The Sustainability Issues Facing the ICT Sector

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Introduction:
For this report we were asked to report on 18 reviews covering a range of topics regarding the sustainability of the ICT sector. These had been broken into 3 main areas which were E-Waste, Resources and Energy & Climate Change. I will cover these 3 main topics by integrating them into the lifecycle of electronic parts from resources through manufacture and use right up to the products end-of-life and its disposal.

While discussing the topics it will become clear that there are 3 issues which are all related when it comes to sustainability of the ICT sector. These are social, environmental and economic issues. It can all be brought together under the title of sustainable development.

“Sustainable development refers to a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also for generations to come.”

Resources:

resource  [rɪˈzɔːs - ˈzɔːs]  
2. (often plural) a source of economic wealth, esp of a country (mineral, land, labour, etc.) or business enterprise (capital, equipment, personnel, etc.) [1]

In regards to resource sustainability the two biggest issues facing the ICT sector are the quantities of resources and corresponding cost. Generally as the rarity of a resource increases, so does the cost to mine it. The mining industry is driven by profit, for example, in less than 100 years the copper content in mined ores has dropped from 9% to lower than 1% [2]; however because of current demand and market price it is still a profitable endeavour. Scarcity of materials will become a bigger issue in the future. Bayan Obo deposit accounts for the majority of China’s 31% share of the world’s rare earths reserves. This illustrates how one country could claim such a massive proportion of a particular material. An important thing to note is that in most regions of the world, the exploration drilling rarely exceeds 200 m in depth. The mineral deposits and reserves at present are located close to the surface with the deepest open pit mine less than a kilometre deep and the deepest underground mine is roughly 4 kilometres deep. This may have to change in the future as elements become scarcer. [3] Hewlett Packard (HP) has been pre-emptively replacing copper wires with fiberglass with the aim of replacing copper wires at the printed circuit board (PCB) level and eventually the chip level. This removes the need to process thousands of tonnes of copper and other materials and also avoid the unreliable raw material market.

The security of these resources is also a major issue. In the DRC there are 13 major mines (mining a large portion of the world’s Tin, Tantalum, Tungsten and Gold) of which it is estimated that 12 are controlled by armed groups [4] like the FDLR (Democratic Forces for the Liberation of Rwanda). A single armed conflict involving any of these mines has the potential to disrupt the global supply of these metals.
The dark side of the electronic industry can be seen where companies buy from these sources where workers are clearly exploited as a leading minerals expert from the region described, “In the FDLR mines in Burinyi, the local population is there, but they are like slaves.” [5]. There is currently no real regulation when buying minerals from these areas other than a simple question, “Did you get this from a conflict area?”. Any seller at this stage is going to say “yes” to complete the purchase without providing proof to back up his answer. These types of trade place a dark cloud over the ICT sector; however to the everyday consumer this is rarely an issue.

We are still failing to keep up with requirements for global energy sustainability and efficiency. Energy demand is set to increase by +33% up to 2035 with China, India and the Middle East accounting for 60% of this increase. With regards to improving energy efficiency, 80% of the building sector and ~50% of industry still remains unregulated. Because of the growth in energy demand countries are going to become more concerned about their own resources which could lead to trade related conflicts in the future. A growing need for electronic related resources could lead to a similar situation to that of oil where conflict in the Middle East can often be traced to. Many people have said that the Iraq war was mainly due to oil, and now that this war is over Iraq is set to earn over $15 trillion due to their reserves of oil.

Manufacture:

1. To make or process (a raw material) into a finished product, especially by means of a large-scale industrial operation. [6]

A large issue with the manufacturing phase of a product is the effect on the environment, mainly due to emissions. The process used to create microchips for example uses tens to hundreds of chemicals, many of them toxic, whence potential impacts of emissions on air, water, and ground systems are major environmental concerns. It is estimated that the total weight of secondary fossil fuel and chemical inputs to produce and use a single 2-gram 32MB DRAM chip are estimated at 1600 g and 72 g, respectively.) [7] With the growth of the electronics market the effects of these processes will be felt more and more, also putting a strain on the resources of the chemicals/materials needed in their production. Another fact to note is that the largest consumer of energy in Ireland is the Intel manufacturing plant in Lexlip.

