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asia eco-design electronics

Country report on the Chinese electronics sector

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

By Renmin University of China

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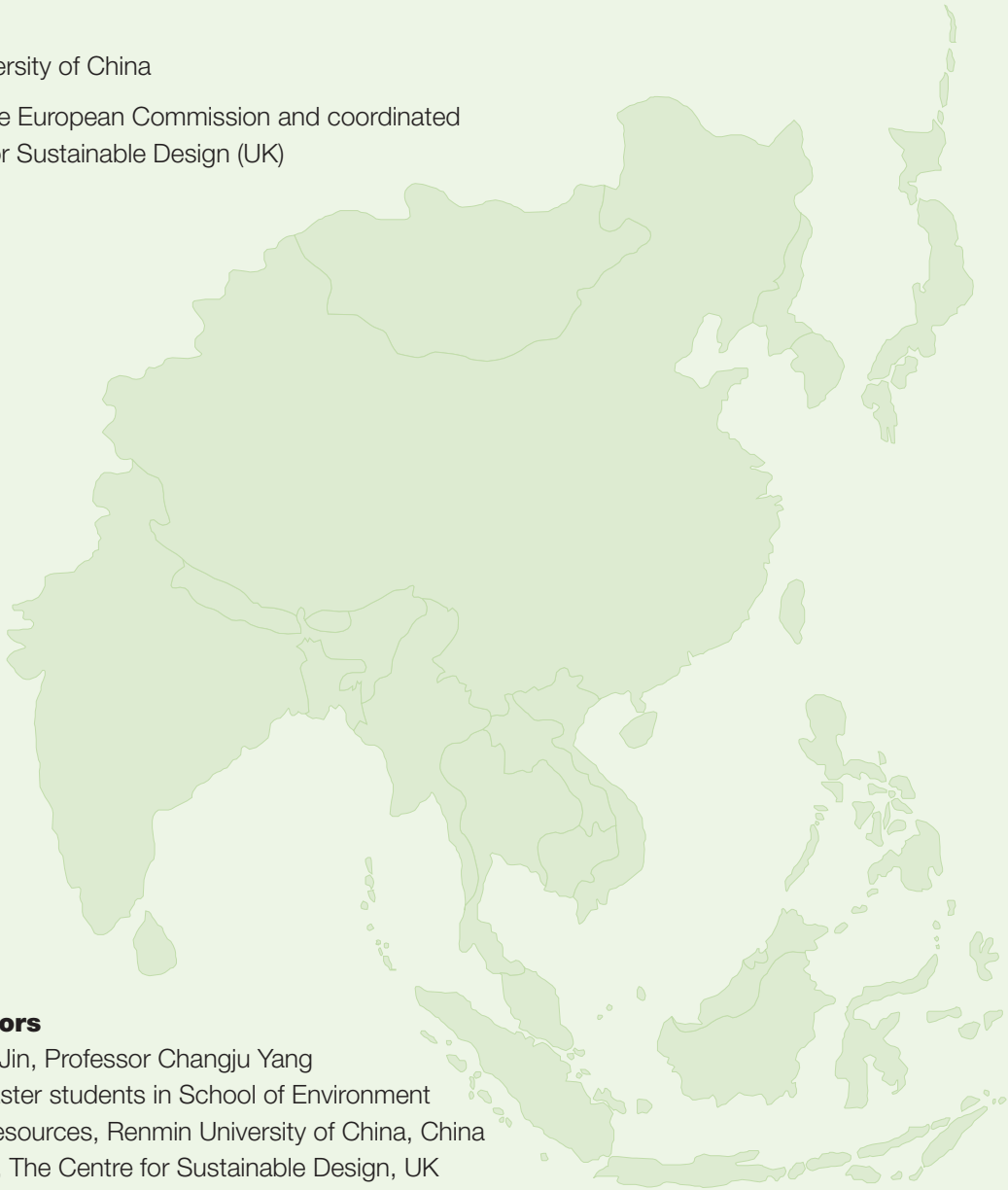

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Asia Eco-Design Electronics (www.cfsd.org.uk/aede) aims to raise awareness of product-related environmental issues and develop eco-design tools for the Chinese, Indian and Thai electronics industries

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Background

This report aims to provide appropriate and up-to-date information to Chinese suppliers covering the implications of the European Union's Restriction of Certain Hazardous Substances (RoHS), Waste Electrical & Electronic Equipment (WEEE), Energy using Products (EuP) Directives, Registration, Evaluation and Authorization of Chemicals (REACH) and Corporate Social Responsibility (CSR) initiatives. Aligned to these developments, the European Commission (EC) funded the Asia Eco-Design Electronics (AEDE) project, to support the Asian electrical and electronic equipment and home appliance industry to meet the challenges.

The objective of this report is to provide information to support the AEDE project. This includes details on:

- The realities of the electrical and electronic industries in China
- Information on related Chinese legislation
- Information on the possible impacts of the implementation of the EU Directives and Japanese laws
- The difficulties that Chinese small and medium-sized enterprises (SMEs) are facing.

Five parts are included in this report.

1.0 Introduction

This section includes information on the main electronics industry categories, speed of market development, scale of exports as well as the quantity, main market, mode of export and the characteristics and existing problems of the SMEs in China. Also discussed are the main factors that affect the exports of Chinese electronic and electrical products. The key electronics industry associations, multipliers and information dissemination routes in China are also identified. The impacts of a range of European and Japanese laws are also described: WEEE, RoHS and EuP Directives, Home Appliance Recycling Law (HARL), Law for the Promotion of Effective Utilisation of Resources (LPEUR), Green Purchasing Law (GPL) in Japan. The impacts on China's legislation and eco-design are also described.

2.0 Legislation and industry initiatives

This section consists of an overview of the existing legislation, websites pertaining to environmental and sustainability requirements in the EU and Japan and the existing Chinese legislation related to environmental, health, safety and labour requirements, as well as an assessment of the voluntary electronics industry initiatives.

3.0 Implications for suppliers

Key findings in relation to the Chinese electronics and electrical equipment (EEE) industry, key gaps, implications for suppliers of the existing and forthcoming green EU and Japanese legislation and industry initiatives are presented. The impacts on employment creation, labour standards, small suppliers and possible marginalisation, poverty alleviation, costs of compliance, testing facilities, technology and process changes, incentives for recycling/reuse and associated costs/benefits, eco-design competence and skills, training and education are also discussed. Finally, the implications on competitiveness in relation to other Asian suppliers are also analysed.

4.0 Gaps and future needs

Firstly, management issues are analysed including the need to integrate eco-design, green procurement and supply chain issues into existing management systems. Secondly, technical issues are discussed to identify the training requirements for eco-design, process change and testing facilities. Measures for potential poverty alleviation for SMEs who are in danger of being marginalised as a consequence of EU and Japanese laws, and industry initiatives are discussed. In addition, specific gender related issues are highlighted.

5.0 Capacity building plans

Brief descriptions are made of short, medium and longer term plans. This includes needs for awareness raising, direct training with companies, as well as a major education plan for the Chinese EEE sector. In the longer-term, this means systemising training, setting up industrial associations, improving communication channels between companies and government, establishing information centres related to trade and environment, as well as setting up environmental certification. The development of international cooperation is a further requirement.

Note: The research for this report was completed in September 2006 and the majority of references and figures used were collected before that time; some have been updated.

1.0 Introduction

1.1 Overview of the electronics sector in China

Characteristics and present situation of the exportation of Chinese electronic products

Since beginning its open-door policy in 1979, China has boasted one of the fastest growing economies in the world. The electronics industry with growth of nearly 20% annually has been a pillar of China's success. The Organisation for Economic Co-operation and Development (OECD) reported recently that China has already surpassed the United States and has become the largest exporter of Information and Communications Technology (ICT) products, including personal computers (PCs), mobile phones, DVD players and digital cameras.

At present, electronics companies are mainly concentrated in the southern coastal region in China. These companies include a mixture of foreign investors (including cooperative, joint venture and exclusively foreign-owned), state-owned, domestic cooperatives or private firms.

There are five main export categories of Chinese electronic and electrical products. These are Consumer Electronics (also called Black Electronics), Electronic Components, Household Appliances (including White Electronics and Small Electrical Appliances), Automatic Data Processing Equipment and Telecommunication products. Foreign-invested companies are the key exporters of Chinese EEE products to developed countries. The export of the previously mentioned five product categories, accounts for more than two-thirds of total exports of EEE.

The main characteristics of exported Chinese EEE products are:

- The market is mostly in the developed countries
- The electronics are a vital export for the Chinese economy
- Foreign-invested companies are the main exporters
- The imported material and parts are processed and assembled in China to make the finished product for export.

The export of Chinese EEE products has changed significantly in recent years, led by foreign-invested companies. The export value of the above five main export categories of Chinese EEE amounted to 84.3 billion USD in 2002 and 113.05 billion USD in 2003, accounting for more than 25% of China's total export value; the export value was over 200 billion USD in 2004. The electronics industry maintained a higher growth in 2005, with export values reaching one-third of China's total export value.

Table 1.1: China's top ten exports of electromechanical products in 2005 (in billion US dollars)

Export products	Total USD	Annual increase (%)
Computer equipment, parts and accessories	105018	4.8
Household electrical appliances and consumer electronics	54502	9.5
Telecommunication equipment and components	48502	3.3
Electronic components	39197	6.3
Electrical appliances and equipment	25948	8.4
Mechanical foundations	14795	6.6
Automobiles and auto parts	10930	4.0
Game sets	9147	0.2
Lifting and construction machinery and parts	8930	4.2
Illumination devices and components	7455	1.4

Source: Department of Electromechanical Products of Ministry of Commerce

Table 1.2: China's imports of top 10 electromechanical products in 2005 (in billion US dollars)

Imported products	Total	Annual increase %
Electronic components	135457	27.3
Computer equipment, parts and accessories	35945	19.7
Electrical appliances and equipments	27262	18.9
Telecommunication equipment and components	17905	11.8
Automobile and key parts, accessories	13609	–16.7
Automatic instruments or implements for measurement examination analysis	9564	6.1
Mechanical foundation	8998	13.7
Aircraft and spacecraft and components	7384	34.1
Household electric appliances and consumer electronics	6757	–2.6
Metalworking machine tool	6496	9.8

Source: Department of Electromechanical Products of Ministry of Commerce

In 2005, the Chinese electronics industry achieved considerable success. The manufacturing output of computers, mobile phones and colour television (TV) sets made in China achieved first place in the world. The new Audio-Video products, Communications network equipment and New Type Display devices also became a new area of growth. The sales, added value, total profits and employment in the regions of the Pearl River Delta, the Yangtze River Delta and the Bohai coast increased significantly and now account for 70% of the Chinese electronics industry. However, although the manufacturing output and the sales grew fast, the profits and tax revenues decreased. The high growth of the electronics industry in China is highly dependant on exports to the international market.

Characteristics of SMEs in China

The SMEs have become the new force for accelerating economic development, increasing market supply and enlarging employment in China. In recent years, the number of EEE companies has increased quickly and at present, there are over 26,000 electronics enterprises in China, most of which are SMEs. The SMEs have contributed a lot to the development of the sector and because they are mostly privately owned, they are quite flexible. Most of the SMEs in China are labour-intensive and exhibit the following characteristics:

- Small scale with little centralised production
- Single-product provision, lack of capital, poor technology and specialisation level, and slow at launching products
- Weak awareness of environmental protection and lack of strict environmental management systems
- Low capacity to acquire information and little knowledge of social responsibility, environmental and product safety issues
- Lack of necessary investment for technical improvement.

Due to the above problems and more strict requirements on EEE from the developed countries, it is very difficult for SMEs to deal with the above environmental legislation e.g. RoHS, standards, conformity procedures and other initiatives. If environmental management is not strengthened and investment is not made in R&D in areas such as eco-design, Chinese SMEs may be marginalised in the era of new global *green* production requirements.

