



Title:

Using a life-cycle perspective to assess potential social impacts of ICT services – a pre-study

Authors: Åsa Moberg, KTH; Malin Picha, The Swedish Media Association; Birgitta Erlandsson-Segerström, TeliaSonera; Catherine Karagianni, TeliaSonera; Jens Malmödin, Ericsson; and Lennart Wiklund, Bonnier Group

Report from the KTH Centre for Sustainable Communications

ISSN:1654-479X

TRITA-SUS 2009:1

Printed by: US AB Stockholm, 2009

PREFACE

This study was carried out at the Centre for Sustainable Communications. The project group consisted of representatives from the Centre's partners Bonnier Group, Ericsson, TeliaSonera and The Swedish Media Association.

Comments from Dag Lundén at TeliaSonera and Göran Finnveden at KTH are gratefully acknowledged.

Centre for Sustainable Communications

The Centre for Sustainable Communications was established in 2007 by VINNOVA (The Swedish Governmental Agency for Innovation Systems). The Centre has established a strong research environment at the KTH Royal Institute of Technology in collaboration with several business partners, public authorities and civil organizations. Pursuing an interdisciplinary research approach, the Centre's mission is to enable innovative media and communication services for sustainable practices.

Website: www.sus.kth.se

Partners (2009-2012)

Bonnier

Ericsson

IEF - Swedish Inland Communities' Association

Institute for Future Studies

KTH Holding

Office of Regional Planning, Stockholm County Council

Stampen

Stiftelsen Folkets Hubb - Community Hub Foundation

Sting (Stockholm Innovation and Growth)

The City of Stockholm

SVT

TeliaSonera

TU - The Swedish Media Association

CONTENTS

1. BACKGROUND	8
2. SOCIAL RESPONSIBILITY (SR)	11
2.1 General	11
2.2 Bonnier	12
2.3 Ericsson	13
2.4 TeliaSonera	14
2.5 The Swedish Media Association	15
2.6 Summary of companies' SR work	16
3. SOCIAL AND SOCIOECONOMIC LIFE CYCLE ASSESSMENT	18
3.1 Methodology	18
4. SCREENING OF TWO ICT SERVICES	21
4.1 Goal and scope	21
4.2 Mobile news- System screened	22
4.3 Video meeting – System screened	23
4.4 Results	25
4.4.1 Raw material acquisition	25
4.4.2 Production/Manufacturing	27
4.4.3 Use	31
4.4.4 Disposal	32
5. DISCUSSION AND CONCLUSIONS	35
5.1 Social responsibility of companies and organisations	35
5.2 Life cycle perspective	36
5.2.1 General	36
5.2.2 Test	36
5.2.3 S-LCA	37
5.3 Further research	39
5.4 Conclusions	39
REFERENCES	40

SUMMARY

Buying that new mobile phone may make your life easier, provide continuous access to the net and change your image, but what social impact will your action have on others? Different stakeholders along the life cycle of the mobile phone will be affected, in positive and negative ways. Who is responsible and how can we know the impact?

Handling environmental impact with a life cycle perspective, for example using life cycle assessment (LCA), is today common practice. A similar technique for social impact, social and socio-economic LCA (S-LCA) is under development (Benoit and Mazijn, 2009). The aim of the current pre-study was to consider the use of S-LCA for information and communication technology (ICT) services to learn more about the product and facilitate consideration of social impact in different decision-making situations.

From a company perspective, social responsibility is handled in various ways, often under the heading of CSR, corporate social responsibility. Firstly, the company's own employees are easily targeted and acted on by providing good working conditions, fair wages and working hours, etc. Considering social impact throughout a product's life cycle is the next step and here measures and responsibilities are less clear-cut. How is a product distributed (supply chain), how is it used and how is it finally disposed? Different stakeholders are differently affected, positively and negatively.

Four companies and organisations, all partners in the Centre for Sustainable Communications, took part in this study. They currently have different experiences and degrees of activity regarding social responsibility. The telecommunications companies, Ericsson and TeliaSonera, have started to consider social aspects in their supply chain and for their consumers. Social aspects are not only considered in terms of impact of the company management but also of impact related to products (goods and services). The media organisations (Bonnier Group and the Swedish Media Association) have not handled social aspects to the same extent as the telecommunications companies, but of course their products also give rise to social impact throughout their life cycles.

To enable a discussion on the usability of S-LCA, a simplified test was carried out, inspired by the ongoing work on including social aspects into LCA within the UNEP-SETAC Life Cycle Initiative (Benoit and Mazijn, 2009). This screening test was based on a selection of published and readily available information on potential social impacts along the life cycle of two defined ICT services. The goal was not to provide an assessment of social impact, but rather to give a rough sketch and reflect on possibilities and limitations with the method. The two ICT services in the test were mobile news and video conferencing, provided by a newspaper company and a telecommunications company respectively. An interesting feature of both these services was that the company providing the service was not providing the electronic device, the hardware platform of the service. This gives one more dimension in the consideration of who is responsible for social impacts with a life cycle perspective.

There was a lot of information available on potential social impact for parts of the respective life cycles. This kind of information is gathered by scientists, NGOs and others. A small share of the information was compiled for the selected stakeholder groups: worker and consumer. This information indicated that there are social impacts all

along the life cycle and that these may be positive or negative and of differing magnitude. As stakeholders become aware of the possible negative social impact, increasing engagement from organizations and companies in social responsibility will be requested.

When companies start to consider social impacts in the supply chain, it is expected to be easier to reach the first and second tier of suppliers. However, ILO (2007) has established that the workers at the beginning of the supply chain (farthest away from the end-product) are generally the most disadvantaged. In some cases, handling e-waste is also leading to major negative social impacts. Raw material acquisition and waste management may have large implications on the social impact related to a product, with best case or worst case possibly leading to significantly different results. A life cycle perspective would facilitate identification of improvement potential. A key question is who is responsible, or rather who will accept responsibility.

As there is information available for parts of the processes and stakeholders throughout the life cycle of the ICT services studied, the question remains how this information can be used by companies providing products for end-consumers. This pre-study indicates that it can be useful to apply a life cycle perspective and compile data in relation to a specific product also when considering potential social impacts. This would facilitate the inclusion of processes and stakeholders for example at the beginning of the life cycle, where impact may be considerable and negative, and make these more visible. Development of S-LCA is thus interesting in order to provide transparent and 'standardised' assessments of potential social impact. By providing guidelines or standards, the assessments of social impact could be interpreted and criticised more easily. The possibilities for using S-LCA to increase knowledge and ultimately improve social conditions should be further studied and developed.

In the field of S-LCA there is plenty of future research to be carried out, examples of which are provided by Benoit and Mazijn (2009). One important way of getting more experience and enabling further development of the method and its practice is through performing case studies. ICT products would be an interesting field for this.

SAMMANFATTNING

När du köper en ny mobiltelefon, kan det förenkla ditt liv, ge dig ständig uppkoppling på nätet och samtidigt förändra din status, men frågan är vilka sociala effekter ditt inköp har för andra? Olika aktörer i en mobiltelefons livscykel påverkas, i positiv eller negativ mening. Vem bär ansvaret? Och hur kan vi utvärdera denna påverkan?

Att bedöma miljöpåverkan med ett livscykelperspektiv, till exempel med livscykelanalys (LCA) är idag vanligt. En liknande teknik för social påverkan är under utveckling; social och socioekonomisk LCA (S-LCA) (Benoit och Mazijn, 2009). Syftet med denna förstudie har varit att studera användbarheten av S-LCA för media och kommunikationslösningar för att få mer kunskap om dessa produkter och tjänster och underlätta beaktandet av social påverkan i olika beslutssituationer.

Från ett företagsperspektiv kan socialt ansvar hanteras på olika sätt, ofta under paraplyet CSR, corporate social responsibility (företagets sociala ansvar). Man börjar ofta med företagets egen personal, och ser till arbetsförhållanden, löner och arbetstid etc. Social påverkan i leverantörskedjan, för konsumenter och vid avfallshantering kan vara nästa steg, där åtgärder och ansvar är mindre tydliga. I en produkts livscykel, påverkas olika aktörer på olika sätt, positivt och negativt.

Fyra företag och organisationer, alla partners i Centre for Sustainable Communications, har deltagit i denna studie. De har olika erfarenhet och aktivitetsgrad när det gäller socialt ansvar. Telekommunikationsföretagen Ericsson och TeliaSonera har börjat beakta sociala aspekter i sin leverantörskedja och för sina konsumenter. Det är inte bara hur företaget leds som ger sociala effekter utan även företagets produkter och tjänster. Medicinorganisationerna (Bonnier och Tidningsutgivarna) har inte arbetat med social påverkan på samma sätt som telekommunikationsföretagen. Men självklart ger även deras produkter positiv eller negativ social påverkan under sin livscykel.

För att möjliggöra en diskussion kring användbarheten av S-LCA, genomfördes ett förenklat test, inspirerat av pågående arbete kring hur man tar med sociala aspekter i LCA inom UNEP-SETAC Life cycle initiative (Benoit och Mazijn, 2009). Detta test grundade sig på ett urval av publicerad och tillgänglig information om möjlig social påverkan under livscykeln av två tjänster. Målet har inte varit att uppskatta den totala sociala påverkan, utan att ge en grov skiss och reflektera över möjligheterna och begränsningarna med S-LCA. De två tjänsterna i testet var nyheter i mobilen och videokonferenser, som erbjöds av ett dagstidningsföretag respektive ett telekommunikationsföretag. En intressant aspekt med båda dessa tjänster var att de företag som erbjöd tjänsterna i formell mening inte är leverantörer av den elektroniska utrustningen (hårdvaran i form av mobiltelefon och videokonferensutrustning). Detta ger ytterligare en dimension i frågan om vem som bör ta ansvaret för social påverkan under en produkts livscykel.

Det finns en stor mängd tillgänglig information om möjlig social påverkan under delar av respektive livscykel. Den här typen av information samlas in av forskare, ideella organisationer (NGOs), m fl. En liten del av denna information sammanställdes för de valda aktörskategorierna arbetare och konsument. Sammanställningen visar att det finns social påverkan längs hela livscykeln, den kan vara positiv eller negativ och av varierande grad. Allteftersom medvetenheten ökar hos aktörerna kring möjlig negativ social

påverkan, kommer det att krävas ett större engagemang kring sociala ansvarsfrågor hos företag och organisationer.

När företag börjar beakta social påverkan i leverantörskedjan, så är det inte oväntat lättare att nå första och andra ledet av leverantörer. Å andra sidan slår ILO (2007) fast att arbetare i början av leverantörskedjan (längst från slutprodukten) generellt sett är de mest missgynnade. I vissa fall leder även hanteringen av elektroniskt avfall till betydande negativ social påverkan. Utvinning av råmaterial och avfallshantering kan alltså ha allvarliga följder när det gäller social påverkan relaterad till en produkt. Ett livscykelperspektiv kan göra det enklare att identifiera var förbättringar ger störst effekt. En nyckelfråga är vem som är ansvarig, eller snarare vem som är villig att ta ansvaret.