The toxic waste produced from these chips has been brought to light with a focus on the effect on water supply and usage. A typical 6-inch wafer fabrication plant processing 40 000 wafers per month reportedly consumes 2-3 millions of gallons per day, which corresponds to 18-27 L per square centimetre of silicon. [8] Worldwide water needs are set to grow at twice the rate of energy demand. 583bcm of water were used in energy production in 2010, of which, 66bcm was not returned to source. An 85% increase in water consumption through 2035 represents a more water intensive power grid and an expanding usage of biofuels. More efficient energy production is needed to reduce the strain on the water supply. [9] Another fact to note is that the largest consumer of energy in Ireland is the Intel manufacturing plant in Lexlip.

The large requirement for materials and energy involved in manufacturing means that security of supply is vital. This is an issue for the ICT industry mainly when large companies choose where to set up their plants. IN Europe, for example, half of its energy needs were imported from the Middle East, Russia etc. This is a cause for concern going forward as damage or shut down of these important energy connections can disrupt supply to these plants.
Recently the EU EcoDesign Directive has put a focus on how products are designed and manufactured. More than 80% of the environmental impact of a product is determined at the design stage so proper economical design is of major importance at this time. The EcoDesign directive expects industry to adhere to the new product requirements decided upon by the commission relating to energy efficiency. Manufacturers must adhere to the rules set out by the directive or they will be unable to sell their products in EU trade areas. By 2020 the first EcoDesign regulations on 12 product groups are projected to allow energy savings equivalent to more than 12% of electricity consumption of the EU in 2009. Electrical appliances will have lower power consumption in standby mode. These EcoDesigns will remain cost effective for the consumer and instead provide sustainable competitiveness by allowing manufacturers to increase sales by improving their products performance. [10]

Recently Carbon pricing policies have been recommended by the IMF (international monetary fund) as a way to reduce CO2 emissions and demand for fossil fuels. This will be introduced with the hopes of reducing the use of fossil fuels in energy production and to promote research into more environmentally friendly options to reduce the carbon footprint of large industry. Refunds will also be made available to industries using carbon-capture technology to reduce their emissions.

Use:

\[ \text{use} \]

\( \text{v.} \) \text{used, using, uses} \\
\( \text{v.tr.} \)

1. To put into service or apply for a purpose; employ. [11]

For the usage phase I am going to focus on data centres and their growing usage of energy. It is estimated that the percentage of global electricity used by datacentres in 2010 was 2.2%, this translates to an average power consumption of between 23.2 and 34.4 Gigawatts globally. The usage of these centres is growing at a dramatic rate and the number of datacentres grew by almost 56% from 2005-2010. This translates to an average power consumption of between 23.2 and 34.4 Gigawatts globally. The majority of power in datacentres comes from the main ‘volume’ servers which accounted for 50.5 BkWh (billion kilowatts) globally versus mid-range servers at 6.7 BkWh and high-end servers using 4.2 BkWh. Datacentre growth slowed somewhat due to the financial crisis due to cutbacks needed by companies who needed to increase savings. Another reason for the slowdown has been the increasing use of virtual servers and increasing efficiency of cooling systems, power distribution systems etc. which has increased the sustainability of these centres [12].

In a recent study of LCA (life cycle assessment) of desktop computers a number of issues were identified. A LCA is a technique used to assess the total environmental impact at all the stages of a product’s life cycle from the extraction of raw materials to when the product is no longer of use it is disposed of or recycled. The global ICT sector is responsible for about 2% of global anthropogenic greenhouse gas emissions and half of these emissions are due to personal computers (PC’s). However there is a lack of consensus on the results of these papers as they are mainly based off the estimation of certain time variables such as usage. It was also made clear in the paper that usage lifespans vary depending on geographical location. [13] In general the developing world has a far longer lifespan for ICT products when compared with first world countries where PCs might be replaced every 2-3 years. Other countries such as Japan have implemented a popular take back scheme which increases the reuse of personal computers. For example in 2004, Japan reused 37% of its PCs domestically.
End-Of-Life and Waste:

**end of life**

2. Refers to the planned demise of a hardware or software product due to its natural evolution from utility to obsolescence. [14]

**waste**

v. wasted, wasting, wastes

adj.

