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Social impacts of the production of notebook PCs

Contribution to the development of a Product Sustainability Assessment (PROSA)

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List of abbreviations

ACFTU	All China Federation of Trade Unions
AMRC	Asia Monitor Resource Center
BMBF	Bundesministerium für Bildung und Forschung (German Ministry for Education and Research)
CAFOD	Catholic Fund for Overseas Development
CSR	Corporate Social Responsibility
EICC	Electronic Industry Code of Conduct
FLO	Fair Trade Labelling Organizations International
GeSI	Global e-Sustainability Initiative
GO	Governmental Organization
GRI	Global Reporting Initiative
GTZ	Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
IFC	International Finance Corporation
ILO	International Labour Organization
ITU	International Telecommunication Union
IMF	International Metalworkers' Federation
LCA	Life Cycle Assessment
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
PROSA	Product Sustainability Assessment
RMB	Renminbi (currency of the People's Republic of China)
RoHS	Reduction of Hazardous Substances
SAI	Social Accountability International
SA8000	Social Accountability 8000
SETAC	Society of Environmental Toxicology and Chemistry
SLCA	Social Life Cycle Assessment
SOMO	Stichting Onderzoek Multinationale Ondernemingen (NL: Centre for Research on Multinational Corporations)
StEP	Solving the E-Waste Problem
UNCTAD	UN Conference on Trade and Development
UNEP	United Nations Environment Programme
UNU	United Nations University
WEED	World Economy, Ecology & Development
WSIS	World Summit on the Information Society

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1 Summary

In recent years the demand for sustainable products has risen. Although the main focus so far has been on environmental impacts, consumers are increasingly waking up to the social aspects of the life cycles of products, not least as a result of scandals surrounding various products and companies. For some long time, fair trade certificates and similar labels have provided information about social aspects of agricultural products like coffee, tea, bananas and cotton. These approaches have not yet been applied to more complex product groups, however. One recent exception has been the certification of a certain number of hand-crafted products (soccer balls, pumps). But the social aspects of heavy industrial products and more complex products, such as domestic appliances, cars and computers, have not yet been analysed sufficiently, and certainly not certified or labelled. The main reason for this is the large number of product components and materials and the large number of suppliers and other actors, which makes it particularly difficult to document and evaluate social impacts in production.

The current situation is unsatisfactory for all stakeholders. While own-brand manufacturers in all sectors are confronted more and more often with negative social aspects in the life cycle of their products, there is no reliable information on the specific social impacts of individual products and brands. Yet information of this kind is indispensable to efforts in the direction of sustainable consumption and improvements throughout product life cycles and systems.

Nor is the electronics industry an exception to these developments. NGOs, consumers and workers' rights organizations are increasingly raising questions about the manufacturing conditions of computers and electronic entertainment devices. Although the industry is already responding with a range of corporate social responsibility (CSR) measures, the introduction of a *fairly produced* computer nevertheless seems to be a very remote prospect as yet.

The obstacles to social sustainable electronic devices go further than the apparently irreconcilable positions of the different actors, and also include the lack of coordinated criteria and methods for defining and evaluating social sustainability.

For this reason, the present study deals with

- the structured recording of social impacts and improvement potentials in notebook PC production (as a representative case study of an electronics industry product),
- and the methodological refinement of product-related Social Life Cycle Assessment (SLCA). In analogy to Life Cycle Assessment (LCA), such a method is intended to facilitate the systematic documentation and evaluation of social aspects throughout the product life cycle and system.

The methods adopted included the involvement of stakeholders (from industrialized countries and emerging economies), reviews of the literature, field studies and expert interviews.

The choice of notebook PC manufacturing as a case study was influenced by the large and constantly growing production volume and the trend towards miniaturization which is also observed in many other electronics products.

Since the value chain for notebook PCs is predominantly based in the People's Republic of China, the study was largely limited to the social impacts in China. Effects in other locations were only touched upon.

The first step in the work was to analyse the structure and actors involved in the different stages of production. Well-known own-brand manufacturers do not normally carry out the design and construction of notebook PCs themselves but put this work out to a few contract manufacturers (Taiwanese companies). A high concentration of such firms is found in the East Asian economic region. Labour-intensive manufacturing processes take place almost exclusively in the People's Republic of China; other production locations (Mexico, the Philippines) are steadily diminishing in importance. The bulk of manufacturing is concentrated in industrial clusters on China's east coast, where all notebook manufacturers now maintain large production bases. Only technologically demanding components (displays, battery cells, etc.) are also manufactured in other locations.

Next, existing approaches by industry alliances, NGOs and consumer organizations were documented and evaluated in terms of their activities on this theme. The analysis revealed that all actors are aware of the social problems in notebook PC value chains. Manufacturers and corporate alliances (the Global e-Sustainability Initiative and the Electronic Industry Code of Conduct) are trying to get to grips with the problems with a combination of codes of conduct, audits and dialogue events known as Supplier Days. The existing auditing approaches, in particular, are viewed critically by most of the NGOs and workers' rights organizations, for a variety of reasons. Individual consumer organizations (*Stiftung Warentest* from Germany and *Consumentenbond* from the Netherlands) are also working increasingly towards a social assessment of complex industrial products although as yet no comprehensive assessment of computers has been carried out.

In the subsequent analysis, attention was turned on the social impacts associated with the manufacturing of notebook PCs all the way along the value chain. Due to the often inadequate data basis, at this point general information on social impacts in the Chinese electronics industry had to be drawn upon. In the course of this, it was possible to gain useful insights into production processes in the notebook industry that are directly linked to the specific product. Processes not immediately linked to the specific product, however, continue to elude more detailed study. Despite these obstacles, a range of positive and negative social impacts of notebook PC manufacturing could be identified.

- Assembly of notebook PCs alone provides employment for between 50,000 and 75,000 people in China. This equates to a workload of approx. 2.5 to 3 working hours per notebook. Taking into account the other stages in the supply chains (assembly of components, manufacturing of individual parts), then figures several times higher can be assumed. In view of China's high unemployment, the notebook industry is thus an important regional source of employment.
- By creating income opportunities for less qualified workers, the Chinese notebook industry is helping to reduce poverty.
- There are virtually no aspects of working conditions which meet Western European standards. Various breaches of ILO core labour standards were also noted. The principal of these are the Freedom of Association and Protection of the Right to

Organise Convention and the Right to Organise and Collective Bargaining Convention (ILO Conventions no. 87 and 98). Although the political framework conditions are partly to blame for breaches of these conventions, corporations make far too little use of the scope for compliance that does exist.

- As a rule, the suppliers in the part of the chain directly linked to the specific product keep remuneration in line with the statutory minimum wage. Overtime payments, in particular, often fail to meet national and international regulations. In isolated cases, pay is also deducted illegally.
- Overtime exceeds statutory regulations in many cases. Reports suggest that some individuals work over 100 hours of overtime per month.[1]
- Certain supply structures (manufacturing of passive electronic components and printed circuit boards, production of semiconductor materials, etc.) pose considerable risks to the safety and health of employees and local communities. Due to poor data availability, however, these risks could not be quantified specifically.
- Poor working and living conditions now represent a serious threat to political and social stability in the People's Republic of China. There are increasing numbers of demonstrations, sometimes involving violence, in protest against the pollution of the local environment or to demand conformity with basic workers' rights. In this context, the notebook PC industry is one of those in a position of considerable social responsibility.

Despite extensive research, it was not possible to produce an exhaustive account of the social impacts of notebook PC manufacturing. This is primarily due to the highly articulated nature of the supplier relationships, over which no single actor in the value chain maintains a complete overview. Problems arose particularly in describing the social impacts of production processes not directly linked to the specific product, such as the manufacturing of individual electronic components. There are numerous indications that these aspects pose considerable risks to the health and safety of workers and local communities. Within the given scope of the project, however, more precise evaluation was not possible.

Key insights were obtained nevertheless, contributing to the methodological development of product-related SLCAs and generating recommendations for the notebook industry:

Notes on methodological development

- To enable the systematic capturing of social aspects, a comprehensive system of indicators was developed. This essentially builds on the relevant international documents (ILO standards, OECD Guidelines for Multinational Enterprises, GRI Sustainability Reporting Guidelines, SA8000) and numerous sectoral codes of conduct. The structure of the indicators follows the recommendations of the UNEP-SETAC Life Cycle Initiative (Grießhammer et al, 2006a).

[1] Chinese legislation specifies a maximum overtime of 36 hours per month.

- Currently, only patchy and unstructured data are available on the social impacts of manufacturing processes. Although it was possible to supplement the data with field research in some categories, for the sake of a comprehensive analysis it was also necessary to draw upon data and information pertaining to higher levels of aggregation. In addition to general information on the Chinese electronics industry, this included information on the national framework conditions. Making use of average figures in this way is a familiar practice from the field of environmental life cycle assessment.
- In addition to the limitations of data availability, the evaluation of individual issue areas also proved difficult. This was partly because the precise causes of acknowledged failings are disputed by different actors (e.g. the limited opportunities for workplace co-determination in the People's Republic of China), and partly because different actors' evaluations of particular matters can be highly divergent (e.g. views on the employment of migrant workers). This underscores the need to involve the relevant stakeholders when carrying out SLCAs.
- There is no expectation that unit process data for product-related SLCAs will be widely available in the near future. Whilst the targeted accumulation of extensive collections of social indicators would be desirable from a scientific point of view, it would tie up resources which are desperately needed for the actual improvement of social problems. The systematic accumulation of unit process data still looks to be worthwhile for processes which are part of many different product life cycles, because such data are likely to be used especially frequently in practice. This applies above all to the extraction of resources, the manufacturing of base materials and the supply of energy. In all other areas, developments with regard to data availability should be monitored closely. In order to be able to carry out assessments in complex value chains, the focus should be kept to known and suspected hotspots. Furthermore it is recommended that rather than conceiving of product SLCAs purely as a quantified account of the status quo, greater efforts should be made to combine them with the identification of improvement potentials.
- When the product SLCA methodology is applied to notebook PCs, it is almost impossible to distinguish between individual brands and products, at least in those parts of the value chain closely linked to the specific product.[2] This is principally due to the pronounced clustering of manufacturing plants with more or less equivalent working conditions. One aspect neglected by this approach is that certain own-brand manufacturers are wholly committed to making improvements in their supply chains. If their commitment is successful, then its positive effects also pay off for the SLCAs of other products and brands. Hence – at least in the case of the notebook industry – a desirable effect is not taken fully into account under this analysis method. Those own-brand manufacturers who demonstrate above-average commitment are placed at a relative disadvantage. For future LCAs in industries with similar structures, the degree

[2] This assertion relates specifically to notebook PC production and is not necessarily true of other products.

and effectiveness of corporate commitment should be included within the terms of the analysis.

Recommendations to the notebook PC industry

- Due to the numerous risks to the health and safety of employees and neighbours, it is recommended that knowledge about relevant problems and possible precautions should be pooled centrally and made available in an appropriate form to all actors in the supply chain. The significance of this point is that no actor is presently in possession of a complete overview of the notebook value chain and the corresponding environmental and health risks.
- Similarly, banned materials lists coupled with the development of less hazardous substitutes provide a sound approach to the health and safety aspects.
- The less than transparent auditing of supplier firms seen hitherto should be supplemented with high-quality independent certification.
- A major cause of breaches of social and environmental standards is the extremely fierce competition that prevails within the industry. Given the incessant price wars and minimal profit margins, it is small wonder that social and environmental standards are neglected. The own-brand manufacturers are called upon to give their suppliers the certainty that compliance with standards and any associated cost increases will not result in the severance of business relationships.
- Examples from other sectors have shown that workplace efforts to involve employees in internal dialogue processes are possible anywhere, including China, and contribute to resolving social problems. The establishment of forms of workplace co-determination is one of the criteria for the issue of the SA8000 certificate, which has already been awarded to almost 100 Chinese factories. The additional advantage of involving employees is that (unlike external auditors) they are well informed about working conditions in their workplace at all times, and are best placed to draw attention effectively to urgent improvement potentials. This strategy necessitates a twin-track approach: on the one hand, the employees must be granted co-determination rights at work, and on the other hand they must be informed about their rights in the workplace and about labour law in general.
- A further strategy here is to establish independent complaints agencies which are not specific to particular supply chains.
- Due to the social impacts on local communities (air and water pollution, possible expropriation and/or non-compensation of residents), associated problems should be addressed proactively by setting up dialogue fora.
- In the major consumer markets for notebooks, there is mounting awareness of the social issues surrounding production. The way that notebook PCs are currently marketed, no decision-making aids are provided to give guidance on socially sustainable consumption. As a counter-argument to the widespread fear that more sustainable products would have negative repercussions on market pricing, in fact the wage costs of notebook production only account for a relatively low percentage of the

product price. A minor increase in wage and non-wage labour costs would only have marginal implications on the final price.

2 Introduction

The outsourcing of industrial manufacturing processes to developing and newly industrializing countries is a key characteristic of globalization. Whereas in the past the role of developing countries was almost exclusively confined to resource extraction, since the mid-1980s some of these countries have succeeded in starting up manufacturing industries. Since then, these countries have played an increasingly important role in global trade, and there can be very few product groups for which manufacturing is not organized across several international borders. This trend towards the globalization of production and value chains has numerous positive and negative impacts on people in developing, newly industrializing and industrialized countries. Although a few developing countries succeeded in creating urgently needed jobs and income opportunities in the secondary sector, numerous reports are in circulation which draw attention to degrading and exploitative working conditions in “sweatshops”. This creates the impression that the economic development of countries such as China, Vietnam and Bangladesh is an inequitable process, at the expense of the health of millions of workers, whilst jobs are being lost in the traditional centres of industrial production. In the terms of the anti-globalization debate, multinational corporations are usually blamed for the negative impacts of this development. All in all, however, neither governments nor individual corporations nor consumers alone can halt the decline of labour and social standards. For the most promising solutions, the actors involved have to join forces effectively: *Governments and international agreements* must determine the legislative and normative framework for socially equitable production. *Corporations* on the one hand are obliged to conform to these legislative standards, and moreover within the framework of the United Nations they are called upon to participate proactively in shaping a liveable world. The challenge incumbent upon *consumers*, for their part, is to actively demand compliance with social standards and to take account of this aspect in their purchasing decisions.

In some areas this interplay of actors has already been tried and tested with success: for instance, the government of Cambodia guarantees that all textile factories in the country conform to the ILO core labour standards. In agricultural production, there are various certificates attesting to “fair” production conditions, which thus support socially ethical purchasing choices. Generally these approaches are measures with a relatively minor influence in the market as yet, but current trends indicate that sustainability certificates will gain in importance whilst effective CSR approaches will achieve a broader impact.[3] This presupposes, however, that alongside the relatively manageable value chains in the textile and food industries, other more demanding industrial products can be evaluated and

[3] In 2005, the global market for fairly traded products saw year-on-year growth in turnover of 37% (FLO, 2006).

compared with reference to social criteria. Due to the complexity of many global value chains, no such method has yet been established. Whilst there are reports from different sectors on fundamental breaches of established social standards, product-specific information on social impacts is not generally available. As a result, on the one hand there is widespread but nebulous knowledge of undesired social impacts in various product groups, but on the other hand, problems cannot be associated explicitly with particular products.

This situation is also characteristic of the electronics industry, in which numerous social failings are reported whilst at the same time very little information is available on sustainability problems in its supply chains. The negative reports range from the extraction of scarce raw materials in areas of Africa torn by civil war, to the disregard for fundamental workers rights in low-wage countries, to the improper disposal of electronics waste. In contrast, there is no transparent indication of how far a consumer contributes to these problems by purchasing an electronic device. It is even less possible to say with certainty which particular products and brands are most and least to blame for negative social impacts. The absence of any structured analysis leaves product information devoid of relevant facts, and reinforces the industry's reticence on the subject. As long as private sector actors do not have the certainty that social commitment will be rewarded as such, relevant activities will concentrate on the reduction of commercial risks – in this case, the deflection of scandals.

This paper provides a structured study of social impacts in the production of notebook computers, and sheds some light on the electronics sector at a product-specific level – a level seldom studied. In methodological terms this follows the procedure used in Life Cycle Assessment (LCA). Thus the study also makes a practical contribution to the development of product-related Social Life Cycle Assessment (SLCA) as has been called for by a working group of the UNEP-SETAC Life Cycle Initiative (Grießhammer et al, 2006a). Moreover the study is part of the methodological development of a comprehensive Product Sustainability Assessment (PROSA), as is currently being pioneered under a project supported by the German Federal Ministry for Education and Research (BMBF) and Öko-Institut – Institute for Applied Ecology (see Grießhammer et al, 2006b).

In chapter 3, the objectives of the study are presented. Chapter 4 describes the scope of the study. Chapter 5 deals with the key methodological innovations which were necessary in order to carry out the study. Chapter 6 consists of a presentation of the results of a review of literature in the field, covering the structure and characteristics of the notebook PC industry (section 6.1), the outcomes of the stakeholder dialogue (section 6.2), industry-led CSR approaches (section 6.3), initiatives and campaigns by NGOs and workers' rights groups (section 6.4), evaluation approaches by consumer organizations (section 6.5),social aspects in the Chinese electronics industry (section 6.6) and specific social impacts of notebook PC manufacturing (section 6.7). Chapter 7 goes on to summarize and present the research findings. Chapter 8 comprises an evaluation with suggestions for further development of product-related SLCAs (section 8.1) and recommendations for the notebook industry (section 8.2).

3 Objectives of the study

One objective of the case study is the systematic capture of social impacts in the production of notebook computers. The social impacts of resource extraction, transportation, trade, consumption and waste treatment/recycling are not a part of the study. The results are intended to highlight ways of making efficient improvements in the social conditions of those involved in the production of electronics products. To this end, the hitherto general discussion on social impacts in the electronics industry is focussed upon notebook PCs as a product group.

A further objective of the study is to refine the methodological approaches for the systematic evaluation of social impacts in product life cycles (product-related Social Life Cycle Assessments, SLCA). Here one focus is on the question of how an analysis of this structured nature can be applied to complex value chains. In the medium term such a procedure will facilitate targeted information on the sustainability aspects of particular products, as is currently standard practice in some parts of the food sector (organic and fair trade labels). A further possible application of the methodology is to identify potentials for sustainable process and product optimization.

In espousing these objectives, the study is addressed to two target groups: the substantive part is essentially addressed to the actors in electronics production (the industry, workers' rights groups, NGOs and consumer organizations). The methodological part is directed at the LCA research community.

The study's purpose is not to evaluate or compare individual products and manufacturers.

4 Scope of the study

4.1 Function and functional unit

The present analysis is only concerned with notebook computer production. The distinction between different types of computers is significant to the analysis since notebook and desktop PCs differ fundamentally in both construction and equipment. Whereas integration density is a relatively unimportant factor for conventional desktop computers, it is a key feature of notebooks and makes special manufacturing processes a necessity in many aspects of their production. Moreover, notebooks – in contrast to desktop computers – are fitted with battery packs, the production of which can have a major influence on the overall social impact.