Eftersom det finns tillgänglig information för vissa processer och aktörer kopplade till de studerade tjänsterna kvarstår frågan hur denna information kan användas av företagen som tillhandahåller produkter för slutkonsumenter. Denna förstudie visar på nyttan med ett livscykelperspektiv för studier av sociala påverkan. Processer och aktörer, till exempel i början på livscykeln, där den sociala påverkan kan vara betydande och negativ omfattas då på ett naturligt sätt och synliggörs. Utvecklingen av S-LCA är intressant för att metoden kan möjliggöra en transparent och 'standardiserad' bedömning av möjlig social påverkan. Genom att tillhandahålla riktlinjer eller en standard, skulle uppskattningen av social påverkan lättare kunna tolkas och också kritiseras. Möjligheterna att med hjälp av S-LCA kunna öka kunskapen om och förbättra sociala villkor bör studeras och utvecklas vidare.

Inom området S-LCA återstår mycket framtida forskning, flera exempel nämns av Benoit och Mazijn (2009). Ett sätt att öka erfarenhet och kunskap och därmed möjliggöra fortsatt utveckling av metoden, är att genomföra fallstudier, där IKT-produkter skulle vara ett intressant område.

1. BACKGROUND

Information and communication technology (ICT) is sometimes put forward as a means towards sustainable development, being able to replace or form an alternative to less sustainable products, services and processes. At other times, ICT is criticised for not being in line with sustainable development, through e.g. increasing total direct energy use, giving rise to large amounts of electronic waste and containing hazardous substances. Berkhout and Hertin (2004) conclude that there is no single answer to whether ICT is 'good or bad'.

Sustainable development is often described as being dependent on three dimensions, covering ecological, social and economic aspects. These may be overlapping and they are inter-connected. How these three dimensions relate to each other and their respective importance may be discussed. In general, there are more tools available for assessing the environmental sustainability of a system than for social sustainability. Therefore, the social part was the primary focus when starting research on sustainability assessment within the Centre for Sustainable Communications. In a pilot study, a screening sustainability assessment of a specific mediated service was performed (Moberg et al., 2008). The study's purpose was to evaluate and indicate the economic, environmental and social consequences of introducing mediated meetings for the provision of a service provided by the Public Employment Service in comparison with existing or alternative solutions. In addition, the study aimed to gather experiences and create a basis for future development of methodology and sustainability assessments within the Centre for Sustainable Communications. Only the use phase was considered. One of the experiences was that the social dimension of sustainability is not a clear-cut, well-defined category, but an area that demands further discussion and that differs significantly depending on the focus of the study. The lack of a life cycle perspective was noted as a limitation of the study.

ICT has an important role regarding the social dimension of sustainable development. In this case too there are pros and cons. For example, ICT can lead to increased availability and social inclusion, but can also result in danger to health e.g. in cases of improper waste handling. The distribution of the benefits and disadvantages may in some cases not be in line with sustainable development, as in many cases benefits are provided to those who are already well-off and the drawbacks may end up where there is already poverty and need. Increased knowledge and more transparency can support the social benefits of ICT and decrease the disadvantages and unsatisfactory distribution of benefits. In the same manner as for environmental impacts, considering the social impacts of ICT products (goods or services) needs to be done using a life cycle perspective. This avoids the risk of assessing goods or services (hereafter addressed as products) based only on the impact, positive or negative, in one part of the life cycle. For example, a service provided to a user may have a considerable positive social impact for the user, but this positive impact needs to be related to possible negative (and positive) impacts occurring in production, waste handling, etc.

Heiskanen (2002) argues that life cycle thinking together with other initiatives could be part of a path towards increased transparency leading to less anonymity and increased responsibility. There is a need to define the roles and relate responsibility to actors in terms of 'who is accountable for what, and to whom' (Heiskanen, 2002).

Social responsibility is today part of the management in many companies and organisations. There are international initiatives, such as the guidelines on social responsibility, ISO 26 000, under preparation within the International Organization for Standardization, while the Global Reporting Initiative (GRI) is providing a sustainability reporting framework incorporating social, economic and environmental aspects outlining and facilitating social responsibility. There are specific initiatives that consider aspects relevant for the ICT sector, such as Electronic Industry Citizenship Coalition (EICC), Global e-Sustainability Initiative (GeSI) and StEP (Solving the e-waste problem). The social responsibilities of companies, which were initially mainly directed at the employees of the company, and other issues directly related to the company are starting to spread to the supply chain and to some extent incorporate a life cycle perspective. In some cases the possibilities to practise responsibility are less straightforward and more experience, collaboration and discussions are needed.

There are different tools/techniques for assessing social impacts related to companies (or organisations). These tools, in the same way as tools for environmental assessment, differ regarding aspects such as object of study and impacts considered (Finnveden and Moberg, 2005). The company as an object can be assessed using management systems with auditing, while GRI indicators may be used in reporting on company performance. On the other hand, projects, plans and policies may be assessed using social impact assessment (SIA) in the same way as environmental impact assessment (EIA) is used for the environmental perspective. Regions and nations may also be the object of study, for example through including social aspects in the environmental accounts (e.g. SCB, 2004). In some tools social aspects are part of the sustainability assessment, which also considers economic and environmental aspects. If products are the object of study, social impacts can be assessed using social life cycle assessment, just as environmental impacts of products are assessed with a life cycle perspective through environmental LCA.

The technique of social LCA is under development and there are several suggestions by different authors on how a this assessment can be performed (see e.g. Jørgensen et al., 2008; Dreyer et al., 2006; Hunkeler, 2006; Norris, 2006; and Weidema, 2006). There is also a joint effort within the UNEP-SETAC Life Cycle Initiative where guidelines for social and socioeconomic life cycle assessment (S-LCA) have been suggested (Benoit and Mazijn, 2009), based on the standardised methodology for environmental LCA (ISO 2006a, b). The further development and improvement of S-LCA will probably continue over a long period.

Many of the studies considering ICT and social aspects so far focus on one or a few steps in the life cycle of the product or product group. Considering each separate process related to the life cycle of ICT in one way or another, there are probably large amounts of information on specific social impacts. Manhart and Griesshammer (2006) and Manhart (2007) cover a large part of the life cycle in two separate studies, the production of notebook PCs and the production and WEEE-recycling of electronics. These studies are based on the methodology of S-LCA and the work of the UNEP/SETAC task force as mentioned above. In addition, there are impacts from more general processes as well. For example electricity generation, with consequences of hydro-power dams on local communities and effects related to transportation of equipment, such as health impacts on truck drivers. The use phase with its positive and possibly negative impacts on the product user needs to be considered as well.

The aim of the current pre-study was to consider the use of S-LCA for ICT services. A simplified test was made based on a selection of published and readily available information on potential social impacts along the life cycle of two defined ICT services. The aim of the test was to provide a basis for discussion on the usability of S-LCA and also to consider the availability of information for these kinds of services. Thus, the primary goal was not to provide an assessment of social impacts in practice, but rather to make a first attempt and mainly reflect on possibilities and limitations of the method.

The study was carried out within the Centre for Sustainable Communications and four of the Centre's partner companies took part in the work. Experiences from this pre-study will facilitate future studies in this field within the Centre. The simplified test of S-LCA in this report is framed by descriptions of how the four Centre partner companies handle social responsibility issues in practice today. These are presented in Chapter 2 and are based on material provided by the participating companies. The screening test was inspired by ongoing development of the S-LCA technique, as briefly described in Chapter 3, and was performed through the identification of two ICT services to study, inventory of information, compilation of information and interpretation as presented in Chapter 4. The discussion in Chapter 5 then elaborates upon the possibilities and limitations of assessing potential social impacts of ICT services with a life cycle perspective.

2. SOCIAL RESPONSIBILITY (SR)

2.1 General

As mentioned above, there are several initiatives aimed at social responsibility of organizations and companies. In this section we briefly describe how social responsibility is handled in practice in four organisations. The text is based on documents and information provided by the respective organisations. In some cases the text has been shortened, since the aim was not to provide a full, comprehensive, independently certified description of the work with social responsibility at each organisation, but rather to provide an illustration of the practice and the context wherein the information on potential social impacts of products with a life cycle perspective could be used.

Social responsibility may be practised on different levels, which can be illustrated as tiers of the supply chain or by using a life cycle perspective. Here, the stakeholders of a product life cycle are illustrated based on the list of stakeholders suggested in the Guidelines on S-LCA (Benoit and Mazijn, 2009) and listed in section 3.1 below.

2.2 Bonnier

The Bonnier Group is a family-owned international media group based in Stockholm, Sweden. The group comprises more than 200 companies, has 12,000 employees and operates in more than 20 countries. Its business includes most media formats, including books, newspapers, magazines, broadcasting, films, theatres and radio.

The Bonnier Group is a diverse group and the conditions for the companies that form part of the group differ. The social responsibility must be handled by the management of each company. The CSR work of the Bonnier Group is transparent and a brochure describing the values and ethics of the Bonnier Group is distributed to all **employees**.

In general, the work on social responsibility within the Bonnier group is mainly based on policies and guiding principles, which are then put into practice by each company in the group. Examples of policy formulations regarding **supply chain** include that the Bonnier Group strives to purchase products which have been produced under fair working conditions and therefore have requirements for suppliers and partners. Regarding Bonnier **employees**, the work in practice is managed at each company, but group-wide values are stated to include health and well-being for employees, inclusion and training.

Bonnier, as a media group, may have an important social impact related to important issues such as freedom of speech and learning.

(Based mainly on the Bonnier Group brochure: Värdegrund och etik (Values and ethics, authors' translation))

2.3 Ericsson

Ericsson is a global telecommunications company with customers in 175 countries and more than 74,000 employees in 2007. Ericsson was founded in 1876 and is headquartered in Stockholm, Sweden. The market leader in 2G and 3G mobile technologies, Ericsson supplies communications services and manages networks that serve more than 185 million subscribers. The Company's portfolio comprises mobile and fixed network infrastructure, and broadband and multimedia solutions for operators, enterprises among others.

Ericsson's corporate responsibility (CR) focus is two-fold: how telecommunications can deliver environmental and social benefits to **society**, and on having the necessary controls in place to minimise risks in this area regarding the governance of the Company's own operations. One of the key material issues listed by Ericsson is "Telecommunications as an enabler of human rights – supporting the right to health, the right to education, the right to safety and security, and the right to livelihood, among other rights".

Ericsson's Code of Conduct and Code of Business Ethics guide and shape the day-to-day behaviour and give clear guidelines in working with suppliers, colleagues and partners within and outside Ericsson. Ericsson's Code of Conduct is a commitment to **employees** and the **supply chain**, and it is based on the United Nations Global Compact principles that are designed to safeguard human rights, promote fair and safe labour conditions, environmental management and high ethical standards.

Ericsson Market and Business Units are responsible for securing their respective **suppliers'** compliance with the Code of Conduct and the Environmental Requirements. A risk assessment model for prioritising and selecting markets and businesses for Code of Conduct audits was introduced in 2006. Ericsson's Code of Conduct requirements have been a part of the supplier evaluation concept since 2005. The number of audits and follow-up visits increased significantly during 2007, to 110 from 40 in 2006. An audit is much more than an opportunity to assess a supplier's compliance with the Code of Conduct requirements. It is an opportunity to further strengthen the relationship between Ericsson and the supplier, to inform and educate the supplier about requirements in a way that is comprehensible given the supplier's line of business and particular conditions.