1.2 Identification of key electronics industry associations, multipliers and information dissemination routes in China

1.2.1 Key electronics industry associations

Key electronics industry associations (state level) are listed below:

China Computer Industry Association
www.chinaccia.org.cn/

China Association of Computer Automated Measurement and Control Technology
www.chinamc.net.cn/

China Computer Users Association
www.ccua.org.cn/

China Communication Industry Association
www.cace.org.cn/

China Household Electrical Appliance Association
www.cheaa.org/

China Electronic Products Industry Association
www.ceia.org.cn/index2.htm

Chinese Electronic Components Industry Association
www.ic-ceca.org.cn/

Chinese Electronics Standardization Association
www.cesa.cn/

Chinese Association for Artificial Intelligence
www.caai.cn/

China Instrument and Control Society
www.cis.org.cn/

China Institute of Communications
www.china-cic.org.cn/index.aspx

Chinese Association of Automation
caa.gongkong.com/defaultasp

Chinese Association for System Simulation
cass-sim.buaa.edu.cn/

China Computer Federation
www.ccf.org.cn/

At present, Chinese EEE industry associations are playing an increasingly active role in disseminating and transmitting information on the related regulations and laws. This involvement is expanding the channels that companies can use to gather information. But the associations are usually only for their own members and broader dissemination is needed.

1.2.2 Information dissemination routes

The present channels open for Chinese enterprises to obtain information on environmental requirements for EEE products for international markets include:

- Official (Chinese government and foreign governments) and unofficial networks
- Official information bulletins and official documents
- Seminars organised by relevant domestic and foreign departments and institutions
- Some foreign organisations
- Industry associations
- Relevant consultation and research institutions
- Some relevant departments within the enterprises.

2.0 Legislation and industry initiatives

2.1 Overview of the existing legislation pertaining to environmental and sustainability requirements in EU and Japan

The EU has taken a leading position on environmental legislation compared to other parts of the world. Several *green* electronics laws have been passed in recent years. The Waste Electrical and Electronic Equipment (WEEE) Directive was passed on 13 February 2003, along with the related Directive on the Restriction of Certain Hazardous Substances (RoHS); and the Energy Using Products (EuP) Directive became law in the EU on 11 August 2005.

Existing environmental legislation related to the EEE sector in Japan includes the Law for the Promotion of Effective Utilisation of Resources (LPEUR) which came into force in June 2000, the Household Appliance Recycling Law (HARL) was enacted in May 1998 and implemented in April 2001, and the Green Purchasing Law (GPL) that was passed in April 2001. The following websites provide detailed information on the relevant EC and Japanese legislation.

WEEE, RoHS and EuP Directives

Below are a series of web-links that provide a range of useful information on legislative developments:

www.cfsd.org.uk/aede
This site provides a range of useful information and reports on green developments related to Asian companies.

www.cfsd.orguk/seeba
The site provides a range of free information (in English) on legislative developments in the electronics sector.

http://164.36.164.20/sustainability/weee/index.htm
A good site for progress on what is happening in Europe on WEEE and RoHS.

www.europa.eu.int/comm/environment/waste/index.htm
European site on waste management that includes the WEEE/RoHS legislation.

www.buyusa.gov/europeanunion/weee.html
US government website on WEEE and RoHS with member state information.

www.europeanleadfree.net
Provides a range of useful lead-free information.

www.europa.eu.int/comm/enterprise/eco_design/index.htm
European website for the EuP Directive.

HARL, LPEUR and GPL in Japan

The site below provides useful information on Japanese legal developments:
http://www.meti.go.jp/english/policy/index_environment.html
An overview of key waste management and recycling laws in Japan.

2.2 Existing legislation in China pertaining to environmental, health, safety, labour requirements

2.2.1 Laws

Environmental Protection Law of the People's Republic of China

Approved by the Standing Committee of the National People's Congress (NPC) of the People's Republic of China

Adoption date: 26 December 1989
Effective date: 26 December 1989

This Law was formulated for the purpose of protecting and improving the environment, preventing and controlling pollution and other public hazards, safeguarding human health and facilitating the development of socialist modernisation. The main contents include supervision, management, protection and improvement of the environment, as well as prevention and control of environmental pollution and other public hazards. This Law is considered to provide a foundation and basis for other rules of law and is the basic law in the area of environment protection in China. Therefore it is also the base for all the regulations and policies on pollution prevention in the Chinese EEE industry.

Cleaner Production Promotion Law

Approved by the Standing Committee of the NPC of the People's Republic of China

Adoption date: 29 June 2002
Effective date: 1 January 2003

This Law was enacted in order to promote cleaner production, increase the efficiency of resource utilisation, reduce and avoid the generation of pollutants, protect and improve the environment, ensure human health and promote the sustainable development of both society and the economy. Through encouraging and promoting cleaner production, this Law aims to increase resource efficiency and utilisation, whilst reducing and avoiding the generation of pollutants. In addition, measures that contribute to sustainable development are required to be taken by all the producers across the whole production process, this includes EEE manufacturers. It is also the base for other policies related to eco-design and the restriction of hazardous substance in the EEE products in China.

Labour Law of the People's Republic of China

Approved by the Standing Committee of the NPC of the People's Republic of China

Adoption date: 5 July 1994
Effective date: 1 January 1995

This Law is formulated in accordance with the Constitution in order to protect the legitimate rights and interests of labour. Through regulating working condition standards and workers'

interests such as welfare, insurance and vacation, this law protects the legitimate rights and interests of employees. Of course, the legitimate rights and interests of the workers in the EEE industry are included in this law. This law intends to ensure safe working conditions and protect workers from harmful and hazardous substances.

Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste

Approved by the Standing Committee of the NPC of the People's Republic of China

Adoption date: 30 October 1995
Effective date: 1 April 1996
Amending date: 29 December 2004
Effective date after amendments: 1 April 2005

This law is formulated for the purpose of preventing environmental pollution caused by solid waste. It aims to safeguard people's health, maintain ecological safety and facilitate sustainable economic and social development.

This Law makes a clear statement on the duties of preventing environmental pollution caused by solid waste, and provides enhanced rights and obligations for the State Environmental Protection Administration (SEPA) and all the environmental protection bureaus at provincial, municipal and local levels. It is the basis for solid waste management policies, recycling and waste laws for EEE

Safe Production Law of the People's Republic of China

Approved by the Standing Committee of the NPC of the People's Republic of China

Adoption date: 29 June 2002
Effective date: 1 November 1995

This Law is formulated for the purpose of strengthening the monitoring and management of safe production, preventing and reducing accidents during production processes, and safeguarding people's lives and property.

The law aims to prevent production accidents and guarantee the safety of employees and provides a foundation for all the regulations and policies related to safe production in the EEE industry.

2.2.2 Current regulations and policies developed by ministries and administrations

Administrative Measure on the Control of Pollution Caused by Electronic Information Products

Ordered by:

- *Ministry of Information Industry of the People's Republic of China*
- *National Development and Reform Commission*
- *Ministry of Commerce of the People's Republic of China*
- *General Administration of Customs of the People's Republic of China*
- *State Administration for Industry & Commerce*
- *General Administration of Quality Supervision, Inspection and Quarantine*
- *State Environmental Protection Administration of China*

Date of issue: 28 February 2006
Date of implementation: 1 March 2007

This measure was created on the basis of the People's Republic of China's policy on the Promotion of Cleaner Production, and the People's Republic of China's policy on the Prevention and Control of Environmental Pollution by Solid Waste. It intends to control and reduce environmental pollution caused by discarded Electronic Information Products (EIPs) , promoting the manufacture and sale of EIPs with lower levels of pollution, thereby protecting the environment and human health. This regulation will play a vital part in preventing the use of toxic substances and encouraging the replacement of toxic substances in EEE in China. It is also called Chinese 'RoHS'.

Regulations on Checkout and Supervision Procedures concerning Imported Used Mechanical and Electrical Products

Ordered by General Administration of Quality Supervision, Inspection and Quarantine

Date of issue: 18 August 2003
Date of implementation: 1 October 2003

The regulation stipulates that the General Administration of Quality Supervision, Inspection and Quarantine is in charge of checking, supervision and management of the import of used electro-mechanical products nationwide. Pre-assessment of the safety, health and environmental aspects of imported used electromechanical products is required according to compulsory technical specification.

This regulation strengthens the nationwide checking, supervision and management of the importation of used electromechanical products. This regulation was put forward in order to avoid the dumping of e-wastes into China from foreign countries. However the illegal importation of e-wastes remains a challenge to the implementation of this regulation.

Bulletin Regarding the Strengthening of Environment Management for Waste Electrical and Electronic Equipment (WEEE)

Ordered by State Environmental Protection Administration of China

Date of issue and implementation: 26 August 2003

This bulletin was formulated on the basis of the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste. The purpose is to strengthen the environmental management of WEEE, to promote recycling and re-use of the used EEE in an environmentally-friendly way. It restricts enterprises that generate used EEE, requires all producers to coordinate their environment management inside their organisation, and aims to increase environmental consciousness in the whole lifecycle of the EEE. The regulation aims to improve recycling and disposal methods for dealing with WEEE.

Administrative Statute on the Recycling of the Used Home Appliances and Electronic Products (under legislation)

Prepared by National Development and Reform Commission

Date of delivery: 18 August 2004

The statute has been submitted to the legislation office of the State Council and requires producers to adopt eco-design and recycling of home appliances and electronic products. Dealers and after-service agencies have an obligation to take back the used home appliances and electronic products and be responsible for environmentally-friendly disposal.

This statute is a little similar to the WEEE Directive but different in content. No concrete recycling targets have been stipulated except requirements on the establishment of a recycling system, responsibilities for stakeholders, supervision and management. One important characteristic of this statute is the division between used home electrical appliances and end-of-life home electrical appliances. All used home electrical appliances are allowed to be sold and used legally in the market as second-hand products as long as they meet the requirements laid down by the standard for safety and function of used home electrical appliances.

Technical Policy for controlling Pollution of WEEE

Ordered by:

- *State Environmental Protection Administration of China*
- *Ministry of Science and Technology of China*
- *Information Industry of the People's Republic of China*
- *Ministry of Commerce of the People's Republic of China*

Date of issue: 25 August 2006

This technical policy is based on the Cleaner Production Promotion Law, the People's Republic of China's Law on the Prevention and Control of Environmental Pollution by Solid Waste and other related national, regulations and standards. The policy's objectives are to reduce the output of WEEE, improve the recycling rates of WEEE, decrease environmental risks during the disposal of WEEE, as well as to smooth the international trade of EEE. This technical policy will act as the foundation for the management of EEE recycling in China.

Technical Policy for controlling Pollution of Waste Battery

Ordered by:

- *State Environmental Protection Administration of China*
- *National Development and Reform Commission*
- *Ministry of Commerce of the People's Republic of China*

Date of issue: 9 October 2003
Date of implementation: 9 October 2003

This technical policy was formulated on the basis of the People's Republic of China's Law on the Prevention and Control of Environmental Pollution by Solid Waste and other related laws, regulations, policies and standards, for the purpose of developing environmentally-friendly disposal and recycling techniques, standardising the disposal and recycling behaviour for waste batteries. This technical policy builds a foundation and provides regulation for the disposal and recycling of waste batteries.

Technical Policy for controlling Pollution of Hazardous Waste

Issuing authority: State Environmental Protection Administration (SEPA)

Date of issue: 17 December 2001
Date of implementation: 17 December 2001

This technical policy was formulated on the basis of the People's Republic of China's Law on the Prevention and Control of Environmental Pollution by Solid Waste and other related laws, regulations, policies and standards. This policy intends to develop management and disposal technologies to prevent hazardous wastes being released.

This technical policy stipulates the technological choice of hazardous waste treatment from the production process to the end-of-life. It also sets products' maximum allowable content for the restricted substances. It is a supplement to the implementation of the Administrative Measure on the Control of Pollution Caused by Electronic Information Products.

Administrative Measures Regarding the Environmental Administration of New Chemical Substances

Issuing authority: State Environmental Protection Administration (SEPA)

Date of issue: 12 September 2003
Date of implementation: 15 October 2003

These measures have been formulated for the purpose of strengthening the environmental management of new chemicals, preventing environmental pollution and safeguarding human health and the ecological environment. The measures regulate the use of new chemicals in products, especially those that are imported from the overseas. According to the requirements of these measures, an application and recording system will be implemented for the new chemicals; detailed requirements for the application, recording, monitoring and management and legal responsibility are also stipulated by these measures.