The decision to focus on notebooks was taken with an eye to the study's potential breadth of impact: although notebook users constituted only 23% of computer users in the year 2004 (Heise Online, 2004), in the past few years the notebook market has been growing significantly faster than the market for desktop computers (Gartner Marktforschungsinstitut, 2005). Growth rates reached year-on-year levels of up to 40% (iSuppli, 2006). Notebook production can therefore be expected to reach a similar scale as desktop production before long. Moreover, technological developments of the notebook segment must be viewed in conjunction with the trend towards miniaturization throughout the electronics sector. It can be assumed that both the methodology and the key findings will be transferable to other electronics products such as mobile phones, digital cameras and iPods.

In the further analysis, no attempt was made to study a concrete model or a specific brand for reasons relating to data availability. Instead the endeavour was to analyse the social impacts of what is a standard mid-class notebook by current market standards (price point between EUR 1,000 and 1,500).

In order to be able to relate social impacts to products, the analysis must be based on a functional unit, to which all quantitative estimates can – as far as possible – be related. For the present study, this unit is deemed to be the "ready-for-sale device". A more precise definition of the functional unit is not necessary because, due to the heterogeneity of the data, it was not possible to make quantitative links systematically, and a product comparison was not carried out.

4.2 Section of life cycle to be studied and system boundaries

As mentioned above in relation to the objectives (chapter 3), the present study is concerned solely with the production of notebook PCs. Other sections of the life cycle are excluded. However, since electronics products – especially computers – are associated with so many social aspects in the course of their production, use and disposal, only a full life cycle analysis would permit a coherent synopsis of the many different issue areas. In order to provide an overview of the current state of debate, the following section will give a brief presentation of the main social impacts for each section of the life cycle.

Resource extraction

The arena of resource extraction is often fraught with social tensions: health hazards and heightened risks of accidents for employees and neighbours are often weighed in the balance with benefits to society in the form of foreign direct investment, a positive contribution to the balance of trade and valuable revenue for the national budget. The contribution to employment promotion varies greatly depending on the subsector and location (i.e. the degree of mechanization). In some countries this has permitted the raw materials sector to make a contribution to poverty reduction. In other countries, however, resource extraction is associated with human rights violations and the financing of armed conflicts. The far-reaching social impacts of resource extraction, along with critical questions about the way loans are granted, have since been taken up by the World Bank in an Extractive Industry Review Process (Salim, 2003; Hayes & Burge, 2003; Heidelberger Institut für Internationale Konfliktforschung, 2004).

Due to the diversity of raw materials in use, it was not possible under this project to carry out an analysis of social conditions in the extraction of resources for computer production. The same applies to the subsequent sections on transportation processes, supply of base materials, research and development, software development, marketing, and product use, recycling and disposal.

Transport

The social impacts of the transport sector vary greatly depending on the subsector: for instance, shipping only has impacts on local communities in and around port facilities, whereas for road transport the impacts (noise, traffic jams, accidents, air pollution...) account for a significant part of the “social rucksack”. With a few exceptions, work in the transport sector is characterized by long absences from home and family and the social setting. For this reason, employees in the transport sector are often at higher risk of HIV/AIDS. In many regions in the world, the sector is contributing significantly to the spread of the pandemic. In the trucking subsector, the maximum permitted working hours are often exceeded. Assessment of the consequences for national economies and budgets is particularly difficult for shipping, since many cargo ships operate under “flags of convenience” (e.g. registered in Malta or Panama). For these countries, it can be assumed that global shipping makes a significant contribution to their national budgets, but their low rates of taxation reduce the global potential amount of state receipts. Air freight is essentially used to transport high-value electronics products to consumer markets. Noteworthy factors here are the major effect of airports on their immediate environment, and the low tax receipts due to the tax-free status of aviation fuel (Sabbagh-Ehrlich et al, 2005; White, 2005; World Bank, 2005).

Supply of base materials

The social impacts of the supply of base materials (metals and plastics) can only be captured with difficulty because information from the relevant branches of industry (the chemical and

metal processing industries) is not disaggregated into categories which readily correspond to applications in computer manufacturing. As a general rule, however, these are branches of industry in which workers are exposed to higher than normal health risks. In many industrialized countries, strict health and safety rules (special protective clothing, safety training, etc.) have distinctly improved occupational safety. Moreover, where large numbers of jobs were associated with extreme working conditions (especially heat), now the use of machines has reduced their numbers. During production spikes, extended overtime and shift work are common. Various reports originating from the chemical industry in newly industrializing countries document violations of basic workers' rights. Both branches of industry are often linked with heavy environmental pollution in the environs of their plants. Time and time again, local communities report serious health consequences and mortalities occur (U.S. Department of Labor, 2004; European Foundation for the Improvement of Living and Working Conditions, 2005).

In the event that a systematic analysis of the various base materials becomes available (which is not currently the case), the results could be applied to computer production, based on the percentage of quantities used.

Research and development

In the area of research and development, numerous positive social impacts have been noted. This is attributable both to the area's relatively low impacts on human health and to the predominance of highly qualified and hence highly paid employees. Problems are caused by the strong pressure to compete and innovate, which makes professional life highly demanding in terms of quality expectations and working hours. Overall the above-average levels of investment in research and development lead to positive economic and social impacts at local and national level. In many places, however, corporations enjoy corresponding tax concessions and subsidies, and therefore contribute less than average to those countries' national budgets. The overwhelmingly positive impacts must not distract entirely from the fact that only in a few electronics production locations in newly industrializing and developing countries has it been possible to achieve the requisite "upgrading" for more demanding activities, i.e. those such as research and development. The positive impacts therefore remain restricted to a few regions at present (Kishimoto, 2003; Sperling, 2003b; U.S. Department of Labor, 2004).

Electronics production

The production of the hardware (which includes the manufacturing of individual electronic components and assembly of electronic devices) is characterized by large numbers of workers in low-wage and minimum-wage employment. Depending on the type of work they do, workers can be exposed to health risks from hazardous substances over considerable lengths of time. There are numerous reports concerning violations of basic workers' rights in the low-wage sector (see inter alia CAFOD, 2003; Schipper & De Haan, 2005). The counterpart to these is the clear impact on local and national economic growth, a major contribution to exports and a significant proportion of foreign direct investment. In a few

countries, such as China for instance, the impacts on the national budget are unclear because many firms enjoy significant tax concessions and subsidies. Particularly in China (but also in Taiwan), the ICT industry plays a part in attracting flows of migrant workers, which are associated with a range of social problems.

Software development

For reasons similar to those in the research and development branch, the development of software has numerous positive social impacts but also some negative impacts relating to the workload of highly qualified employees. A negative "hotspot" appears to be the employment of less qualified employees for data entry. In this respect, relatively poor working conditions can be assumed in many cases (long working hours, noise and eye strain, etc.). A majority of software development and data entry is currently done in India (UNCTAD, 2002; Dompke et al., 2004; U.S. Department of Labor, 2004; Haughey, 2005; IFC, 2005).

Marketing

In the marketing of PCs and notebooks in the retail sector, relatively good working conditions can be assumed because the bulk of the products are sold in industrialized countries with high standards of labour and social standards. One exception is when sales are channelled through discount chains, for which numerous reports exist, even from OECD countries, on violation of basic workers' rights (U.S. Department of Labor, 2004; Paterson, 2004).

Use

The phase in which a PC is in use involves far-reaching social impacts on consumers and society. A PC opens up countless new possibilities for the user in the spheres of work, education and leisure, but also gives rise to more demanding standards of performance at work, threats to data security, a heavy investment of time to learn new applications, and the danger of becoming lost in a virtual world. A further problem is the threat to the private sphere which results from digital traces on the Internet and spyware. At societal level, too, the use of PCs has far-reaching impacts. Representative examples of these are new means of communication as well as the problem of the digital divide (Dompke et al., 2004; U.S. Department of Labor, 2004; WSIS, 2005).

Due to the far-reaching changes to social life, the impacts of ICT use have not been dealt with exhaustively in the present work.

Recycling and disposal

Despite relevant international agreements, some recycling and disposal of electronic devices takes place in newly industrializing and developing countries. There the devices are disassembled by hand and the parts are sorted according to the most important material groups. Some metals are extracted from the components in wet-chemical processes; other parts (e.g. cables) are burned on an open fire for the same purpose.

Reports on the nature and structure of work suggest that it takes place mainly in the informal sector. It can thus be assumed that in these countries it is an industry which generates little or no state revenues and makes a negligible contribution to economic growth and the balance of trade. All reports agree that this takes an enormous toll on the health of workers and local communities. A further corollary of the informality of the sector is that apart from (minimal) basic insurance under the state scheme, no social security systems are in evidence. Moreover, remuneration in the recycling sector is minimal in any case. The only positive factor to be mentioned is the high labour intensity and hence the creation of basic income for relatively high numbers of employees (Meinhardt Infrastructure & Environment Group, 2001; China Labour Bulletin, 2005c; Greenpeace International, 2005; Widmer et al., 2005).

Interim conclusions

This overview demonstrates that every phase in the life cycle has clear social impacts. None of the phases involves purely positive or purely negative impacts. During the course of the research it became apparent that for some subsections of the life cycle, structured and high quality work had already been done on the assessment of social impacts and potentials for improvement. Mention should be made of the following initiatives and projects:

- The positive and negative impacts of resource extraction are currently being addressed by the World Bank in a broadly-based Extractive Industry Review Process. This is more than a review of the status quo, as it also involves the formulation of guidelines for the improvement of social impacts (see inter alia Salim, 2003).
- The social impacts of the usage phase are currently being addressed comprehensively within the framework of the World Summit on the Information Society (WSIS).[4]
- The disposal and recycling of electronics products is attracting a great deal of attention from various NGOs and governmental organizations. Among other things, the *StEP Initiative* – a forum of representatives from research, business and civil society – is engaging intensively with this issue area (StEP, 2005).

The manufacturing of electronic devices, on the other hand, has only been investigated in a few selective analyses and some journalistic articles (see inter alia CAFOD, 2003; Balmès, 2004; China Labour Bulletin, 2004). Systematic and product-specific studies are not available as yet. For this reason, the present work concentrates on a study of the social impacts of notebook production. This comprises the assembly of the notebook PCs from parts and components, the assembly of components, and the manufacturing of parts from raw materials supplied from the chemical and metal processing industries. The generation of products from the chemical and metal processing industries and the extraction of resources were not analysed systematically. Likewise, the means of production which are not incorporated into the final product (e.g. infrastructure, premises, machines, process

[4] The UN Summit was held in Tunis in November 2005.

chemicals) were not included in the study. Similarly, software development and research and development were not taken into account for the analysis. Thus the study concentrates on those production steps which workers' rights organizations, NGOs and consumers are increasingly associating with the violation of basic workers' rights (see inter alia CAFOD, 2003; Schipper & De Haan, 2005; WEED, 2006; Smith et al., 2006).

4.3 Data quality requirements

One objective of the study is to refine the methodological approaches for the evaluation of social impacts in complex industrial products (see chapter 3). This comprises both the identification and qualitative assessment of available data and information. In the course of the project, the following data quality requirements and recommendations for handling information from diverse origins were formulated.

Temporal scope

Data on social impacts are liable to vary dramatically over time. For this reason, only information collected later than the year 2001 was taken into account.

Geographical scope

During the research the fact crystallized that most processes involved in notebook PC production are carried out in the People's Republic of China, and that current production-shifting processes continue to favour China as a location. For this reason the collection of data was essentially confined to social impacts in the People's Republic of China.[5] Dynamic effects (e.g. job losses) in other locations were only touched upon.

Technological scope

The analysis considers the technologies currently practised in the People's Republic of China for the production of notebook computers.

Accuracy, completeness and representativeness of the data

A considerable shortage of data was noted at the process and factory level. For this reason, it was necessary to fall back on additional data from other tiers of industry (e.g. the Chinese electronics industry). Recommendations on handling such data are set out in section 0.

[5] A few production processes are carried out in countries like South Korea or Japan. Because these economies are considered highly regulated, unlike the People's Republic of China, it can be assumed with some certainty that any negative social impacts in these countries would be on nothing like the scale of the potential negative social impacts in mainland China.

Information on the social impacts of industrial manufacturing processes is often not representative enough to be transferable to other factories and locations. For this reason efforts were made to derive any core assertion from several separate information sources.

Consistency and transparency of the applied methods

The fundamental procedure used for the study, and for the collection of data, is guided by the methodology of Social Life Cycle Assessment within PROSA, and by the recommendations of the UNEP-SETAC working group Integration of Social Aspects into LCA (see Grießhammer et al., 2006a; Grießhammer et al., 2006b). The aim of these methods for social assessments of product systems is to study the impacts on four fundamental stakeholder groups: employees, local communities, society, and product users.[6] Hence in some areas thematic overlaps will arise with the ecological and economic dimensions of sustainability (e.g. pollution of drinking water, contribution to the national economy). System boundary delimitation is carried out in terms of the specially devised list of indicators (see section 5.2). The assignment of the data to impact categories is not possible because these have not yet been developed and agreed for social themes.

Data sources and their representativeness

The analysis makes use of both quantitative and qualitative data and thus follows a recommendation of the UNEP-SETAC working group on Integrating Social Aspects into LCA (see Grießhammer et al., 2006a). Since as yet no unit process data exists for product-related SLCAs, data and information originating from very diverse sources were used. The sources comprised information from industry (sustainability reports), analyses by workers' rights organizations, technical articles, newspaper reports and our own field research. Representativeness was achieved by means of a synopsis of information from a variety of sources.

Uncertainty of information

In some issue areas the synopsis of information from different sources produced considerable divergences. This primarily affects themes such as working hours, the remuneration of overtime and the health impacts of different production processes. In such cases, known uncertainties were indicated and taken into consideration in the subsequent assessments.

[6] The stakeholder group of “product users” is relevant to a social analysis only during the phase of product use. Since the present study is focused on production, no analysis of social impacts on product users was undertaken.

4.4 Involvement of stakeholders

In developing a coherent situation analysis it was indispensable to make contact with actors from different stakeholder groups. Stakeholder workshops and qualitative interviews enabled the collection of data and facts on the relevant branches of industry. This form of communication also exposed conflicting interpretations of results and evaluations. In addition, in communication with different actors it was possible to concretize and verify their particular assessments. For this reason, a stakeholder workshop was carried out in the framework of this project and bilateral links were forged with various stakeholders on the ground.

The stakeholder workshop took place on 7 and 8 February 2006 in Eschborn, Germany. The following organizations took part:

Dell, Deutsche Telekom, GeSI, GTZ, Hewlett-Packard, IMF, Oxfam Deutschland, SOMO, Sony, Sustainabilty Agents, UNEP, UNU.

A second meeting with stakeholders took place between 18 and 21 April 2006 in Hong Kong. For organizational reasons, the meetings were staggered over different venues and dates. The following organizations were involved in this process:

Asia Monitor Resource Center, China Labour Bulletin, China Labour Support Network, CSR-Asia, Human Rights in China, Labour Action in China, Oxfam Hong Kong.

In bilateral meetings, contact was also established with *Stiftung Warentest*, *Fujitsu-Siemens Computers* and *Hewlett-Packard*.

4.5 Comparison between systems

In the present work, no comparative studies of products, brands or systems were undertaken. The analysis relates exclusively to general aspects of notebook production.

4.6 Aspects of the critical review

No critical review of the study was undertaken. In return for the provision of data and background information, the companies *Hewlett-Packard* and *Fujitsu-Siemens Computers* were given the opportunity to comment on a preliminary version of the study. The final decision on whether to incorporate comments and suggested amendments remained with Öko-Institut.

5 Methodological development during the study

Since the end of the 1980s there has been a fundamental change in the debate concerning the sustainability of products and consumption. With Life Cycle Assessment (LCA) a scientific, standardized and internationally agreed method has been created which permits comparative evaluation of the environmental impacts of products and processes (ISO 14040 ff.). It has been used to objectify numerous ecological debates and as data availability improved, it became an effective compass to guide the evaluation and optimization of the environmental dimension of sustainability. The method is used to a great degree by product developers themselves, enabling them to exploit the most efficient optimization potentials to the full.

Spurred on by this progress, since the end of the 1990s efforts have also been in hand to develop similar methods for the social dimension of sustainability and for an integrated sustainability assessment. A notable initiative is the PROSA – Product Sustainability Assessment method developed by Öko-Institut (Grießhammer et al., 2006b), the principles for which were proposed as early as 1987 under the German name of "*Produktlinienanalyse*" or "comprehensive product system assessment". But on the industry side, too, there are several company-specific developments which include the analysis of social aspects, for instance the SEEBalance method used by BASF, Sustainability Compass by Deutsche Telekom, the Product Sustainability Assessment Tool (PSAT) used by Procter & Gamble (Grießhammer, 2006) and the specification of the social dimension of sustainability in the joint research project on sustainable aromatic chemistry (Öko-Institut et al., 2005). In the development of all these methods, it has become clear that the analysis of social aspects is poorly developed and particularly difficult.

Under the auspices of the UNEP-Setac Life Cycle Initiative, a Task Force was therefore established to examine the question of whether and how product-related SLCAs might be methodologically possible. Similar lines of enquiry were also discussed in the context of the Swiss LCA Discussion Forum and in various expert papers and case studies (see inter alia Dreyer et al. 2006, Norris, 2006; Weidema, 2006). In a feasibility study, the UNEP/SETAC Working Group came to the conclusion that whilst a social life cycle assessment analogous to an environmental life cycle assessment is possible in principle, the lack of consistent systems of indicators and the shortage of coherent data stand in the way of further standardization of the methodology and implementation of case studies (Grießhammer et al; 2006a). The close relationship with CSR concepts at company level also became evident.

To overcome fundamental problems, the Task Force recommends that relevant case studies should be undertaken with a view to gathering practical experience. The present work responds to this recommendation and takes its orientation from the key methodological guidelines mapped out by the Working Group. Thus, in carrying out this study, in addition to the research on the actual subject matter, a contribution has also been made to developing the methodology for product-related Social Life Cycle Assessment (SLCA). A detailed account of the methodological results would be beyond the scope of this study, but interested readers may wish to follow up this aspect in the publication PROSA – Product Sustainability

Assessment (Grießhammer et al., 2006b). At this juncture the main inputs to the development of the methodology will be summarized, as these are important to follow the study's line of argumentation. Sections 7.1 and 8.1 present key elements of experience gained in the course of applying the methodology, as well as suggestions for refining it further.

5.1 Creating a coherent system of indicators

To systematically capture the social impacts of an industrial process or service, it is essential to make use of a consistent list of appropriate targets and indicators. Such a list enables data to be collected not only on aspects relating to themes such as workplace conditions and employment (*employees* as the stakeholder group) but also on impacts on other stakeholder groups, namely *local communities, society* and *product users*. This corresponds to a fundamental decision by the working group on Integrating Social Aspects into LCA of the UNEP-Setac Life Cycle Initiative[7] (see Grießhammer et al., 2006a). A further requirement of such a list of indicators is its applicability to a wide diversity of sectors. This is particularly significant for the chosen product system approach, which is intended to enable an assessment of social impacts across the entire life cycle. For example, the survey of the social impacts of resource extraction must be governed by the same criteria as production or recycling. As yet, however, there is no internationally agreed list of indicators to be applied in product-related SLCA studies.

For this reason it was necessary to develop a new system of indicators to meet the above requirements. This was done with the aid of relevant documents from international organizations, studies from the field of CSR, and sectoral codes of conduct. At the first level of its structure, the resulting list of indicators breaks down according to the four main stakeholder groups. At the second level it is subdivided into social themes which were addressed repeatedly in the works reviewed.

