as well as open backyard recycling processes like smelting, etc. Government to define responsibilities, incentives and penalties.
Eco-design	A few companies implementing eco-design – but basically is virtually non-existent at present. Lack of coordination between industry and institutes with government playing a passive role with no clear future plans.	Initiate collaborative work with industry-academia-government. Eco-design work for major electronic products could begin on a project basis at the national level. Product life cycle management and de-manufacturing to be given priority.
Lead free processes	Satisfactory awareness but only few companies are ready. No concerted programme from government. Some good benchmarks exist in the industry.	Make standard processes available and provide testing and other infrastructure to bring down compliance cost for lead free process. Focus on SMEs and use existing
Eliminating ROHS items	Barring few, most companies are way behind and not properly focused on RoHS imperatives. Existing industry benchmarks can help and there are professional experts who can be utilised. Compared to other nations, government in India is way behind. General industry is reactive.	Immediate RoHS legislation, enforcement and support needed from government. Pool of technical professionals for training required. Standardised processes for SMEs to be developed. Information and awareness programmes needed.
Capacitors	This highly fragmented industry is not RoHS ready. EMS practices are often misunderstood. WEEE compliance for SMEs unlikely in near future.	Few good industry leaders can offer good benchmark for EMS including RoHS and WEEE compliances. Government support and training as well as infrastructure needed.
Resistors	Only very few companies are nearing compliance and EMS practices are lagging behind.	Those nearing compliance can associate with others in the industry. Government support and standardised processes can help immensely.

Product/processes	Current status & concerns/gaps	Action plans/capacity building
Connectors	Well advanced, most leading companies are RoHS compliant and have made good progress towards WEE as well as other EMS practices. Smaller companies have lot of catching up to do.	Successful companies can play a leadership role for the industry. These companies can start a 'greening supply chain' campaign and also create industry benchmarks.
Switches, relays & other electronic mechanical	Mixed industry response and few confirmed success with RoHS and other compliances.	Awareness and training programmes along with government support can help.
EM services	Once again a mixed response given the variety of activities involved. Need to gear up.	Here some leading companies part of the global supply chain have taken a lead. Immediate infrastructure and government support required.
CRT and parts	Most companies are RoHS compliant but recycling and WEEE compliance needs focus.	Those not fully compliant need to gear up and have the resources and capacity to do so.
Semiconductors	Only a few players in the industry are already RoHS compliant and have taken rapid strides in EMS.	This is a highly competitive industry and regular international benchmarking can be useful.
PCBs	Great initiatives by some companies but others have to catch up. Some companies have come up with highly innovative EMS solutions.	Industry associations and government can work closely with the leading companies to speed up compliance and EMS culture across industry.
Waste management	India's e-waste management problems are alarming with no government action. Some micro level initiatives from companies cannot solve a major national problem, which is growing.	Apart from strict legislation and enforcement, the government needs to create a robust ecosystem for waste management and encourage/support those taking initiatives. A WEEE Legislation is required urgently. Presently in draft stage.
Energy management	Average industry performance satisfactory but the culture has to spread further. Presently driven by market for products with lower operating cost.	Industry bodies/government agencies can popularise energy saving demonstrating the benefits. Need for mandatory energy labelling of products and align with EU Standards.
Effluent treatment	This is extensively done in the electronics industry.	National level programmes can be run regularly.
Water management	Has started with some companies.	Demonstration projects can be run by industry.
ISO 14001	One-third of the electronics industry has it, many others are to get the certification.	ISO 14001 is the means and not the end. Integrate compliance with ISO 1400.
Corporate Social Responsibility (CSR)	Recognised primarily by publicly listed companies or those with broad-based stakeholders.	Concerted effort by industry, international benchmarking and case studies can help.
Stakeholder perspective	This is still at an incipient stage.	International benchmarking needed.

Based on the industry survey and supplemented by interactions, expert opinion and information in the public domain.

Annex 3: Ministry of Environment & Forests (MOEF) – generic approach and recent moves

Legislations on environment, forests, and wildlife

Sr. No.	Category Name	Sr. No.	Category Name
A	Water Pollution	D	Public Liability Insurance
B	Air Pollution	E	National Environment Appellate Authority
C	Environment Protection	F	National Environment Tribunal
1)	Coastal Regulation Zone	G	Animal Welfare
2)	Delegation of Powers	H	Wildlife
3)	Eco-marks Scheme	I	Forest Conservation
4)	Eco-sensitive Zone	J	Biodiversity
5)	Environmental Clearance – General	K	IFS
6)	Environmental Labs		
7)	Hazardous Substances Management		
8)	Noise Pollution		
9)	Ozone Layer Depletion		
10)	2-T Oil		

Recent Draft WEEE Notification brought out by MOEF for comments

This draft was prepared for deliberations at the National e-waste Legislation Workshop on 3 and 4 May 2006, organised by the Ministry of Environment and Forests (MOEF), Government of India and German Technical Cooperation (GTZ). This draft was compiled by ASEM-GTZ (Advisory Services for Environment Management) for MOEF.

The draft says:

- 1) These rules may be called the WEEE (Management and Handling) Rules, 2006, wherein WEEE is Waste Electronic and Electrical Equipment as listed in Schedule 1.
- 2) They shall come into force on the date of their publication in the Official Gazette.