2.2.3 Related standards

Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products (EIPs)

This was drafted by Ministry of Information Industry of the People's Republic of China

This was assessed by related experts on 14 July 2006 and issued on 22 August 2006 on the website www.cesa.cn/

The final version was issued on 6 November 2006

This standard considers the need to control hazardous substances at source by the producer of EIPs, and also takes into account the feasibility of supervision and inspection. It also links up with relevant international standards and defines the maximum permissible concentration of hazardous substances in EIPs.

This standard is formulated for the purpose of the implementation of Administrative Measures on the Control of Pollution Caused by Electronic Information Products. It will be used to control the EIPs described in Administrative Measure on the Control of Pollution Caused by Electronic Information Products. It will help to set up the concrete methods to enhance the environmental management of the EEE supply chain.

Testing Methods for the Hazardous Substances in Electronic Information Products

Drafted by Ministry of Information Industry of the People's Republic of China

This was assessed by related experts on 14 July 2006 and issued on 22 August 2006 on the website www.cesa.cn/

The final version was issued on 6 November 2006

This standard is also formulated for the purpose of the implementation of Administrative Measure on the Control of Pollution Caused by Electronic Information Products and applies to all the EIPs sold within the territory of the People's Republic of China. This standard specifies the testing method for lead, cadmium, chrome, mercury and two kinds of bromide flame retardant PBB and PBDE in EIPs.

Labelling for the Control of Pollution caused by Electronic Information Products Drafted by Ministry of Information Industry of the People's Republic of China

This has been assessed by related experts on 14 July 2006 and issued on 22 August 2006 on the website www.cesa.cn/

The final version was issued on 6 November 2006.

This standard gives detailed explanations of the roles of producers and importers of EIPs, recycling and packaging requirements related to the production, and import and disposal of the EIPs. This standard requires producers to include labels for hazardous substances in EIPs, the expiry period within which the hazardous substances will become harmless to the health of the environment or humans, whether or not recycling is possible, the place of original production and the names of packaging materials used. This standard is formulated also for the purpose of the implementation of Administrative Measure on the Control of Pollution Caused by Electronic Information Products and will help to set up methods (such as self-declaration) to improve the environmental management of the EEE supply chain.

The above three standards are considered to be supplements and the first step to the implementation of Administrative Measure on the Control of Pollution Caused by Electronic Information Products. Producers are allowed to test their products in-house or by a third party according to the Testing Method Standard. The products are required to be assessed according to the Limits for the Concentration of Certain Hazardous Substances Standard and then the producers can make a self-declaration according to the Labelling Standard.

2.2.4 Local governmental regulations

Guangdong Provincial Planning for the control of pollution caused by solid waste

Issued by the Standing committee of Guangdong provincial People's Congress

Date of issue: 14 January 2004
Date of implementation: 1 May 2004

According to this plan, a series of disposal centres for the treatment of WEEE will be built in Guangzhou, Foshan, Shenzen, Zhuhai, Zhanjiang, Qingyuan and Shantou according to the requirements of national environmental protection standards. At the same time, a provincial disposal centre for hazardous WEEE will be built in Huizhou city, which will treat displays from personal computers (PCs). 8 disposal centres in the above cities (which can treat 90% of the WEEE produced in Guangdong province) will be built before end of 2010 according to this plan. Two special local regulations on WEEE in Guangdong, the 'Guangdong Provincial Regulation on Administration for preventing and controlling WEEE' and the 'Guangdong Provincial Regulation on Administration for the recycling of WEEE' will be formulated before 2010.

Administrative Measures on the Control of Pollution Caused by Electronic Information Products in Shanghai (under development)

The Administrative Measures on the Control of Pollution Caused by Electronic Information Products in Shanghai was listed in a work plan by The Shanghai Municipal Information Committee in 2006. This measure will try to apply economic incentives to the prevention and control of WEEE in Shanghai. Enterprises will be provided with technical support for the recycling of WEEE, retailers will need to provide collection facilities for WEEE and consumers will need to take-back WEEE to designated places and pay for its disposal. It highlights the need for names and the concentration of the hazardous substances contained, whether or not parts of the products are recyclable according to the national or industrial control standard for the hazardous substances It is expected that the administrative measures implemented in Shanghai will be more stringent than the national regulations.

2.3 Assessment of voluntary electronics industry initiatives covering electronics and Corporate Social Responsibility (CSR) in China

China continues to try and determine the best way to respond to European WEEE and RoHS to ensure Chinese EEE products are successfully exported. As a result of the implementation of the RoHS Directives, it was estimated by China Chamber of Commerce for Import and Export of Machinery and Electronic Products that the value of Chinese electromechanical products exported to the EU market which will be directly affected by RoHS is 317 billion US dollars. This accounts for about 71% of the total value of Chinese electromechanical products exported to the EU market. This means the WEEE Directive will have a great impact on the export of Chinese EEE products to the EU market. With the implementation of RoHS, the exporters of EEE products will face greater challenges in complying with the requirements of RoHS, such as the challenge of eco-design for EEE. In China, it is concluded that WEEE will result in cost increases and RoHS sets a technical barrier to Chinese exporters.

2.3.1 On the national level

The Chinese governmental ministries, industry associations and companies have taken pro-active measures to try to deal with the new environmental requirements from developed countries.

In recent years, a number of Chinese policies, regulations and laws have been issued e.g. the Administrative Measure on the Control of Pollution Caused by Electronic Information Products, Bulletin Regarding the Strengthening of Environment Management of WEEE and the Rules for Recycling of End-of-life Household Appliance and Electronic Products. The Cleaner Production Promotion Law and Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste have also been amended. In addition, the Developing Circular Economy Law is under construction. Emphasis on waste material recycling is indicated in The 10th five-year plan for energy saving and all-purpose utilisation of resources and The 10th five-year plan for environmental protection industry. Some relevant governmental ministries and departments, such as The National Development and Reform Commission (NDRC), Ministry of Commerce (MoC), State Environmental Protection Administration (SEPA) and the Ministry of Information Industry (MII) have attempted to actively steer industry in line with the trends in international markets by making and implementing various policies, laws and regulations. The process aims to contribute to the improvement of the technological level and competitiveness of China's EEE enterprises in order for trade to proceed smoothly. The MoC developed a series of guidelines for export, and decided to identify 100 export-oriented technical service agencies to provide product-related export services. By 2007,19 service agencies have been identified to provide information and technology services and guide the producers of EEE on how to meet the environmental requirements from developed countries, e.g. WEEE and RoHS Directives.

Standards related to the six substances covered by RoHS have passed verification testing and expert assessment and been issued by MII. The 18 laboratories that can test the hazardous

substances in the EEE products have also been identified. Research on the development of standards, detection methods and substitution technologies is being conducted under the guidance of related governmental ministries in order to upgrade the capacity of the electronics industry and improve the manufacturing level of the upstream enterprises.

Since the issuance of the WEEE and RoHS Directives, a range of conferences and workshops have been organised in China. Some were organised domestically, some in conjunction with foreign organisations e.g. German Technique Cooperative Corporation (GTZ) and some in association with European government departments e.g. Department of Trade & Industry (DTI) from the UK. For example, on 23–24 June 2004, an 'International Seminar on Foreign Environmental Requirements for Electrical and Electronic Equipment and its Impact on China' was co-organised by SEPA and the GTZ. Experts from Germany, Norway and other EU members together with representatives from Chinese industry associations and enterprises held detailed discussions on environmental management laws and regulations in relation to EEE and how to implement these in China. Discussions also addressed issues related to the environmental requirements made by developed countries and the corresponding implications for producers of EEE and the possible impacts on the Chinese EEE sector. As a result some measures and recommendations were put forward to the Chinese EEE industry. On 28 September 2005, a workshop on 'Two EU Directives and the Countermeasures' was organised by Hubei Provincial Bureau of Commerce and Bureau of Quality Supervision, Inspection and Quarantine in Wuhan city. Experts from the General Administration of Quality Supervision, Inspection and Quarantine and Hubei Bureau of Quality Supervision, Inspection and Quarantine explained the WEEE and RoHS Directives. Experiences from some enterprises such as Yichang Yayuan Electronics Company and Guanjie Display Technology Company Ltd were shared. About 100 delegates from related enterprises and companies attended the workshop. On 30 June 2006, a speaker from the MoC indicated just before the enforcement of RoHS: 'The Ministry of Commerce is paying attention to WEEE and RoHS. The supervision method for the EU market and the detection standards and methods are still uncertain. In addition, the timetables of the adoption of the two EU Directives by EU member countries are different. All the above uncertainties will seriously impact the normal trade between China and EU countries in the field of electrical and electronic products. China hopes that the EU will be able to resolve this soon.'

Other national policy developments will also impact on the Chinese EEE industry. For example, The 11th Five-Year Plan on the Development of Economy of China also highlights that energy consumption per person should decrease by 20% and that a natural-resource-saving and environmentally-friendly society is planned.

2.3.2 On the industry level

Since the announcement of the WEEE and RoHS Directives, various industry associations, trade organisations, research institutions and enterprises have launched activities e.g. research projects, seminars, study-tours etc. The China Chamber of Commerce for Import and Export of Machinery and Electronic Products (CCCCME) organised a seminar with the related departments of MoC in September 2003 and invited officials and experts from the UK DTI to introduce the background and contents of the WEEE and RoHS Directives to Chinese EEE manufacturers and exporters. At the same time, MoC, as well as The Ministry of Science and Technology (MoST) launched research projects in order to make or amend related regulations, policies, technical standards and to implement practical measures.

Industry also organised various events. On 31 March to 1 April 2005, The China Electronics Quality Association organised a seminar on 'Green Supply Chain Management in The Electronic Information Industry'. On 10 June 2005, a seminar on 'Two EU Green Directives' was also held in Leqing City, Zhejiang Province; this was organised to improve understanding of the WEEE and RoHS Directives amongst the EEE companies in Zhejiang province. Topics discussed included how to detect restricted hazardous substances and how to improve standards. A seminar on 'Industrialisation of waste home electrical appliances recycling and disposal in China' was also held in Qingdao city on 22 September 2005. About 200 officials and representatives from central and local governmental departments, domestic and overseas EEE manufacturers, domestic distributors, recycling companies and expert representatives from research institutes, universities and other representatives from the community attended. There was considerable discussion about the industrialisation of waste home electrical appliances, their recycling and disposal. On 19 October 2005, a bilateral conference between the Chinese Home Electrical Alliance Association (CHEAA) and the European Union Home Electrical Alliance Association was held in Beijing, during which the problems and future development issues between China and the EU were discussed. On 18 November, 2005, another workshop on 'Two EU Directives and China's Countermeasures' was organised by the China Institute of Home Electrical Appliances. In addition, a range of other seminars were held
in 2006, these included:

- 7–8 March, a seminar on 'Research and Application of Lead-free Jointing Technology in Germany and China', organised by CHEAA in Guangzhou.
- 16–18 March, 'Peak Forum for Green Electronics in China', organised by China Electronics Association in Shenzhen.

- 28 March, a seminar 'Green Manufacture in China' was organised by CHEAA. Experts from Germany, USA and Japan were invited to attend the seminar and presented on trends in green manufacturing in the developed countries. Companies did not pay as much attention to the seminar as was expected.
- 13 April, the Sixth International Special Workshop on Electronics Detection and Measurement was held in Shenzhen and focused on EU and Chinese RoHS.
- 8 July, Electronic Environmental Protection Strategy Conference was held in Qingdao to discuss the EU and China RoHS.
- 28 July, in Shanghai, a Seminar on 'Establishing the Monitoring and Controlling System for RoHS according to International Standards' was organised by The Association of the Foreign Invest Enterprises in Pudong new region in Shanghai, Shanghai Bureau of Quality Supervision, Inspection and Quarantine, Shanghai Electronic manufacturing Industry Association and Shanghai Integrated Circuit Industry Associations.
- 22 September, the launch meeting of CWRU in Beijing was organised by the China WEEE Recycling Union (CWRU) together with China Home Electrical Appliance Research Institute (the WEEE Recycling Branch of CHEAA), and the Home Electrical Appliance Branch of China Chamber of Commerce for Import and Export of Machinery and Electronic Products, China Resale Goods Trade Association and China Electronics Scientific and Technical Development Company of China Electronics Group (with the membership including the key exporters of home electrical appliances such as Heir, Changhong, Skyworth etc). At the meeting cooperation was announced between CWRU, Hellmann Worldwide Logistics and Hellmann Process Management of Hellmann Group in Germany In November 2006, The C&E (China and Europe) Recycling Portal was built in Germany to enable Chinese exporters to recycle WEEE in the EU market.