Ericsson works to find a collaborative approach with suppliers and engages in formal and informal dialogue to improve relationships and results in supply chain management. According to several suppliers, complying with Ericsson's requirements has given them an advantage when competing for orders from other major companies.

Equal opportunities for Ericsson **employees** are worked upon through achieving a representative proportion in terms of gender at all levels of the organisation and increasing the proportion of people from different backgrounds (nationalities) in senior management. Ericsson is committed to providing a safe workplace for all employees.

Ericsson also provides direct services to **society**. The Ericsson Response programme is a global initiative that aims to develop a better and faster response to human suffering caused by disasters. Ericsson has a great deal of experience in humanitarian response activities and brings its expertise to relief efforts around the world.

The Corporate Responsibility report follows the GRI guidelines.

(Based on Ericsson Corporate Responsibility Report 2007)

2.4 TeliaSonera

TeliaSonera is the leading telecommunications company in the Nordic and Baltic region, with strong positions within mobile communications in Eurasia, Turkey and Russia. Based in Stockholm, TeliaSonera employs 31,000 people altogether and has more than 144 million subscribers. TeliaSonera state that sustainable development affects its way of doing business. Strategic topics include customer protection, accessibility, sustainable communication and impacts on stakeholders.

TeliaSonera is a vital part of the social and economic infrastructure in the markets where it operates. Communication services can drive growth, competitiveness and the transition to a knowledge-based society. Communication services can help people and companies communicate in a simple and effective way. Concerning social impacts, TeliaSonera manages several issues related to **customers**. Accessibility and the risk of network failure and down-time are handled through a crisis management plan. Other risks for the customers/users that TeliaSonera tries to act on include different kinds of harassment and sexual exploitation of children. This is handled through co-operation with different organisations such as The World Childhood Foundation, ECPAT and Friends, as well as signing up to official and voluntary agreements to facilitate safe surfing on the internet. Customers are informed about safe internet usage. Questions regarding electromagnetic field radiation and the concerns of customers are handled through participation in research activities and dialogue.

TeliaSonera **employees** are supported through e.g. facilitation of the combination of professional life and life as a parent. TeliaSonera uses indicators for health among its employees and supports health activities such as exercise and quitting smoking. There are several activities aimed at equal opportunities and there is an aim to have more female leaders within the organisation. In the event of redundancy, employees are supported through skills development programmes and extensive programmes to find new positions inside or outside TeliaSonera.

Regarding the employees in the **supply chain**, requirements were launched during 2008 and the implementation is ongoing. The aim is to be able to contract reliable suppliers in terms of sustainable behaviour and to facilitate open and transparent dialogue between TeliaSonera and its suppliers. Supplier requirements will be verified by self-assessments, reviews and audits.

Common standards of behaviour have been defined in the Code of Ethics that applies to all employees in majority-owned operations as well as contractors, suppliers and service providers. A specific Code of Ethics and Conduct for the Eurasian operations focuses on particular challenges found in these markets. The Corporate Responsibility report follows the GRI guidelines. The corporate responsibility reporting is gradually expanding to cover not only the wholly-owned operations, with majority-owned operations covered in 2008.

2.5 The Swedish Media Association

The Swedish Media Association is the trade association for Sweden's daily newspapers and other media companies. The association is based in Stockholm and has around 15 employees divided between departments for law, marketing, training, development, information and administration. In total, the association has around 240 members, of which the daily newspapers make up around 170. The daily press has a stable readership with a daily reach of 88 percent, and a total circulation of about 4 million copies per day.

Traditionally, the Swedish Media Association was also an employers' association, and one of the main tasks was to coordinate and negotiate different aspects of the media industry, most importantly the social aspects. A majority of these issues were focused on the **employees** of the member companies and were regulated in the agreements between the Association (as the employers' organisation) and the different unions in the media business. Among other things, these agreements regulated wages, working hours, equal opportunities, discrimination, health, safety, social benefits and social security. Today, the employers' branch of the association belongs to a separate organisation, called Medieföretagen (Media Industries Employers' Association).

Ultimately, it is up to each member company to make sure that the regulations mentioned above are followed. However, many media companies have even chosen to go beyond these agreements, in order to take their social responsibilities one step further.

Freedom of speech and a free press have always been core issues for the Swedish Media Association. In the past few years, there have been changes in the Swedish laws which constrain these freedoms. The Association is working actively to inform politicians, initiate debates and increase general interest for these issues.

Media in general is an important source of learning, public debate and democracy in all societies. Naturally, these issues are always on the agenda for the Swedish Media Association and are encouraged through a variety of channels and activities.

Based on information from The Swedish Media Association.

2.6 Summary of companies' SR work

The four organisations that took part in this study differ in several ways. They can mainly be split into two large international telecommunications companies and two umbrella organisations (one association and one group) in the media sector. From the text boxes above and through discussions with representatives at the four organisations, it is clear that their involvement and progress in social responsibility issues also differ.

The two telecommunications companies declare social responsibility for their employees, and Ericsson in particular has an established system for supply chain management or collaboration. For telecommunications companies the product supply chains are complex, making full influence and monitoring of supplier performance difficult. Ericsson has tried to solve this through prioritising efforts using risk assessment, but the suppliers at the very beginning of the supply chains are still seldom considered. TeliaSonera has more recently started its social responsibility supply chain management (the environmental sustainable supply chain management has been ongoing since 1996) and it focuses primarily on the suppliers closest to the company. TeliaSonera has a close relationship to the end consumer and addresses social impacts on customers to a large extent, customer trust being one of the headings of the 2007 Corporate Responsibility Report. The last phase of the life cycle, disposal and waste management, is acted on by Ericsson mainly through sector initiatives (e.g. StEP, an initiative of various UN organisations with the overall aim of solving the e-waste problem). The order of action when introducing social responsibility can here be roughly listed as own sites; supply chain first (and second) tier; use phase (customers); disposal activities; use phase (society), beginning of supply chain (raw material acquisition). The issue of responsibility needs to be further studied and the use of a life cycle perspective to assess and illustrate potential impacts may help to identify hotspots where the responsibility issue needs immediate attention. Actions on processes that are farthest away from the end-producer may be identified, implying a shift of focus. In these cases, many end-producers will have a common responsibility.

The two media organisations have a different reality and a different decision framework. The context of producing companies differs from associations/groups. Both media organisations provide support and possibly guidelines for their member companies. So far, the Swedish Media Association has mainly been negotiating with unions on agreements covering working conditions. No social responsibility issues are specifically handled for its own employees and there is no particular support to member companies regarding more proactive social responsibility in the companies or the supply chain or life cycle. The Bonnier Group has a joint CSR group where representatives from different companies meet. There is also a joint declaration on values and ethics which the Group and the companies must adhere to. The translation of these values and ethics into practice is up to the management of each company in the Bonnier Group.

For both the telecommunications companies and the media organisations, the goods and services that they, or their member companies, provide have a clear relevance for social impacts and development. Through media, increased learning as well as inclusion through knowledge may be gained, implying great concern regarding publishing ethics. Freedom of speech is a key aspect of media and a human right. Telecommunications may be a means for making e.g. information accessible and increase possibilities for inclusion, and Ericsson places emphasis on the potential social impacts of its products (mainly the

positive impacts) in the use phase. There may also be negative social impacts in the user phase, and in other parts of the life cycle there may be positive and negative impacts. Just as for environmental issues, life cycle thinking needs to be used to get a more comprehensive view and learn more about potential social impacts of products. How this could be done is tested and discussed in the following chapters.

3. SOCIAL AND SOCIOECONOMIC LIFE CYCLE ASSESSMENT

3.1 Methodology

Social and socioeconomic life cycle assessment (S-LCA) is a technique under development. The ongoing work in a project within the UNEP-SETAC Life Cycle Initiative, with the aim of integrating social aspects in LCA, recently published guidelines for social life cycle assessment of products (Benoit and Mazijn, 2009). The test carried out in the current study was inspired by the work within the UNEP-SETAC Life Cycle Initiative. However, the guidelines were not finalised when the test was performed.

The S-LCA technique builds largely on the standardised technique of environmental life cycle assessment as described in ISO standards 14040 and 14044 (ISO, 2006a and b). The essence of a life cycle assessment is that aspects and impacts of products (goods and services) are assessed taking into account all steps of the so-called life cycle. This means that raw material acquisition, production, use, disposal as well as transportation should be covered. All impacts should be related to the so-called functional unit, which describes and quantifies the function provided by the product studied.

The S-LCA methodology involves some adjustments and adaptations of the methodological framework as suggested for environmental LCA in ISO 14040 and 14044 (Benoit and Mazijn, 2009). The specific methodology of S-LCA is not handled in detail here, but some main characteristics are mentioned.

One main difference is the stakeholder categories used in S-LCA. The suggested list of stakeholders to cover by default is as follows (Benoit and Mazijn, 2009):

- Worker
- Local community
- Society
- Consumer
- Value chain actor (excluding consumers)

For each stakeholder a set of subcategories is suggested (Benoit and Mazijn, 2009). These can be illustrated by a range of inventory indicators, quantitative as well as qualitative. In the current test, we chose to focus on two of the stakeholder groups, Workers and Consumers. The subcategories suggested for these stakeholder groups are listed below. In addition, we added a category indicator 'other' to see whether we could find social aspects of the stakeholders that were relevant but did not fit within any of the suggested subcategories. Since the work on this study began, the subcategories in the Guidelines have been modified (Benoit and Mazijn, 2009). The subcategories 'Feedback mechanisms' and 'End-of-life responsibility' were not covered here, as they were added to the list after our test.

Subcategories for Stakeholder Worker

- Freedom of Association and Collective Bargaining
- Child Labour
- Fair Salary
- Working Hours
- Forced Labour
- Equal Opportunities/Discrimination
- Health and Safety
- Social Benefits/Social Security

Subcategories for Stakeholder Consumer

- Health and Safety
- Consumer Privacy
- Transparency
- (Feedback mechanisms)
- (End of life responsibility)

As the Guidelines for S-LCA were under development when our test was being performed, the procedure as described in Benoit and Mazijn (2009) was not followed in detail. Our test had the aim of providing a basis for a discussion and for future studies in the area. This first screening of available data can be compared with the very first step of so-called hotspot assessment, which can function as a pilot for a more thorough study. Hotspot assessment, as presented in Benoit and Mazijn (2009), is a generic analysis which aims to give an overview of the possible social problems in an area (country region) or a sector. The risks rather than the benefits are often covered in hotspot assessment (Benoit and Mazijn, 2009).

In order to aggregate information along the life cycle and get an indication of the importance of different activities, working hours are suggested as a so-called activity variable. In the current test activity variables were not used.