Annex 4: Environmental management in Indian electronics industry (extract from Annual Report, MC&IT, India)

Environmental protection and pollution abatement towards sustainable development are the thrust areas throughout the developed world. The need to adopt more environmentally responsible manufacturing processes forcing industry to make changes in the conventional processes, product and services offered, for sustainable development. Sustainable development rests on three pillars: economic growth, social progress and protection of our environment and natural resources. Cleaner production is to minimise the environmental impacts of products and services. Cleaner production plays a critical role with respect to influencing changes in consumption and production patterns. To avoid jeopardising future generations, all efforts should be made to ensure that services and products respond to basic needs and improve the quality of life while minimising use

of natural resources and toxic materials. The Department is helping industry in using cleaner production technologies by sponsoring such activities at R&D institutions for technology development. Considering the importance of Environment, the Department of Information Technology implemented a UNDP sponsored programme on 'Environmental Management in Indian Electronics Industry'. Phase I of the programme was successfully completed and a technical guide was prepared for use by industry and creating awareness among stakeholders. Based on the findings of phase I, a second phase programme was prepared and submitted to UNDP for funding. Interaction is also developed with Indo-German Environment programme (GTZ) for supporting the second phase.

Annex 5: Sample questionnaire for Indian IT and electronics industry

A Brief company profile

- 1 Company name & year of commencing commercial operation:
- 2 Main products manufactured covering minimum 80% of annual turnover:
- 3 Top customers (name 4-6 domestic and foreign buyers accounting for majority of sales – about 80%)
- 4 Main end-use segments supplied to (i.e. consumer electronics, automobile, IT, telecom, industrial applications)
- 5 Total production in Rs (latest financial year available)
- 6 Are you aware of WEE, RoHS and other environmental regulation imposed by EU as well as other countries and if so, since when and what were the sources?

B Action, responses and benefits related to environment management

- 7 Please specify what initiatives were taken by your organisation towards environment management and meeting EU as well as other compliances (these initiatives may include EU directives on RoHS, WEEE, ISO14000, lead free manufacturing, eliminating copper plating, waste re-cycling, effluent treatment plus usage of various chemicals and metals listed as hazardous and polluting substances and unclean process technologies (attach separate Word document, if necessary).
- 8 Please specify some positive gains for your organisation in terms of: operational efficiency (including energy, cheaper substitutes, processes technology changes), cost savings, increased market access in India as well as other major buyers including EU.

C Initiatives, efforts and capability building measures

- 9 What steps have you taken in terms of greening supply chain by effectively managing internal and outsourced material, consumables, etc. and what were the major hurdles.

Can you please highlight some initiatives taken on your own to address various stakeholders – government, customers, suppliers and others to achieve a better operational environment including a robust corporate social responsibility action plans and implementation roadmap. In this context, any award or recognition received by your organization may be indicated.

For your current capability building measures as well as that for future, what is your recommendation for government, industry associations and other promotional bodies (some aspects you may cover include a) awareness programmes and updates on compliances, b) case studies of companies in India and elsewhere, c) training, d) testing and common infrastructure support, e) tax subsidy on investment for eco-design and EMS (Environment Management Systems particularly for SMEs) and f) providing industry performance benchmarks).

Annex 6: Companies participating in the primary survey

1	TVS Electronics Ltd.
2	Bharat Electronics Ltd.
3	Elin Electronics Ltd.
4	Celetronix India Pvt. Ltd.
5	Solelectron Centum Electronics Ltd.
6	Hical Magnetics Pvt. Ltd.
7	Vishay Components India Ltd.
8	Deki Electronics Ltd.
9	AT&S Pvt. Ltd.
10	Circuit Systems India Ltd.
11	Continental Devices India Ltd.
12	Samtel Colour Ltd.
13	EPCOS India Pvt. Ltd.
14	Videocon Industries Ltd.
15	Technik Electromeconics Pvt. Ltd.
16	Tyco Electronics Corporation India (P) Ltd.

Annex 7: Readings and references

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Stimulating Sustainable Trade In Electronics: Challenges, Realities and Strategies for the Indian Component Sector, Rajiv Gandhi Foundation of Contemporary Studies

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Annual Report (2005–06), Ministry of Communication and IT, Government of India

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WEEE Directive of EU – see www.cfsd.org.uk/aede

RoHS Directive of EU – see www.cfsd.org.uk/aede

HARL and Green Purchasing Law (Japan) – see www.cfsd.org.uk/aede

WEEE Draft Legislation, Ministry of Environment and Forests, Government of India

CSR Paper of EU



The Centre for Sustainable Design

An initiative of



university college
for the creative arts
at canterbury, epsom, farnham, maidstone and rochester



The Centre for Sustainable Design

The Centre for Sustainable Design

University College for the Creative Arts
Farnham Campus
Falkner Road
Farnham
Surrey GU9 7DS
United Kingdom

Tel +44 (0)1252 892772
Fax +44 (0)1252 892747
Email cfsd@ucreative.ac.uk
Web www.cfsd.org.uk



ELCINA

Electronic Industries Association of India
ELCINA House
422 Okhla Industrial Estate
New Delhi
India
110020

Tel +91 (011) 2692 4597, 2692 8053
Fax +91 (011) 2692 3440
Email elcina@vsnl.com
Web www.elcina.com