2.3.3 On the enterprise level

Generally speaking, manufacturer's awareness of the environmental and health requirements of export markets is at a relatively low level. There are different levels of awareness according to the scale of enterprises with large Chinese firms' awareness greater than that of SMEs.

Large electronic products manufacturers

According to the Vice-Chairman of The China Chamber of Commerce for Import and Export of Machinery and Electronic Products, figures from the MoC showed that 75% of the exported machinery and electronic products from China is manufactured through joint ventures with overseas companies and some Chinese large enterprises. There are relatively few problems for these firms to meet the product-related environmental requirements of the European, American and Japanese legislation due to existing internal knowledge and competence. An example of an approach used by large companies was the establishment of a 'Team for Dealing with the WEEE and RoHS Directives' by Galanz, Gree, Midea, TCL and others to study issues and countermeasures needed to comply with WEEE and RoHS.

Below are some examples of companies that have taken proactive steps in relation to the WEEE and RoHS Directives. The Chunlan Group, one major manufacturer and exporter of air-conditioners and washing machines, has started a range of initiatives including incorporating restricted hazardous substances and other product-related environmental requirements into its management and production systems. The Group also established *green* R&D, and strengthened procedures focused on the eco-design of its products.

500 suppliers of the Skyworth Group convened in Shenzhen on 23 July 2005 to sign the 'Agreement on the Green Supply Chains', an initiative focused on lead-free materials. As one of the global suppliers for Electrolux, Midea promised in July 2005 that all the products supplied to Electrolux would meet the environmental requirements of the RoHS Directive. According to a spokesperson from the Midea quality control department, Midea have built up material testing, supplier auditing and production assurance systems to cope with the two EU directives.

TCL also formed a special supplier-oriented environmental team to cover components and parts supplied to the firm that fell within the scope of the RoHS Directive.

Zhigao Air-conditioner exported 1.5 million air-conditioners in 2005 with 30% to the EU market. The firm implemented procedures to deal with RoHS requirements from 1 December 2005; this included:

- Distinguishing the products exported to the EU market and other markets by coding
- Requiring suppliers to submit a testing report together with the disassembly information and the signing of an assurance
- Requiring suppliers to submit a quality certificate and also undertake sample testing.

At the end of 2005, China Mobile, Motorola and Nokia launched the initiative called the 'Green Box Environment Plan'. This project aims to 'take back' used mobile phones and accessories within 40 cities in China. About 30,000 used mobile phones and accessories were collected. On 18 April 2006, Bird, LG, Lenovo, NEC, Panasonic and Amoi announced their membership of the scheme. This is deemed as the first initiative to recycle e-wastes within China. This initiative was considered to be a positive impact of the WEEE Directive on China's Electronics Industry.

Foreign-investment and export-oriented enterprises

The majority of the foreign investment in the EEE industry in China is in export-oriented ventures. These firms are familiar with environmental and health requirements and standards in China and in the countries that they export to. Foreign-owned companies also initiated environmental programmes much earlier than domestic Chinese EEE companies. For example, at Panasonic's conference in April 2005, a leader from the firm announced that it would achieve RoHS compliance by the end of 2005. In addition, many multinational enterprises worked with domestic component or part suppliers to meet the requirements of the WEEE and RoHS Directives in order to manage the environmental requirements along the supply chain. For example, Phillips has provided guidance and training for Chinese suppliers since 2001. Phillips' joint-ventures in China had RoHS compliance control systems implemented prior to July 2006. Panasonic trained its suppliers through a establishing a school to educate engineers on technical issues associated lead-free soldering and technicians regularly go to suppliers' factories to provide guidance and training on innovative green production technology.

SMEs in China

Most SMEs in China have little awareness about relevant environmental, health and safety requirements (EHS) in international markets. Their competitiveness is primarily built around low costs rather than high levels of management or technical competence, which makes it difficult for them to deal with the environmental laws, regulations, standards and conformity assessment procedures. SMEs in China invest little in R&D and have a weak capacity for technological innovation. These SMEs have little motivation to apply for eco-labels and environmental management certification e.g. ISO14001 and most have no capacity to find information about EHS requirements in overseas markets, to recycle or conduct eco-design. This means that SMEs in the EEE sector in China are currently facing the serious possibility of being marginalised, if they do not improve the current situation.

The recently amended or issued laws and regulations in China are also likely to reveal the short-comings of SMEs selling domestically within China itself.

With the implementation of WEEE in most EU Member States and RoHS Directive in July 2006, the entire Chinese EEE industry is in a state of tension. This means that suppliers in the middle of the chain feel increasing pressure in relation to complying with environmental requirements. For example, Guangdong PAK Electrical Appliance Co. Ltd, reported that by the end of 2004, testing certificates related to the relevant articles in WEEE and RoHS Directives had been requested by three or four clients. However, at that stage it was impossible for all their products to meet all the requirements of the RoHS Directive by 1 July 2006. Like many SMEs, they faced some major challenges. Many of their lighting products contained restricted substances under the RoHS Directive and the use of alternative materials would mean costs would increase significantly. When interviewed, a manager from the company stated that most of their products were sold domestically, so they did not need to consider new technology and R&D. 'But this does not mean that we do not focus on relevant Directives about electrical and electronic equipment constituted by the EU and the forthcoming regulations by Chinese government and ministries. We need to get some help to build up SMEs' capacity to meet the environmental requirements on the electrical and electronic products.' To help the SMEs comply with international and national environmental laws, the government is likely to need to provide subsidised or low cost advice and support.

Case on Hongyi Electronic Company in Ningbo

Hongyi Company is the largest manufacturer in Ningbo City producing electrical sockets exported to the EU market, with exports worth $60 million. From June 2004, Hongyi Company began to prepare for the implementation of the RoHS Directives by organising a working group and as a result in September 2005 an environmental substances management department was established. From April 2005, all the suppliers were required to submit test reports from certification agencies e.g. SGS and ITD. In addition, analyses of raw materials and quality assurance guarantees were required. In July 2005, two training sessions were completed for upstream suppliers to improve their understanding of RoHS and its associated technical problems. By 2005, 200 suppliers to Hongyi Company claimed to have resolved technical issues and were able to guarantee the quality of products. In order to avoid the potential problems associated with third party certification agencies, Hongyi Company bought a XGT-1000WR x-ray fluorescence device to make sure that they could analyse suppliers' products to detect any restricted substances. Other detection instruments such as ultraviolet (UV) detectors were also bought. This was, of course, a major investment for the firm.

The other difficulties that Hongyi Company faced were finding substitutes for the restricted substances and the uncertainty surrounding RoHS implementation. Substitution was predicted to lead to increases in cost and price. Managing these issues through the supply chain is a great challenge for the company.

Public awareness in China

In China, general public awareness of international and domestic environmental policies is still low, although it is increasing. As a result the Chinese public has initiated few environmental initiatives. It is not easy for the Chinese public to pay voluntarily for environmental actions e.g. recycling of WEEE. This situation means China is considerably behind Europe.

The Chinese public still needs to be educated about ‘social responsibilities for producers and consumers’ and on the need and urgency to build a resource and-energy-saving society. This is a reality for China, as a country with a large population but limited natural resources and energy.

3.0 Implications for suppliers

3.1 Implications for suppliers of existing EU/ Japanese legislation and industry initiatives

Environmental protection and sustainable development are increasingly affecting the Chinese electronics industry. Particular drivers are recent European and Japanese legislative developments focusing on eco-design, recycling and the reduction of hazardous materials in EEE products. The compulsory and voluntary requirements in relation to certification for safety, quality and environmental management systems, and energy-efficiency are increasingly becoming a potential trade barrier in the international market. For manufacturers, tackling the EU Directives it is not only a technical or legal issue but also a business issue due to the compliance cost associated with the WEEE, RoHS and EuP Directives predicted to be very high.

As highlighted above, the Chinese government has constituted regulations, rules, administrative measures and standards in order to guide Chinese domestic suppliers and producers to meet the requirements of the EU Directives, to help establish the domestic recycling system and to prevent e-waste entering China from the EU and other developed countries. From the research completed by RUC, it was found that all suppliers along the EEE supply chain will be directly and indirectly affected by the EU Directives. The impacts and implications can be seen from the following analysis in relation to employment, marginalisation of SMEs, compliance cost, recycling benefits, the need for testing and technology, education and training.

3.1.1 Impacts on employment creation and labour standards

China's employment and labour standards will be significantly affected by the impacts of EU and Japanese legislation. From the study, the implementation of WEEE and RoHS Directives, will impact on employment in China in the following ways.

Impacts on employment

For most large enterprises, implementation of the EU Directives will inevitably increase the cost of production, which will result in lower profits. This is likely to result in unemployment. Taking Glanzs as an example; the company sells 8 million microwave ovens into the EU market which represents 60% of the total air-conditioners made by the company. Meeting the requirements of WEEE and RoHS, means that Glanzs will face cost increases of 10% or more.

Colour television manufacturers also face great challenges. According to the financial reporting of the main manufacturers, in 2005 the net profit of manufacturing a colour TV set was less than 1%. With WEEE compliance, it was estimated that on average an additional 10 Euro will be charged for recycling one TV set (this may differ slightly in different EU Member States), which is almost equal to the net profit of one TV set. In addition, the traditional CRT TV with high lead content has historically been the main product exported from China to Europe. This leaves TV manufacturers with a dilemma as to whether or not to continue producing this kind of product given the requirements of the RoHS Directive. If production of CRT TVs is stopped, unemployment will be inevitable.

At present, the SMEs are playing a very important role in providing job opportunities for people living in towns and rural areas in China. By the end of 2004, SMEs accounted for 99.6% of the registered enterprises in China, with the value of services and products provided representing 58.5% of GDP. In addition, over 75% of workers in towns were employed by SMEs, representing 48.2% of total taxation income. As mentioned previously these SMEs lack technologies relating to the substitution of hazardous substances, eco-design skills and face increased compliance costs associated with WEEE, RoHS and EuP. Therefore, without proper measures to mitigate the above effects, bankruptcy and marginalisation of SMEs is likely to occur, resulting in increased levels of unemployment. In addition, most workers employed in SMEs have low skill levels and unemployment of these workers will be both a cost to the individual as well as the community.

Impacts on labour standards

The EU and Japanese Directives have resulted in the Chinese ministries issuing standards and implementing a series of labour regulations for the EEE industry. The WEEE and RoHS Directives have directly impacted on exporters to the EU market, but have already had, or will also have significant indirect impacts on the implementation of forthcoming regulations, rules, administrative measures and standards (as mentioned in 2.2.2 and 2.2.3). Most of these target the process of recycling WEEE and the restriction and substitution of the hazardous substances in China. This will help gradually change the present tradition of collecting and disassembling e-wastes in 'handmade workshops', where the employees are poorly protected from the hazardous substances. So the implementation or forthcoming regulations, rules, administrative measures and standards in China will have a positive impact on the improvement of labour standards.

In China, e-wastes (whether imported or domestically produced) are traditionally collected and recycled in 'handmade workshops'. The traditional way of recycling e-waste has often been harmful to the operating workers' health and will be replaced or improved in the future as a result of newly implemented or forthcoming Chinese legislation. At the same time, restricted hazardous substances will be substituted along the whole production process, which will reduce workers' exposure to hazardous substances and potentially improve labour standards in China.

3.1.2 Small suppliers and possible marginalisation

The export of Chinese machinery and electronic products has been greatly affected since the implementation of the WEEE Directive. According to the August 2005 statistics from Guangdong province (one of the biggest exporting provinces of machinery and electronic products), the export of machinery and electronic products to the EU was 2.2 billion US dollars; although this figure increased by 17.1% compared to the same month in the last year, the rate of increase was 5.8% less than the average rate over the previous 7 months. Export in September 2005 was only 2.25 billion US dollars, and the rate of increase continued to fall, reaching 14.6%. The export of air-conditioners from Guangdong to the EU market had an obvious decrease, and less than 100,000 air-conditioners were exported in August and September. RUC's study indicated that a number of major Chinese EEE producers had been forced to establish recycling operations in EU member states to comply with the WEEE Directive.

