eWaste: taking responsibility

IFIP Position Paper

[version 22-09-2018 after Technical Assembly]

Authorship:
The creation of this paper has been led by David Kreps, Chair of TC9. Contributors over the past twelve months of its development have included Thomas LENNERFORS, Per FORS, Chris ZIELINSKI, Norberto PATRIGNANI, Robert DAVISON and Maya van der VELDEN, from TC9; Ulrike SCHULTZE and George M. KASPER of TC8; and the Technical Assembly of IFIP, who considered and commented upon the draft at the TA Meeting on 22nd September 2018.
Members of the General Assembly would wish to comment upon this draft are invited to do so on 24th September 2018, with a view to a final draft being drawn up thereafter.

1 Introduction

The popular image of the ICT industry is one of a clean, high-tech, shiny digital world that exists in a virtual, or cyber, space beyond the humdrum realities of the everyday. To a great extent this remains true and, as the possibilities of artificial intelligence smooth our interactions with the digital this image is likely to shine all the brighter. There is, however, increasing awareness, now, of the underbelly of this image: that the hardware upon which the digital rests – the cables, circuit boards, chips and cooling fans of the data centres, and the sleek handheld devices we replace on average every 18 months – are having an increasing impact upon the physical environment, and make up a growing part of the global problems of resource depletion, pollution, and climate change. Key amongst these new understandings, is that the global context is a finite one: planetary boundaries must be respected.

This IFIP Position Paper – begun in Autumn 2017 - sets out some of the detail of the problem, as it currently stands, and what role the International Federation for Information Processing sees it can play in trying to redress it.

2 Definition and scope

The principal areas of concern for this Position Paper are eWaste and sustainability. eWaste is the term used to describe surplus electronic and electrical equipment that is not suitable for reuse, in other words whatever is not recycled in some form and ends up simply being thrown away. The StEP Initiative has defined it more precisely as follows: “eWaste is a term used to cover items of all types of electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of re-use.” [1]

Sustainability is the term used by the United Nations to describe all activity that meets the needs of the present without compromising the ability of future generations to meet their own needs [2]. Goal 12 of the United Nations Sustainable Development Goals, to ‘Ensure sustainable consumption and production patterns’ [3] and Goal 9, to ‘Build resilient infrastructure, promote sustainable industrialization and foster innovation,’ are the most

relevant to this topic. The most relevant of the 169 individual targets of the UN Sustainable Development Goals are two of Goal 12's targets: '*By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse*,' and '*Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle*.' Also, one of Goal 9's targets is relevant: '*By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities*.'[4] Beyond these UN goals, are increasingly strong voices reminding us that we live in a finite world.

This Position Paper is focussed upon ICT systems as a waste problem, and an issue concerning the use of resources, and how the ICT industry and ICT professionals can help create solutions. Energy use, and its contribution to anthropogenic climate change, is an important, but separate issue, and is not dealt with directly in this paper. How IFIP can play a role in helping industry to overcome the problems associated with resource use and pollution, beyond merely pointing out the problem, will be significant.

Broadly, the role IFIP could play in regard to eWaste is envisaged in three primary streams:

(1) Promoting research towards systems development to help with waste management, end-of-life design, and communication between producers and disposers;
(2) Helping to bring the problem to the attention of the IT industry, through publications, declarations, membership criteria etc, focussed on the reality that many of the environmental problems in ICT can be addressed only at 'design-time,' or 'by design.' Specifically, therefore, in order to:
    a. Prevent or postpone ICTs becoming eWaste through interventions in the design of ICTs - e.g. making them more reparable, using less glue
    b. Make eWaste non-toxic through interventions in the design of ICTs - e.g. by developing and using less hazardous materials
(3) Encouraging more creative economic thinking, similar to the 'circular economy' ambitions of the EU (see below), and other sustainable business models.

Additionally, this Position Paper calls for contributions from the IFIP community towards the possibilities of an IFIP eWaste Control Certification scheme, or Badges, and such mechanisms by which IFIP might promote cleaner, greener ICT across the industry.

3 The Global eWaste Problem

eWaste is a global, and growing, problem just beginning to arise in general consciousness. In the months since IFIP began the process to create this position paper, the United Nations University, ITU and ISWA published their own Emerging Trends Report on the issue (ITU 2018). This increased awareness is none too soon. "Over the past two decades," according to recent UN research, "policymakers, producers and recyclers in various countries have created specialized 'take-back and treatment' systems to collect eWaste from final owners and process it in professional treatment facilities. Unfortunately, despite these efforts, the collection and state-of-the-art treatment of eWaste is limited, and most nations are still without such eWaste management systems." [5]. About 41.8 million metric tons (tonnes, or

MT) of eWaste was generated in 2014 and estimates in 2015 were "that this number will increase to 50 MT already by 2018" [6]. "By 2016, the world generated 44.7 million metric tonnes (Mt) of eWaste and only 20% was recycled through appropriate channels." (ITU 2018). The majority of the other 80% seems to be ending up in the Global South.

Commercial efforts to address the problem are in place. Computing giant Apple have, on Earth Day 2018, introduced some end-of-life responsibility for their products, with a 'take-back' scheme, albeit that such a scheme might be interpreted as an encouragement to upgrade to their latest model. Also, fairphone.com, for example, have made a huge effort in the repairable-by-design direction. But, such efforts are limited in scope, in comparison to the scale of the problem.