1. Regarded or discarded as worthless or useless [15]

With regards to the ICT sector in Europe, there are 2 main directives when it comes to product waste/recycling. These are WEEE directive (Waste Electrical and Electronic Equipment Directive) and the ERP (European Recycling Platform).

The WEEE directive mainly focuses on laying down measures to protect environment and human health by reducing adverse impacts of the generation and management of WEEE and by reducing overall resource use. WEEE covers any broken or unwanted electrical or electronic device. It includes a wide range of products from computers, printers and faxes, to washing machines and fridges. (Note: WEEE directive does not apply to medical, military and large scale equipment.) By 2016 the minimum collection rate aims to be 45% calculated on the basis of the total weight of WEEE collected, expressed as a percentage of the average weight of EEE placed on the market in the three preceding years. By 2019 the aim is to reach 65% by 2019. [16]

Extended Producer Responsibility (EPR) emerged in Sweden and Germany in the early 1990’s. Its main aim is to create incentives for manufacturers to create eco-designs of packages and products, leverage private sector expertise to achieve public goals and to internalize the costs of waste management into product prices. There are no truly accurate numbers on costs and benefits of EPR. The data and accounting challenges in calculating and allocating costs and benefits in EPR programs is a major undertaking. ERP takes the responsibility of recycling the product off the consumer and onto the manufacturer, however as this increases the cost of production many manufacturers are not in favour of the idea and may not be completely truthful of the cost of production. [17]

In countries with less regulation, a lot of E-waste (electronic waste) is exported to the developing world to be recycled. Generally the recycling is carried out by scavengers in poor working conditions for a low wage. This ‘recycling’ often involves the burning of E-waste in large bonfires to release any metals within the packaging. Not only is this practice dangerous and extremely harmful to the environment, often the majority of waste is still not collected and instead buried in the ground. The workers mainly focus recover of copper, steel and aluminium while palladium, gold, silver, indium and germanium are left behind. While there are obvious problems with this system, strong regulation would have a large impact on the economies of countries like Ghana who rely on this trade. Results show that the volume of obsolete PCs generated in developing regions will exceed that of developed regions by 2016-2018. By 2030, the obsolete PCs from developing regions will reach 400-700 million units, far more than from developed regions at 200-300 million units. Should this trade be cut off, these countries may be cut off from technological advances for years to come. [18][19]

The amount of different metals used in the manufacturing of products has risen dramatically over the years due to finding better suiting, cheaper and more durable materials. This has become a major headache for recycling as it is becoming increasingly difficult to separate these materials efficiently. This has caused EOL-RR (End of life recycling rate) to vary a lot from metal to metal with a range of less than 1% to >50%. A low EOL-RR can easily be due to lack of knowledge on how to recycle a certain material. For example, Zinc which is used in car batteries is widely recycled and has a EOL-RR of 90-95%. The ICT sector must increase the recycling rate of special metals or face an uncertain future when it comes to resources and the growing costs of materials as they become harder and harder to find. [20]
Conclusion:
In conclusion, the ICT sector has a great number of sustainability issues facing it. Between keeping up with the ever growing demand for materials to recycling end-of-life products efficiently there is a lot of work to be done across the board. One can hope that as technology advances and new methods of mining, manufacture and recycling are discovered the process will become easier. A recent move to reduce the carbon footprint of industry has also had an effect on ITC industry (e.g. carbon capture).
Another cause for concern is the increasing demand for energy across the globe, even in modern times around 1.3 billion people remain without access to electricity. Asia and sub-Saharan Africa account for 66% of this. Even with current policy changes, increases in population will mean that by 2035 1billion will still be without electricity. A cumulative investment of over $1trillion is needed to achieve universal access by 2030.
The new European directives (WEEE and ERP) are starting this move towards more sustainable systems and it is up to other large countries (e.g. China, United States) to follow suite and strive towards a more sustainable ICT industry as a whole.

References:
[5] Interview with civil society mining expert, Bukavu, June 10, 2009