The implementation of RoHS has created much more pressure on domestic EEE accessories and parts manufacturers due tougher requests from the large enterprises. In Guangdong province, the main manufacturers of machinery and electronic products exporting to the international market are foreign investment manufacturers, but the accessories and parts suppliers are mostly from domestic SMEs. Large companies pay more attention to the quality control of the accessories and parts in relation to the environmental and health requirements so the accessories and parts provided by SMEs will need to meet the requirements of RoHS.

Sony introduced 'Sony Green Partner Certification' based on its 'Environmental management of substances contained in components and materials' before the implementation of the RoHS Directive. An evaluation of all Chinese suppliers was initiated by Sony in 2005. According to the Shenzhen Computation Quality and Check Academe's statistics, Sony has applied this evaluation to around 4000 Chinese suppliers. Only around 1000 suppliers passed the requirements. The suppliers who met the requirements of the related standards were treated as the 'green suppliers' from whom large scale purchasing followed, whereas those suppliers who failed to meet the requirements were no longer able to supply to Sony. The Panasonic Company conducted the same evaluation of its suppliers. The evaluation included 208 suppliers – which represented 7268 accessories and parts for air-conditioning equipment. Around 25% (1860) of the accessories and parts were not eligible, which meant that a quarter of products provided by the suppliers could not meet the new requirements of RoHS.

Other international electronic giants such as Omron and Foxconn have also implemented programmes to check their suppliers. China's domestic electronic enterprises, such as Konka, Haier and Hisense have strictly enforced the environmental requirements on products provided by suppliers. As a result it is estimated that Haier has reduced their suppliers from 1500 to 900.

It was estimated that in the Ningbo region alone, the RoHS Directive will affect at least 500 EEE manufacturers who export products such as refrigerators, washing machines, air-conditioners, vacuum cleaners, irons, ovens, pans, and lighting equipments to the EU market. The loss of trade volumes due to RoHS compliance was estimated at 100 million USD.

Through the supply chain, the pressure and impacts caused by the WEEE and RoHS Directives are directly transferred to national SMEs, and this is likely to have greatly accelerated the marginalisation of these enterprises, as detailed below:

Technological factors

SMEs have encountered major difficulties as a result of a lack of available technology to re-design their products, upgrade production processes and substitute the restricted substances to meet the requirements of EU and Japan environmental regulations. As a result some components are no longer used in the supply chain. Therefore, some small suppliers may continue to supply products that do not meet the requirements of RoHS. They maybe fined and asked to remove products from the market or even be forced into bankruptcy.

Cost factor

Production costs are predicted to increase by 5% due to the need to substitute restricted substances in a number of products; for some enterprises, the production cost is estimated to increase by 20%. This means technology upgrades will be required but SMEs will not be able to afford these costs.

The requirement for strict certification is another additional cost for SMEs. As stated previously, enterprises in developing countries chronically lack the cleaner technologies required to meet environmental regulations. The capacity to upgrade technology is limited by a lack of funds or financial support, intellectual property rights as well as many other factors. The testing and certification systems in the developing countries are rarely accepted by the developed ones, which results in suppliers in the developing countries mostly having to apply for foreign certificates. All these have significant cost implications.

3.1.3 Poverty alleviation

The employment created by quality control on the restricted substances, supply chain management within the EEE manufacturers or in the industry associations, and third-party certification by the third-party agencies can help to alleviate poverty.

To comply with RoHS, it is crucial to test and control materials, production and products in the whole production process at every section along the supply chain. This means that more positions related to the supervising or monitoring of the production process have been created, which has resulted in new employment opportunities.

In addition, the strict requirements for suppliers have created opportunities for third-party certification, which will inevitably create new opportunities for employment in China. Third-party certification agencies which are authorised by government still play a key role in China. With the implementation of Chinese RoHS and other related standards (see 2.2.3), certification of non-restricted substances and labelling will be needed for all EIPs in the Chinese market. At present only a few large companies have their own in-house departments to deal with the testing issues. However, with the increasing environmental and health requirements for the production of EIPs and the limited self-testing capability of SMEs, there will be many opportunities for professional third-party certification agencies to assure the reliability of the components and products.

As a counter-measure to meet the requirements of the WEEE Directive and prevent the dumping of e-waste in China, Chinese central and local governments and some relevant ministries have implemented some regulations and administrative measures, and are engaging in improving domestic legislation. These will help to establish the take-back and collection, recycling and recovery system for used EEE products. In addition, more recycling plants and factories will be established which will create new employment. In China at present, the main way to take e-wastes back is through vendor collection and by processing these by hand in a workshop. The newly issued regulations and policies by the related ministries of the Chinese government will standardise the way that producers, distributors and consumers will need to handle e-wastes (as analysed in 2.2). New recycling and disposal systems for e-wastes will be built up in the future, which will be a driver for the emergence of new industries in China that will potentially create more employment opportunities.

3.1.4 Costs of compliance

Statistics from The General Administration of Quality Supervision, Inspection and Guarantee of China revealed that the WEEE and RoHS Directives will have significant impacts on approximately two-thirds of machinery and electronic products exported to the EU from China. The statistics from CHEAA revealed that the recycling fees for different home electrical appliances in those EU Member States who have adopted the WEEE Directive are on average: 20 Euro per refrigerator, 10 Euros for a washing machines or air-conditioners, 5 Euros for a microwave, and 1 euro for one small household appliance. (Source: CHEAA's statistics. Note: fees are likely to be different in each EU Member State).

According to a rough estimation, the two EU Directives will increase the prices of home electrical appliances made in China by 10% due to the following factors:

High cost of the removal or substitute in technique

The RoHS Directive has resulted in a cost related to removal or substitution of processes. Take tin soldering for example, the cost of soldering with a high content of lead used by most of the manufacturers is about 60 RMB per kilogram. However, RoHS's strict requirements mean that companies must use the non-lead tin soldering with a market price of around 260 RMB per kilogram. This means that, for example, when a manufacturer uses 1 ton of tin soldering for production, there will have been a sharp increase in the production costs of around 10 thousand RMB.

Although the substitution of lead is expensive, alternatives have been found. However, in relation to the other restricted substances, there is limited availability of new technologies and the R&D of alternative technology requires huge investment. Therefore finding a practical way to comply fully with RoHS for many Chinese companies (especially SMEs) is extremely problematic.

Product certification and testing

In the context of RoHS, designing or producing products with non-compliant materials will waste time and money, and may mean the removal of products from the market with consequent impacts on reputation. Lack of early involvement of specific departments in the product development process can also have serious implications in the manufacturing process.

With the implementation of RoHS Directive, manufacturers of final products need to have strict requirements on the components and parts from the upstream suppliers in the supply chain either through the professional third-party certification agencies or by the suppliers' self-testing certificates for compliant components, which undoubtedly creates new costs for suppliers.

Certification or labelling of non-restricted substances in final products also increases cost. For example, the insulation covers of electrical wires must not have any lead content, and the ice box in the refrigerators cannot contain components containing chrome, etc. As an example, these requirements will cost the manufacturer money for testing and inspection, and for SMEs, these costs are extremely high.

Charges stipulated by WEEE

According to the WEEE Directive, Chinese enterprises will pay high extra costs for the take-back and recycling of e-wastes if they are deemed to be a 'producer' in Europe. This includes:

- Registration fee: if a producer wants to put its products into the EU market, it or its agents must register with the related agencies in every member country explaining in detail the recycling and treatment methods and pay a registration fee. The registration fee will change every year and differs from different member states. As an example, the basic registration fee in Germany was estimated at about 150 Euros for every brand a company wishes to register. There may also be some other items, which require payment. (Source: Mr David Perchard from DTI (UK) and Dr. Chris Robertson from ERA (UK) from the seminar on WEEE and RoHS held 17–18 May 2005)
- Take-back and recycling guarantees: an amount of money will be paid if one company wants to sell its products in the EU market, to make sure that it will carry out its responsibilities for take-back and recycling of used products in a suitable manner. For instance, companies may participate in a collective take-back scheme with other companies, which would require a joining fee. The second option is to organise separate, individual contracts with recyclers.
- Information fee: firstly a recycling symbol (a crossed-out wheelie bin) must be displayed on the product during its entire product lifecycle. Secondly, information about the recycling methods, collection plants or sites or the related governmental agencies must be communicated to consumers through the label or other methods. This kind of information was estimated to account for more than 8% of the total recycling fee for Chinese companies who want to sell their products in the EU market.
- Sorting and collection fee: This is mainly included in the cost of transportation and management on the storage sites for the e-waste during the recycling process in Europe.
- Recycling fee: firstly, there is the cost of dismantling and treating e-waste in Europe, with most dismantling done by hand. Secondly, the delivery of the reusable materials and parts will have an associated cost. The cost of recycling differs for different kinds of products and different materials used.
- Producers will be responsible for the environmental pollution caused by incorrect recycling methods or any unavoidable environmental pollution in the recycling stage. It is difficult to estimate the costs associated with this requirement for environmentally-friendly recycling because different kinds of products are made of different raw materials. According to estimates carried out in the EU, the cost is between 297–547 Euros/ton e-waste, wherein the cost for the machinery treatment such as collection, sorting and recovery accounts for 14%, 38%, and 23% respectively. (source: one report from Pony Lab Physical and Chemical Analysis, http://www.ponytest.com/content.asp?id=603)

The cost of compliance may be the same for all manufacturers, but the significance is different. For many SME exporters the costs will be hard to bear.

3.1.5 Testing facilities

In order to meet the requirements of RoHS many suppliers will have to update their quality control and inspection systems as every product and every component has to be inspected against the new restrictions. It will be necessary for suppliers to purchase or rent new testing equipment or facilities. These kinds of testing facilities are for single components or single products rather than for all the components or the whole production line, which means different types of testing equipment or facilities will be needed for different components or products. When new components or products are launched, new testing facilities will be required.

The General Administration of Quality Supervision, Inspection and Guarantee of China and the Committee of National Certification and Accreditation issued 6 kinds of testing criteria targeting the six kinds of hazardous substances restricted by the RoHS Directive. These criteria were implemented in January 2006. The testing criteria and the named list of 18 laboratories that complete testing and inspection tasks for EEE manufacturers has been published. In May 2005, the 6 testing criteria aimed at RoHS drafted by the Shenzhen Inspection and Quarantine Bureau successfully passed the experts' authentication. At the same time, the General Administration of Quality Supervision, Inspection and Guarantee of China launched research on the standards, testing and inspection techniques and substitute technologies. This has been coordinated with other Ministries in order to prepare for new regulations and policies, which are considered to contribute to the improvement of the manufacturing capacity for the EEE industry and upstream suppliers in China.

With the implementation of the RoHS Directive and the related Chinese regulations and policies, the suppliers will face more and more stringent requirements. In addition, with the limitation of technology and investment, suppliers (especially SMEs) will have limited capacity to control products due to insufficient testing facilities and technicians.

3.1.6 Changes in technology and production process

Innovations in technology and production process will be needed to meet the requirements of the above mentioned legislation.

For example, Skyworth set up a special department within the company to introduce the requirements of the WEEE and RoHS Directives in September 2004. As a first step, Skyworth required all the upstream suppliers to offer a testing certificate by SGS that was stricter than RoHS – this was used to identify compliant and non-compliant suppliers in advance. Secondly, Skyworth carried out internal changes to management procedures and supervision. In 2003, TCL launched 'Lead-free Engineering' (which aimed at changing the processes and technology used) and a 'Green Procurement Union' together with the upstream suppliers. TCL also focused on complying with international energy efficiency standards. TCL's TV's with LCD screens achieved US Energy Star with the energy consumed being only one-third of the energy required by the Chinese Mandatory Energy Consumption Standard. TCL also established a special leading team in order to meet the requirements of WEEE and RoHS Directives, which was composed of leaders from each department of TCL. TCL also set up collaboration with Philips and some other well-known companies, and focused on establishment of the production control system in order to assure removal of the restricted substances. Three non-lead production lines were set up and put into use by TCL in 2005. By January 2006, all the production lines of TCL in the five production bases all over the world were upgraded to non-lead production lines.