Table 1 gives an overview of the social issues covered. The complete Öko-Institut list of indicators can be found in the publication PROSA – Product Sustainability Assessment (Grießhammer et al., 2006b). Both the structure and the thematic subdivisions were presented to and discussed with external actors on various occasions (e.g. at the stakeholder workshop and with Fujitsu-Siemens Computers and Stiftung Warentest). None of them raised fundamental objections to the classification system. Some actors also emphasized the necessary coherence with sustainability indicators used in other applications.

[7] The Working Group has opted to encompass the *users* of a product as a fourth group of stakeholders. Since the present work is only concerned with production, however, neither an analysis of the impacts on product users nor a corresponding selection of indicators was undertaken.

Table 1: Structure and categories of the PROSA social indicators

Stakeholder group	No.	Theme
A. Employees	A.01	Safe & healthy working conditions
	A.02	Freedom of association, right to collective bargaining & workers' participation
	A.03	Equality of opportunity and treatment & fair interaction
	A.04	Abolition of forced labour
	A.05	Abolition of child labour
	A.06	Adequate remuneration
	A.07	Adequate working time
	A.08	Employment security
	A.09	Social security
	A.10	Professional development
	A.11	Job satisfaction
B. Local communities	B.01	Safe & healthy living
	B.02	Respect of human rights
	B.03	Respect of indigenous rights
	B.04	Community engagement
	B.05	Maintaining and improving social and economic opportunities
C. Society	C.01	Public commitment to sustainability issues
	C.02	Prevention of unjustifiable risks
	C.03	Employment creation
	C.04	Vocational training
	C.05	Anti-corruption efforts & non-interference in sensitive political issues
	C.06	Social & environmental minimum standards for suppliers and cooperation partners
	C.07	Contribution to the national economy and stable economic development
	C.08	Contribution to the national budget
	C.09	Prevention & mitigation of armed conflicts
	C.10	Transparent business information
	C.11	Protection of intellectual property rights

5.2 Nature and reference level of indicator values

Establishing the reference levels of the available information proved a methodological challenge. Despite the availability of a multitude of data and information on working conditions in the electronics industry and the industrial context in the People's Republic of China, for SLCAs these data need to be disaggregated to the product level. How far this affects the validity of specific assertions must be examined in each instance. For example, mounting components on printed circuit boards (PCBs) for desktop computers is a labour-intensive process, but the same statement cannot be transferred uncritically to notebook production. Whilst PCBs for notebooks also require populating with components, the high degree of integration means that this stage of production is largely automated.

Clearly the data and information used are only amenable to analysis with certain reservations. Often, only a careful synopsis of such diverse information from disparate sources yields a picture approximating to the real-world situation. In order to facilitate the evaluation and assessment of information, a scheme was developed for tagging the information used, based on its regional and industrial reference level. This labelling will enable rapid and uncomplicated identification of the substantive relevance of the given information. Taken together with the references to sources, this results in an adequate set of metadata permitting conclusions to be drawn about the quality and reference level of the information (see Table 2).

Table 2: Scheme for tagging data and information for Social Life Cycle Assessments

			Regional level			
			Factory	**Local**[8]	**National**	**International**
			1	**2**	**3**	**4**
Industrial level	**Single process**	**A**	A1	A2	A3	A4
	Production process	**B**	B1	B2	B3	B4
	Company	**C**	C1	C2	C3	C4
	Branch of industry	**D**	-	D2	D3	D4
	Industry	**E**	-	E2	E3	-
	Economy	**F**	-	F2	F3	-

In the example of PCB manufacturing and component mounting, the rubrics from Table 2 can be interpreted as follows:

Single process (A1-A4): Information on PCB component mounting within a single factory (A1), in the industries in a specific region (A2), in one

[8] "Local level" in this case refers to administrative and geographical entities at sub-national level. In China these are provinces, cities and Special Economic Zones.

	country (A3) or on current international manufacturing practice (A4).
Production process (B1-B4):	Aggregated information on the processes involved in manufacturing the PCB substrate, the print and etch process, through-connection, lamination of single layers and population with components. This information relates to a single factory (B1), the industry in a specific region (B2), in one country (B3) or to current international manufacturing practice (B4).
Company (C1-C4):	Information about a single company involved in PCB manufacturing and/or component mounting, relating either to one of its factories (C1) or to the local (C2), national (C3), or international (C4) activities of that company.
Branch of industry (D2-D4):	Information on the electronics industry at local (D2), national (D3) and international level (D4).
Industry (E2-E3):	Information on manufacturing industry at local (E2) and national level (E3).[9]
Economy (F2-F3):	Information on the economy at local (F2) and national level (F3).

It is obvious that information relevant to processes within a single factory (A1 and B1) is the ideal source for product-related SLCAs. It will mainly cover aspects such as health and safety in the workplace and the labour-intensity of manufacturing processes. If aggregated studies are already available (A2-A4, B2-B4), these may be used for the analysis instead.

In many cases, information on a single factory (C1) permits conclusions about the production process for a particular product. Particular mention should be made here of the themes of freedom of association and right to collective bargaining, and to non-discrimination, equal opportunities and fair interaction. But information relevant to the company level must still be examined critically. For instance, a manufacturer of batteries and battery packs was recently implicated in cadmium poisoning of workers (Frost, 2006a). The company also produces battery packs for notebook PCs, but since these do not contain cadmium, any direct links between these cases of poisoning and the notebook industry appear improbable.

Information on the wider social and economic context (C2-C4, D2-D4, E2-E3, F2-F3) is most suitable for a comparative classification of process and factory information. For example, the wages paid can only be evaluated by making reference to the operative national regulations and cost of living. Nevertheless, data with broader geographical relevance can be very useful for SLCAs if they consist of average figures based on factory-level data.

It becomes clear that SLCA for products should be based on information of type A1, B1 and C1 or on average figures generated from that basis. Information relevant to other levels is

[9] Information on the manufacturing industry at international level is too unspecific for the present application.

ideally only suitable as reference values for interpretations. In the present case study, however, it became evident that there was a considerable lack of information relevant to the process and factory levels (A1, B1 and C1). For this reason, many themes could only be discussed by making reference to information on the social and economic context. The information in this category comprises not only generally applicable statements on the legal position in China, but also process and factory information from other areas of electronics production. Taken in its entirety, this can be used to show evidence of structural problems.

This circuitous route via average industry data was developed in the context of the LCA and can be justified with the argument that, as things stand, without this procedure no analysis would be possible at all. Data from companies which exceed the industry average can only be included once they have been published.

6 Life cycle inventory analysis

For the Life Cycle Inventory Analysis (LCI), the data evaluated came from specialist literature, journalistic reports and research studies as well as information from corporations, industry alliances, NGOs and workers' rights organizations. A wide-ranging discussion took place at the stakeholder workshop (section 6.2). Initiatives by industry alliances are presented in section 6.3, by NGOs and workers' rights organizations in section 6.4, and by consumer organizations in section 6.5. Further research findings are compiled in sections 6.1, 6.6 and 6.7. In addition, Öko-Institut undertook a study visit to China in order to gather data and meet stakeholders, including suppliers.

6.1 Structure and characteristics of the notebook industry

The following chapter seeks to identify the predominant production locations and characteristic processes for selected sections of the notebook PC value chain. The significance of this knowledge about the value chain is that social impacts are critically dependent on the prevailing social and political framework conditions as well as the nature of the production process.

6.1.1 Composition of notebooks

Notebook PCs consist of 1,800 to 2,000 parts. Every part is normally subject to several production steps, which can in turn be distributed over several locations. A detailed and fully inclusive study of all sections of the value chain would be extremely time-consuming and almost impracticable. A diagram has been inserted below summarizing the stages in the value chain of a notebook PC, from resource extraction to the marketing of the finished device (see Table 3). The grouping of different production processes in lower-tier industries was carried out on the basis of the intrinsic similarity of production processes and the degree of processing undergone in the manufacturing of the final product, the notebook PC.

The following analysis describes the characteristics and geographical distribution patterns of the lower-tier industries marked on Table 3. The diagram starts with marketing as the final stage in the value chain and traces the preceding stages of production in reverse order. Due to the vast complexity, only the two tiers of production closest to the final product could be dealt with exhaustively. Nevertheless, it was possible to examine a few selected third- and fourth-tier industries.

Table 3: Schematic diagram of the notebook PC value chain

	Production stages	Products and intermediate products										
6.	*Marketing*	Branded notebook										
5.	*Final assembly*	Notebook										
4.	*Assembly of complex components*	Motherboard and network card	LCD display	Optical drive	Hard disk	Keyboard	Touchpad	Battery pack	Power supply	Cooling system	Case	Other
3.	*Manufacturing of single components*	Microchips	Passive electronic components	Printed circuit boards	Cables	Operator controls	Plug connections	Screw connections	Battery cells	…	…	
2.	*Refining of raw materials*	Silicon wafers	Glass products	Raw plastic products	Copper products	Copper-zinc products	Aluminium products	…	…	Palladium products	Tantalum products	…	…
1.	*Resource extraction*	Quartz sand	Crude oil	Copper ore	Zinc ore	Bauxite	…	Palladium ore	Tantalum ore	…	Scrap metal	

The cells shaded in grey represent intermediate products whose industrial manufacturing is covered in greater detail in the following chapter.

The diagram does not show the relationships between the vertical levels. The fact that two cells are shown horizontally or vertically adjacent to one another does not therefore indicate any functional relationship between them. In particular, the relationships between tiers 2, 3 and 4 are so diverse as to render a graphical representation impossible in the present context.

6.1.2 Final assembly and marketing of notebooks

The marketing of notebook PCs is essentially carried out by firms with well-known brand names such as *Dell, Acer, Hewlett-Packard* and *Fujitsu-Siemens.* These firms are collectively known as "own-brand manufacturers" (OBM). Yet only in the rarest cases does the brand name reveal any information about the actual firm responsible for manufacturing. In the past, many of the well-known OBMs maintained their own PC production facilities, but as part of the global outsourcing process, most of these firms scaled back these activities to concentrate on their core competencies such as brand management and global marketing. In a few cases, the original production branches were converted into subsidiary companies which now manufacture for their parent companies but also carry out certain manufacturing processes for other clients. One example of this is the firm *Wistron*, which was formed as a spin-off from *Acer* and now carries out a sizeable part of its notebook production (Global Sources, 2005a). The majority of notebook PCs are manufactured by independent firms such as *Quanta* and *Compal*, however, which generally run production lines for several brand-name vendors simultaneously. A closer look will be taken at this practice, known as "contract manufacturing", in section 6.1.3. The proportion of the production process which is ultimately still carried out by the OBMs varies from one firm to another. In some cases the devices are designed and manufactured entirely by external firms to performance and price specifications. Other firms are more intensively involved in the areas of technological development and design. For either variant, in general only the "barebone" notebook – finished but not installed with its chipset and main memory – is delivered to locations conveniently close to OBM customers.[10] These generally undertake final assembly. In the high-end segment only, a few brand-name manufacturers are still involved in notebook construction themselves (e.g. Sony, Fujitsu).

Despite outsourcing, the OBMs are highly involved in the costing and quality assurance of notebook production, and thus retain a certain overview of the value chain. Normally, key components with a major impact on the price of the devices are purchased directly by the OBMs and delivered to the contract manufacturer. This is usually the case for the display, the hard disk, the microprocessor, memory modules and the optical drive. A similar method is often adopted for components with safety implications (battery packs, power supplies and power cables). Besides controlling costs and safety, this method is extensively used for quality assurance.

[10] These locations are primarily in Central and Eastern European transformation countries for the European market, and in Mexico for the United States.

Most of the well-known OBMs are corporations with a long tradition in the electronics sector, domiciled in the USA, Japan and Europe. In addition, a few newer firms from Taiwan and China have succeeded in extending their production operations successfully to encompass global marketing (e.g. *Acer* and *Lenovo*). All in all, the marketing of notebooks calls for a worldwide presence, and the OBMs generally establish numerous branches all over the world.

Table 4: The ten largest own-brand manufacturers of notebook PCs

Brand	**Company domicile**	
Dell	USA	*no manufacturing operation of its own*
Hewlett-Packard	USA	*no manufacturing operation of its own*
Lenovo (formerly IBM)	China (formerly USA)	*no manufacturing operation of its own*
Acer	Taiwan	*no manufacturing operation of its own*
Toshiba	Japan	*partly own manufacturing operation*
Fujitsu-Siemens	Japan & Germany	*own high-end manufacturing operation*
NEC	Japan	*no manufacturing operation of its own*
Sony	Japan	*own high-end manufacturing operation*
Apple	USA	*no manufacturing operation of its own*
Asus (= Asustek)	Taiwan	*own manufacturing operation*

Source: ct 2006, issue 16 and own research

6.1.3 Design and construction of notebooks

In contrast to the public perception, only a few own-brand manufacturers (OBMs) are active themselves in the design and construction of notebook computers. In general these activities are undertaken by *contract manufacturers*. Depending on the spectrum of services provided, this work can be subdivided into *Own-Design Manufacturing* (ODM) and *Own-Equipment Manufacturing* (OEM).[11] ODM comprises work in the areas of concept and product design as well as assembly of the devices. OEM, on the other hand, refers to manufacturing to the client's precise specifications. All of today's notebook manufacturers have ODM competence in-house and operate in both the ODM and OEM segments. In certain instances, such firms have even ventured into global marketing and successfully penetrated the OBM segment

[11] Usage of the terms OBM, ODM and OEM in the literature is variable and at times contradictory. In many cases the companies active in marketing are referred to as ODMs (instead of OBMs). Accordingly, all firms which manufacture the product themselves are OEMs, regardless of whether or not they are involved in concept and product design.

(Kishimoto, 2003). *Clevo Computers* and *Twinhead International* are examples of this (Global Sources, 2005a).

The construction of notebook PCs normally consists of the mounting of components on the motherboard, assembly of the devices and a final quality control. Moreover it is also the responsibility of contract manufacturers to organize their supply chain in such a way that sufficient numbers of components are always available. This applies especially to components that are not purchased and supplied directly by the OBMs.

Apart from a few models in the high-end segment, all notebooks are currently manufactured by eleven Taiwanese firms. In the past few years, these firms have relocated their production en masse to locations in the People's Republic of China. Almost all producers have a presence there, with large factories in the Shanghai-Suzhou region. Only the firm *Wistron* has a production location outside of China, maintaining a facility in the Philippines. The following list gives an overview of the notebook manufacturers and their estimated production volumes for the year 2006.

Table 5: Major notebook manufacturers

Company	**Company domicile**	**Production location**	**Production volume in 2006 [units]**
Quanta	Taiwan	China	22,000,000
Compal	Taiwan	China	15,000,000
Wistron	Taiwan	China, Philippines	11,000,000
Inventec	Taiwan	China	7,000,000
Asustek	Taiwan	China	6,500,000
Mitac	Taiwan	China	2,500,000
Uniwill	Taiwan	China	2,200,000
FIC	Taiwan	China	2,000,000
Arima	Taiwan	China	1,300,000 – 1,600,000
Twinhead	Taiwan	China	approx. 800,000
Clevo	Taiwan	China	approx. 800,000

6.1.4 Assembly of complex components

Electronic devices can be broken down into a multi-layered structure. The top layer is the finished electronic device. At the next level down, a number of components can be distinguished, some of which are themselves complex in structure. In the case of a notebook, these are essentially the assembled main board and network card, cooling system, hard disk, the case, the keyboard, the display, the optical drive, the loudspeakers, the battery pack, the power supply, the touchpad, the infrared interface and the SD-card reader. These components in turn consist of a multitude of parts and subcomponents.

The more expensive components and those with safety implications, in particular, are purchased by the OBMs directly and delivered to the notebook manufacturers' factories (see section 6.1.2).

Almost all these components are produced by similarly structured industries: Assembly work is done almost exclusively by large, mainly South Korean, Taiwanese or Japanese firms. Labour-intensive assembly processes are normally carried out in low-wage locations, particularly the People's Republic of China. Below, the structure of some of these branches of the industry is briefly explained.

6.1.4.1 Display

Notebooks are usually fitted with liquid crystal displays (LCD). These essentially consist of two thin glass plates, polarizing and colour filters and a layer of liquid crystal controlled by a layer of electrodes. This unit is lit from behind by an external light source. Due to this very specific construction, LCD manufacturing is a largely independent segment of the industry. LCD production is technologically very demanding and takes place in a fully automated and closed process. The manufacturing of the glass plates is technologically costly, due to the minuscule wall thicknesses and high quality standards required.

LCD displays for use in notebooks are essentially produced by large Japanese, Korean and Taiwanese manufacturers. In the main, these maintain production facilities in their countries of domicile and, in many cases, additional new factories in mainland China. Until recently the notebook manufacturer *Quanta* operated its own display manufacturing facility (*Quanta-Display Inc.*). This division was sold, however, in April 2006 to the Taiwanese firm *AU Optronics*.

Table 6: Major manufacturers of notebook displays

Company	Company domicile	Production location	Market share
AU Optronics	Taiwan	Taiwan, VR China	26%
Samsung	South Korea	South Korea, China	24%
LG.Philips	South Korea, Netherlands	South Korea, China, Poland	23%
Chi Mei Optoelectronics	Taiwan	Taiwan, China, Philippines	7%
Toshiba Matsushita Display	Japan	Japan, Singapore	6%
Chunghwa Picture Tubes	Taiwan	Taiwan, China	5%
Sharp	Japan	Japan, Poland	3%
BOE Hydis	South Korea	South Korea, China	3%
Hitachi	Japan	Japan, Taiwan	2%
IDTech	Japan	Japan	>1%
HannStar	Taiwan	Taiwan, China	>1%
Toppoly	Taiwan	Taiwan, China	>1%
Torisan	Japan	Japan	>1%

6.1.4.2 Optical drive

The production of optical drives (CD and DVD drives) is a branch of the hardware industry in its own right. Optical drives are complex products and they too are made up of a diverse range of components (a laser, a printed circuit board, a motor, passive electronic components, etc.). For notebooks, a slim rewritable DVD drive (slim DVD-RW) is currently the standard equipment. The development of such drives is dominated by Japanese and South Korean firms. The labour-intensive assembly of the drives is partly outsourced to Taiwanese firms with production facilities in the People's Republic of China. According to Global Sources (2005c), ten Taiwanese firms currently manufacture 42% of all optical drives produced worldwide. Other production facilities are located in Taiwan, the Philippines, Malaysia and Indonesia. The notebook manufacturer *Quanta* has its own manufacturing operation, *Quanta Storage Inc.*

Table 7: Major manufacturers of optical drives for use in notebook computers

Company	**Company domicile**
Lite-On	Taiwan
Panasonic	Japan
Hitachi-LG Data Storage (HLDS)	Japan, South Korea
Toshiba-Samsung Storage Technology (TSST)	Japan, South Korea
Quanta Storage Inc. (QSI)	Taiwan
Teac	Japan
NEC	Japan

6.1.4.3 Battery pack

Due to the relatively high product safety risks associated with defects in the battery pack, special attention is devoted to the manufacturing of these components within the notebook industry. The critical points are less in the assembly of the battery packs than in the manufacturing of the battery cells (see section 6.1.5.2).