The use of stakeholder categories for assessing social impacts was also applied in an earlier study at the Centre for Sustainable Communications (Moberg et al., 2008) to assess a service provided using video-mediated meetings. In this case the social indicators selected were partly based on Swedish government objectives (Public Health Policy, known as *Folkhälsomålen* in Swedish) and previous studies on behaviour and social practices (Räsänen, 2006). Moberg et al. (2008) focused on the use phase and the indicators used can be aggregated under the headings:

Stakeholder Worker:

- Participation and influence
- Working conditions
- Health

Stakeholder Consumer/User:

- Accessibility
- Health
- Coordination with other daily activities
- Satisfaction

These are partly incorporated in the subcategories listed above for S-LCA, but for the consumer the aspects considered in Moberg et al. (2008) are more specific for the studied service and directly related to the user experiences. The S-LCA subcategories are aimed at illustrating impacts from relationships between the company and the stakeholder, and actions of the company are assessed in terms of compliance with regulations, practices for assuring consumer satisfaction, etc. This illustrates that as suggested by Benoit and Mazijn (2009), the S-LCA needs to be complemented with other studies if consumer experiences are to be explicitly covered. As stated in the Guidelines ‘the assessment of the usability and satisfaction of the users...may be better assessed through other tools or become a future field of research for S-LCA’ (Benoit and Mazijn, 2009, p. 78).

4. SCREENING OF TWO ICT SERVICES

4.1 Goal and scope

Two ICT services were selected for the test, with the selection based on the interests of the participating companies and organisations. These two services were:

- Video conferencing
- News reading via mobile phone

The goal of the test was to provide a basis for discussion on the usability of S-LCA and also to consider the availability of information for these kinds of services. Thus, the goal was not to provide an assessment of social impacts in practice, even though an assessment of some of the potential social impacts was made.

To set the boundaries of the two systems, earlier environmental life cycle assessments were consulted and flow schemes reused. As the life cycles of the selected services are complex and the test was limited, considerable cut-offs were made. The selection of processes on which to gather information was made based on assumed availability of data and relevance to project participants. The selection was thus not a prioritisation regarding assumed social relevance, as a result of the aim and scope of the study.

In addition, the stakeholders and social subcategories to address were limited to the subcategories of Workers and Consumers.

The collection of information was made through internal sources and knowledge at the participating companies and organisations, literature and internet searches and a few interviews. It should be noted that there are more sources of information available than those used here and that the illustration is by no means complete.

It is interesting to note regarding the two selected services that in the cases studied, both are provided by companies that are not themselves providing a specific platform for using the service. Video conferencing can be performed using different kinds of screens, etc. and the newspaper can be read on any brand of mobile phone. The consumer buying the mobile news service has bought the mobile phone mainly for other purposes and the company buying a video conferencing service from a telecommunications company has the possibility to choose different equipment to use for this service.

4.2 Mobile news- System screened

The test of S-LCA for mobile news could have the objective of providing a newspaper company with information on the potential social impacts of its service. The functional unit of the study could be average mobile reading of Newspaper Y by one person during one year. As the newspaper company cannot influence the brand of mobile phone that is used for reading the news, average data and general information on the production of mobile phones, electronics and raw material were used here.

Mobile phones have been studied using a life cycle perspective (e.g. Bergelin, 2008; Nokia, 2005). The production of mobile phones and all components needed results in a complex process scheme, as a lot of materials, subcomponents and components have to be manufactured and assembled. Figure 1 shows a simplified flow chart of this process, including the transport network and editorial work. Not all the processes shown were considered in our test (see below).

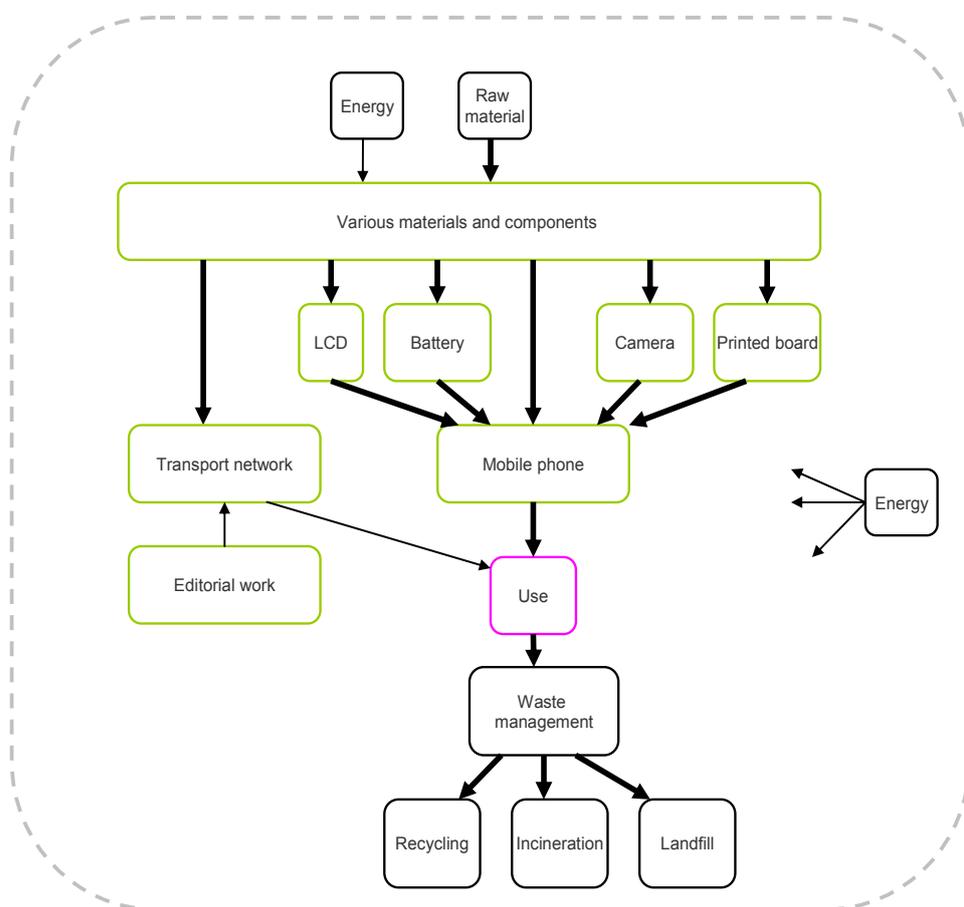


Figure 1. Simplified flow chart of the product system for mobile news. Arrows indicate transport, bold arrows physical flows and thin arrows digital flows or distribution of electricity and heat. In the test performed here, only parts of these processes were considered, often as aggregates.

For the purposes of our test, we needed to make major simplifications and cut-offs in the system studied. The information sought was frequently available in aggregated form for sectors, e.g. mining and electronics manufacturing. Information is presented for the following processes or aggregates of processes in the service life cycle:

- Raw material acquisition
 - Mining of different metals
- Production/Manufacturing
 - Editorial work
 - Production of mobile phone and components
- Use
 - Reading news
- Disposal
 - Management of e-waste
 - Recycling of e-waste

Major processes, such as transportation and energy generation, were not included. This choice was made as we wanted to focus on processes more specific for the ICT sector at this stage.

In this case, the editorial work when publishing news stories on mobile platforms is geographically located to offices in Sweden. The specific newspaper company is anonymous. However, the editorial work covers national and international news. The news published via this channel has more focus on Swedish than international news. The geographical location of the user of the mobile news is mainly Sweden. Technically, it is possible to get news updates via the mobile phone and use the internet on the phone to access the mobile site wherever the user is located in the world. However, there is reason to believe that most people who sign up for this service are already readers of this newspaper, and that they are located in Sweden.

4.3 Video meeting – System screened

The test of S-LCA for video meetings could have the purpose of providing a company with information on the potential social impacts of the service they want to sell. The functional unit of the study could be one year of video conference meetings at Company A.

Video conferencing was previously studied using a life cycle perspective by TeliaSonera looking at the environmental impacts (Östermark and Eriksson, 1998), but that study is more than 10 years old. However, for the test performed here we decided to use the flow chart of this study as inspiration (Figure 2). Major cut-offs were made to make the inventory work reasonable and only parts of the processes were considered, often as aggregates.

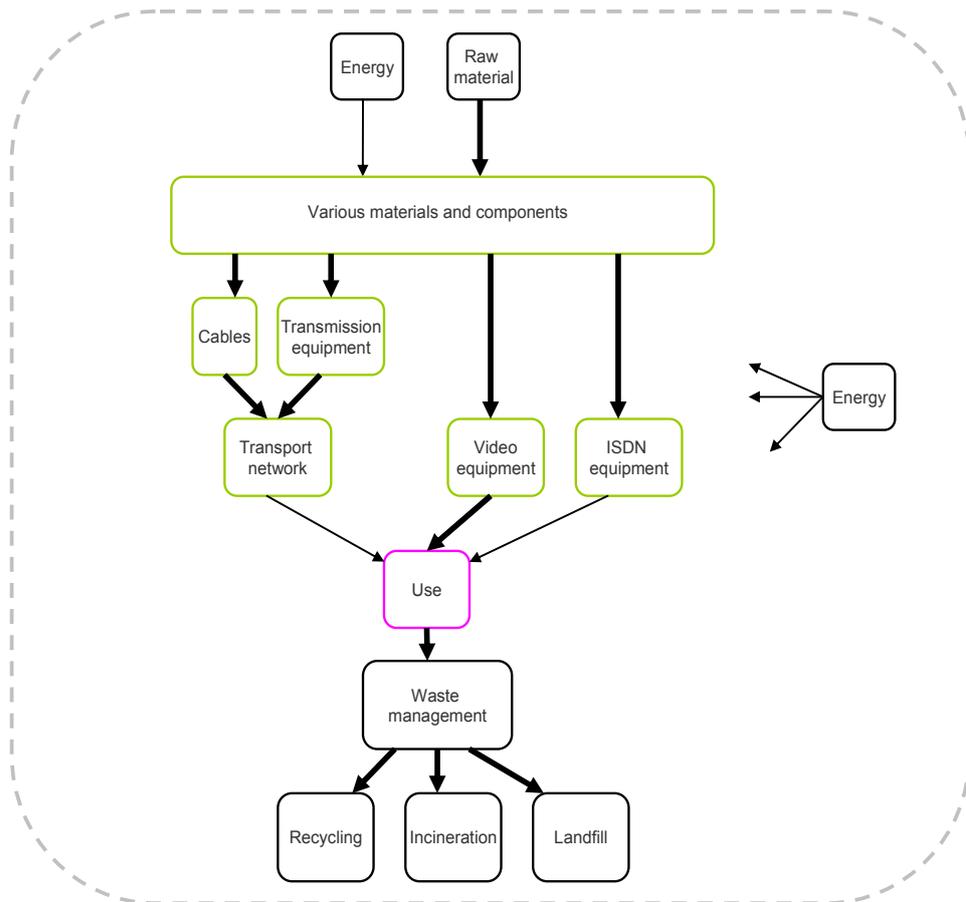


Figure 2. Simplified flow chart of the product system for video conferencing. Arrows indicate transport, bold arrows physical flows and thin arrows digital flows or distribution of electricity and heat. In the test performed here, only parts of these processes were considered, often as aggregates.