The Konka group announced in March 2006, that their non-lead production line had been rebuilt according to RoHS requirements. Since 2005, Konka has completed two non-lead production lines in Guankang, one non-lead production line in Ankang, and another non-lead production line in Mudanjiang city. An emphasis was placed on the upgrading of the joining technology. All the production lines are now green manufacturing without hazardous substances. A 'RoHS Total Solution' was developed by Konka, which included eco-design criteria, third-party certificate requirement on the up-stream suppliers, standardised procedures for the production process control and testing of finished products. In addition, Konka also initiated requirements on products from suppliers. A strict non-lead quality guarantee system was set-up to make sure that the shift of production from lead to non-lead production went smoothly. Furthermore, third-party certification was employed by Konka to scrutinise the upstream suppliers so that any hazardous materials were effectively screened-out during the purchasing process to ensure that the components and the parts did not contain lead, mercury or any of the other hazardous substances.

However, for most SMEs in China, the technical innovations are very difficult to carry out because of their low levels of the required technology and a lack of financial support for *green* R&D. For example, silver cadmium oxide (AgCdO) is a necessary touch material and is used widely in switch nodes, polybrominated diphenyl ether (PBDE) is a commonly used flame-retardant in plastic and lead stearate is a popular plastic heat stabilizer. At present in China, it is still difficult to find any substitute technologies for the above mentioned materials. With the implementation of the Chinese RoHS on 1 March 2007, some SMEs, who previously planned to withdraw their products from the EU market due to being unable to meet the requirements of RoHS Directive will also have to try to change their production processes and upgrade their technology in order to sell in the domestic Chinese market.

In some areas such as in Zhejiang province where a lot of SMEs are concentrated, some SMEs have invested in changing the production processes and technology to try to meet the requirements of RoHS Directive and the Chinese RoHS. However, the SMEs are facing increasing cost, which implies that many SMEs will do nothing to meet these requirements. The data from Guangdong statistics reveals that 10% of the parts and components from Zhuhai and the surrounding area failed to pass the testing (RoHS) and 50% of whole products were disqualified according to the requirements of RoHS.

Some downstream manufacturers are trying to help the upstream suppliers by guiding the suppliers to upgrade processes and technology through training programmes. For example, TCL trained 500 suppliers to meet the requirements of RoHS through a 3 year training programme and technical support. However, this kind of training and support is limited compared with the total need from SMEs in China.

3.1.7 Initiatives for recycling/reuse and costs/benefits

As the analysis at the beginning of 3.1 indicated, there is an urgent need to find an agency in the EU to deal with the collection, recycling and disposal system for e-waste generated by exported EEE products from Chinese producers. In the long run, it is necessary for the EEE industry to establish professional environmentally-friendly collection, recycling and disposal systems for e-waste in China. Along the supply chain, all the manufacturers and producers need to consider eco-design and cost at the end-of-life phase.

Table 3.1 summarises the category of e-waste.

Initiatives to collect, recycle and reuse e-waste in an environmentally-friendly way will also be helpful to avoid the dumping of e-waste from the developed countries into China. In past years, a huge amount of e-waste has been imported into China from developed countries. In China, e-waste treatment is profitable because labour costs are cheap and appropriate regulations are non-existent or not well implemented compared with those taken by developed countries. It is estimated that it is ten times cheaper to treat the cathode ray tubes (CRT's) shipped to China from the US than to treat them there. Due to this, large amounts of e-waste have been imported to China illegally and this has endangered ecological systems and human health as a result of the pollutants produced during the simple and crude recycling and disposal processes. Some hazardous substances e.g. flame-retardants generated from the

Table 3.1: Category of e-wastes

Product Category	Product Group	Examples
Large appliances	Household appliances, other large appliances,	Washing machines, dishwashers, boilers
Appliances with screens	TV sets, screens	
Small appliances	Computer and telecommunication, Equipment, video and audio equipment, cameras, household appliances, other small appliances	PCs, facsimiles, photocopiers, radios, amplifiers, CD players, video recorders, vacuum cleaners, coffee machines
Other appliances	Cooling appliances, consumer batteries, accumulators, fluorescent tubes	

crude recycling and disposal process threaten the unprotected workers' health during the dismantling process. Backyard disassembly is the main recycling method. Uncontrolled facilities operating in this manner cause a loss of resources and are a potential high risk to human health and the environment. Although building up a recycling system will need a huge investment, it will have great long-term benefits.

From the Corporate Social Responsibility (CSR) perspective and competitiveness in the long run, initiatives such as the recycling and proper disposal of e-waste will also benefit domestic consumers. This will result in an improvement in products' competitiveness in the long run.

3.2 Implications on competitiveness of other Asian suppliers

The impact of the WEEE and RoHS Directives, particularly the RoHS Directive, on other Asian suppliers can be seen from the statistics below. In recent years, the Chinese government, the machinery and electronic industry associations and exporters have been keeping a much closer eye on the related legislation in the developed countries such as the EU and Japan. However, there is already trade with Asia.

In 2005, the gross value of the machinery and electronic products exported from Thailand to China reached 3.83 billion US dollars, accounting for 42.1% of the total value of the exports from Thailand to China. This was an increase of 42.9% compared with the previous year.

The export of automatic data processing equipment and components to China from Thailand was 1.79 billion US dollars; integrated circuit and micro-electronic components reached 0.41 billion US dollars. The rate of increase was 118.9% and 82.9% respectively. See Table 3.2.

In 2005, Thailand imported machinery and electronic products from China worth 5.94 billion US dollars. This was an increase of 43% compared with previous year, accounting for 53.3% of the total import value in Thailand. Other statistics for imports from China to Thailand are listed in Table 3.3. The major category of bilateral trade in electronics between China and India is machinery and electronic products. From January to June in 2005, the import of machinery and electronic products from China to India reached 0.65 billion US dollars, accounting for 16.3% of the total import value from China. While in the same period, the import of machinery and electronic products from India to China was of a relatively low quantity, and not listed in the top 10 categories. (Data from Ministry of Commerce, 'National Trade Report', 2006.)

For a long time, the main export markets for Chinese machinery and electronic products were not in the developing countries in the Asia-Pacific area. However, the statistical data has revealed that China's trade with India and Thailand is gradually expanding. From the analysis, the main products imported to China are equipment parts, while products exported are mainly daily household appliances. In recent years, the Chinese machinery and electronic product exporters, who are mainly bigger companies, have been keeping a much closer eye on the related standards in the developed countries such as the EU and the USA, and therefore the products exported to India and Thailand have no barrier in complying with the standards of the machinery and electronic products in India and Thailand. Also, these developing countries' regulations hardly affect the imports of machinery and electronic products from China.

Table 3.2: Machinery and electronic products exported from Thailand to China in 2005 (in billion USD)

Product	Gross value	Annual Increase (%)
Total	3.83	28.1
Automatic data processing equipment and components HS8471xxxx)	1.79	118.9
Integrated circuit and micro-electronic components (HS 8542xxxx)	0.41	82.9

Source: www.chinacustomsstat.com, “HS” is used by China Custom to classify the different kinds of commodities

Table 3.3: Machinery and electronic products Thailand Imported from China 1n 2005 (in billion USD)

Product	Value	Annual Increase (%)
Total	5.94	43
Wireless telephones and telegraph equipment etc HS8525xxxx	0.76	73.6
Automatic data processing equipment and components HS8471xxxx	0.65	27.2
Integrated circuit and micro-electronic components HS8542xxxx	0.37	82.9
Telephone and telegraph equipments HS8517xxxx	0.26	95.6

Source: www.chinacustomsstat.com, “HS” is used by China Custom to classify the different kinds of commodities

4.0 Gaps and future needs

In the EEE industry there are a number of gaps between China and some developed countries in relation to environmental awareness, environmental management, eco-design, green procurement and supply chain management. As mentioned previously, the gaps are significant amongst SMEs. There is a need to improve the environmental management in the Chinese EEE industry not only to meet the requirements of the EU Directives and Japanese legislation, but also to ensure industrial sustainable development.

4.1 Management needs

In order to meet the requirements of EU Directives and Japanese legislation, the environmental awareness of the whole electronics industry needs to be raised. It is essential for Chinese companies to adopt better environmental management. Although integrating eco-design, green procurement and supply chain management into the existing management systems is complicated, it can be solved to some extent by applying the ISO14000 series, especially if product aspects are clearly addressed.

4.1.1 Pressure from the supply chains

In 2005, processed and assembled products with imported material and components were China's major EEE exports. This indicates that trade of the products that are at the bottom of the industrial chains are a key component of exported Chinese EEE products e.g. computer components and accessories. The export of products made by exclusively foreign-owned enterprises and joint venture enterprises accounted for more than 66% and 85% of exports respectively. This means they can control the quality of the components from the foreign suppliers and have little difficulty in meeting the requirements of RoHS.

For the products made by the exclusively foreign-owned enterprises and joint venture enterprises, quality is controlled as these enterprises have already implemented procurement procedures. The cost increases due to compliance of RoHS may be transferred to the exporters of the whole product. However, SMEs in China who supply the raw materials for component manufacturing such as the joining and plastic material for the computers, face great difficulty in meeting the requirements of RoHS due to the limited capacity in technology and funding. It was estimated that the cost increases for the SMEs would be 5–20%, which is much more than the 10% profit. The most serious problem is that it is difficult to find substitutes for some restricted substances in the Chinese domestic market. The high cost for some patent technology is one of the main barriers for the SMEs to find substitutes for hazardous substances.

4.1.2 Awareness of environmental/health and information management

Awareness of environment/health and its impacts on Chinese enterprises

In China, there are different levels of awareness depending on the size and the scope of the enterprise. Most foreign investment and large state-owned enterprises' awareness of the environment and health is at a much higher level than SMEs.

At present, there are more than 26,000 home electrical appliance enterprises in China. Of these, 10,000 enterprises are located in Guangzhou, Beijing, Shanghai and Jiangsu provinces, with nearly half of these enterprises in Beijing and Guangzhou. In recent years, EEE manufacturers have lost market share due to the technical barriers in the export markets. A large proportion of these barriers in export markets are related to environmental and health regulations. Chinese enterprises have suffered heavy losses because of their low level of awareness of the importance of these issues.

On 10 May 2005, Wei Jianguo, the vice president of the MoC of the People's Republic of China pointed out that after entering the WTO, two-thirds of the Chinese export-oriented corporations encountered technical barriers to trade (TBT) in the overseas market and two-fifths of the exported products were affected to differing degrees by these TBT. The annual amount of trade lost due to this was estimated at around 20 billion US dollars. The report carried out by MCPRC in 2003 indicated that 80% of the EEE products exported were affected, and the monetary value was estimated at 1.45 billion US dollars, accounting for around 10% of the total loss from TBT.

According to the survey, the electro-mechanical industry believes that there are two main reasons for the restriction in exports. One reason (the most important), is the difference in regulations and standards; and the second is the requirement on the protection of the environment and human health in foreign countries.

Table 4.1: Important causes of the TBT

Electro-mechanical industry	
Protection of domestic industry	21%
Discriminative treatment	21%
Different standards and rules	64%
Different customs	7%
Protection on human health and environment	46%
Other reasons	0%

Source: This data was issued by Department of the Science and Technological Development and Trade in Technology of China, May, 2003

Collecting, sorting and disseminating information

The present channels for Chinese enterprises to obtain information on environmental requirements for EEE products in international markets include:

- Official and non-official networks
- Official information bulletins
- Seminars organised by relevant ministries and associations
- Information gathered by industry associations
- Information provided by consultations agencies
- Analysis by relevant research institutes.

The government plays an important role in collecting, sorting and disseminating the EEE product information on environmental and health requirements in key export markets. The governmental ministries involved include the Ministry of Commerce, the Ministry of Information Industry, General Administration of Quality Supervision, Inspection and Quarantine and all the local governmental departments in charge of the electronic and information industry management. The relevant associations and research institutes can also help enterprises collect relevant information on changes in policies and regulations in time. Other sources are communications with other enterprises in the same industry and with suppliers and raw material providers. Relevant networks are highlighted in Appendix 1.

Besides the network of governmental ministries and organisations, some research centres attached to universities also play a useful role in information dissemination. For example, China Research Centre for Technical Barriers to Trade (CCTBT) is a non-profit research organisation composed of domestic and foreign experts, entrepreneurs, officers, and industry associations. It was founded 2 November 2000, and headquartered at the University of International Business and Economics. In addition, the WTO consultation centre of the Commercial College of Wuhan University actively engages in WTO consultation and training services based on its strengths in economics and management.