The battery packs used in notebooks generally contain six Li-Ion cells. Li-Polymer cells are currently only used in the high-end segment due to their higher price. The assembly of battery packs with the associated electronics is not considered to be very technologically demanding, and the processes are largely carried out manually (Brodd, 2005). Accordingly, numerous firms of different sizes operate in this segment. The manufacturing facilities are almost entirely located in the Special Economic Zones of the Pearl River and Yangtze deltas. The process of production-shifting from Mexican locations to mainland China is believed to be completed, for the most part (Brodd, 2005).

Table 8: Select examples of manufacturers of battery packs for use in notebooks

Company	Company domicile	Production locations
Simplo	Taiwan	China
GLW	Taiwan	China
New Sun	Hong Kong	China
Gold Peak	Hong Kong	China
Jingyou	China	China
Vina	China	China
Strongwill	Hong Kong	China
Sanger	Hong Kong	China

6.1.5 Manufacturing of parts

6.1.5.1 Motherboard

For the motherboards of notebook PCs, six-layer printed circuit boards (multilayer PCBs) are currently in use. Due to the required integration density, the printed circuit boards (PCBs) are populated on both sides using the fully automated surface mounting technology (SMT) process.

The integrated graphics and sound card functions are fitted to the motherboards by the notebook manufacturers themselves. These are also responsible for the design of the board but are not involved in the manufacturing of the unpopulated PCBs or their preparation (print & etch).

Currently there are approx. 2,000 companies worldwide which are active in PCB production (i.e. manufacturing of the substrate material and subsequent processing). 75% of total production is carried out by the 110 largest companies. Although many PCB manufacturers are based in OECD countries, extreme pressure on costs and the desire for proximity to large customers are giving Asian producers a growing pre-eminence (Gensch et al., 2004). For mass production of notebook PCs it can be assumed that the PCB material is procured entirely from Asian production facilities. In the People's Republic of China numerous large producers have a presence in Shenzhen, Guangzhou, Dongguan and Huizhou in the Pearl River Delta region.

6.1.5.2 Battery cells

The production of Li-Ion cells must meet high standards of product safety. As well as damaging the device, defective battery cells can start smouldering fires and thus cause damage to property and people (see also section 6.1.4.3). Whenever defects occur, which has happened regularly, they result in costly product recall programmes and pose a major potential risk to brand-name manufacturers' reputations. For instance, in August 2006 the firms *Dell* and *Apple* had to launch product recall campaigns for the battery packs of 5.9 million notebooks (Heise Online, 2006).

Company size is a particular factor in this market segment, in that the costs of any given recall programme are passed on to the responsible parties. For smaller companies, this poses the risk of financial ruin. Moreover, the facilities for manufacturing battery cells are extraordinarily capital-intensive (Brodd, 2005). For these reasons, battery cells for use in notebook battery packs are only manufactured by a few large Japanese and Korean companies. The production process is highly automated. In addition to the manufacturing locations in Japan and Korea, battery cells are increasingly being produced in the People's Republic of China. The crucial factor governing this trend is not so much low wage costs as financial incentives offered by the Chinese government (Brodd, 2005).

Table 9: Major manufacturers of Li-Ion cells for use in notebook PC battery packs

Company	Domicile	Production locations	Market share[12]
Sanyo	Japan	Japan	28%
Sony	Japan	Japan, China	15%
Samsung SDI	South Korea	South Korea	12%
MBI Panasonic	Japan	Japan	12%
LG Chem	South Korea	South Korea, China	7%

[12] These market shares relate to the lithium ion (Li-Ion) cell market as a whole. Estimates of the market shares for use in notebook PCs could be somewhat higher, since not all competitors in the Li-Ion cell market offer products for this specific application.

6.1.6 Interim conclusions

By analysing individual branches of the notebook PC industry, it is possible to gain an overview of structures and trends in the electronics industry. Apart from the obvious concentration around the East Asian region, the following conclusions can be drawn:

Decreasing production depth

The notebook PC industry is a conspicuous example of a rapid reduction in production depth. Whereas until a few years ago original brand manufacturers (OBMs) were themselves involved in the design and construction of notebooks, this work is now carried out by eleven less widely known Taiwanese firms. These actual manufacturers of the notebooks, for their part, are highly specialized firms which outsource all steps in production apart from the mounting of components on the motherboard and the assembly of the finished product. This trend towards outsourcing is also advancing in other parts of the notebook PC value chain, resulting in an almost indeterminable proliferation of actors and subsidiary industries.

Challenge of supply chain organization

The large number of components and materials calls for stringent organization of the supply chain: if availability or quality issues arise with just one of the 1,800 to 2,000 individual components, the entire downstream production process is held up. For this reason it is advantageous, particularly for suppliers of non-standardized components (e.g. cases), to be located in geographic proximity to large customers. Components which are largely standardized (e.g. passive electronic components, plug connections) are obtained through distributors which assume responsibility for on-time deliveries. These structures are not unique to notebook manufacturers; they are just the same for manufacturers of complex components (e.g. optical drives, displays, battery packs). Due to these highly articulated structures, at no single point in the value chain is there a complete overview of all the actors and locations involved.

Stability of supplier relationships

The many non-standardized components give rise to the need for close technological coordination between business partners. Therefore good supplier relationships do not depend solely on cost aspects, but also on the degree of mutual trust and experience built up from past cooperation ventures. Thus, in comparison to other sectors (e.g. textiles), many supplier relationships in the electronics sector are of a longer-term nature. This does not apply to standardized components, however, which are traded in a highly flexible spot market.

Formation of internationally significant clusters

Despite the global character of the value chain, a strong trend towards cluster formation can be observed in the notebook PC industry. This is manifested on the one hand in a concentration of suppliers around individual large customers with market dominance, and on the other hand in a concentration of competitors within a region. Both of these trends are closely interlinked. For the purposes of efficient organization of the supply chain, large customers with market dominance make many supplier contracts dependent upon geographical proximity, in a deliberate effort to induce firms of suppliers to locate themselves nearby. Competing companies with less powerful influence over supplier structures find that they, too, are forced to stay within a certain proximity to their suppliers, but can only achieve this by relocating themselves. Besides the purely organizational advantages of industry clusters, this also gives rise to attractive innovation regions with tight-knit informal communication and coordination opportunities.

In the area of the notebook PC industry immediately linked to the specific product (the manufacturing of notebook PCs), the process of cluster formation has almost completely run its course: the firm *Quanta* makes location within its own industrial complex a condition for the award of supply contracts. The resulting Quanta City and the appeal of the industrial environs of the Shanghai-Suzhou region have encouraged almost all other notebook PC producers to relocate there.

Despite all this, a notebook also contains numerous parts and components which are manufactured in other locations. On the one hand, these include parts and components which are subject to short innovation cycles and the production of which requires high-level technological know-how (processors, chipsets, displays); on the other hand, there are also parts which are used in numerous products other than notebooks and in other industries (e.g. passive electronic components, cables, plastic granulate).

Importance of quality management

High standards of quality and product safety prevail in the notebook PC industry. Since any faults pose an especially high risk to the equipment distributors (OBMs), the latter retain a certain influence over the phase of the value chain immediately linked to the specific product. This is exercised partly through the direct purchase of critical components (display, optical drive, hard disk, battery pack, power supply, power cable) and partly through independent quality control of products and manufacturing processes.

Fierce predatory competition

All steps in production are subject to heavy downward pressure on price. This can be demonstrated by the fact that the prices of mid–range notebooks have more than halved – despite rapidly rising specifications – since the year 2000. This price drop has been achieved

through intense competition in all sub-segments of notebook, component and parts production. The consequence has been to reduce profit margins to an average of 3% (Taylor, 2005). This adversarial competition results in attrition in the number of competing actors, a process which is not yet completed in many sub-segments of the value chain.

Company size as a strategic advantage

Without exception, the developments outlined favour large business units which can keep production costs low by means of high unit shipments and highly rationalized processes, and can also provide their customers with sufficient warranties in terms of quality and liability. These prerequisites are fulfilled primarily by those companies which successfully built up capital and know-how in the past, during the formative era of the electrical and electronics industry. Where the occasional newcomers are found, they are only engaged in technologically simple manufacturing processes (e.g. assembly of battery packs).

Concentration in the People's Republic of China

The vast majority of notebook PC production is located in the People's Republic of China. This applies not just to assembly of the devices but also to the production of components and parts. The current situation is the result of a largely completed process of production shifting, predominantly from other production locations in Asia (Taiwan, Korea, Japan, Singapore). Only technologically demanding steps in production are still carried out mainly in traditional industrial countries (Taiwan, Korea, Japan, USA, Europe). Current trends in production shifting among locations are, firstly, the shifts between the Asian low-wage countries and, secondly, the progressive shifting of technologically demanding production processes to the People's Republic of China. All these processes are currently working to China's advantage. Low-wage countries such as the Philippines are tending to lose out. Other potential production locations (Vietnam, North Korea) are not yet particularly significant for the notebook industry. Due to the extreme scale of cluster formation and the relatively high investment costs, this situation cannot be expected to change substantially in the foreseeable future.

6.2 Outcomes of the stakeholder workshop

At the invitation of Öko-Institut – Institute for Applied Ecology, a stakeholder workshop held in February 2006 brought together representatives from NGOs (*SOMO, Oxfam Deutschland*), international cooperation organizations (*GTZ, UNU, UNEP*), sustainability consultancies (*Sustainability Agents*), employees' organizations (*IMF*) and industry (*Dell, Deutsche Telekom, GeSI, Hewlett-Packard, Sony*) to discuss social conditions in the manufacturing of electronics products. A representative of the *Workers' Assistance Center*, a labour organization in the Philippines, had accepted the invitation but was unable to take part in the

workshop due to administrative difficulties in obtaining a visa. A representative of the German consumer body *Stiftung Warentest* also had to pull out at short notice for scheduling reasons. Since these last-minute absences meant that not all stakeholder groups were fully represented, representatives of consumer organizations (*Stiftung Warentest, Verbraucherinitiative, Verbraucherzentrale NRW*), Asian workers' rights organizations (*Asia Monitor Resource Center, China Labour Bulletin, China Labour Support Network, Human Rights in China, Labour Action in China, Oxfam Hong Kong*) and the sustainability consultancy *CSR-Asia* were involved in additional bilateral and trilateral stakeholder meetings. A similar approach was agreed with the company *Fujitsu-Siemens Computers* and, somewhat later, with *Hewlett-Packard*. The key outcomes of this stakeholder process can be summarized as follows:

Confirmation of the indicator system used

There is currently no uniform, internationally standardized or recognized system of indicators for measuring social impacts. Existing systems are mostly tailored to sector-specific standards, and are thus only of limited use for the evaluation of complex value chains and product systems. The system of indicators developed by Öko-Institut (see section 5.1) is intended to fill precisely this gap, and was therefore compared with other approaches both at the stakeholder workshop and in the various bilateral talks (OECD, 2000; SAI, 2001; GRI, 2002 & 2006; Stiftung Warentest, 2004; EICC, 2005). The discussions essentially confirmed the structure and classification system used for this list. Suggestions were made in respect of individual indicators and were taken into consideration in the further development of the list. Some actors explicitly emphasized the substantive agreement with existing systems from other applications.

Focusing on product systems as a new approach

Existing studies in the field of CSR generally concentrate on the social impacts of individual companies or sectors. The structured analysis of social impacts throughout a product life cycle and system, making use of Product Sustainability Assessment (PROSA) or Social Life Cycle Assessment (SLCA), comes as a new approach for many actors. Although various studies at sectoral and company level – particularly from NGO campaign work – have been transferred to the product level, the corresponding analyses are largely restricted to one phase of the life cycle. Different actors have different views about the value of developing a comprehensive product system assessment. For instance, some representatives of workers' rights organizations raised no objections to such a process in principle but, in various ways, expressed the fear that an elaborate scientific analysis would tie up urgently needed resources without achieving real improvements for the people concerned.

The consumer organizations, in particular, specifically welcomed the development of PROSA and SLCA. Some of the organizations are already actively developing their own methods, but require technical assistance to do so, especially in relation to complex industrial products. In this regard, it was emphasized that in developing the methodology, thought should be given to the workload implications of the analysis beside its scientific precision.

Critical assessment of existing monitoring and auditing systems

Those from NGOs and workers' rights organizations are almost unanimously critical of existing monitoring and auditing systems operated by and within companies and suppliers. Criticism flares up especially around the view that social auditing, as practised for close to two decades[13], is not thought to have brought about any notable improvement in labour standards in any sector. Instead, the practice has given birth to an “auditing industry” in its own right, which no longer exclusively serves the interest of improving social standards. In the view of the NGOs, the top-down approach practised by big international businesses, whereby stringent social controls are imposed on suppliers, is often hard for the suppliers to follow. Suppliers often face the dilemma of having to maintain quality while producing at lower and lower prices. The auditing process often fails to incorporate guidance of fulfilling these demands whilst complying with all minimum social standards, and thus the only solution is systematic deception of the auditors.

Moreover, many NGOs criticize the great lack of transparency in the monitoring systems. They complain that the relevant documents are never made available to the public and not even the list of suppliers is published. Likewise, they point out, sustainability reports fail to give adequate information on actual working conditions, and audits conducted by independent organizations with involvement from the employees concerned are particularly rare in the electronics industry.

Workers' rights organizations and NGOs, in particular, opposed the idea of more intensive auditing for the purpose of a Social Life Cycle Assessment (SLCA). What they find significantly more important in this regard is to involve workers in existing CSR programmes and audits.

[13] Audits have long been common practice in the textile, shoe and toy industries. Comparable approaches have only begun in the electronics industry in the last few years (see section 6.3).

Access to information is difficult

Almost all of the large brand-name manufacturers are very well aware of the social problems and challenges in the manufacturing of their products. Due to the vast complexity of value chains, the diverse supplier and subcontractor relationships and the prevalent secrecy for competitive reasons, the mix of actors is almost impenetrable (see section 6.1). Especially in stages of the value chain not immediately linked to the specific product, it is virtually impossible to gauge what breaches of social and environmental standards might be taking place. The strategies for responding to this challenge vary, but are essentially based on a combination of codes of conduct, auditing of supplier factories, and Supplier Days (information sessions for suppliers). By means of these measures, many brand-name manufacturers have already managed to build up considerable knowledge about social impacts in their supplier structures and have initiated isolated changes in some cases. Whilst this knowledge certainly exists in documentary form (audit reports), the relevant reports are not accessible to external actors, other than in exceptional cases. This is not solely due to the risk that the contents may be reputation-damaging: even extremely positive audit results cannot be published in many cases because they would still reveal sensitive competitive information such as the nature and length of business relationships. Moreover, audits are generally bound up with confidentiality agreements between the business partners concerned. Although tentative efforts are under way to collect audit reports in a central database and make them available industry-wide,[14] as yet the establishment of such a system has been delayed by the sensitivity of the topic and the need for major consultations.

For this reason, the necessary information for a product-related SLCA is proving extremely difficult to access. Thus external analyses rely either on journalistic methods (interviews outside the factory gates) or on cooperation with industry partners. Both approaches entail considerable risks as to their independence, selectivity and meaningfulness. A further problem is posed by the vast complexity of value chains: even if all audit reports were publicly accessible, only the stage of the value chain immediately linked to the specific product would be transparent, at least at this point in time. Often even the suppliers have no knowledge of the stages not immediately linked to the specific product, let alone the social conditions in which production takes place.

[14] The establishment of a central database with self-reporting forms and audit reports is being driven forward within the Supply Chain Working Group of the Electronic Industry Code of Conduct and the Global e-Sustainability Initiative.

6.3 Initiatives by corporate alliances

6.3.1 Global e-Sustainability Initiative

The Global e-Sustainability Initiative (GeSI) is an alliance currently consisting of 14 companies from the information and communications technology industry, supported by the *United Nations Environment Programme (UNEP)* and the *International Telecommunication Union (ITU)*. In most cases, the members' core business is in the telecommunications sector but a few, notably *Ericsson, Hewlett-Packard, Motorola* and *Panasonic Mobile Communications* are original brand manufacturers of hardware products and computers.

The objective of the alliance is to help to shape the sustainability debate in the field of information and communications technology, to publicize its members' voluntary sustainability approaches and to support information and communications technologies which contribute to sustainable development (GeSI, 2006). In becoming members, the firms undertake to comply with defined ecological and social criteria and take part in working groups to draft statements and approaches for optimizing individual aspects of sustainability in the telecommunications industry. In addition to themes like the digital divide, climate change, coltan extraction and the continued refinement of sustainability reporting guidelines, one working group is devoted to social and environmental issues in information and communications industry supply chains. In this Supply Chain Working Group the dominant question is how the GeSI can contribute to addressing the social and environmental risks in supplier structures effectively.

6.3.2 Electronic Industry Code of Conduct

In response to the "Clean up your Computer" campaign by the British NGO *CAFOD* the electronics groups *Dell*, *Hewlett-Packard* and *IBM* set up the *Electronic Industry Code of Conduct* (EICC). The EICC, the alliance's centrepiece, is intended to ensure compliance with minimum social and environmental standards in the manufacturing of electronics products. The Code has been in existence since October 2004 and a revised version was published in October 2005. In the meantime more than 15 firms in the electronics sector have joined this alliance, including not only various well-known brand-name manufacturers but also a number of globally operating contract manufacturers (subcontractors) and large software companies. The document refers essentially to relevant international and transsectoral documents (ILO Labour Standards, the Universal Declaration of Human Rights, Social Accountability International, etc.) and, as such, represents an approach for adapting the stipulated social and societal norms and standards for use in the electronics industry context. The contents of the Code are broken down into sections on working practices, health and safety, the environment, ethics, and the overarching theme of management systems. The precise terms of the Code on some points – particularly in respect of the freedom to organize in trade

unions and the right to collective bargaining – are a contentious issue among NGOs and workers' rights organizations (see e.g. Lindsay, 2005).

Within the EICC an implementation group deals with questions relating to strategies and mechanisms for implementing the principles set out in the Code.

6.3.3 GeSI-EICC Supply Chain Working Group

In the year 2005, the *GeSI Supply Chain Working Group* and the *EICC Implementation Group* entered into formal cooperation in order to address issues relating to the implementation of social and environmental standards in supply chains. Their primary focus is on the development of pragmatic approaches to the evaluation of risks with reference to CSR performance, and mechanisms to improve existing problem areas. In this context, a higher-level procedure was developed for the future identification and mitigation of CSR risks in electronics industry supply chains. Within this strategy, various tools are currently being developed, some of which are already being piloted in practice. The procedure essentially uses the Electronic Industry Code of Conduct as a normative basis, but some companies have supplemented this internally with additional principles of their own. Overall this "Supplier Engagement Model for Social & Environmental Responsibility" is structured as a four-phase process:

- In the **first phase**, supplier firms are divided into different risk groups on the basis of their specific economic activity and their regional and political context. In addition, suppliers are informed about the relevant CSR principles and called upon to sign a corresponding compliance declaration. This declaration essentially states that the signatory company will implement the principles both in the course of its own business activity as well as in relation to its own suppliers.
- In the **second phase**, the suppliers assessed as higher-risk are sent standard self-reporting forms. The completed forms are subjected to a plausibility test and fed back into the risk evaluation. In addition, the suppliers receive detailed feedback based on the findings thus far.
- If a supplier continues to be classified as high-risk, it is subjected to an audit in the **third phase**. The purpose of this audit is firstly to survey the specific CSR risks, and secondly to use the results as a basis for a catalogue of corrective measures. This "Corrective Action Plan" is sent to the company, and contains a list of improvement measures accompanied by concrete compliance deadlines. Depending on the nature and scope of any identified breaches of the EICC and company standards, a follow-up audit is undertaken.
- In the **fourth phase**, the success of the procedure is evaluated with reference to medium- and long-term trends. Here the crucial question is whether the methodology applied has actually brought about an improvement in social and environmental

standards in the supply structure. Moreover, this phase also incorporates various measures for supplier capability-building and sensitization in relation to social and environmental issues.