The processes selected for study were:

- Raw material acquisition
 - Mining of different metals
- Production/Manufacturing
 - Production of Electronic components/Monitor
- Use
 - Use of video conferencing equipment
- Disposal
 - Management of e-waste
 - Recycling of e-waste

Major processes, such as transportation and energy generation, were not included. This choice was made as we wanted to focus on processes more specific for the ICT sector at this stage.

In the system studied, the user was assumed to be in Sweden. As the video conferencing service provided by TeliaSonera does not demand a specific monitor for use, general data and information on production of monitors were sought. However, for a company assessing the potential impacts of different purchasing options, specific equipment of different kinds should be assessed.

4.4 Results

This section contains information on potential social impacts (based on the subcategories listed in 3.1) of the selected processes and stakeholders. A note on the location of the processes is given for each. As the study only defined the geographical location of the user, the other locations are dependent on the information found. The sources of information are noted as well, and it should be clear that no review of the data found was used within this study. The two cases are handled together concerning common activities such as mining of metals, manufacturing of electronic components and waste management of electronic devices. When no information was found or gathered, this is noted. This may indicate that there is no impact or that no information on such an impact was found.

4.4.1 Raw material acquisition

In a study by Wu et al. (2008), the constituents of two different mobile phones were analysed and found to be 40 and 43% plastics; 40 and 35% metals, 12% ceramics (incl. glass) and 6 and 7% epoxy. Wu et al. (2008) noted that even though the two phones differed in model, brand name, manufacturer, production year, weight, etc., the material constituents and their percentages were rather similar. It can be noted that even though the two telephones analysed had similar composition, the absolute weight was almost halved in the newer model.

Here, we narrowed raw material acquisition to metal mining and did not consider the raw materials for plastics, glass, chemicals, etc. It is difficult, or even impossible, to trace the sources of metals used in electronics back to specific producers and mines, as they are often bought from the global pool of metals (GHGm, 2008). Buyers on this market often only consider the price (GHGm, 2008) and are not interested in the location of mines.

The mobile phones analysed by Wu et al. (2008) included 24 different metals, the main ones being aluminium, iron, copper, cobalt, zinc, nickel, tin, chromium and lead. Among the other 15 were gold, palladium, arsenic and cadmium. Some of the metals (cadmium, chromium (VI) and lead) are part of the RoHS Directive (Restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC) and will be phased out of these products.

In a bill of materials for LCD screens (IVF, 2007, p. 126), the metals listed include aluminium, copper and iron. The metals in printed boards are not specified.

An overview of social and environmental aspects of metal supply to the electronics industry was prepared at the request of the Electronic Industry Citizenship (EICC) and the Global e-Sustainability Initiative (GeSI). The report broadly covers aluminium, cobalt, copper, gold, palladium and tin (GHGm, 2008). Generally, mining activities can include both positive and negative impacts; the former through increased economic prosperity, improved quality of life and better public infrastructure, and the latter through human rights violations, labour issues, socio-economic disturbances, corruption and conflict (Azapagic, 2003; GHGm, 2008). The Mining, Minerals and Sustainable Development Project (MMSD) was initiated by nine of the world's largest mining companies to study the minerals sector in relation to sustainable development (IIED and WBSCD, 2002). In a report from the project, several social impacts of the mining industry are discussed (IIED and WBSCD, 2002). There are several other sources of

information available, giving the NGO perspective and more geographically specific information.

Some issues regarding the stakeholder Worker are listed below.

Process: Mining of different metals

Stakeholder: Worker

Location: Different countries globally

Sources: Various written sources

For the potential social impacts from mining of different metals described below, different sources of information were used. In most cases mining in general is considered but country-specific data are referred to in some specific cases. For more detailed and specific case studies, country or site-specific information should preferably be used.

Freedom of Association and Collective Bargaining

In the mining industry, the right to form unions and to collectively bargain has often been a reason for conflict (IIED and WBSCD, 2002, p. 126).

Child Labour

In artisanal and small-scale mining (ASM), child labour is a major concern (EIR, 2003; ILO, 2006). There are one million children working in ASM (ILO, 2006). According to ILO (2006), children are quite young when they start accompanying their parents (from 4 years). Using low-cost and simple techniques lacking safety measures and carrying out more adult tasks before having the judgement and strength of an adult leads to increased risks to child health and safety. Living under conditions where conflicts between miners and neighbouring communities are not infrequent and where drugs and prostitution may be common has an additional impact on these children. (ILO 2006; EIR, 2003)

In addition, a number of large-scale companies have been accused of using child labour (Handelsman, 2001 as cited in IIED and WBSCD, 2002, p. 188).

Fair Salary

In many parts of the world today, mine labour represents relatively high-wage work (IIED and WBSCD, 2002, p. 68), but a number of large-scale companies have been accused of not paying fair wages (Handelsman, 2001 as cited in IIED and WBSCD, 2002, p. 188).

Working Hours

Mining schedules of up to 14 days of 12-hour shifts in a row and the consequences of mineworkers spending more time away from home and new health concerns were reported in an ILO survey in Australia (Heiler et al., 2000 as cited in IIED and WBSCD, 2002, p. 130). On the other hand, there are examples where companies have agreed to flexible working hours to enable e.g. indigenous people employed to be able to take part in traditional activities etc. (IIED and WBSCD, 2002, p. 207 and p. 215).

Forced Labour

Bonded labour may occur in small-scale mines in a few states in India and in Myanmar. (Tata Energy Research Institute, 2001 as cited in IIED and WBSCD, 2002, p. 190).

Equal Opportunities/Discrimination

There is a dominance of male workers in mine-related work, partly due to regulations on women working underground (IIED and WBSCD, 2002, p. 205). However, roughly 30% of ASM miners are women and they are often overlooked in initiatives and development programmes (Hinton et al., 2003 as cited in GHGm, 2008).

As the workforce is generally decreasing in the sector, there may be difficulties in increasing employment of women (IIED and WBSCD, 2002, p. 205).

Health and Safety

Accidents are a main concern in the mining industry. Mining is responsible for 5% of fatal accidents at work, but only represents 1% of the world's work force (ILO, 2001 as cited in IIED and WBSCD, 2002, p. 128).

Reduced rates of accidents, injuries and occupational disease have been achieved in modern mining. However accidents are still frequent, gold mines in South Africa, Chinese coal mines and Bolivian tin mines being examples given in IIED and WBSCD (2002, p. 65). Occupational diseases, such as cancers and respiratory conditions, are health problems related to mining, as is HIV/AIDS (IIED and WBSCD, 2002; GHGm, 2008).

Social Benefits/Social Security

In modern mines there are social security and social benefits, e.g. providing support in the event of unemployment (IIED and WBSCD, 2002, p. 205).

4.4.2 Production/Manufacturing

Process: Editorial Work (Mobile News)

Stakeholder: Worker

Location: Sweden

Sources: Interview with company

The process information and data presented below are based on information from a Swedish newspaper company gathered for this test by Malin Picha, Swedish Media Association. Only information from the company is used, no review has been made.

Freedom of Association and Collective Bargaining

The editorial employees are free to join any union or association of their choice. Most likely, it is the Swedish Federation of Journalists (in Swedish Journalistförbundet, SJF) that represents the editorial staff in discussions with the employer.

Child Labour

No child labour occurs.

Fair Salary and Working Hours

According to the company, the salaries for the editors working with mobile news and news on the web are equivalent to those of other editors in the company. The working hours are divided into four shifts: 05.30-16.00, 06.00-16.30, 09.00-17.00, and 14.30-01.00.

Forced Labour

No forced labour occurs.

Equal Opportunities/Discrimination

There are no known cases of discrimination among the staff working with mobile news or web news.

Health and Safety

The company works very actively with health care issues. This is true for the whole staff, not only for the mobile and internet editors. The staff can for example exercise for free in the gym at the company, and through the company health care initiative, the employees can access doctors, nurses and physiotherapists. The company also pays for a thorough medical examination every two years for all employees. Massage is offered to the employees at a reduced price. The sickness rate for the mobile and internet editorial staff is the same as for other equivalent groups in the company.

Social Benefits/Social Security

Social benefits and social security are part of the Swedish social security system.

Process: Production of Electronic Components / Monitor

Stakeholder: Worker

Location: Different countries globally and China specifically

Sources: Various written sources

No specific studies were found on the social aspects of producing monitors (which may be used for video conferencing). However, there are studies on production of electronics and computers specifically (Manhart and Griesshammer, 2006; Brigden et al., 2007; Manhart, 2007). In addition, a document on the changing labour force requirements in production of electronic components for the ICT industries has been prepared by ILO (2007).

Manhart and Griesshammer (2006), also inspired by the work in the UNEP/SETAC task force on S-LCA, considered similar social aspects for the workers involved in production of laptops in China. According to Manhart and Griesshammer (2006), the production of the LCD (liquid crystal display) screen is technologically demanding and the process is fully automated and closed.

Some results from the assessments mentioned above are listed for the Worker stakeholder category indicators. Generally for workers producing electronics for the ICT industry supply chain, ILO (2007) states that these workers are affected by the lack of stability in demand as well as the shift in regional locations and changes in ownership in enterprises. ILO (2007) further reports that it is the worker at the bottom end of the supply chain (farthest away from the end-product) that is generally the most disadvantaged.

Freedom of Association and Collective Bargaining

The electronics industry has a record of low or non-existent unionisation (ILO, 2007). Manhart and Griesshammer (2006) conclude that in the Chinese electronics industry, even though there are some efforts made in a few multinational companies, few functioning worker representations are to be found. In many Asian countries the ICT industry is located in so-called export processing zones (EPZs) where there are restrictions on unions (ILO, 2007).

Child Labour

In the electronics sector in China, only a few unconfirmed reports are found (U.S: Department of Labor, 2006, as cited in Manhart and Griesshammer, 2006).

Fair Salary

Reports from 2003 and 2005 state that Chinese workers are among the cheapest globally (CAFOD, 2003 and UBS, 2005, as cited in Manhart and Griesshammer, 2006). However, the electronics sector wages are still relatively high compared with other sectors (CAFOD 2003 as cited in ILO, 2007). In Mexico, wages can often be below minimum wage (ILO, 2007).

Working Hours

Long working hours during production peaks and also cases without weekly recovery days in the electronics industry in e.g. China, Mexico and the Philippines are consequences of manufacturing 'just-in-time' (ILO, 2007).

Forced Labour

According to Manhart and Griesshammer (2006), forced labour has not been reported in the electronics industry in China.

Equal Opportunities/Discrimination

In the manufacturing of electrical and electronic products, women earn less than men (ILO 2007). This pattern illustrates average earnings, and may to some extent reflect possible differences in qualifications, seniority, physical demands of work, etc. This wage discrepancy is increasing over time, except in Finland (ILO, 2007).

In China, the workforce in the electronics industry is mainly women in the ages 18 to 25 (Roberts, 2005 as cited in Manhart and Griesshammer, 2006). This gives an indication of non-equal opportunities, as young women are not as frequently found among better-paid workers and foremen (Schmidbauer, 2004 as cited in Manhart and Griesshammer, 2006; ILO, 2007). For a worker above 30 years of age, it is difficult to get employed in the electronics sector, according to ILO (2007).