4.1.3 ISO14000 certification

In 1996, China introduced the ISO14000 standards series and began to conduct demonstrations in selected enterprises and regions. In May 1997, the State Council approved the establishment of the Chinese Steering Committee for Environmental Management System Certification to manage the promotion of the ISO14000 series in China. Encouraging the export-oriented corporations to apply for the certificate of ISO14001 and in some instances acquire an eco-label from the importing country.

Some of the large home electrical appliance manufacturers have provided *green* household appliances to the domestic and overseas market such as *green* refrigerators, *green* air conditioners, *green* televisions and *green* computers. Haier Company, for example, aims to open up the market for *green* household appliances. In 1996, before the Chinese government formally introduced the certification programme for ISO14001, Haier had taken steps to implement ISO14001. In 1998, it became part of the first group of enterprises to apply for certification under ISO14001. Haier subsequently implemented an environmental management system and achieved its ISO 14001 certification.

The '3C' certification has been implemented by agencies authorised by the Chinese government. Large enterprises are trying to achieve it e.g. Haier Frequency Conversion Refrigerator was the first refrigerator to have gained the '3C' certificate. In addition, another 12 kinds of home electrical appliances from Haier have achieved '3C' certificates e.g. washing machines, colour television sets, mobile telephones, microwave ovens, iceboxes, irons, cleaners, suction lampblack machines and electricity water heaters.

Most foreign investments in the EEE industries in China are export-oriented ventures. They are familiar with the requirements and standards of environmental and health in general and have a relatively high level of awareness of the requirements in their own countries. For example, three of the four Sony (China) Co. factories owned in China acquired the ISO14001 certificate in 1998. In September 1999, the Sony Beijing headquarters and Sony Hong Kong Co, Ltd. acquired the ISO14001 certificate, which was carried out by CCEMS and United Kingdom Accreditation Service (UKAS). Suohong Electronic Co, Ltd. in Beijing was the first communication terminal manufacturer to receive ISO14001 certificate in September 1998. It was also the first enterprise in China to receive a certificate from UKAS.

As a developing country, China has numerous growing SMEs that not only seriously pollute the environment, but also generate large amounts of waste and consume considerable energy and natural resources. This has become a major obstacle hampering further growth of the economy and exports. In order to keep up with this certification trend, great efforts should be made to adapt the ISO14000 series for SMEs. There is a need to publicise the relevant information on the ISO14000 series across the country and for SMEs to have a greater understanding of CSR and increased environmental awareness.

4.1.4 Improving the eco-labelling system in the electronic industry

The China Certification Committee for Environmental Labelling (CCEL), as a third-party certification agency, was established in May 1994, under the authorisation of the China State Bureau of Technology Supervision (CSBTS) and the State Environmental Protection Administration (SEPA). It represents the government in relation to environmental labelling certification as well as administering and supervising the environmental performance of enterprises after the certificate is issued.

The programme also encourages the demand for those products and services that are environmentally-friendly, helps to guide the consumers in their purchase decision-making and promotes public awareness of environmentally-friendly products.

Presently in China the following six types of products are treated as having priority for the environmental labelling certification, including:

- Products related to and abiding by, international treaty commitments, such as ODS-free products
- Recyclable products
- Products that lead to regional environmental quality improvements
- Products that create in-house environmental quality improvements
- Products that benefit health protection
- Products that enhance resource and energy efficiency.

The label-awarded product categories of the electric and electronic equipments in China are similar to those in other countries. Among the major machinery and electronic product categories, the certification focuses on household electric appliances, such as refrigerators and energy-saving and noise-suppressing air-conditioners etc. In the category of electronic and communication equipment, the certification always centres on low-radiation colour TVs and energy–saving computers. The ordinary mechanical engineering remains untouched. So far, 12 machinery and electronic product categories with corresponding criteria have been created as listed below.

Most enterprises that have achieved environmental labelling certificates in China have a large share of the domestic market and a good reputation among customers for complying with environmental requirements. However, some enterprises have suspended the environmental labelling certificate because they have not complied with the requirements after they were awarded the certification.

Table 4.2: Major machinery and electronic products included in environmental labelling technical criteria

Number	Products
1	Energy-saving light products
2	Energy-saving computers
3	Energy-saving & noise-suppressing air-conditioners
4	Household refrigeration appliances
5	Low-noise washing machines
6	Low-pollution light vehicles
7	Low-pollution light motors
8	Low-radiation colour TVs
9	Chlorine-fluorine-free refrigeration appliances for industrial and commercial purposes
10	Photocopying machines
11	Low-pollution kitchen appliances

Table 4.3: Scope of electronic products in 3C certification

Cord sets	Cables and cords
Switches and socket-outlets for household and similar purposes	Switches for household and similar fixed electrical installations
Plugs, socket-outlets and couplers for industrial purposes	Appliance couples for household and similar general purposes
Thermal links	Enclosures for accessories for household and similar fixed electrical installation
Cartridge fuse-links for miniature fuses	Small-power motors
Electric welding machines	Household electrical appliances
Lighting appliances	Electrocardiographs
Fire alarm products	Fire hose products
Automatic sprinkler system products	Detectors for intruder alarm systems

4.1.5 '3C' certification and export permission

'3C' certification

In China, all products covered in Table 4.3 should obtain a '3C' Certificate before they are sold, imported or used for any commercial purpose. The '3C' Certificate is helpful in removing the technical barriers because the '3C' certification sets up national standards and technical specifications on the basis of international conformity assessment procedures. Large Chinese electric and electronic enterprises such as Hisense, Kelon, Midea, Gree, Changhong, TCL have all achieved a '3C' certificate. Foreign corporations such as Samsung, Toshiba, Sony, Panasonic are also actively participating in the programme.

Export permission

According to the Committee for Quality Administration of Electronics for Export, EEE product producers that apply for export permission must meet at least one of the following technical requirements:

- Domestic standards and foreign advanced standards
- Current national standards and electronic industry standards
- The enterprise standards approved by the government or transitional standards.

If there are specific requirements on quality in the foreign trade contract, products must meet the requirements of the contract and packaging standards of the relevant import country. The producers must comply with the local quality permission and checkout system for export electronics.

4.1.6 Need to establish an in-house environmental department (IED) inside the enterprise

Function of the IED

Establishing an IED inside the company will help facilitate environmental management and potentially accelerate eco-design and greening of supply chains for the restricted substances. However, it is essential that environmental aspects are integrated into business functions and the organisational processes. Without this focused approach, it is unlikely that the relevant resources and information will be fully utilised.

In the context of RoHS, the IED should work with technical departments to control the restricted substances used in the products. For the up-stream suppliers, the first step the IED should take is to assess products and the target markets in order to confirm the scope and the limits of the restricted substances. The IED should also formulate policy and procedures to control the restricted substances, and standardise procedures for the documentation of materials in the supply chain.

Moreover, the IED should also have overall responsibility for testing the restricted substances during the whole production process together with other departments inside the enterprise. Finally the IED will need to document all the control measures and results for the proof of non-toxic restricted substances in order to meet the requirements of RoHS.

IED in large enterprises and foreign-investment enterprises

The majority of large enterprises and the foreign-owned enterprises have already set up IEDs to manage environmental issues sharing experience from overseas. But the function of the IED depends on its role and position during the decision-making process within the enterprise.

Obtaining certification is an important job for the IEDs in large and foreign-investment enterprises. Another important role of IEDs is to manage the supply chain and control the production process, such as testing reports and ensuring that all the parts and raw materials used are free of the restricted toxic and hazardous substances as required by the company's standards of green procurement.

IED for SMEs

For SMEs, having IED is as important as for large enterprises. However, the real problem for SMEs is the increased cost associated with setting up an IED.

In China, a lot of SMEs produce similar products. The investment for such kinds of SMEs is very small, which means that SMEs face heavy competition in the market. Providing products at a lower price is the most important factor for a SME to win business. Increased costs will lead the SME to lose market share. So the best choice for SMEs is to supply certain large companies with qualified and reliable products according to their long-term requirements. Most large companies pass the pressure of environmental requirements of the WEEE and RoHS Directives to the 1st tier and then subsequently to SMEs along the supply chain. In this respect, IED is very important for SMEs to control quality, especially to control the restricted substances.

In addition, even with an IED set up within a SME, it is still difficult for the IED to function as described above due to the lack of technicians and information collection and analysis. For those SMEs who want to establish their own IEDs to meet the requirements of the RoHS Directive from the large companies, it will be a tough task to collect the required information on time and set up different standards for the products provided for different downstream producers.

Therefore, it is difficult for SMEs to set up IEDs at present due to a lack of investment, information and technicians. However, there is an urgent need for product-related environmental management amongst SMEs in China.

4.2 Technical needs

4.2.1 Eco-design

Eco-design can be described as 'the integration of environmental considerations into product development and design' (as referenced by ISO/TR 14062). A key element of eco-design is that environmental impacts need to be reduced throughout the lifecycle from material extraction, through manufacturing, transport, use and final disposal. Eco-design is not simply focused on environmental compliance, but is rather an integrated, cross-functional approach. For example, research departments should explore opportunities for environmentally-driven innovation, procurement departments should start to explore *green* materials and components and marketing departments may communicate the relative environmental benefits of the products.

At present, eco-design of EEE products in China is still at the developmental stage – but discussion of the approach is staring to emerge in companies. There are also few eco-design research projects sponsored by the government. Some industry associations are helping enterprises gain a better understanding of the concept through seminars or overseas field trips, and some researchers in the universities and institutes are starting to design and develop products using eco-design principles. Some large companies are trying to explore ways to conduct eco-design e.g. Haier Group have organised eco-design teams and initiated eco-design practice.

Most Chinese enterprises do not have the capacity to take environmental considerations into account in the design and development of their products. Given growing product-related requirements, it is important to initiate eco-design training in the EEE industry in China and this might act as a useful demonstration for other industries.

According to the requirements of the EU Directives, Japan legislation and newly issued and implemented Chinese regulations, there is a need to build the technical capacity in eco-design in the EEE sector and this should include consideration of issues such as the selection of the raw material, integration of the disassembly aspects into products during the design stage, etc. In this respect, the EU, Japan and other developed countries have a lot of experience that China could learn from.

4.2.2 Process and technology change

Restriction of the toxic and hazardous substances

To ensure that products are RoHS compliant, EEE products should ensure that the threshold levels of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr+6), Polybrominated biphenyl (PBB), Polybrominated diphenyl ether (PBDE) are achieved. According to the concrete requirements in the Administrative Measure on the Control of Pollution Caused by Electronic Information Products (see 2.2.2), the manufacturers and producers must consider the removal of the restricted hazardous substances from the design phase. Production with environmentally-friendly materials or technologies is being increasingly required. Some large companies have tried non-lead production lines and other

innovations for new materials and technologies. However, most SMEs are facing great challenges in changing the production process and technology to meet the restriction of the toxic and hazardous substances, which means a huge amount of investment and increased costs and technical capacity.

In order to meet domestic and international environmental requirements, the Chinese EEE industry (especially the SMEs) will need technical training on how to achieve restricted substances targets and this will mean the need for capacity building in technical innovation.

Reduction of energy consumption in electric and electronic products

Conducting R&D for new technologies and new products in the Chinese EEE industry is one pro-active way to try to achieve the energy-saving objectives in China's tenth 'Five-Year planning' and to meet the requirements of EU and Japanese legislation. It is also key issue for Chinese EEE products entering the international market.

Example of refrigerators

A new standard for refrigerators named 'Limit of Electricity-consumption and Grade of Energy Efficiency of Household Refrigerators' was implemented in China on 1 November 2003. Since that date, refrigerators put on the market must have the energy efficiency label and this will help avoid the so-called 'green trade barriers' in international trade. According to the level of electricity efficiency calculated from the experimental results comparing electricity-consumption and volume, refrigerators are classified into five grades: A, B, C, D and E, which are ranked in order of energy-saving performance with grade A the best. Grades D and E will be discouraged from further production and use by the government. The electricity consumption of refrigerators has already been significantly reduced by 15%. Refrigerators whose energy-consumption figure is close to the present limit will be pushed out of the market in the near future.

This indicates that in the near future, eco-design related to energy- and resources-saving will have an increasingly important technical need in the Chinese EEE industry.