Depending on the company, parts of the procedure are currently still in the development and testing phase. Systematic measurement of effectiveness has not yet been carried out. Although individual companies such as *Hewlett-Packard* and *Dell* report various improvements among their notebook PC suppliers, it is not evident whether these successes are primarily attributable to the GeSI-EICC approach or the general level of commitment shown by these individual companies. Overall it can also be assumed that the recommended procedure is being applied in varied forms in individual firms. On the one hand it is quite possible that the procedure is being utilized mainly as a control mechanism; on the other hand, the four phases can also be enriched with additional measures for capability building and to reinforce workers' rights. To what extent the procedure will influence social impacts on employees, local communities and society at large remains to be seen.

The Supply Chain Working Group has also developed a database which is intended to enable common management of the self-reporting forms and the audit reports. A common document management system of this kind will reduce the overhead for individual firms and relieve suppliers of the burden of excessive numbers of enquiries and audits. The greatest challenge in the development of the database is the issue of how to anonymize sensitive data. Ultimately, every audit report also includes commercially sensitive information on the nature and scope of business relationships.

6.3.4 Other industry-led initiatives

Not all of the brand-name manufacturers have signed up to the *Electronic Industry Code of Conduct* or the *Global e-Sustainability Initiative.* An example of a firm which has not become a member is *Fujitsu-Siemens Computers*, which attempts to strengthen social and environmental standards in its supply structures by means of its membership in the *UN Global Compact*. Moreover, various companies operate internal standards, partly as independent approaches and partly as a supplement to existing codes of conduct. For instance, although *Hewlett-Packard* adheres to the *Electronic Industry Code of Conduct*, it also supplemented it with a wide-ranging clause on the issue of freedom to organize in trade unions and the right to collective bargaining.

Furthermore, some brand-name manufacturers had gained experience in social auditing even prior to the drafting of the *Supplier Engagement Model for Social & Environmental Responsibility*. Various brand-name manufacturers also make use of special Supplier Days to stimulate dialogue on minimum social and environmental standards, or organize CSR training programmes for their suppliers' executives.

6.4 Initiatives by NGOs and workers' rights organizations

Awareness of social problems in the manufacturing of electronics products goes back many years. As early as 1985, a handbook published by the *Asia Monitor Resource Center* reported on the working conditions and health risks involved in the production of electronics products (Gassert, 1985). However, it took another 18 years for the issue to gain wider recognition beyond Asia and in European countries. This was substantially achieved through the activities of the British NGO *Catholic Fund for Overseas Development (CAFOD)*, which published a detailed account of the fundamental structures of the electronics industry and their impacts on workers (CAFOD, 2003). Since then, various NGOs in developed countries have taken up the issue of working conditions in the global electronics industry, among them the Dutch *Centre for Research on Multinational Corporations (SOMO)*, which made an attempt (disputed by the industry) to trace poor working conditions in supplier firms back to the respective brand-name manufacturers (Schipper, De Haan, 2005). In Germany, the NGO *Weltwirtschaft, Ökologie & Entwicklung e.V. (World Economy, Ecology and Development – WEED)* launched an initiative to educate the public on the social and environmental impacts of the global computer industry (WEED, 2006).

The issues of working conditions and health risks are also being raised by numerous organizations in the relevant production locations. These are mainly smaller organizations in direct contact with affected workers and neighbours. Mention can be made of such examples as the *Workers Assistance Center* (Philippines), *Labour Action in China* (China), *Silicon Valley Toxics Coalition* (USA) and *CEREAL* (Mexico). Although most of these organizations concentrate on activities in their own regions, some are seeking to coordinate on a supraregional basis.

6.5 Initiatives by consumer organizations

With rising awareness of the social and environmental impacts of production processes in the globalized economy comes a rising demand for environmentally and socially sustainable products, which have only captured low percentages of market share until now. Thus in 2005 there was 37% year-on-year growth in the worldwide market for fair trade goods (FLO, 2006). Currently the relevant labels are largely confined to the food sector, but with schemes for footballs and ball pumps *Fair Trade Labelling Organizations International* has recently also ventured into the certification of industrially manufactured products. Although the certification of more complex industrial products such as computers or televisions currently seems a remote prospect, the demands for fair practices in electronics production are growing increasingly vocal (see e.g. Böhm, 2006). In this situation, various consumer organizations are currently developing methods for assessing the social impacts of industrial products. The aim of the organizations is not to award special fair trade labels but to assist consumers in making their purchasing decisions. With regard to these efforts, special

mention should be made of the German consumer organization *Stiftung Warentest* which has already carried out and published several CSR tests of products and manufacturers (see e.g. Stiftung Warentest, 2005 & 2006). Likewise the Dutch organization *Consumentenbond* is taking a similar line, including studies of electronic entertainment devices. At present, these evaluations are essentially based on information supplied by brand-name manufacturers (Consumentenbond, 2006).

6.6 Social impacts of the electronics industry in China

In the following chapter, results from a review of the literature together with some of the field research findings will be presented in summarized form. Analysis is principally concentrated on the industrial regions on China's east coast. These have become the most important locations for global electronics production. The notebook value chain is no exception; indeed, its more labour-intensive processes have been shifted almost completely to mainland China.[15]

Based on this fact and numerous critical reports on inadequate compliance with social and environmental standards, various studies on the social impacts of the Chinese electronics industry are already available. Below, information from these sources will be presented for each of the indicators listed above, giving particular prominence to the relevant national framework conditions.

The chapter, it must be emphasized, is not an analysis of the specific social impacts of the notebook industry, but provides an initial overview of the problems, opportunities and developments in the Chinese electronics industry. On the one hand, the information is provided in order to locate the notebook PC industry within its wider context. On the other hand, it should also facilitate the identification of specific problem areas and risks which are also relevant to the notebook industry.

6.6.1 Impacts on employees

6.6.1.1 Safe and healthy working conditions

The law of occupational safety and health in China is comprehensively regulated by Chinese legislation and fully in line with international standards. However, the implementation of laws causes considerable problems, partly due to lack of resources and enforcement capacity, and partly due to a clear prioritization of economic development (UBS, 2005). International

[15] A more detailled analysis of the regional structure of the notebook PC industry and its supply chain structure is presented in section 6.1.

comparative data from the ILO attest to a higher rate of workplace accidents and occupational illnesses in the industrial sector in the People's Republic of China than in countries at a comparable level of development (ILO, 2005). Nevertheless, there are growing signs that the authorities have the will to enforce the statutory requirements more effectively (Liu, 2005). This new trend is allied with the insight that the long-term social and economic costs of workplace accidents and occupational illnesses are completely disproportionate to the short-term economic benefit.

The main health problems reported in the electronics industry worldwide arise primarily from the handling of toxic materials. The main practices cited are the handling of chemical substances without suitable protection (including in the production of printed circuit boards) and prolonged exposure to vapours (e.g. in soldering, injection moulding processes, coating of components and the semiconductor industry) (CAFOD, 2003; Schipper & De Haan, 2005). Time and again, massive breaches of threshold exposure limits for toxic substances have been reported in semiconductor production. Links were made between a proportion of these incidents and increased rates of cancer as well as reduced fertility among female workers. However, most of these studies relate to factories in the established industrialized nations. On the other hand, at least one of the controversial companies has meanwhile shifted production to the People's Republic of China (LaDou, 2006; China Labour Bulletin, 2004). Recently there have also been cases of raised cadmium levels in workers producing battery cells and batteries in China's Pearl River Delta (Frost, 2006a). This is confirmed by an LCA of computers, which found that the use of toxic materials is most prevalent in the production of electronic components, whereas the assembly of the devices is a less critical stage in comparison (Choi et al., 2006).

Although the European Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) is bringing about a distinct reduction in toxic substances in the electronics industry,[16] exemptions and the fact that numerous toxic substances are not covered by the Directive mean that the electronics industry will not become entirely free of toxic substances. For instance the exemption granted for decabromodiphenylether (DecaBDE) will no doubt result in its continued use in casing-plastics.[17] Moreover, RoHS has not restricted the use of potentially toxic

[16] The RoHS Directive prohibits the use of cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers in electrical and electronic products marketed in Europe from 01.07.2006. The People's Republic of China has meanwhile passed a similar directive derived from RoHS.

[17] However, some electronics firms have internal substance elimination lists which go further than the requirements of the RoHS Directive. One internal standard at *Hewlett-Packard* (2005) prescribes the elimination of various brominated flame retardants and other toxic substances in HP products. The standard also covers decabromodiphenylether (DecaDBE).

tetrabromobisphenol A (TBBA) – a key element in the polymer matrix of printed circuit boards. Also, the RoHS Directive only applies to the constituent substances of electronic products. Substances which are used in the production process but not incorporated into the final product are not covered by the Directive as a matter of principle.

In addition to toxic substances, assembly line work combined with high production targets poses further potential health hazards. Working with small components and carrying out optical quality inspections leads, in many cases, to eye strain and eye irritation (U.S. Department of Labour, 2004). In some instances, reports also mention high noise levels in the workplace as well as injuries and burns caused by machines (Schipper & De Haan, 2005; Leong & Pandita, 2006). These instances relate to the manufacturing of case parts.

6.6.1.2 Freedom of association, right to collective bargaining

The ILO core labour standards No. 87 *Freedom of Association and Protection of the Right to Organise Convention* and No. 98 *Right to Organise and Collective Bargaining Convention* have not as yet been ratified by the People's Republic of China. Moreover the Chinese government does not allow any trade unions outside of the state-controlled *All-China Federation of Trade Unions* (ACFTU). Trade union structures are not prohibited per se, however, and in fact Chinese legislation expressly provides for them in companies with 25 employees or more (China Labour Bulletin, 2005a). Thanks to official efforts to promote a “harmonious society”, the proportion of worker representations in foreign companies will shortly be increased to 60% (Maass, 2006). Due in no small part to the fact that management representatives are often appointed to sit on works councils (UBS, 2005), this system generally proves unsuitable in practice for the representation of workers’ interests. Likewise, the right to collective bargaining is enshrined in law, but is barely applied in reality (Freedom House, 2005).

There have recently been repeated attempts by workers to found trade union branches within factories. These attempts have virtually all failed at the stage of negotiating affiliation with the ACFTU, which wanted to replace employee activists with its own officers (AMRC, 2006). Moreover, the proponents of alternative employee structures are often subjected to harassment, obstruction and dismissal (China Labour Bulletin, 2005-1). Employee activists have also been detained repeatedly (Freedom House, 2005).

In the past few years, alternative forms of employee-employer communication have developed in some sectors in China. These are generally rooted in the CSR activities of multinational corporations and provide simple forms of dialogue and ways of making anonymous complaints. One example of this alternative form of complaints management is the establishment of independently staffed telephone hotlines for employees. The complaints are forwarded in aggregated form to the relevant large customers/multinational corporations, thus enabling them to make a more realistic assessment of problems in their supply chain. These measures are normally linked with independent training programmes on the topics of

labour law and occupational safety. In addition, some case studies exist in which multinational corporations not only tolerate the organization of employees at factory level in their supply structure but even explicitly support it (see inter alia Welford, 2006).

Based on the circumstances described, however, it must be assumed that few if any functioning worker representations are to be found in the Chinese electronics industry. For example, in 2004 an attempt to found a trade union branch in a factory manufacturing cordless phones was met with dismissals of employee spokespeople and the early curtailment of employment contracts (China Labour Bulletin, 2005a). As yet there is no known example of an alternative system of employee co-determination having been established. Only the "complaints boxes" installed in some factories act as a simple form of anonymous complaints system.

Nevertheless, in a few multinational electronics firms, approaches exist to strengthen basic employee rights in respect of freedom of organization and collective bargaining. An amendment to the *Electronic Industry Code of Conducts* added by *Hewlett-Packard* alone provides for alternative forms of employee-employer communication in those regions where they are not fully enshrined in legislation (EICC & HP, 2005).[18]

6.6.1.3 Equality of opportunity and treatment and fair interaction

In 1990 the People's Republic of China undertook to implement the ILO core labour standard No. 100, the *Equal Remuneration Convention.* As yet it has not ratified the ILO core labour standard no. 111 *Discrimination (Employment and Occupation) Convention.* The present level of economic growth in Chinese coastal regions is substantially dependent on the labour of migrant workers from other parts of the country. Manufacturing industry, and the electronics industry in particular, predominantly employs young women between the ages of 18 and 25 (Roberts, 2005). Admittedly this age structure and gender distribution is also favoured by the composition of the flow of migrants as well as labour market supply (men tend to find more work in the construction industry). But despite all this, in a company with several thousand employees it is barely conceivable that the workforce would consist almost exclusively of 18-25 year-old women unless some form of discrimination came into play in relation to recruitment and the renewal of contracts. This assumption is reinforced by the observation that the short-term motives for labour migration seen in the past are increasingly giving way to longer-term migration destinations, i.e. permanent employment in the coastal regions (Ping & Shaohua, 2005). A further form of discrimination cited is the

[18] "Where worker representation and collective bargaining are restricted by law, participants are to facilitate open communication and direct engagement between workers and management as alternative ways of ensuring that workers' rights, needs and views are considered and acted upon appropriately and in good faith."

underrepresentation of young rural women amid the ranks of the better-paid skilled workers and foremen (Schmidbauer, 2004).

Various authors also report that degrading treatment is meted out to staff. According to Yang and Liu (2005) verbal chastisement of assembly line workers by managers is the norm in many companies. Reports of similar incidents have also emerged from the electronics industry (Schipper & De Haan, 2005).

6.6.1.4 Forced labour

The ILO core labour standards no. 29 *Forced Labour Convention* and no. 105 *Abolition of Forced Labour Convention* have not been ratified by the People's Republic of China. Forced labour is encountered in China in a variety of forms. These may involve the employment of political prisoners, the use of a pressed workforce on infrastructure projects, the semi-enslavement of workers in manufacturing plants, and the use of debt bondage labour (verbal communication, China Labour Bulletin, 2006). For the electronics industry, only the last two forms pose a certain risk. The overwhelming reliance on migrant workers, who are housed in the company's own accommodation, effectively hands the firms a far-reaching influence over their employees' private lives. Some cases have come to light in which doors were permanently bolted and staff kept in a state of semi-imprisonment (Leong & Pandita, 2006).

A substantially more common practice is the systematic delaying of wage payments in order to deter employees from quitting prematurely (Yang & Liu, 2005). Although such practices can only be ascribed to the "grey zone" in terms of forced labour, they contravene all national and international regulations and standards.

In the electronics industry, as yet no explicit cases of forced labour have come to light. Nevertheless, Schipper and De Haan (2005) report the retention of wages in the event of premature dismissal.

6.6.1.5 Child labour

The ILO core labour standards no. 139 *Minimum Age Convention* and no. 182 *Worst Forms of Child Labour Convention* are both ratified by the People's Republic of China. Until quite recently, child labour was not considered a major problem in China, especially in comparison to some of its Asian neighbours. Child workers were mainly to be found in the agricultural sector, whilst the manufacturing industries were largely free of child labour (Cheung & Welford, 2005). More recently, however, there are mounting reports of an increase in child labour extending to the industrial regions on the east coast (Cheung & Welford, 2005, Frost, 2006b; China Labour Bulletin, 2006a). The reasons given for this increase are local shortages of workers: particularly in the Pearl River Delta, often the demand for cheap labour can no longer be met by new migrant workers. This gives rise to new forms of recruitment such as hiring on student work placement contracts (Frost, 2006b) or targeted recruitment of employees' family members (China Labour Bulletin, 2006b). Another form of child labour is

the use of forged identification documents to fulfil hiring criteria. Thus, according to the China Labour Bulletin (2006b), it is possible for firms to employ underage workers quite inadvertently.

According to the U.S. Department of Labour (2006), just a few unconfirmed reports are available which document instances of child labour in the Chinese electronics sector. Likewise the HP Global Citizenship Report (2006) asserts that child labour is encountered only occasionally in the worldwide supply structures. Those concerned are said to be young workers aged between 16 and 18, who are employed on night shifts or in dangerous activities. It was not possible to determine the extent to which this affects Chinese supply structures.

6.6.1.6 Remuneration

The large number of extremely cheap workers is crucial as a key factor in the economic growth currently taking place in the People's Republic of China. Legislation makes provision for minimum wages at regional level. These are set at between 235 and 690 RMB per month.[19] More recently, a few regions have even begun to progressively raise their statutory minimum wages (Roberts, 2005). In many cases wages are held below the statutory minimum by charging disproportionately high amounts for board and lodging, or ensuring that minimum wage levels can only be earned by working overtime (UBS, 2005).

Under both national and international standards a higher than average hourly wage is payable for overtime. Under Chinese law, overtime is payable at 150% of the normal rate of pay on weekdays, 200% at weekends and 300% on public holidays. Nevertheless there are numerous reports indicating that overtime is remunerated inadequately or not at all (Frost, 2006c).

In both areas – failing to pay statutory minimum wage levels and inadequate remuneration of overtime – similar practices have been reported in the electronics industry (CAFOD, 2003; Balmès, 2004). In addition, it emerges from the HP Global Citizenship Report (2006) that in the global electronics industry, there are instances where pay is deducted for poor work performance or causing defects.

From the companies' viewpoint, Chinese workers are among the cheapest worldwide (CAFOD, 2003; UBS, 2005). From the workers' perspective, international comparisons of wage levels must also be viewed in relation to the applicable cost of living. According to data from the IMF (2004) it is possible to calculate that electronics workers in emerging

[19] In August 2006, the RMB to EUR exchange rate was 0.09814. The minimum wages therefore convert to between EUR 23 and 68 per month. Minimum wages relate to the statutory working time of 40 hours per week.

economies – despite a lower cost of living – generally have to work longer to purchase a representative basket of goods than their colleagues in industrial countries (see Table 10). The IMF did not collect data for the People's Republic of China, but it can be assumed that the figures are roughly on a par with those of Mexico, the Philippines and India.

Table 10: Relative time worked by electronics workers in different countries for a representative basket of goods[20]

Country	Relative working time
Germany	1.0 (reference value)
USA	1.9
Poland	2.0
Czech Republic	2.0
South Korea	2.1
Hungary	2.6
Hong Kong	3.6
Indonesia	4.0
Thailand	4.6
Mexico	7.8
India	9.3
Philippines	10.0

Source: calculated from IMF (2004) data

[20] The basket of goods relates to a family of four, and contains 32.3kg cereals, 3.2kg beef, 4.0kg poultry, 31.6l milk, 5.4kg fish, 0.4kg butter, 4.6l vegetable oil, 44.1 eggs, 11kg potatoes, 18.1kg rice, 6.4kg sugar, 0.2kg tea, 0.4kg coffee, 3.9kg oranges, 0.08 suits, 0.32 long-sleeved shirts, 0.08 men's coats, 0.24 men's shoes, 0.08 women's dresses, 125.9l diesel, rent for a three-room apartment, 0.004 deep freezers, 0.004 television sets, 0.0056 cassette recorders, 0.0008 motor cars (mid-sized), national rate of income tax. Each of the calculations is based on global average monthly per capita consumption. The figures compared were the theoretical working hours equating to consumption of the described basket of goods.