Health and Safety

According to ILO data, there is a higher rate of accidents and occupational illnesses in the industrial sector in China compared with the industrial sector in other countries at a similar level of development (ILO, 2005 as cited in Manhart and Griesshammer, 2006).

The main health problems in the electronics industry are caused by handling of hazardous chemicals (Manhart and Griesshammer, 2006; ILO, 2007). Greenpeace analysed a range of laptops for the presence of selected toxic chemicals (Brigden et al., 2007). The studied metals lead, cadmium, mercury and hexavalent chromium were not detected in any of the samples analysed. However, bromine, brominated flame retardants, PVC (polyvinyl chloride) and phthalates were found in several samples. The assembly phase, which is that closest to the multinational companies selling the final products or services, often does not involve any use of toxic substances (Manhart and Griesshammer, 2006). The manufacture of PCBs (printed circuit boards) gives rise to the highest risk to health, as there is direct contact with chemicals (ILO, 2007).

Social Benefits/Social Security

Employers often do not comply with Chinese law on workers' rights to basic social security regarding health, unemployment and old age pensions (China Labor Support Network, as cited in Manhart and Griesshammer, 2006).

Process: Production of Mobile Phone and Components

Stakeholder: Worker

Location: China and Philippines

Sources: Various written sources

There are reports from NGOs specifically studying the social impacts of mobile phone production (e.g. Chan et al., 2008). In their report on the social impacts of mobile phone production, Chan et al. (2008) studied the labour conditions in six factories in China and the Philippines where different components used in the big mobile phone brands are produced. Some information provided by these is given below. General information on production of electronic components given above is also relevant for the production of mobile phones.

According to Chan et al. (2008), there are complaints from the suppliers that the buyers have high set environmental and social requirements for suppliers, but that they are not willing to pay extra for this to be implemented. Workers are generally not aware of the codes of conduct of the purchasing company.

Freedom of Association and Collective Bargaining

One issue raised by Chan et al. (2008) was lack of independent unions, as in the four Chinese factories studied there was no union in place or the union was connected to the management system, according to the workers interviewed. The Philippine workers also mentioned lack of freedom of association (Chan et al., 2008).

Child Labour

No information was readily available on this topic.

Fair Salary

Issues raised by Chan et al. (2008) include long hours at low wages; health and safety; lack of independent unions; and unequal opportunities.

Working Hours

The reports on working conditions in the four Chinese factories studied state that overtime was lengthy and exceeded the legal limit (Chan et al., 2008).

Forced Labour

No information was readily available on this topic.

Equal Opportunities/Discrimination

There are many female workers on the production lines, presumably because the employers consider them to be less likely to cause trouble and fight for their rights (Chan et al., 2008). Young migrant women workers are 'at the bottom of the social ladder', according to Chan et al. (2008).

Health and Safety

The occupational health and safety measures in the Chinese factories studied by Chan et al. (2008) were not sufficient, as in some cases workers were not provided with protective equipment needed.

Social Benefits/Social Security

Information on social security provision was not made clear to all workers (Chan et al., 2008).

4.4.3 Use

Process: Accessing Mobile News

Stakeholder: Consumer

Location: Sweden

Sources: Interview and written sources

The information and data on consumer privacy below were provided by the newspaper company's mobile manager, and by one of the author's (Malin Picha) own experiences while using this news service.

Health and Safety

Health and safety issues discussed today in relation to the use of mobile phones are mainly related to possible health effects of radiation (e.g. WHO, 2009) and traffic accidents. WHO (2009) state that "despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health". Regarding the possible risks with radiation, these are probably even smaller when the phone is used for mobile news, as it is then not as close to the head as it is when communicating without a headset.

Consumer Privacy

As far as consumer privacy is concerned, the mobile users sign up for the mobile news service via text messaging. In the signing-up process, the consumer is also given clear instructions on how to sign off and end this service. There are no time obligations or extra fees for this particular service.

The news alerts are sent out as text messages to the readers during the day, usually not before 6 a.m. or after 10 p.m., but the consumer has no way of knowing exactly when the messages will be sent out, so if they do not want to be disturbed it is best to turn off the sound or turn off the phone completely.

The company naturally has a list of all their subscribers, but when subscribing there is no name mentioned, so the company's subscribers list only consists of a long list of telephone numbers. Consequently, the company does not know the members of this target group other than that they are subscribing to this service, which limits the possibility of direct marketing.

Transparency

No information was readily available on this topic.

Other – Human Capital and Inclusion

In addition, it can be noted that mobile news may contribute to social sustainability through increased knowledge and inclusion in society, which is a social impact on the consumer as well as society.

Process: Use of Video Conferencing Equipment

Stakeholder: Consumer

Location: Sweden

Sources: TeliaSonera

In 2004, TeliaSonera made a survey regarding the meeting habits of employees in Sweden. The survey considered 'Telemeetings' and 574 employees answered the questionnaire sent out. It should be noted that telemeetings are held by phone and thus differ from video conferencing. The results of the survey showed that people chose telemeeting mainly because it was more efficient. It saved time and money and people tended to attend to a higher extent. Physical meetings were used when people needed to get to know each other, e.g. at the beginning of projects. Physical meetings were also favoured when there was a need to create relationships and develop the team, in more sensitive situations and when the meetings were expected to take a long time.

There was no information available on the category indicators suggested for S-LCA (see section 3.1). However, some other interesting social impacts were found. These are more in line with the social aspects considered by Moberg et al. (2008), where the social impacts on users were assessed more directly related to experiences by the users.

Other – Usability

The TeliaSonera study showed that it is simple to organise and take part in a telemeeting, but that it is not a satisfactory way to meet to form relationships with colleagues or clients

Other – Coordination With Other Daily Activities

Telemeetings may increase the opportunities for work and contribute to the balance between work and free time.

Other - Efficiency

The telemeeting can save time and money. The meeting may be more efficient as more people attend, but it may be less efficient if people have not had the opportunity to meet face to face. It may be difficult to conduct the small talk that may be important to smooth the meeting.

It is important to note that the current study considered video conferencing, which differs from telemeeting (held by phone) in that it is more similar to physical meeting. Some of the above-mentioned negative effects and consequences might be offset by the video conference or the telepresence meeting.

4.4.4 Disposal

Regarding the disposal of e-waste in Sweden the amount collected per inhabitant in Sweden is high, which is due to high consumption of electronics, good collection systems and environmentally conscious inhabitants, according to the Swedish Waste Management authority (Avfall Sverige, 2008). As there are no relevant consumption statistics available, according to Avfall Sverige it is not possible to state how much e-waste is not collected

and treated. It is not known how frequently electronic waste is illegally exported from Sweden. However, the collection system in Sweden is well established, making it probable that much of the e-waste is handled within the system. In this study we also considered waste management of electronics disposed of outside Sweden, to give an indication of possible social impacts.

There are substantial differences concerning the handling of e-waste and also the availability of data and information on e-waste handling internationally (Greenpeace, 2008a). There are differences between industrial countries, e.g. the U.S. and EU27, and also within EU27, and there are differences between industrialising countries such as China and India (Greenpeace, 2008a).

Based on the S-LCA methodology under development, Manhart (2007) assessed the social impacts of electronics production and WEEE-recycling in China, which is referred to below. It should be noted that the Manhart (2007) study focuses on the situation in China and that there may be substantial differences compared with the average situation globally, especially compared with large-scale modern recycling facilities.

Process: Management of e-waste

Stakeholder: Consumer

Location: Sweden

Sources: No sources

The social impacts of consumer handling of e-waste were not studied here, but it can be assumed that there are some impacts related to the provision of information on how to handle e-waste, coordination with other daily activities, etc.

Process: Recycling of e-waste (and reuse)

Stakeholder: Worker

Location: China (and Global)

Sources: Various written sources

Freedom of Association and Collective Bargaining

Manhart (2007, p. 15, citing several sources) states that mainly small and informal companies handle e-waste recycling in China and there is hardly any worker organisation. Globally, the recycling in large-scale facilities will hold other opportunities for workers.

Child Labour

The extent of child labour in this field in China is unknown (Manhart, 2007).

In a report from Greenpeace (2008b) on e-waste management in Ghana, much of the work was reported to be done by children at the sites studied. The children were between 11 and 18 years, but some were as young as five (Greenpeace, 2008b).

Fair Salary

According to NBSC (2006, as cited in Manhart, 2007), wages in China are lower than the national wages of staff and workers, both for workers at licensed and informal enterprises. The wages of the latter are substantially lower.

Working Hours

There is little knowledge regarding working hours. For WEEE-disassembly, Eugster and Fu (2004, as cited in Manhart, 2007) reported an average of 240 working hours per month and employee in Beijing, China. Manhart (2007) argues that the work in most cases is dependent on daylight, limiting the working hours to 10-11 hours per day.

Forced Labour

There is no forced labour reported in Chinese WEEE-recycling (Manhart, 2007).

Equal Opportunities/Discrimination

Manhart (2007) draws the conclusion that the small-scale family or two-man businesses that are often the case in the informal recycling industry in China run less risk of systematic discrimination. There are not many data available, but what Manhart (2007) does note is the unequal distribution of tasks between the local people doing the business and migrants carrying out the physical work (Sun Yat-sen University & Greenpeace, 2003 as cited in Manhart, 2007).

Health and Safety

Health and safety for employees recycling electronic waste has been much debated, especially as a large part of the recycling activities are illegally managed in industrialising countries, including e-waste exported from industrialised countries (e.g. Manhart, 2007; Greenpeace, 2008a). Managed appropriately the risk would be low, but inappropriate practices lead to dangerous emissions (e.g. Leung et al., 2008; Nnorom and Osibanjo, 2009).

Health issues are closely related to the techniques used for recovering raw materials, such as copper, lead and precious metals. The recovery is performed through open burning and use of chemicals (e.g. Manhart, 2007; Greenpeace, 2008a). Williams et al. (2008) compare landfilling of waste computers to material recycling, taking into account that recycling will lead to a higher risk for toxic emissions and human health impacts. They refer to studies in Guiyu in China, where a lot of informal recycling of electronics takes place. The studies show high levels of lead in the blood of children, as well as daily exposure to dioxins and furans 15-56 times higher than the WHO recommendations (Li et al., 2007 as cited by Williams et al., 2008).

However, these health issues can be handled through better techniques and improved protection measures. Easy measures include inhalation protection against dust (Manhart, 2007).

The challenge is to compete economically with the informal recovery activities (Greenpeace, 2008a).

Social Benefits/Social Security

Manhart (2007) makes the assumption that very few of the workers in the field of e-waste recycling in China hold labour contracts, health insurance, unemployment schemes or old age pension schemes.

5. DISCUSSION AND CONCLUSIONS

In this pre-study we wanted to consider the use of S-LCA for ICT products, i.e. the possibilities and limitations of using a life cycle perspective regarding social impacts of products. Two ICT services were chosen as test cases: mobile news and video conferencing. The companies participating in our study currently have different degrees of knowledge and practice regarding social responsibility and life cycle thinking (this is probably the case for companies in general). The scope of an S-LCA is not often considered today and the current pre-study is part of the ongoing generation of knowledge and experience in this field.