Promotion on interchangeability of parts

'Interchangeability' means one part with the same function and structure that can be interchanged or replaced in different products with different brands. The interchangeability will help reduce the numbers of parts produced for use in different products. The interchangeability of different parts needs to be taken into consideration in the product design phase. During the design phase, the general and individual characteristics of different products must be comprehensively analysed to find out those parts with common characteristics. These parts will be treated as standard parts of different finished products or the same product with different brands. Designers should try to find more opportunity to use these standard parts in the designing of products. Moreover when a new product is designed, the designer should try to use existing standard parts, and when designing new parts should consider how they may be used in future products. In China, it is important for both the EEE enterprises and industry associations to co-operate together to improve the interchangeability of the parts used in different finished products. If some parts from different producers can be interchanged freely, such as mobile phone chargers, it will lower the cost of recycling e-waste and facilitate the union for the collection of the e-waste among the EEE industry. It is therefore particularly important for SMEs to realise interchangeability within the EEE industry. The SMEs in the EEE industry usually manufacture several kinds of parts or accessories, or provide different types of parts for different producers. If the parts are not interchangeable within the EEE industry, it is difficult for SMEs to implement. Thus, it requires that the entire EEE industry, especially the professional associations and large enterprises to launch an interchangeability of parts initiative.

4.2.3 Establishment of e-waste call-back, reuse and recycling system: stakeholder needs

Government

The Chinese government needs to learn from successful experience of e-waste call-back, reuse and recycling systems in developed countries such as Japan and some of those in the EU. In China, the following measures have been taken in relation to home electrical appliances (HEAs):

- A working scheme to develop a call-back and recycling system for waste HEAs
- A recycling task force was established by the Ministry of Commerce, Ministry of Finance, State Administration of Taxation, General Administration of Quality Supervision, Inspection and Quarantine, Ministry of Science and Technology, Ministry of Information Industry, Ministry of Construction, and State Environmental Protection Administration
- Administrative measures were drawn up on waste HEA recycling
- Overseas HEA collection and recycling systems were reviewed
- Economic and efficient HEA recycling technologies are being developed, related to the specific circumstances in China.

All the above measures taken by the Chinese government are in need of technical assistance from developed countries that have advanced experience and have a strong technical capacity. Technical co-operation on a government level will have significant implications for the capacity building of enterprises.

Enterprises

When the enterprises undertake recycling, the following technical needs may occur during the eco-design process:

- Technologies for interchangeability and standardisation of parts
- Using well-proofed cutting-edge technologies
- Technologies for an environmentally-friendly solution
- Technologies related to cost reduction.

This study carried out an analysis of the needs of different types of enterprises as follows:

Large enterprise

It is necessary for the large enterprises to establish their own recycling systems. Most of the large Chinese enterprises who have a presence in the EU market have already found one EU company to take back and recycle their e-waste. In the future, they also need to do this in the domestic market. It is obvious that these large companies need to learn from the experience of foreign companies on how to economically establish e-waste take back and recycling. On the other hand, it is also important for these large enterprises to learn further from developed countries through international co-operation, where large, well-known international companies have established take back and recycling of e-wastes through a union (or a united way) considering cost factors. In early 2002, Sony (Japan), HP (USA), Electrolux (Sweden) and Braun (Germany) co-operated in Europe to establish a united service and procurement company engaged in purchasing, transportation and recycling of e-waste. It was reported that the cost of recycling was reduced by 30-40% through this co-operation. As mentioned previously, China WEEE Recycling Union (CWRU) has united some key exporters of home electrical appliances in China such as Haier Company, Changhong, Skyworth etc to contract with Hellmann Process Management of Hellmann Group in Germany for e-waste take back, reuse and recycling in the EU market.

There is also a key need for the large companies to understand the techniques of product quality control along the supply chain. It is also important for large companies to consider the eco-design requirements in order to facilitate recycling at the end-of life.

Foreign-investment enterprise

Generally, the foreign-investment enterprises in China are transnational. They have respective environmental goals in their medium and long-term strategic plans. They also have suitable technical capacity to deal with take back of e-waste, reuse and recycling and some parent companies of these foreign-investment enterprises in China also indirectly participate in the formulation process of these EU directives and Japanese legislation, therefore they can usually deal with the environmental requirements of the EU directives and Japanese legislation. They have already passed the pressure to their up-stream suppliers. Presently they are guiding their up-stream suppliers on how to meet these environmental requirements or screening the suppliers to identify who can meet their requirements.

SMEs

Most SMEs in China will need technical assistance in every aspect. Therefore the government should provide opportunities for SMEs to get involved in the research on e-waste take-back, reuse and recycling, and technical innovations. This can be done through incentives, regulations and policies such as tax refunds and low-interest technical loans, etc. This will help SMEs in China to conduct eco-design, technology innovation or substitution R&D.

5.0 Capacity building plans

5.1 Main purpose of training

The main purposes of training to support capacity-building are:

- Raising awareness of environment and safety issues in the EEE enterprises, especially SMEs
- Introducing producers and the relevant ministries to the specific requirements of the environmental, safety and resource-saving regulations and laws related to EEE equipment implemented by the EU, Japan and the USA
- Explaining the impacts of the WEEE, RoHS and EuP Directives on the Chinese EEE industry and ways to reduce the negative impacts
- Enhancing EEE enterprises' capacity to conduct eco-design
- Enhance the technical capacity to substitute the six substances restricted by the RoHS Directive
- Enhance the capacity for SMEs to avoid being marginalised
- Enhance EEE firms' ability to integrate environmental requirements into the quality control system (ISO 9000), as well as the manufacturing processes
- Enhance EEE enterprises' capacity to meet the requirements of the relative EU and Japanese regulations and laws.

5.2 Training plans

5.21 Short-term plan

Organisers of training

Training should be initiated by various professional industry associations. Training centres should be established by the industry associations, together with related universities, research institutes and governmental departments in charge of this issue.

The primary tasks of the training centres could be:

- To formulate the training programmes
- To invite trainers and organise the trainees
- To determine the numbers of the trainees and the payment standard
- To develop training content and determine the time of enrolment
- To check the training performance
- To issue the graduation certificates for the trainees.

Targets of the training

- Administrative managers from the electronics enterprises, especially those from SMEs
- Technical managers from the electronics producers (including suppliers)
- Designers from the electronics enterprises (including suppliers)
- Managers working with governmental trade-related ministries or related departments in charge of the import and export of electric and electronic products
- Managers from the industry associations.

Training content

The training and content will need to be focused on a particular audience to maximise the usefulness. Topics that might be covered include:

- World Trade Organisation (WTO) multilateral trade agreements, especially the 'TBT Agreement' and the 'SPS Agreement'
- Requirements on EEE products including the RoHS, WEEE, EUP Directives from the EU and HARL, LPEUR, GPL from Japan
- Related laws, regulations and policies in China (see also 2.2)
- Capacities and skills for eco-design
- Impacts of the EU Directives on the export of Chinese EEE products, the possibility for SMEs to be marginalised
- Production process and methods
- How to substitute the six kinds of hazardous substances restricted by RoHS
- Analysis of methods and cost of the recycling of e-wastes
- Relationship between the WEEE, RoHS and EuP Directives
- Possible ways for the Chinese EEE enterprises to meet the requirements of the EU Directives.

5.2.2 Medium/longer-term plan

Institutions building a medium/longer term plan

The plan may be divided into the following two parts:

a) Setting up a training centre

- The training centre should be set up by relevant government departments, professional associations, import and export associations of commerce, universities and the development facilities

- Conduct regular training for trainees from enterprises and relevant government departments; gradually build the training base, which might be located within one university or enterprise
- Strengthen the environmental education amongst management and technical personnel of companies involved in export. Employees should be trained to adopt more advanced green management ideas e.g. eco-design and clean production, to ensure that overseas environment and health requirements are met.

b) Developing all-around education on the environment and safety

Education for environmental awareness should be conducted by all primary and middle schools, universities and public organisations throughout China in order to make the society more aware of issues related to environmental protection, human health and safety. This includes giving publicity to environmentally-friendly products and green consumption in order to help promote greener lifestyles.

Perspectives for the medium/longer term plan

China should strengthen education in relation to the following aspects:

- Sustainable development should become the basic policy for the modernisation in China
- Development of the economy and foreign trade must take account of environmental protection
- Technical eco-innovation for new production technologies and processing methods must be promoted
- Training should be enhanced among companies, for example:
  - Training in green management
  - Training in eco-design skills
  - Training in green marketing.

Appendix 1

Networks of governmental ministries and organisations

Ministry of Commerce of PRC
http://www.mofcom.gov.cn/

Ministry of Information Industry
http://www.mii.gov.cn/mii/index.html

Information Industry Department of Hebei Province
http://www.ii.gov.cn

Information Industry Department of Hainan Province
http://ito.hainan.gov.cn/index.php

Information Industry Department of Jilin Province
http://www.jlsxxcyt.org/

Shanghai IT
http://218.1.64.134/

The Working Office of Beijing IT
http://www.bnii.gov.cn/

Information Industry Department of Jiangxi Province
http://www.jxdii.gov.cn/

Information Industry Department of Guangdong Province
http://www.gdiid.gd.gov.cn/

Information Industry Department of Zhejiang Province
http://www.zjdii.gov.cn/

General Administration of Quality Supervision, Inspection and Quarantine of PRC
http://www.aqsiq.gov.cn

Guangzhou Testing & Inspection Institute for Household Electrical Appliances
http://www.84462525.com

China Certification Center
http://www.ccci.com.cn/

Industry associations

China Chamber of Commerce for Import and Export of Machinery and Electronic Products
http://www.cccme.org.cn/

China Household Electrical Appliance Association
http://www.cheaa.org/

China Electronic products Industry Association
http://www.ceia.org.cn

Shanghai Electronics-making Association
http://www.sema.org.cn/

Chinese Electronic Components Industry Association
http://www.ic-ceca.org.cn/

Ningbo Electronic Industry Association
http://www.nbelec.org/

WTO consultation organisations and other networks

PRC China WTO Notification and Enquiry Center
http://zxj.mofcom.gov.cn/

WTO/TBT-SPS Notification and Enquiry Center
http://www.tbt-sps.gov.cn/gb/main.aspx

WTO Consultation
http://www.chinawtoinfo.com/default.asp

China Standard Consultation
http://www.chinastandard.com.cn

Zhejiang WTO/TBT Information Service
http://www.cnzjqi.com/wto-tbt/index.html

Shantou WTO Consultation Service
http://stwto.shantou.gov.cn/anli/bilei.htm

Suzhou WTO Consultation Center of Chinese Economic forum
http://www.sz-wto-fzlht.com/fzt.html

Guangdong WTO Affairs Consultation Service Center
http://www.gdwto.org.cn/wto.asp

Shanghai WTO Affairs Consultation Center
http://www.sccwto.net:7001/wto/index.html

Information networks of the electronic industry

China Electronic Industry Communication
http://www.ceic.gov.cn/search?channelid=201,202&templet=index.jsp

International Electron Business News
http://www.ebnchina.com/HOME.HTM

Global Electronic Component China
http://www.gecmag.com/index.asp

China Electronic Investment Information
http://www.ceiinet.gov.cn/default.asp

China Electronic Component Information Network
http://www.chinaecnet.com/index.asp

EL Electronics-China
http://www.ele-china.com/

21IC China Electron Network
http://www.21ic.com/

China Inspection and Quarantine Times
http://www.cngm.org/default.htm

Wenzhou Import and Export Fair Trade
http://www.fairtrade.gov.cn/yujing.asp

Others

Chongqing WTO Affairs Consultation Center, Hainan WTO Information Enquiry Center Anhui Quality Supervision Bureau, WTO Notification and Enquiry Center, Wuhan WTO Notification and Enquiry Center, Jilin WTO Notification and Enquiry Center, Zhejiang WTO Notification and Enquiry Center, Yantai Technology Supervision Information Research, WTO Notification and Enquiry Center, Changzhou WTO Affairs Consultation Center, Tianjin WTO Information Research and Consultation Center.

(Note: The information on environmental and health requirements in Chinese export markets is mainly publicised on the network of WTO/TBT notification and enquiry centres and the corresponding reports.)

The Centre for Sustainable Design

An initiative of

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

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