6.6.1.7 Working hours

Officially China prescribes a 40-hour working week with a maximum monthly overtime of 36 hours (Piepel, 2006). Reports from many sectors of manufacturing industry indicate, however, that daily working time of 10 to 14 hours is quite normal (UBS, 2005). According to various studies, the electronics industry is no exception (Schipper & De Haan, 2005; Torres, 2005; China Labour Bulletin, 2005b). Even *Hewlett-Packard* reports in its latest Global Citizenship Report (2006) that excessive overtime loads are a common problem in their supply structure. This assessment can probably be applied without reservation to the supply chains of other electronics firms.

In addition to extremely long working hours during production peaks, cases were also reported of periods without weekly recovery days (Schipper & De Haan, 2005). A list of the "20 worst sweatshops" in Guangdong Province compiled by the *Guangdong Labour Authorities* features three manufacturers of electronics products (China Labour Bulletin, 2005b).

Any evaluation of moderate overtime loads should take into account, however, that to many Chinese migrant workers this can equally be a very welcome opportunity to earn a higher income. This is a view shared by various critical observers (see inter alia Piepel, 2006).

6.6.1.8 Employment security

In Chinese manufacturing industries, it is quite usual for employment contracts to be limited to one or two years. In many cases, employment contracts are renewed at regular intervals so that employees effectively remain employed for longer terms. Due to the sustained high level of economic growth, mass redundancies have never yet taken place in the private sector. Since forecasts indicate a continuation of rapid economic growth in future, relatively stable employment can be assumed in most cases. Problems can arise when companies use renewal or non-renewal of employment contracts as a means of pressurizing their employees. Under the existing household registration (*hukou*) system, the result of dismissal or non-renewal of an employment contract is not only the loss of income and accommodation, but also the loss of the worker's regional residency permit. Furthermore, in some sectors informal and hence highly insecure employment of workers is widespread (Piepel, 2006).

In the Chinese electronics industry, limited-term employment contracts are the standard practice (Schipper & De Haan, 2005; own investigations). Moreover, some reports attest to the dismissal of workers without notice and the early curtailment of existing contracts. This particular intervention was directed at workers who had campaigned to start a union in their workplace (China Labour Bulletin, 2005a).

Although the hiring of workers from external contract labour firms is mentioned regularly in connection with the global electronics industry (see inter alia CAFOD, 2003), so far this has been relatively insignificant in the People's Republic of China.

6.6.1.9 Social security

Chinese labour law specifies that workers should have basic social security covering the areas of health, unemployment and old age pensions. Nevertheless it is reported that numerous employers fail to comply with these requirements and do not take out obligatory statutory social insurance for their staff. Thus numerous cases have been reported in which staff involved in accidents have been discharged from hospital prematurely because their insurance had not been paid by their employers (China Labor Support Network, 2006).[21]

Although no specific information is available on the social safeguards for workers in the electronics industry, it is safe to assume that similar problems exist, particularly where employment is not covered by proper employment contracts.

6.6.1.10 Professional development

The majority of activities in the Chinese manufacturing industry do not require any special experience or initial training. Assembly line workers generally receive a several-day induction when they commence employment and are then assigned directly to the corresponding position on the assembly line. Due to the very limited career opportunities, further training measures are unnecessary from a commercial viewpoint. Retraining measures aim solely to give basic instructions for new positions. This situation is certainly applicable to the bulk of the electronics industry.

More recently, cases have come to light where student work placement contracts were in use, not so much to fulfil any training function as to enable the temporary employment of young people in the grey zone bordering on child labour (see section 6.6.1.5). However, cases like this have not yet been reported in the electronics industry.

6.6.1.11 Job satisfaction

The situation of Chinese migrant workers is a topic of controversy in the literature. Some authors criticize the generally detrimental effect of predominantly poor working conditions on their quality of life (see sections 6.6.1.1 to 6.6.1.10), the lack of leisure facilities in and around their factory accommodation and the limited access to cultural opportunities (e.g. UBS, 2005). Other studies emphasise the opportunity for young unmarried women “to escape the

[21] In the cases reported, the employers initiated premature dismissals because they were liable for the costs of hospitalization and medical treatment.

confines of the village with its many constraints, at least for a few years, and (often for the first time) to have their own income" (Schmidbauer, 2004). In this connection, reports from various sources mention a growing labour shortage in the last two years, which has put workers in a more positive position of choice and is said to have resulted in slight improvements in working conditions, accommodation and leisure provision (Roberts, 2005). According to the assessment of the Asia Monitor Resource Center (2006) however, this phenomenon is geographically very limited.

Any attempt to assess other people's satisfaction – especially in different cultural contexts – appears fundamentally problematic. Nevertheless, the recent distinct increase in strikes and demonstrations by migrant workers indicates a high level of dissatisfaction. This wave of protest merits all the more attention since the individuals involved are taking significant risks upon themselves (see section 6.6.1.2).

According to the China Labour Bulletin (2006b) the demands of these employee movements can essentially be broken down into three categories:

- Improved working conditions
- Better pay
- Reduced working hours

In some cases these protests result in sizeable production stoppages. One of the largest strikes, in which 10,000 workers took industrial action, took place in April 2005 in a factory producing cordless telephones (China Labour Bulletin, 2005a).

6.6.2 Impacts on local communities

6.6.2.1 Safe and healthy living

Rapid industrialization in the economic centres on the Chinese east coast had drastic impacts on the region's environment. Up until the 1980s, major areas of the Pearl River and Yangtze deltas were still largely agricultural land; now the two regions are the largest contiguous industrialized regions in the world. The region's environment has not escaped these changes unscathed: in situ, it is almost impossible to ignore the manifest evidence of water, soil and air pollution, all of which are having a measurable effect on the health of the local population (see inter alia Loh, 2006). There have even been some reports of deaths associated with pollution of the local environment (Süddeutsche Zeitung, 2005). The extent to which the electronics industry is contributing to these environmental problems has not been investigated in detail so far. What is known is that some segments of the electronics industry – above all, semiconductor manufacturing – cause a disproportionate level of pollution, relative to the economic value they generate (Williams et al; 2002). Similarly, the production of other electronic components is associated with substantial air and water pollution as well as problematic waste materials. According to the results of an LCA for

desktop PCs, the emissions of copper, selenium, mercury, fluoranthene and nickel are the most problematic. The production of printed circuit board material also results in oil emissions. In the manufacturing of PVC parts, wastewater is polluted with cadmium. The assembly of electronic devices, on the other hand, is largely free of toxic emissions (Choi et al, 2006).

6.6.2.2 Human rights

The People's Republic of China is known for regular and frequent breaches of basic human rights. However, such infringements are generally committed by state offices and institutions, and are seldom directly linked with private sector activities. In the course of advancing industrialization, there have repeatedly been incidents where the perpetrators were state actors but private sector actors predominantly reaped the benefits. In this regard, Amnesty International (2005) cites the redesignation of land and the forced resettlement of the resident population for the purposes of industrialization. The use of force to crush protest is reported to be quite common. One case came to light, in January 2006, in which illegally expropriated common land was used for the establishment of a textile factory.[22] One fatality and several casualties were reported as a result of action taken to crush the protests of the affected population (Frost, 2006d). The extent to which establishments in the electronics industry have benefited, directly or indirectly, from expropriation of this kind has not been investigated as yet.

6.6.2.3 Indigenous rights

According to the People's Daily Online (2006), the People's Republic of China is home to 56 ethnic minorities, most of which live in other parts of the country great distances away from the economic boom regions of the east coast. There are at least four indigenous ethnic minorities in the economically significant coastal regions: the *Gaoshan*, the *She*, the *Yao* and the *Zhuang*. It was not possible to determine the extent to which these groups are adequately included in or excluded from the region's economic development.

[22] According to Frost (2006d), whilst the residents were willing to sell the land, the agreed compensation payments were not in fact subsequently paid.

6.6.2.4 Community engagement

The less democratic elements of the state system in the People's Republic of China are well known, an issue that is repeatedly decried from the western perspective. Under these conditions it is difficult to set up, either independently or in cooperation with state bodies, functional complaints systems for residents and other directly affected population groups.[23] It was not possible to ascertain the extent to which any such systems have been established and are functioning nevertheless.

6.6.2.5 Social and economic opportunities

The large number of new industrial estates on the east coast of the People's Republic of China has undoubtedly led to substantial economic growth and rapidly rising per-capita income in the locality (Auswärtiges Amt, 2005; Ping & Shaohua, 2005). In the course of a rapid technological learning process, this economic growth has also been a springboard for the creation of numerous high quality jobs. The great demand for low-qualified workers opens up employment opportunities primarily for migrant workers from other parts of the country. Whist the quality of these jobs is extremely doubtful in many cases (see section 6.6.1), these employment opportunities certainly offer alternatives to agricultural work or the rural unemployment which is widespread. Ping & Shaohua (2005) assert that money transfers from migrant workers to their home regions also spread positive social and economic benefits to those regions.[24] Moreover, many migrant workers return home with savings which enable them to found their own small businesses and achieve a not inconsiderable level of social advancement.

These positive economic and social impacts at local level are often offset by negative effects, however: besides the risks to health and safety (see section 6.6.2.1) and the resettlement of local communities (see section 6.6.2.2) the establishment of industrial plants generally competes for environmental resources with environmentally-dependent sectors, particularly agriculture and fishery. Employees in these sectors can therefore be assumed to suffer a decline in social and economic opportunities.

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[23] "Description of jointly managed community grievance mechanisms / authority" is one indicator in the Sustainability Reporting Guidelines 2002 of the Global Reporting Initiative (2002).

[24] According to Ping & Shaohua (2005), cash transfers from migrant workers to their regions of origin are primarily used to meet regular housekeeping expenses, for children's education, house building and improving agricultural production.

6.6.3 Impacts on society

6.6.3.1 Public commitment to sustainability issues

According to He (2006) the concept of social and environmental corporate responsibility is fairly new and, as yet, not particularly developed in China. Existing concepts derive mainly from multinational corporations who adopt these approaches with the aim of protecting their brands from reputation-damaging scandals. Whilst approaches involving certification to environmental standards are widespread (esp. ISO 14001), large numbers of forged certificates are increasingly bringing their credibility into question. One exception in the field of social standards is the fraud-proof SA8000 certificate, which is currently held by close to 100 Chinese plants and firms.

This general picture is certainly applicable to the electronics industry: social and environmental values are generally proclaimed only by brand-name manufacturers of international stature on their websites, in sustainability reports and within the context of sector and industry alliances. In the electronics sector there are currently only two relevant alliances on sustainability issues: the Global e-Sustainability Initiative (GeSI) with a membership drawn predominantly from telecommunications firms, and the Electronic Industry Code of Conduct (EICC) whose members are primarily large international electronics firms (cf. section 6.3). The significant absence of Asian manufacturers[25] makes it clear that seen from a Chinese perspective, these are predominantly external initiatives.

So far four plants in the Chinese electronics industry hold SA8000 certification.

Confusion was caused by a report in the South China Morning Post of 22.04.2006, according to which the European Chamber of Commerce in China was campaigning against a planned revision of the existing labour legislation. According to the newspaper article, the Chamber of Commerce was criticizing plans to strengthen workers' positions where the terms of employment contracts were unclear, and to give unions a greater role in the event of mass redundancies. The criticism from the Chamber of Commerce thus clearly contradicts other efforts to improve working conditions in China. Various electronics firms are among the members of the European Chamber of Commerce.

[25] The membership of the EICC currently includes three Asian electronics firms: *Flextronics* (Singapore), *Foxconn* (Taiwan) and *Sony* (Japan). *Panasonic Mobile Communications* (Japan) is the only Asian representative in the GeSI.

6.6.3.2 Unjustifiable risks

Flows of Chinese migrant workers are shown to have a causal relationship with the spread of HIV/AIDS in China (Winkelmann, 2004; Frost, 2005). The extent to which actors in the Chinese economy, and the electronics industry in particular, are contributing to solving this problem is largely unknown.

Beyond this, the electronics industry, and particularly the manufacturing of electronic household appliances, is not under suspicion of directly generating unjustifiable risks for the rest of society. One such risk would be the use of nuclear energy for electricity production, with which there is an indirect relationship by virtue of the energy consumption of electronic devices.

6.6.3.3 Employment creation

As discussed in section 6.6.2.5 above, the electronics industry provides a large number of jobs which make varying levels of demands. The major economic importance of the industry (7% of GDP) gives further weight to this number. Particularly in the field of assembly and testing of electronic devices, there is enormous demand for manual labour. However, even in China, jobs are increasingly being replaced with automated production processes. For example, until a few years ago the mounting of PCB components was still seen as a very labour-intensive area, but in the interim this manufacturing process has been almost entirely automated, particularly in the highly integrated electronics segment. For the time being, however, the unrelenting pace of economic growth is largely compensating for this effect. Moreover, for the foreseeable future, job losses due to offshoring of processes from mainland China are not anticipated.

However, for the purposes of this study it must not be forgotten that the high concentration of production in China entails negative effects on labour markets elsewhere. Particularly in emerging economies such as the Philippines and Mexico, job losses are being recorded in this connection.

6.6.3.4 Vocational training

The promotion of university education is a keystone of China’s current economic success. In addition to the country’s sheer volume of cheap labour, this policy aims to embed industrial and economic know-how to bring long-term stability to the economic upturn. However, this education campaign is largely sponsored by state actors (the universities, for instance) (Flavin & Gardner, 2006). In the private sector, and particularly in the mass production of export products, the role played by initial and further training programmes is of minor importance.

6.6.3.5 Corruption

On the Corruption Perception Index published annually by Transparency International, in 2005 the People's Republic of China ranked in 78th place (out of 158). According to Transparency International (2005), government offices and the building industry are currently perceived by the public as major focuses of corruption. In an earlier study by the organization, it was also found that among the globally operating firms from the 21 leading export nations, Chinese firms (after Russian firms) were the second most willing to pay bribes to high-ranking officials, with Taiwanese and South Korean firms not very far behind, according to data in the report. Furthermore, a greater willingness to engage in corrupt practices is generally found in local firms than in foreign actors (Transparency International, 2002).

Although these general evaluations do not permit adequate conclusions to be drawn for the electronics industry, it can certainly be assumed that companies in China are expected to make irregular payments in certain situations. To what extent corporate action itself contributes to or combats corruption could not be clarified in this context.

6.6.3.6 Social and environmental minimum standards for suppliers

As shown in section 6.6.3.1, concepts of social and environmental corporate responsibility are largely new in China. As a rule, only global operators impose standards on their suppliers. Checks to ensure compliance with minimum standards are generally done with the aid of audits, which are carried out by the company's own employees or by commissioned firms. Recently, the effectiveness of such audits has been called into serious question (see inter alia Piepel, 2006; Clean Clothes Campaign, 2006). In addition to the methodological limitations of these measures, a further point to note is that where the lower tiers of value chains are highly articulated, normally only the larger suppliers will be covered by the system. Smaller firms and aspects of the value chain not immediately linked to the specific product (suppliers' subcontractors) are not inspected in many cases.

The Chinese electronics industry is no exception in this respect. Admittedly most large brand-name manufacturers of electronics products operate social and environmental codes of conduct, but the importance of compliance with the stated principles is only stressed to large suppliers by means of social audits and Supplier Days. There is no equivalent system covering firms in the lower tiers of the supply structure.

6.6.3.7 Contribution to the national economy

The annual growth rate of the Chinese economy has not fallen below 7.2% at any point in the last ten years, and has taken China from the status of a developing country into the echelons of the world's most important economic players. This rapid growth has also led to a clear reduction in poverty: between 1981 and 2001, average per-capita income trebled. In the same period, the proportion of the population living in extreme poverty fell from 64 to 17%[26] (Jenkins, 2005). Thus the People's Republic of China is making a significant contribution to achieving the Millennium Development Goals (United Nations, 2005).

The electronics industry accounts for a substantial 7% share of GDP and thus has a significant role in this development. High-tech industry, which obviously includes large sections of the electronics industry, is expected to continue to play a key role in the country's economic development in future (Auswärtiges Amt, 2005). Given the current level of investment in the field of electronics production, these expectations appear perfectly realistic. The trend for shifting industries to China continues unabated and the large number of modern and capital-intensive production facilities make any immediate reversal of this trend seem improbable. What needs to be considered, however, is that whilst on the one hand the unit shipments of manufactured goods are rising significantly, profit margins are subject to downward trends across the board (Taylor, 2005).

Great uncertainty currently prevails as to the possible impacts of social developments on economic growth. Although the proportion of people in absolute poverty has been reduced significantly, the gap between rich and poor is widening at great speed. Whilst higher income groups have largely reached the standard of living which is familiar in classic industrialized countries, a large proportion of China's 150 million migrant workers have an income which is only marginally above the absolute poverty line. According to Messner and Humphrey (2006), there is no country in the world where social polarization is growing at such a pace as in China. It is unclear how far the social consequences of economic development permit sustainable growth at all. This concern is shared by many, including high-level decision-makers in the People's Republic of China (Cody, 2005b).

Besides considering the opportunities and risks of the electronics industry in China, it must be kept in mind that China's dominance of labour-intensive manufacturing industries has serious consequences for the economies of other newly industrializing countries. The manufacturing industries in countries such as the Philippines and Mexico are coming under enormous competitive pressure because of developments in China. These countries face the threat of serious [economic] upheaval, according to Jenkins (2005).

[26] The definition relied upon here is that of the World Bank, whereby people are extremely poor if they have to live on less than 1 dollar a day.

6.6.3.8 Contribution to the national budget

China's industrial development is substantially steered by the state through the designation of special economic zones. In these zones, firms are exempted from import and export duties, in addition to which they receive further tax concessions. Besides these direct tax concessions, additional economic incentives are offered to companies producing future-oriented technology (Auswärtiges Amt, 2005). Thus the Chinese government is pursuing a policy of active promotion of private enterprise which, although tax receipts from individual companies are low, nevertheless generates substantial revenues thanks to the large numbers of firms. This strategy is not restricted to the People's Republic of China but is currently standard practice in most industrialized countries and emerging economies.

Another point to consider is that externalized costs such as water pollution and harm to the health of employees and local communities will rebound as societal costs in the medium and long term, and eventually take their toll on the national budget.

Data on the electronics industry's contribution to the national budget could not be obtained.