5.1 Social responsibility of companies and organisations

In starting to act on social responsibility (SR), the company's own employees are easily targeted and influenced. Working conditions at company sites, wages and working hours can be handled through internal actions. In the next steps, considering social impacts in the supply chain, for consumers and in disposal activities actions may be less clear-cut. The first step may be to formulate supplier requirements. However, there is at times a conflict between the supplier requirements set and the company's willingness to pay for improvements in practice (Chan et al. 2008; Manhart and Griesshammer, 2006). This raises the question of who is responsible.

As more information is communicated to the public and other stakeholders, more remedial action will be required from companies. Campaigns such as Make IT Fair will increase the pressure on companies to obtain knowledge and act.

Both Ericsson and TeliaSonera consider the social impacts of their products, taking part in initiatives on safe internet use and discussions on electromagnetic radiation, as well as promoting products as beneficial, making life easier for the user. This is not as apparent for the media organisations, even though important social aspects such as learning and freedom of speech are a basis for their activities. This may be due to mainly positive social impacts being related to these areas, at least in Sweden.

Many companies start to integrate social aspects in supplier requirements. It is understandably easier to reach the first and second tier of suppliers in the chain. However, as ILO (2007) has shown, it is the workers at the beginning of the supply chain (farthest away from the end-product) who are generally the most disadvantaged and thus there is a need to consider these as well. The main impacts occurring at the beginning of the supply chain are probably correlated to negative impacts on local communities as well. Clift and Wright (2000) conclude in their paper on relationships between environmental damage and economic value added that the greatest environmental damage is associated with industry at the beginning of the supply chain, which is of course connected to negative social impacts. Positive impacts should be promoted as negative are reduced. Ericsson uses risk assessment to select where supplier audits should be focused: 'The market risk factors include revenue, market maturity, and social and political aspects. The commodity risk factors are set as a function of how critical each line of business' processes and activities are from a Code of Conduct perspective.' (Ericsson, 2008, p. 24).

5.2 Life cycle perspective

5.2.1 General

Considering environmental impacts using a life cycle perspective has been common for several years now and producers take into account environmental impacts occurring in distant parts of the life cycle, including emissions of other stakeholders, in their own sphere of responsibility. As life cycle thinking was a new term and the LCA technique was developed for assessing the environmental impacts of products, it was not obvious to use a life cycle perspective for calculating the environmental impacts of products. In a similar way, society is now asking for knowledge about social concerns related to products. There are certainly social impacts throughout the life cycle of a product and without concern about origins, there is a considerable risk that negative social impacts may be a result of consuming products. By learning more about the social impacts using a life cycle perspective, these issues can be considered and improvement can be facilitated.

5.2.2 Test

As part of this pre-study a test was made to illustrate social impacts of ICT products. Parts of the life cycles of two ICT services were checked regarding a selection of social aspects. The test was not comprehensive and the potential impacts were not related to a functional unit and not interpreted, as the main purpose was to facilitate a discussion on the possibilities and limitations of S-LCA. The test was too incomplete to draw conclusions on potential social impacts.

However, the test showed that there are social impacts along the life cycle and that this may be positive or negative, with differing magnitudes. In any case, we need to know that consumption leads to social impacts. As stakeholders start to impose demands, there is an increasing engagement from companies and organisations to widen their sphere of responsibility or at least knowledge. Heiskanen (2002) saw a possibility for life cycle thinking to have a role in illustrating and reminding us of impacts of consumption which tend to be erased through outsourcing and globalisation. Heiskanen ends her paper with the sentence 'Environmental governance through the logic of life cycle thinking seems to call for a broader discussion about who is accountable for what and to whom.' This is indeed a valuable discussion in the case of social impacts too.

Our test showed that there is a lot of information on social impacts, although in the study we were only able to consider a small part. There is probably more lack of data for the other stakeholder groups, as Workers is a more easily defined, and studied, group. How this information is used, could be used and should be complemented needs further attention.

Even though the test was incomplete, it can be noted that at both 'ends' of the life cycle, raw material acquisition and waste disposal, there are problems that may be serious and hard for companies to manage. Raw materials are often bought on a market where the origins are not known and the management of e-waste is to some extent also made in a non-satisfactory way and where a specific product ends up cannot be foreseen. The positive social impacts due to e.g. providing working opportunities in developing countries are not as well described. There is a risk that the negative social impacts are not satisfactorily balanced against actual positive impacts.

5.2.3 S-LCA

In conducting an S-LCA the purpose needs to be clear. Manhart and Griesshammer (2006) emphasise the focus on efforts for improvement, to make the impacts on stakeholders more positive or at least less negative. At first, as uncertainties will be large, the use of S-LCA for learning, monitoring and facilitating improvements seems like a valuable application. Comparing different products will probably be difficult due to e.g. varying availability of data and lack of impact assessment methods.

One key characteristic of the S-LCA, compared with the environmental LCA, is the stakeholder categories. In our test only the stakeholders Workers and Consumers were considered. For workers, there are a number of international agreements and regulations aiming to safeguard workers' rights. These form the basis for the subcategories related to this stakeholder (Benoit and Mazijn, 2009). Consequently, this area is well covered by the subcategories suggested and there is information available for most of the subcategories. The difficulties may lie in valuing the possibly different views of workers, or their representatives, and their employers. Chan et al. (2008) give examples where the statements of workers are contradicted by those of management.

Concerning the customers or users, the social impacts may be diverse, as products serve different purposes and users have different contexts. From a sustainability point of view the product may have a purpose that is contributing, e.g. providing education in developing countries, or the opposite, e.g. cigarettes. The negative impacts of the latter would be considered as part of the subcategory health and safety, while the positive impact of the former would not obviously, but possibly, be considered as indirectly contributing to health and safety.

In LCA the benefit of the product should be described and then formulated, preferably in quantitative terms, in the functional unit. In S-LCA (Benoit and Mazijn, 2009) it is stated that the social utility needs to be considered when describing the function of the studied product, as well as the technical utility. As in environmental LCA, the definition of the functional unit should cover properties that the product 'must' have, and thus social aspects such as convenience, image and satisfaction may be lost, as they are not part of the category indicators inventoried. The impact categories suggested for the stakeholder consumer in the S-LCA code of practice mainly cover impacts based on relations between the company and the stakeholder, e.g. transparency and consumer feedback mechanisms. However, the category indicators health and safety and consumer privacy may relate to impacts caused by the product rather than the company management. Here it is interesting to consider whether positive impacts will be assessed or whether the assessment ends up with the negative impacts, as these may be easier to get knowledge about while the positive impacts may be considered too subjective.

In the information provided by TeliaSonera on telemeetings, both positive and negative impacts were considered. The subcategories could have been usability and efficiency. In a study on video-mediated meetings (Moberg et al., 2008), social indicators included coordination with other daily life activities and satisfaction. Even if the function of the service is fulfilled as such (e.g. a meeting between two persons providing a certain service or performing a task), the activity may or may not fit into the daily life of the intended user, thus having different social utility. Many companies perform user studies and know much about their target groups. It can be discussed how detailed information should be used in an S-LCA and what should be analysed separately when it comes to consumer

social impact. It may be more relevant to combine the LCA with some kind of user study to capture these social impacts on the stakeholder consumer, including the product utility.

Another key characteristic of S-LCA is emphasising the need for site- or company-specific information and data. Identifying 'where and by whom' will not be possible or relevant in the cases where the provider of a service does not provide the platform where the service is to be used. This is the case for the mobile news and video conferencing used as cases here. However, a video conferencing service could be sold with certain equipment and companies or organisations providing the service could give advice on choosing a platform. Options could include devices selected based on environmental and social preferences.

Site-specific information may be difficult to obtain in many cases since the raw material is acquired through the global market, where there is little knowledge on the origin of the specific material bought (GHGm, 2008). In a similar way, it is difficult to know where a product will eventually be disposed of and where and by whom the waste management will be handled. This may have great implications on the social impacts related to a product, as best case or worst case raw material acquisition and waste management may lead to significantly different results.

With the aim of reducing negative and increasing positive social impacts of products, one solution could be to take part in efforts aimed at improvements in the respective sectors generally. For example, the way Ericsson is targeting the issue of e-waste is through participating in StEP, where joint forces are targeting the problems. Similar initiatives from the mining and minerals sector as well as the electronic sector will hopefully lead to improvements that may not be particularly beneficial for a specific supplier or product life cycle, but may be highly important for the social impact of the sector activities in general. Sector improvements may be supported by stating relevant supplier requirements, which may be defined through collaboration in the supply chain (as suggested in GHGm, 2008). On the other hand Danielson (2006, p 87) concluded that 'we should maintain a preference and a presumption that issues be resolved as locally as they can be. Global processes should be the exception, not the rule.' It is important that sector initiatives include a clear phase of converting the sector statements and improvement potentials into local actions and solutions adapted to the conditions of the specific sites and companies. Considering Danielson's conclusion, it may be relevant to identify some local/site-specific actions as well. Improvement may be credited to the supporting company or organisation, even though it is not certain that the improved site is actually part of the specific product life cycle.

Another relevant methodological issue relating to the services tested here is the question of dividing impact between the benefits or functions provided by a multifunction platform or device. 'How much' of the social, positive and negative, impact should be allocated to the service of mobile news and to other uses of the same mobile phone? This question is also raised in an environmental LCA.

The methodology of S-LCA is under development. Lacking common databases, the performance of an S-LCA would be very time-consuming and there is of course the risk that many social impacts where (quantitative) information is not available will be left out, providing less relevant results. S-LCA should preferably be used in a transparent way and aggregation should be performed with care. To date, S-LCA impact assessment is 'an

open field for future research' (Benoit and Mazijn, 2009). This will be a most important part of the development, as the distribution of potential impacts should be considered through the impact assessment.

5.3 Further research

In the field of S-LCA there is plenty of future research to be conducted, examples being provided by Benoit and Mazijn (2009). One important way of getting more experience and enabling further development of the method and its practice is through performing case studies. The assessment of potential social impacts of the two services considered in this study, or other ICT products, would be very interesting. Based only on the overview provided in the previous chapters and in previous work (e.g. Chan et al., 2008; GHGm, 2008) it is clear that ICT products will have considerable social impacts, both positive and negative. Assessing these with the aim of improving conditions and opening up the discussion on responsibility would be possible future work.

The usability of such assessments and their results would also be an interesting field of future research. Considering different decision-making processes and the use (and non-use) of different sources of information, the possibilities for S-LCA to enable more informed decision-making and ultimately improve social conditions should be clarified and further developed.

5.4 Conclusions

This pre-study indicates that it can be useful to apply a life cycle perspective when considering potential social impacts of products. This facilitates the inclusion of processes and stakeholders in the beginning of the life cycle, where impacts may be considerable and negative.

Development of S-LCA is thus relevant to provide transparent and 'standardised' assessment of potential social impacts. By providing guidelines or standards, the assessments of social impacts can be interpreted and criticised more easily.