6.6.3.9 Impact on armed conflicts

China's economic development has a range of impacts on the global security situation. On the one hand, interdependencies among major economies has led to a de facto calming of international conflicts (USA-China, China-Taiwan). On the other hand, heightened demand in the raw materials markets also gives rise to conflicts over resources. This last point in particular has some relevance for the electronics industry. In 2001 the electronics industry was accused of indirectly financing the war in the Democratic Republic of Congo, due to the sector's high demand for tantalum[27] (see inter alia Hayes & Burge, 2003). Whilst the market for the metal stabilized again after 2001, the general complex of problems has persisted: various metals used in electronic components are supplied from regions of the world which are rife with political instability. Some of these raw materials – including tantalum and to a lesser extent palladium – are used primarily in the electronics industry, so the societal, political and environmental impacts of their supply can be attributed more or less directly to the electronics industry.

Numerous experts consider that China's increasing social polarization harbours a substantial potential for conflict, with risks to political stability (see inter alia Alpermann, 2004; Messner & Humphrey, 2006). Last year, for instance, even according to official data there were 87,000 social conflicts and protests. This is an increase of 18% in comparison with the year 2004, and 50% compared with 2003 (Willmann, 2006). The rising number of violent protests also

[27] The precious metal tantalum is supplied in the form of the columbite-tantalite ore – better known by the contracted form of its name, "coltan".

poses major challenges for the Chinese government. The primary causes of these protests are said to be the expropriation of agricultural land for industrial use, the pollution of agricultural resources, and conflicts between company managers and migrant workers (Cody, 2005a). All these causal factors are closely related to China's economic development. The degree to which influences from the electronics industry are playing a part as triggers of conflict can essentially be concluded from the sections "Impacts on employees" (6.6.1) and "Impacts on local communities" (6.6.2).

6.6.3.10 Transparent business information

According to a study by Standard & Poor's (quoted after Transparency International, 2003), Chinese firms on average publish only a little more than 50% of relevant business information. Nevertheless, Chinese firms still rank ahead of Taiwanese (25%) and South Korean firms (50%), whereas Japanese firms publish 60% of the relevant information.

Besides merely publishing economic results, large internationally-operating corporations generally also publish data on social and environmental performance in sustainability reports. Whilst these do not currently fulfil all the criteria set out in the GRI Sustainability Reporting Guidelines (GRI, 2002), distinct improvements have been noted in this area (SustainAbility, 2004). Similarly, large internationally-operating electronics companies usually present sustainability reports. Information about suppliers and their social impacts and measures are very rarely available through these channels, however. From the usual publications it is therefore impossible to gain any coherent picture of the number, sizes and locations of suppliers. In many cases, this information is not adequately documented even for corporate-owned factories. Although Taiwanese and Chinese electronics manufacturers are often more transparent with regard to production locations, information on sustainability aspects tends not to be provided.

6.6.3.11 Intellectual property rights

The infringement of intellectual property rights is a central theme running through the debate on China's suitability as a business and production location, and indeed played a prominent role in Hu Jintao's official visit to the USA in April 2006.

In the context of the electronics industry, there is reportedly a high risk of infringement of intellectual property rights (Sperling, 2003a).

6.7 Specific social impacts of the notebook PC industry

The notebook PC industry was investigated in greater depth in the course of a study trip to Shanghai and Suzhou in April 2006. The insights from this research are presented below and, together with the findings from sections 6.1 to 6.6, form the basis for further conclusions. In total three factories were visited: the notebook manufacturers *Quanta* and *Uniwill*, and a *Foxconn* factory making case parts. The visit to *Foxconn* was unannounced, while the management at *Quanta* and *Uniwill* had advance notice of the visit. The methodology applied consisted of qualitative interviews, factory tours, and viewing of workplace environs (accommodation, canteens, leisure facilities). Due to time constraints and for organizational reasons, it was not possible to inspect internal documents in any of the workplaces. In total, ten detailed interviews and several shorter ones were carried out. The people surveyed consisted of representatives of middle and upper management, the human resources department, the facilities management, and assembly line workers. Furthermore, two high-level representatives of the firm *Fujitsu-Siemens* in China and Taiwan were interviewed about relationships with suppliers and about social aspects of the value chain. In a further detailed interview with a German employee working for *Hewlett-Packard* it was possible to confirm and explore various findings which were generally transferable to notebook PC manufacturing. In addition, *Hewlett-Packard* permitted inspection of its internal procedures as well as various audit reports.

The analysis was limited from the outset to the impacts on employees; that is, impacts on local communities and impacts on society were not covered. It should also be noted that only selected production sites could be viewed and that these are positioned in the part of the value chain immediately linked to the specific product. Potential problems in other segments of the value chain, like the health impacts associated with the production of parts and subcomponents, were not touched upon.

6.7.1 Impacts on employees

6.7.1.1 Health and safety in the workplace

The assembly of notebooks (*Quanta* and *Uniwill* factories were visited) is a largely manual process. The assembly process does not involve the use of any toxic substances or other chemicals. During the assembly and subsequent testing of the devices, there is no significant risk of accidents caused by machines or transportation equipment. In the premises inspected, emergency escape routes are clearly marked, and sprinkler systems and fire extinguishers are in evidence. The workplaces are well lit and ergonomically sound on the whole. In most cases, assembly involves relatively large (approx. coin-sized to matchbox-sized) components. Some workers do handle smaller parts (screws), but not so small as to tax their eyesight unduly. When testing the devices, some tasks to be completed demand

concentration over long periods and make heavy demands on workers' eyesight (visual inspection of devices and on-screen checks). Work on the assembly line, along with device-testing, is highly monotonous, meaning that the demands it makes are predominantly mental. This is especially true during periods when large amounts of overtime are required.

The production of case parts (a *Foxconn* factory was visited) is fundamentally different from the assembly of devices: the parts are manufactured using an injection moulding process and subsequently coated in clean rooms. Although the granulated plastic is melted in a closed process, the smell of the indoor air indicates that it is still polluted with vapours. This primarily affects workers who are assigned to deburring the plastic products in the direct vicinity of the moulding machine. The production hall visited seemed relatively well ventilated, nevertheless. The clean rooms for coating could not be entered, but were viewed through a glass panel: plastic parts are spray-coated manually. Although the workers wear protective clothing and simple face masks throughout, the fine atomization of the spray makes it reasonable to assume that workers pick up some contamination. Moreover, the factory made a somewhat disorganized impression: although fire-extinguishers and sprinklers were installed, the improper storage of goods (all sorts of cases, boxes, furniture etc.) in offices and corridors in the immediate vicinity of the production halls raise doubts about organization and fire safety. Intermediate products are transported to where they are needed for the next phase of processing through intermediate storage halls within the plant. This practice calls for the use of forklifts at various points in the production process. Although the routes used by the vehicles are marked on the floor, the relatively tight gangways are also the workers' preferred route between factory halls.

From documents supplied by *Hewlett-Packard* it is also clear that health and safety in the workplace is a problem at different points in the notebook PC industry supply chain, and does not yet meet the standards of the EICC. The main problems cited are inadequate supervision of the handling of chemicals, poor emergency prevention, and physically demanding and unergonomic work processes. With regard to the handling and storage of chemicals, however, *Hewlett-Packard* reports clear improvements in one of its notebook manufacturers.

6.7.1.2 Freedom of association, right to collective bargaining

Workers were not organized in trade unions in any of the factories visited. Although this is perfectly normal in the Chinese context (see section 6.6.1.2), there was no alternative form of worker co-determination either. In the canteens at *Uniwill* and *Foxconn*, letter boxes were installed into which anonymous complaints could be posted.

6.7.1.3 Non-discrimination, equal opportunities and fair interaction

In all the factories studied, the vast majority of employees were young women aged between 18 and 25. Nevertheless in some sections of production, (young) male workers were also found. When interviewed, the staff from the human resources departments stated that there had never yet been a case where an older employee had requested extension of an employment contract and been turned down on age grounds. When asked about the high proportion of young women, they replied that targeted recruitment methods were used, but that employment opportunities were available for men as well. All in all, however, it seems rather implausible that the composition of staff observed could be achieved without overt or covert discrimination in the hiring process. Audits by the firm *Hewlett-Packard* reach a similar conclusion on this point.

The human resources department of the firm *Uniwill* admitted to occasional problems in relationships between foremen and assembly line workers.

6.7.1.4 Forced labour

There were no signs of forced labour at any of the factories studied. According to the responses of human resources staff, wages are paid on time at the end of the working month. In the event of dismissals, wages are settled for the exact hours that staff have worked. After enquiring among employees, these responses seem credible.

6.7.1.5 Child labour

There were no signs of child labour at any of the factories studied. According to the responses of the firms' managers, reaching the age of 18 is a basic prerequisite of employment.

6.7.1.6 Remuneration

In all the factories studied in the region of Shanghai and Jiangsu, assembly line workers received the statutory monthly wage of 690 renminbi (approx. EUR 69) for a 40-hour working week. According to the responses from the human resources departments, overtime is paid in line with statutory requirements at 150% on weekdays, 200% on weekends and 300% on public holidays. At *Uniwill* workers receive RMB 850 for a 40-hour working week, but out of this they have to meet the costs of board and lodging.[28] The resulting basic pay is practically

[28] Whereas *Quanta* employees are housed in free factory accommodation, this is not legally possible in the industrial zone where *Uniwill* is based. Workers are therefore accommodated off-site and have to meet the relevant costs from their wages. Transport between home and the workplace is financed by *Uniwill*. The firm also assists in finding suitable accommodation.

identical with the level of wages in other factories. At both *Quanta* and *Uniwill* workers are provided with lunch or (on night shifts) an evening meal free of charge.

From the questioning of employees, it was possible to obtain broad verification of the wage scales paid at *Uniwill*.

6.7.1.7 Working hours

The official standard working hours in all factories are the statutory 40-hour working week. These are completed as eight-hour days on the five weekdays. Work is interrupted for one ten-minute break morning and afternoon, and for a 40-minute lunch break.

Overtime and night shifts are the rule, especially during production spikes. Care is taken over night shifts to ensure that workers switch shifts as little as possible. In the event of a shift change, the workers concerned are given a day off for acclimatization purposes. Day and night shifts are coordinated so that both shifts of staff can complete up to three hours of overtime a day. This enables two shifts to keep the production process going around the clock, with the exception of the ten-minute and 40-minute breaks.

According to information from the *Uniwill* human resources department, care is taken to keep the monthly overtime load within the statutory limit of 36 hours. On the other hand, there are instances where total weekly working time exceeds 60 hours. The information from *Quanta* and *Foxconn* was less transparent at this point. Nevertheless, various actors hinted that substantial overtime loads of up to 100 hours of overtime per month and more, in some cases, were the industry norm. *Hewlett-Packard* also reports instances of a non-stop seven-day week, but also stresses that some of its suppliers had recorded significant improvements.

Apart from statutory public holidays and the week of the Chinese spring festival, all firms give their employees very little time off for holidays. *Quanta* does not grant any days of holiday in the first year of employment. In the second, third and fourth years of employment, three days of holiday are allowed, rising to seven days from the fifth year onwards.

6.7.1.8 Employment security

The *Quanta* human resources department stated that employment contracts are limited to two years as a matter of policy. At *Uniwill* they are normally limited to a one-year term. Employment contracts are usually renewed once they expire. To raise production during peak periods, additional short-term (three-month and six-month) contracts are issued. So far, according to responses from various sources, the hiring of contract labour firms has not been a notable feature of notebook PC manufacturing in China.

Due to the constantly growing volume of orders, as yet neither *Quanta* nor *Uniwill* has ever resorted to large-scale redundancies on commercial grounds.

6.7.1.9 Social security

All the firms studied stated that they insured their workers in accordance with the statutory requirements. This refers to health, unemployment and pension insurance.

6.7.1.10 Professional development

Quanta operates a trainee programme which aims to attract university graduates to work for the firm. At both *Quanta* and *Uniwill*, assembly line workers undergo a two-week induction phase, with follow-up training in the event of unsatisfactory work performance.

6.7.1.11 Subjective job satisfaction

According to information from the *Uniwill* human resources department, there are often complaints about the behaviour of individual foremen on the assembly lines. The anonymous complaints received through the complaints system (see section 6.7.1.2) mainly concern the transport arrangements to and from work and the quality of the canteen food. The annual "Tourism Day" laid on by *Uniwill* receives an enthusiastic response. The entire workforce is taken on a three-day excursion to a Chinese holiday destination. According to one worker who, from her shared living accommodation, has a good network of contacts with employees in other firms, the working conditions – including working hours and remuneration – are virtually identical in every respect with those of other factories and industries based in the region.

At *Quanta* it was possible to view the workers' accommodation. They are housed in eight-bed rooms in a campus-like complex. The facilities viewed certainly appeared to be very well looked after. In addition, various facilities were provided for leisure (television rooms, sports facilities, libraries etc.), shopping and medical care. However, audit reports by the firm *Hewlett-Packard* attest to occasional breaches of hygiene regulations and permitted accommodation densities in the notebook supply chain. At one of its notebook manufacturers, however, *Hewlett-Packard* also reports significant improvements on this aspect.

6.7.2 Impacts on local communities

The impacts on local communities were not investigated in detail for this study.

6.7.3 Impacts on society

The impacts on society were not investigated in detail for this study. The only impact assessed was the effect on employment, based on the firms' responses:

Quanta employs a total of 30,000 staff of whom 20,000 work in the mass production of notebooks. *Uniwill* employs a total of 2,700 staff of whom 1,700 work in notebook production. Projecting these figures for the entire unit shipments of notebook PCs, it can be estimated

that approx. 60,000 employees are engaged in notebook assembly. If the production volume of the firm *Wistron* is excluded from the calculation (since the firm manufactures the majority of its notebooks in the Philippines), the number of employees in the People's Republic of China is still an estimated 50,000 at least. A representative of *Fujitsu-Siemens Computers* estimates the number of employees working in notebook production in China to be as high as 75,000.

7 Assessment of social impacts

7.1 Suitability and scope of the methodology

The methods used – stakeholder involvement, review of general studies on the electronics industry in the People's Republic of China, factory visits and qualitative interviews – permitted good insights into the structure, trends and problematic issues in notebook manufacturing. Nevertheless it was not possible to address all the potentially problematic aspects of the value chain in sufficient depth. Essentially the present study can only make an assessment of social impacts in the part of the value chain immediately linked to the specific product. Whilst it has been possible to identify potential hotspots in other parts of the chain, a systematic survey remains to be carried out. In a few areas, quantiative assessments were made (workload, wage levels in comparison with other electronics production locations), but due to the inaccessibility of the relevant information it is difficult to systematize these calculations for the entire value chain.

With regard to the ongoing development of Social Life Cycle Assessment (SLCA), this problem cannot be expected to change substantially in the foreseeable future. Structured analyses will thus continue to rely on diverse, unstructured information from different sources. Currently, databases containing quantitative indicator values for unit processes, as used in LCAs, are not in prospect.

The case study shows that comparative assessments of individual social aspects often yield a substantial amount of useful knowledge. Particularly by means of comparisons with other locations and other industrial sectors, aspects often become apparent which can bring greater objectivity to the discussion. For this reason, it is recommended that more comparative surveys of this kind should be carried out during SLCAs.

Looking to the future of SLCA, it is anticipated that at least the availability of individual items of information will improve. In the last few years, for example, there has been a clear increase in the number of reports of varying scope and depth on a range of social problems. This includes not only the reporting done by NGOs and workers' rights organizations. There is also a greater willingness of some companies to allow access to internal documents and procedures. For the work on this study, for instance, the firms *Fujitsu-Siemens Computers* and *Hewlett-Packard* were highly willing to cooperate, even on sensitive issues. Furthermore,

government offices in emerging economies – in the face of rising levels of social protest and unrest – have taken a growing interest in the transparent analysis of social problems.

7.2 Impacts on employees

From the data collected on unit shipments, employees, working hours, remuneration and the assessments of industry representatives, it can broadly be determined that in the People's Republic of China, between 50,000 and 75,000 people are employed in the assembly of notebooks for the mass market. The wage costs of final notebook assembly (including insurance and accommodation of the workers) amount to approx. EUR 1 to 2 per device.[29]

Assuming that these figures are representative for all labour-intensive production processes in the notebook PC industry (assembly of optical drives, battery packs, power supplies, etc.) and assuming that ten times as much labour is required for the production of all other components, then wage costs for the labour-intensive manufacturing processes would not appear to be much in excess of EUR 30 per device.

The analysis in chapter 6 also makes it clear that almost all areas of notebook PC production have close links with Chinese electronics production. Although the firms active in the segments of the value chain immediately linked to notebook production are primarily multinational corporations,[30] the bulk of their labour-intensive production processes are carried out in the People's Republic of China. Working conditions in large multinationals are generally subject to stricter state supervision than in smaller local firms. As a consequence, conditions pertaining to aspects such as child labour and forced labour, remuneration and social security are basically aligned with the statutory requirements. With regard to aspects like working hours, whilst statutory requirements are acknowledged in employment contracts, it can only be assumed that systematic overriding of the limits will continue, particularly during periods when companies' capacity is fully stretched. Similar reservations apply to the payment of overtime, in isolated cases. Despite everything, in these areas as in others, multinational corporations generally provide rather better conditions than many local employers, a fact which has also been acknowledged in relation to the electronics industry in the Philippines (Workers Assistance Center, 2003). A further reason that conditions in this sector are often better is that high standards are set for product quality. In contrast to cheap

[29] For the calculation, between 2.5 and 3 working hours per device were assumed (see section 7.4). Other assumptions were a monthly basic wage of RMB 690, with overtime compensation of 150% (lower estimate) 100% (upper estimate), an insurance contribution of 14% and housing costs of RMB 150 per month.

[30] The definition of multinational corporations used here includes firms which have only one foreign production facility outside the country in which they are domiciled. In the electronics industry this most often applies to Taiwanese companies with production locations in mainland China.

mass-produced products, quality defects in notebook PCs inevitably lead to refund claims and thus to high commercial costs. It is fairly well known that poor working conditions have negative implications in this respect. Nevertheless, the impression arose during the research that certain suppliers do not yet give due credence to this correlation.

Despite relatively low living costs, assembly line production in the People's Republic of China only permits workers a relatively low standard of living. Whilst it is still higher than for many alternative forms of employment (particularly in agriculture), in comparison to their counterparts in industrialized countries, Chinese electronics workers must work several times longer to purchase a representative basket of goods.

It appears problematic that locally, barely any difference could be observed between different multinational employers in respect of pay and working hours. Whilst it seems entirely possible that this situation has arisen spontaneously as a result of competition for workers and efforts to reduce fluctuation, there is also a suspicion that informal collusion between human resources departments has given rise to a de facto collective pay agreement, which has not at any point been negotiated with workers' representatives.

In respect of health and safety in the workplace, no conclusive analysis could be accomplished. Although the assembly line processes required to assemble the final product proved low risk, since they are largely free of potentially toxic substances, the same cannot necessarily be assumed to apply to other production processes – particularly the production of plastic parts, semiconductor material, printed circuit boards, electronic components and battery cells. In these areas, harm to the health of workers (and local communities) cannot be ruled out, and is considered highly probable in some sub-segments.

At this point the limitation of the study becomes evident: the characteristics and structures of the notebook PC industry could only be examined up to a certain point. In the field study, enquiries were restricted to the assembly of notebooks and, in a limited way, the production of case parts. Breaches of basic workers' rights in other parts of the supply chain cannot be ruled out, by any means. Indeed, considering the complexity of the value chain and the diverse potential for social problems in the electronics industry, the existence of such breaches is a strong probability.

A problematic issue in this connection is that the state control mechanisms often fail to deal effectively with breaches of workers' rights, whilst many industry-led initiatives do not go substantially beyond risk management. An especially critical point is that while trade union organization is limited under Chinese law, within the industry little or no use is made of the scope that does exist. Experience from other sectors has shown, however, that the given problems cannot be solved without the workers' participation. The current approaches to supplier auditing are also distinctly limited in this respect.

7.3 Impacts on local communities

The impacts of the notebook PC industry on local communities are largely undocumented. Nevertheless, based on the general situation in the notebook industry, some assertions can be made about local social impacts. This involves such aspects as the contribution to economic growth in the industrial regions of the Chinese east coast and the associated rise in per-capita income, the creation of employment opportunities and positive impacts on the migrant workers' regions of origin. On the other hand, it must not be forgotten that, to a certain extent, these effects have been brought about by global processes of production shifting from elsewhere. Therefore positive aspects are partly offset by negative aspects in other locations.

Considering the rising number of violent protests following the redesignation of agricultural land as industrial zones, and the major environmental impacts of many industries, this will be a theme of growing importance for the electronics industry, and hence for the notebook value chain, in future.

7.4 Impacts on society

As one of the elements driving the economy of the People's Republic of China, the notebook PC industry is playing its part in distinctly reducing levels of absolute poverty. In addition to the pure concentration of industrial processes in the People's Republic of China, the high employment intensity of many manufacturing processes also contributes to this effect. Assembly of the devices alone provides employment for between 50,000 and 75,000 people in China. The assembly of a notebook PC requires a cumulative labour input of approx. 2.5 to 3 hours.[31] Moreover, taking account of other labour-intensive manufacturing processes (assembly of the power supply, battery pack and optical drive) and the less labour-intensive industries (manufacturing of plastic parts, manufacturing of subcomponents) then figures several times greater can be assumed for employees and labour input per notebook. But here, too, the positive employment effects in China are offset by negative effects in other electronics production locations – particularly in newly industrializing countries such as the Philippines and Mexico.

The nature and characteristics of industrial development in China are acquiring special significance because the stability of the region depends substantially on China's social and political development. Although its current economic development is bringing about a distinct

[31] The estimate assumes an annual production volume of 60 million units. The lower estimate is based on 50,000 workers averaging 250 working hours per month, while the upper estimate assumes 75,000 workers and an average of 300 working hours per month.

reduction in absolute poverty, there is no other country in the world where social polarization is increasing at such a pace. There is an obvious relationship between the clear increase in protests, in some cases violent ones, and conflicts between companies and workers and companies and local communities, underscoring that corporations bear a great responsibility for sustainable social development in the People's Republic of China. Aside from the political challenge of formulating effective framework conditions, clearly private sector actors also have responsibilities to fulfil.

In the global context, the electronics industry and hence the notebook industry can be linked with various political and social crises by virtue of the special raw materials they use. This became obvious in the year 2001 when a sudden rise in the price of tantalum exposed the economic links between the electronics industry and the war in the Democratic Republic of Congo.

8 Evaluation of results and recommendations

8.1 Methodological recommendations

In the present case study, the social impacts caused by the production of notebooks have been structured and illustrative data has been gathered. In addition to the actual object of study – the social impacts – a further aim was to enhance the development of the Social Life Cycle Assessment methodology with a case study. In doing so, it has been possible to gain valuable experience which is useful for general application to other products with complex value chains.

8.1.1 Methodological aspects relating to individual indicators

Particularly in the Chinese political and regional context, data collection and evaluation on individual social indicators proved difficult. This is most evident with reference to the example of *freedom of association.* Since there is no provision for independent workers' representations in China, some actors consider the use of corresponding indicators to be invalid. According to this line of argument, as a matter of principle companies cannot be held accountable for the political and social framework conditions in which they operate. Other actors argue that companies are always an integral element of society, and help to shape it through their active or passive engagement with that society. While these actors do not hold individual companies responsible for prohibiting independent trade unions, they do explicitly incorporate company-specific commitment into their demands and assessments, and see alternative options for them to act in keeping with the spirit, at least, of freedom of association (see section 6.6.1.2).

Likewise the topic of *migrant workers* makes it clear that how one evaluates survey data and other undisputed data can vary greatly depending on one's point of view. Whilst some actors

emphasise the new employment opportunities for rural workers and attribute structural deprivation to the state household registration (hukou) system and rural poverty, a few NGOs see migrant workers primarily as victims of private enterprises. Similarly, varying interpretations can be put on the large number of regular and overtime hours worked each week by employed migrant workers, because some of them are certainly interested in earning as much money as possible for the duration of their time-limited contracts (cf. section 6.6.1.7).

The *gender-specific discrimination* in the Chinese electronics industry is a further area for discussion. On the one hand, it is predominantly women who are subject to the (poor) working conditions in the manufacturing industries. On the other hand, factory work is an acknowledged opportunity to escape the social constraints of rural regions for a while. Hence, the precise conclusions drawn about these themes depend greatly on the individual position and attitude of the observer. For the most objective possible assessment of such themes, longer-term discussions on the individual issue areas must be pursued.

8.1.2 Implications of the incomplete data basis

The poor availability of data posed a central challenge for this analysis. The question that arises here for future users is whether it seems worthwhile to invest scarce resources in the comprehensive collection of literally tens of thousands of items of data. In particular, NGOs and workers' representatives can be expected to object, not unjustifiably, that detailed compilation of data does not provide any actual solutions to social and societal problems. The experience gained so far demonstrates that the only sensible answer is to seek a middle path: analyses must be based on sufficiently well-founded data and information, but excessive data gathering is not helpful. This is partly because the majority of social issue areas are substantially more difficult to quantify and evaluate than ecological themes. Hence, even strict schematization of the analysis by no means guarantees the objectivity of the assertions. Moreover, social impacts are often subject to major temporal and geographical deviations which bear absolutely no comparison with the bandwidth of LCA data. Thus it would be a never-ending task to amass an exhaustive collection of social indicator data. Nevertheless, developments in data availability should be closely observed and documented. The fundamental recommendation is to use and add to all kinds of information (at process level, factory and company level, industry and sector data, information on social and economic conditions in the region or country) even-handedly for SLCAs (see section 5.2).

For SLCAs in complex value chains, the greatest data deficiencies currently relate to production processes not immediately linked to the specific product. Improving the availability of data for these parts of the cycle would significantly increase the quality of results.

The analysis of social impacts throughout product life cycles and systems currently seems to be the only effective method of extending sustainability assessments to complex industrial products. For this reason, for the time being at least, it is necessary to find ways of carrying

out such analyses at an acceptable cost. To this end, in principle a variety of approaches should be pursued:

Systematization of indicator values for raw materials, feedstocks and energy supply

The establishment of systematic databases of social indicator values seems a particularly promising approrach for these aspects. In contrast to very product-specific manufacturing processes, these will be required in almost all future SLCAs. Hence the research effort on this issue seems especially worthwhile. Ideally such a database would contain national average values (number of employees per unit of quantity, occupational accidents, economic importance, etc.) on all key raw materials, feedstocks and energy supply.

Focusing on social hotspots

Complex industrially manufactured products can generate a variety of significant social impacts over their life cycles. In the case of electronics products, these include the extraction of special raw materials, the production of electronic components, assembly line workers' working conditions, recycling and waste treatment. To date, the research carried out on these themes varies greatly in scope and depth. Whilst an increasing number of high quality studies are being published on the impacts of recycling, comparable studies concerning the manufacturing of single components are practically non-existent. Here it is necessary to identify individual hotspots more precisely and fill gaps in knowledge with concrete analyses. With the aid of a standard system of indicators, these should then be related to research carried out on other stages of the life cycle. The adoption of such a procedure would not produce a complete product-related SLCA immediately, but it would create a structured overview of the social hotspots in the life cycle for the first time. Another advantage would be the open-ended character of the analysis: if studies on other phases of the life cycle are published at a later date, these can be integrated retrospectively to complete the existing picture.

This procedure – i.e. focusing on analyses of known and suspected hotspots – is also to be recommended for other complex value chains.

Qualitative analyses and indentification of optimization potential

An alternative approach, and one which could also be used as a supplement to other methods, is not to carry out an LCA with the aim of establishing a quantitative ranking, but to focus on identifying areas which are intrinsically problematic and potential ways of improving them. Although there is a risk of being led astray here by under- or over-reporting of particular issues, conscientious procedures together with stakeholder involvement can guard against this. The findings would then not be so much a quantitative description of the status quo as an identification of measures to improve social impacts. As the next step in assessing

the sustainability of products, concrete product- and manufacturer-specific criteria can be derived from the catalogue of measures produced. In contrast to conventional corporate and industry analyses, care should be taken to ensure that all key social issue areas are covered in the analysis. To assist with this, the compiled list of indicators may serve as a guide.

8.1.3 Constraints when evaluating products and brands

In the case of the notebook PC industry, a fundamental problem of the methodology becomes apparent. If one considers the SLCA of individual products and bases the analysis exclusively on determining social impacts, then in the case of the notebook industry it is barely possible to distinguish between individual brands and products: due to the cluster formation that characterizes global notebook PC production and informal collusion over basic working conditions, it can be assumed that no noteworthy differences in social impacts exist in the phases of production immediately linked to the specific product. The extent of overtime load, the level of pay and the degree of trade union organization can be taken as roughly identical for all products. However, this view neglects a vital aspect: as soon as a brand-name manufacturer achieves improvements in its supply structure through individual commitment, these changes have positive repercussions for the SLCAs of competitors' products as well as their own. As a result of this effect, which is wholly desirable, LCAs conducted on a purely aggregate level would be relatively disadvantageous for those who were most actively improving the situation. Conversely, the most uncommitted brand-name manufacturers would benefit from the CSR activities of their competitors. This would, to some extent, circumvent one of the actual targets of the life cycle approach: instead of highlighting ways to make efficient improvements, companies would be given little incentive to demonstrate individual commitment. For future LCAs in industries with similar structures, a further criterion to take into account should be the degree and effectiveness of corporate commitment. Caution must be exercised, however, not to take overblown pronouncements from press releases and sustainability reports as a basis for evaluation. The effectiveness of measures should not only be plausible but should also have measurable positive impacts.

A similar evaluation approach has previously been used by the German consumer organization *Stiftung Warentest* in various studies on products such as footballs and salmon fillets (see inter alia Stiftung Warentest, 2005 & 2006). In more complex value chains, however, greater care must be taken to ensure that relevant CSR activities also reach hotspots in those segments of the value chain that are not immediately linked to the specific product.

8.2 Recommendations to the notebook PC industry

Within the electronics industry, notebook PC manufacturing is a largely autonomous industrial sector. The formation of a few internatioanlly significant clusters, the strategic advantage of large companies and the geographical concentration in the People's Republic of China are specific peculiarities of the industry. Overall, the analysis of notebook PC manufacturing indicates numerous positive and negative impacts. The data made available to researchers within the scope of this project is, however, an insufficient basis for a conclusive evaluation of social impacts. This is attributable principally to the continuing lack of transparency affecting large parts of the value chain. As things stand, it is barely possible to distinguish between individual brands and products on the basis of their social impacts: due to the extreme cluster formation that characterizes global notebook PC production and the informal collusion that takes place over basic working conditions such as remuneration and working hours, it can be assumed that no noteworthy differences in social impacts exist in those segments of the value chain that are immediately linked to notebooks. The extent to which it may be possible in future to find distinctions among brands and products is explored in sections 8.1.2 and 8.1.3.

Despite all this, whilst the study was in progress and in particular during the interviews with different groups of actors, improvement potentials were identified which are listed below. In this regard, the recommendations are directed primarily at companies and the sectoral alliances in the electronics and notebook PC industry.

8.2.1 Identification of critical production processes

At various points in the notebook supply chain, processes are operated which are associated with substantial health risks for workers and local communities. Due to the complexity of the supply structure, however, systematic knowledge of these risks and possible preventive measures does not exist at any one place in the value chain. Particularly in the parts of the value chain immediately linked to the final product, this knowledge should be collected centrally and harnessed as a basis for improvements in supply chains. Above all, this should involve alerting suppliers to their own internal risks and to potential risks in supply structures, and producing guidelines for improvements. Particular attention should be paid to the inclusion of critical production processes in those parts of value chains that are not immediately linked to the final product (e.g. manufacturing of parts).

Similarly, prohibited substance lists coupled with the development of less hazardous substitutes offer a good approach which not only prevents possible negative impacts in production but also contributes to alleviating problems with waste disposal and recycling.

8.2.2 Transparent certification of supplier firms

The current systems for compliance with social and environmental standards in supply structures are essentially based on sectoral and corporate codes of conduct, which together with internal corporate principles define minimum standards for suppliers. Although such codes of conduct are certainly a step in the right direction, the unilateral introduction of manufacturer-dependent catalogues of principles and the conducting of audits are heavily limited in their effects; also, apart from the limitations of the methodology (possibility of manipulating workplace inspections, payroll documentation, etc.) they are mainly criticized for their intransparency. The approach recommended at this point is to check up on minimum social and environmental standards using independent mechanisms, i.e. mechanisms which can also be made publicly accessible. One example that can be cited is the fraud-proof SA8000 certificate which is an independent source of information on compliance with minimum employment standards (especially ILO core labour standards). Such certification is perfectly feasible in the Chinese electronics industry, as demonstrated by the four certificates already issued. It is also significant for the notebook PC industry that one manufacturer of optical drives already holds an SA8000 certificate, namely *Toshiba Information Equipment* for its factories in the Philippines. Whilst such certificates cannot, for the foreseeable future, guarantee compliance with minimum social standards throughout the entire supply structure, a successive expansion of certification is desirable, especially with certain firms and industries thus taking on a pioneering role.

8.2.3 Establishing supply structures based on trust

Most breaches of social and environmental standards are caused by extraordinarily tough competition and downward pressure on costs (in which the brand-name manufacturers play an instrumental role). Although the connection between low social and environmental standards and competitiveness has been refuted by various sources (see inter alia ILO, 2005), company managements often look to radical cost-cutting, at least in the short-term, as the only way out of economic crises. In a sector in which the average profit margins are only approx. 3% and fierce competition prevails, it should come as no surprise that social and environmental standards are often not implemented as well as they should be. In such a situation, company management alone does not dictate whether actual improvements can be achieved in social and environmental terms. The critical factor is the behaviour of customers: if they make the award of contracts dependent on low prices above all else, suppliers can hardly be expected to comply with all social and environmental standards. The observed reliance on social audits and certification schemes does not address the core of the problem, but simply piles a further burden onto suppliers: on the one hand they are supposed to produce at lower and lower prices, yet they are also expected to be investing in social and environmental standards. At this point, what is critical is for companies also to consider the importance of the relevant standards in relation to their own supply structures. Suppliers

must be given the confidence that investing in this area will not put them at a competitive disadvantage. Business relationships based on trust with open dialogue about the importance and implementation of social and environmental standards are the basic prerequisites for this.

8.2.4 Involvement of employees and local communities

The absence of independent trade unions in China does not mean that there is a general ban on workplace employee representation and collective bargaining. Both systems are specifically provided for in Chinese legislation, but frequently the existing scope is insufficiently utilized in practice. According to experience from other sectors, and to judge from the official policies promoting a "harmonious society", such forms of workplace employee representation are not only tolerated by the state but actively welcomed. Likewise, *Social Accountability International* imposes the establishment of alternative forms of workplace employee representation and collective bargaining as a condition for the award of the SA8000 certificate in the Chinese context.[32]

The close involvement of workers should be better utilized as an approach to embed social standards in supply chains. Ultimately, workers – unlike external auditors – are permanently exposed to the relevant working conditions and in a better position than other actors to point out deficiencies and improvement potentials. Whereas auditors only gain a brief, incomplete (and often false) impression of the relevant working conditions, it is virtually impossible to conceal from workers such issues as excessive overtime workloads, poor factory accommodation and overpriced canteen food. As a rule such approaches necessitate a twin-track approach: on the one hand, the employees must be granted co-determination rights at work, and on the other hand they must be informed about their rights in the workplace and about labour law in general. This last point must not be neglected under any circumstances, because employees in the low-wage sector often lack basic knowledge of existing labour law.

How such a strategy can be implemented step by step is demonstrated by the approach adopted by *Disney*: in the past year, various suppliers have declared themselves willing to give their staff access to a telephone hotline, by means of which complaints could be submitted, anonymously if desired. The hotline is run by the recognized workers' rights organization *China Labour Support Network* and thus enjoys the workers' trust. The complaints received are forwarded to the participating firms and *Disney* in compiled and

[32] Criterion 4.2 of the SA8000 Standard reads: "The company shall, in those situations in which the right to freedom of association and collective bargaining are restricted under law, facilitate parallel means of independent and free association and bargaining for all such personnel" (Social Accountability International, 2001).

anonymized form. Moreover the participating suppliers undertake to enable their staff to attend courses in labour law regularly.

Similarly the sports products manufacturer *Reebok* is endeavouring to secure closer involvement of employees in addressing social concerns. Among other things, *Reebok* is supporting the establishment of workers' representations in its Asian suppliers. With the exception of certain pilot approaches, such as *Hewlett-Packard's* amendment of the Electronic Industry Code of Conduct to this effect,[33] as yet no comparable initiative has been seen in the electronics industry.

In the Chinese context it can be assumed that the CSR discussion will be broadened in future to include the geographical surroundings of production locations. This concerns not only the detrimental impacts of air and water pollution on quality of life, but also the possible expropriation and non-compensation of residents and farmers. Conflicts of this nature should be addressed proactively by setting up corresponding dialogue fora.

8.2.5 Incorporating social aspects into pricing

In no small way, the possibility of complying with minimum social standards is strongly linked to consumer behaviour and the brand-name manufacturers' marketing of their products. As long as price is treated as the overriding criterion for purchasing decisions, then fierce competition between brand-name manufacturers and their associated supply structures will concentrate on this criterion. The fact that falling prices are partly made possible by cutting back on social and environmental standards should come as no surprise, in the electronics industry as elsewhere. Nonetheless in the case of the notebook PC industry, the blame cannot be laid solely at the door of buyers: a consumer study carried out as part of the German *EcoTopTen* research project discovered a surprisingly high level of awareness of social aspects in the manufacturing and disposal of computers (Schubert & Götz, 2006). The products on offer are not accompanied by any related decision-making aids to assist with product selection. Admittedly, in this context it is clear that a "fairly produced" computer is still a long way off, and that consumers are rarely inclined to pay a lot more for products which comply with expected minimum standards. This view is put into perspective, however, by the fact that the wage costs of final assembly only account for EUR 1 or 2 of the final selling price of each device, and the wage costs of the labour-intensive manufacturing processes can be estimated at less than EUR 30 per notebook: an improvement in working conditions

[33] "Where worker representation and collective bargaining are restricted by law, participants are to facilitate open communication and direct engagement between workers and management as alternative ways of ensuring that workers' rights, needs and views are considered and acted upon appropriately and in good faith" (Electronic Industry Code of Conduct & Hewlett-Packard, 2005).

would have far less of an impact on product price than is the case for other product groups.[34] A price difference of a few percentage points should not be a reason for any of the actors involved to neglect minimum social standards.

[34] In the apparel and shoe industry, wage costs account for up to 25% of total costs (Van Heerden & Baumann, 2005).

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