ICT is a challenging sector as most hardware consists of many different components, which in turn consist of many different materials. This makes the supply chain, or rather network, complex. In addition, many ICT services are provided by other actors than those providing the devices or platforms. The discussion on responsibility needs to be continued.

REFERENCES

- Avfall Sverige, 2008. Vart tar smått el-avfall från hushållen vägen? Studie av plockanalyser samt hushållens attityder och agerande. (In Swedish) Rapport 2008:03. ISSN 1103-4092, Malmö.
- Azapagic A., 2003. Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production*, Vol. 12, Issue 6, pp. 639-662
- Benoit C. and Mazijn B., Eds., 2009. Guidelines for Social Life Cycle Assessment of Products. Social and socio-economic LCA guidelines complementing environmental LCA and Life Cycle Costing, contributing to the full assessment of goods and services within the context of sustainable development. UNEP-SETAC Life-Cycle Initiative. ISBN 978-92-807-3021-0
- Bergelin F., 2008. Life cycle assessment of a mobile phone a model on manufacturing, using and recycling. Master's thesis. Teknisk- naturvetenskaplig fakultet, UTH-enheten Uppsala University. ISSN: 1401-5773, UPTEC Q08 014
- Berkhout F. and Hertin J., 2004. De-materialising and re-materialising: digital technologies and the environment. *On Futures*, Vol. 36, Issue 8., pp. 903-920.
- Brigden K., Webster J., Labunska I. and Santillo D., 2007. Toxic Chemicals in Computers Reloaded. Greenpeace Research Laboratories Technical note 06/07, September 2007, Amsterdam.
- CAFOD - Catholic Fund for Overseas Development, 2003. Clean up your Computer – Working conditions in the electronic sector. London. As cited in Manhart and Griesshammer, 2006.
- Chan J., de Haan E., Nordbrand S. and Torstensson A., 2008. Silenced to Deliver: Mobile phone manufacturing in China and the Philippines. SOMO and SwedWatch. ISBN/EAN: 978-90-71284-27-4
- China Labor Support Network, 2006. Verbal communication. Hong Kong 2006. As cited in Manhart and Griesshammer, 2006.
- Clift R. and Wright L., 2000. Relationships between environmental impacts and added value along the supply chain. *Technological Forecasting and Social Change*. Vol 65, pp. 281-295.
- Danielson L., 2006. Architecture for change: an account of the mining, minerals and sustainable development project. History. Global Public Policy Institute, Berlin
- Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment Official Journal L 037 , 13/02/2003 P. 0019 – 0023.

- Dreyer L. C., Hauschild M. Z. and Schierbeck J., 2006. A framework for social life cycle impact assessment. *International Journal of Life Cycle Assessment*, Vol. 11, No. 2, pp. 88-97.
- EIR, 2003. Striking a better balance. Volume 1 The World Bank group and extractive industries. The final report of the Extractive Industries Review.
- Ericsson, 2008. Ericsson Corporate Responsibility Report 2007. Everyday actions that count. Ericsson, Stockholm.
- Eugster, M. and Fu, H., 2004. e-Waste Assessment in P.R. China – A case study in Beijing. Swiss e-Waste Programme. Empa - Materials Science and Technology, St.Gallen, Beijing. As cited in Manhart, 2007.
- Finnveden G. and Moberg Å., 2005. Environmental systems analysis tools – an overview. *Journal of Cleaner Production*, Vol. 13, Issue 12, pp. 1165-1173.
- GHGm, 2008. Social and Environmental Responsibility in Metals Supply to the Electronic Industry. Prepared for Electronic Industries Citizenship Coalition (EICC) and Global e-Sustainability Initiative (GeSI)
- Greenpeace, 2008a. Toxic Tech: Not in our backyard. Uncovering the hidden flows of e-waste. Full report. February 2008. Greenpeace, Amsterdam.
- Greenpeace, 2008b. Poisoning the poor. Electronic waste in Ghana. August 2008. Greenpeace, Amsterdam
- Handelsman S.D., 2001. Report on Human Rights and the Mineral Industry. Paper prepared for MMSD. As cited in IIED and WBSCD, 2002.
- Heiler K., Pickersgill R. and Briggs C., 2000. Working time arrangements in the Australian mining industry: Trends and implications with particular reference to occupational health and safety. Sectoral activities programme working paper no. 162, ILO, Geneva. As cited in IIED and WBSCD, 2002.
- Heiskanen E., 2002. The institutional logic of life cycle thinking. *Journal of Cleaner Production*. Vol 10, pp.427-437.
- Hinton J.J., Veiga M. and Beinhoff C., 2003. Women and Artisanal Mining: Gender Roles and the Road Ahead. In G.M. Hilson (Ed.) *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries*. A.A. Balkema, a Division of the Taylor and Francis Group. Rotterdam. As cited in GHGm, 2008.
- Hunkeler D., 2006. Societal LCA methodology and Case study. *International Journal of Life Cycle Assessment* Vol. 11, No. 6, pp. 371-382.
- IIED and WBSCD, 2002. Breaking new ground. The Report of the Mining, Minerals and Sustainable Development Project. Earthscan Publications Ltd, London.
- ILO, 2001. Mining (coal, other mining). Sectoral Activities. ILO, Geneva. As cited in IIED and WBSCD, 2002.

- ILO, 2006. Minor out of mining! Partnership for global action against child labour in small-scale mining. International Programme for the Elimination of Child Labour. International Labour Organization. ISBN: 92-2-118843-4. Geneva.
- ILO, 2007. The production of electronic components for the IT industries: Changing labour force requirements in a global economy. Report for discussion at the Tripartite Meeting on the Production of Electronic Components for the IT Industries: Changing Labour Force Requirements in a Global Economy. International Labour Organization. Sectoral Activities Report. ISBN: 92-2-119459-0. Geneva.
- ISO, 2006a. Environmental management – Life cycle assessment – Principles and framework, International Organisation for Standardisation, International Standard ISO 14040.
- ISO, 2006b. Environmental management – Life cycle assessment – Requirements and guidelines, International Organisation for Standardisation, International Standard ISO 14044.
- IVF, 2007. Lot 3. Personal Computers (desktops and laptops) and Computer Monitors. Final Report (Task 1-8). IVF Report 07004. ISSN 1404-191X.
- Jørgensen A., Le Bocq A., Nazarkina L., Hauschild M., 2008. Methodologies for Social Life Cycle Assessment. International Journal of Life Cycle Assessment Vol. 13, No. 2, pp. 96-103.
- Leung A.O.W., Duzgoren-Aydin N.S., Cheung K.C. and Wong M.H., 2008. Heavy metals concentrations of surface dust from e-waste recycling and its human health implications in southeast China. Environmental Science and Technology, Vol. 42, No. 7, pp.2674-2680.
- Li, H.; Yu, L.; Sheng, G.; Fu, J.; Peng, P., 2007. Severe PCDD/F and PBDD/F Pollution in Air around an Electronic Waste Dismantling Area in China. Environmental Science & Technology Vol. 41, Issue 16, pp. 5641– 5646. As cited in Williams et al. 2008.
- Manhart A. and Griesshammer R., 2006. Social impacts of the production of notebooks. Öko-Institut e.V., Freiburg
- Manhart A., 2007. Key social impacts of electronic production and WEEE-Recycling in China. Öko-Institut e.V., Freiburg.
- Moberg Å., Hedberg L., Henriksson G., Räsänen M and Westermark M., 2008. Hållbarhetsbedömning av en medierad tjänst - en pilotstudie (In Swedish). Report from the KTH Centre for Sustainable Communications, Report 2007:1, Stockholm
- NBSC – National Bureau of Statistics of China, 2006. China Statistical Yearbook 2006. Beijing. As cited in Manhart, 2007.

- Nnorom I.C. and Osibanjo O., 2009. Toxicity characterisation of waste mobile phone plastics. *Journal of Hazardous Materials*. Vol. 161, pp. 183-188.
- Nokia, 2005. Integrated Product Policy Pilot Project. Stage I Report. Nokia Corporation, Espoo.
- Norris G. A., 2006. Social impacts in product life cycles: Towards life cycle attribute assessment. *International Journal of Life Cycle Assessment*, Vol. 11, No. SPEC. ISS. 1, pp. 97-104.
- Östermark U. and Eriksson E., 1998. Life Cycle Assessment of a Videoconference – a comparative study of different ways of communication. Summary. Chalmers Industriteknik, Gothenburg.
- Räsänen M., 2006. Om möten i Distansen: Uppfattningar om möten på distans mellan arbetssökande och handläggare. (In Swedish). Technical report, HCI-report series, HCI-42. Stockholm: Kungliga Tekniska Högskolan (KTH).
- Roberts D., 2005. Waking up to their Rights. In: *BusinessWeek* online dated 22.08.2005. Internet version at: http://www.businessweek.com/magazine/content/05_34/b3948515.htm (viewed on 31.05.2006). As cited in Manhart and Griesshammer, 2006.
- SCB, 2004. Social statistics by industry – Introducing the social dimension into environmental accounts. Rapport 2004:1 Statistics Sweden, Stockholm.
- Schmidbauer H., 2004. Der lange Marsch in die Städte - Landfrauen und Arbeitsmigration in der VR China. In: Kupfer, K. (ed.): 'Sprengstoff in China?' Dimensionen sozialer Herausforderungen in der Volksrepublik. Focus Asien - Schriftenreihe des Asienhauses. Essen. As cited in Manhart and Griesshammer, 2006.
- Sun Yat-sen University Anthropology Department & Greenpeace China (2003): Anthropological report on electronic waste disposal industry in Guiyu. Shantou. As cited in Manhart, 2007.
- Tata Energy Research Institute, 2001. Overview of Mining and Mineral Industry in India. Tata Energy Research Institute, New Delhi. Paper prepared for MMSD. As cited in IIED and WBSCD, 2002.
- UBS Global Asset Management, 2005. Arbeitsstandards in China. SRI Newsletter, Issue 3/2005. As cited in Manhart and Griesshammer, 2006.
- U.S. Department of Labor (2006): China. Internet version at: <http://www.dol.gov/ilab/media/reports/iclp/sweat/china.htm#2> (viewed on 14.06.2006). As cited in Manhart and Griesshammer, 2006.
- Weidema B. P., 2006. The integration of economic and social aspects in life cycle impact assessment. *International Journal of Life Cycle Assessment*, Vol. 11, No. SPEC. ISS. 1, pp. 89-96.
- WHO, 2009. What are electromagnetic fields? Available at <http://www.who.int/peh-emf/about/WhatisEMF/en/> (accessed 2009-06-12)

- Williams E., Kahhat R., Allenby B., Kavazanjian E., Kim J. and Xu M., 2008. Environmental, Social, and Economic Implications of Global Reuse and Recycling of Personal Computers. *Environmental Science and Technology*, Vol. 42, No 17, pp 6446-6454.
- Wu B.Y., Chan Y.C., Middendorf A., Gu X. and Zhong H.W., 2008. Assessment of toxicity potential of metallic elements in discarded electronics: A case study of mobile phones in China. *Journal of Environmental Sciences*. Vol. 20, pp 1403-1408.