Through these and many other schemes, while a good deal of used electronic and electrical products are collected for reuse and recycling, a worryingly large amount – some 34% of all electronic goods produced in the US in 2010 – ended up in landfills, and a total of 8.5% (some 50,000 MT) was exported [7]. These figures have been growing year on year [8]. The export problem, moreover, sits within already well established global inequalities. A United Nations Environment Programme (UNEP) report said in 2015 that, "thousands of tonnes of eWaste declared as second-hand goods are regularly exported from developed countries to developing countries."[9] Whether the data supporting this report is entirely reliable or not, [Lenowski], it is clear that much waste is exported illegally, in the terms of The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention - http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx), which, as of 15 April 2015, has 183 Parties (including all OECD countries except the US, and all EU countries.) Since 1998 the 'Basel Ban' has effectively banned all export of hazardous waste from developed to developing countries, though not all parties to the Convention have separately ratified the Ban (the EU has, but, of the OECD countries Canada, Japan, Australia and New Zealand have not.)[10]

The outcome of this activity is the prevalence of what are publicised as 'eWaste mountains' in developing countries, where the extraction of precious metals is undertaken, in extremely hazardous conditions.[11] Whilst the newspaper reports of such eWaste mountains are at times questionable, issues nonetheless remain. eWaste is, in reality, often imported as second hand electronics. The numbers across various reports differ, but about 30% of these imported second hand goods are not working. Much of this is taken apart, repaired, refurbished, recycled, but still, what is deemed to have no value is inevitably dumped or burned. Secondly, what ends up at places such as Agbogbloshie, in Accra, Ghana - one of the most celebrated of such 'eWaste mountains' - is also ICTs from the domestic market. Ghana has a huge domestic market in mobile phones, computers, and other electronics. In Guiyu, Guangdong Province, China, perhaps the largest eWaste site in the world, [Johnson] some 60,000 eWaste workers are employed at the site, and a 2012 report [Environmental Science and Technology] found shocking levels of toxic metals and other hazardous substances in the environment close to the small villages nearby.

4 A Complex Problem with Multiple Solutions Required

Perhaps the most difficult aspect of this growing problem is its complexity. A breakdown of the problem into its constituent parts reveals a combination of multiple issues, from the depletion of the resources needed to manufacture technological devices, the issues surrounding their end-of-life disposal, the international patterns connected with both resource use and disposal, and the nature of the manufacturing process itself.

Resource depletion is a growing problem for many industries. As the global population rises, and the economic model of GDP growth encourages constant innovation, the use of resources is becoming so rapid that we are likely very soon to run out of them. This includes the depletion of metals, such as Gold and Aluminium and Rare earths.

Rare Earths are precious resources found in only a very few places on Earth, each fraught with problems. China which has the greatest sources of these precious materials, has either restricted or blocked their export on a number of occasions. It is perhaps as much - or more - to do with these resources than relatively cheaper labour that is behind the decisions of Apple and other smartphone manufacturers to base their manufacturing operations in China, rather than elsewhere (Krugman 2010; Jolly 2014; Ferris 2015; WSJ 2016). In the US deposits of these materials are to be found, but only with relative difficulty, and thus expense. A Congressional Research Service Report on Rare Earths (Humphries 2013) pointed out that in 2011 96.9% of all Rare Earth production took place in China, where some 50% of global reserves are to be found, compared to only some 13% in the US, with the rest spread across the world, notably in Russia.

Once technological devices have been manufactured, sold, and used (either to their end-life or, in many cases, sooner,) and they are finally disposed of, there are then multiple issues connected with the means, hazards, and location of such disposal, including:

- **Volume** – the sheer scale and year-on-year growth of the quantity of such technological devices needing to be disposed of
- **Pollution** – the issues connected with the hazardousness of the metals, plastics, and chemicals that have been used in the manufacture, and what to do with them once the device is no longer in use: much of these materials are harmful to human health, and to the environment
- **Toxicity** - where disassembly is undertaken, there is real danger for the workers in the disassembly process unless the right protective clothing, processes, and environment are provided. Even then, as for example in Agbogbloshie, where when free protective glasses, work gloves, and facemasks were provided, some of workers sold the equipment in search of additional income, and others complained how this protective gear hindered them in their work. Education, then, is crucial in addition to the protective equipment.

International patterns affect not just the resources that are being used, and where manufacturing takes place, but also - clearly - the disposal of devices at end-of-life. As we have seen above, the export of eWaste and Second Hand Electronic Goods has been and continues to be a huge business, with a good deal of this material exported illegally according to the terms of the Basel Convention. This results in disassembly workers in

developing countries being exposed to the hazards outlined above without the proper protective clothing and environment for their safety. The largest of all e-Waste mountains, it would seem, is at Guiyu, in China, a nation which has recently begun to block imports of waste - forcing the developed nations of Europe and North America, at last, to begin to address the problem better, at home. (Recycling Today, 2017). The Washington-based Institute of Scrap Recycling Industries (ISRI) says more than $5.6 billion in the wider scrap commodities market were exported from the United States to China in 2016, a market that is now rapidly drying up.

Where disposal is undertaken more safely, often in developed countries, the temptation has been - because it is more cost-effective - simply to shred end-of-life technological devices and either melt them down - using them as feedstock in steel making operations - or simply bury them in landfill. This, needless to say, merely adds to the problems of resource depletion, and the pollution of the environment.

Perhaps, then, the final, and most pressing aspect of the problem, is that the manufacturing cycle of technological devices is simply unsustainable. End-of-life disassembly and recycling should be easy, let alone safe. Upgrades, repairs and improvements should be bolted on or plug-and-play, not require the disposal and replacement of the entire device. The current 'obsolescence' cycle of encouraging customers to acquire a brand new device every 18 months - or sooner - is incredibly wasteful, and the economic model that promotes this is, to put it simply, eating the - finite - planet.

5 IFIP's position on major questions and choices

This section of the position paper comprises a series of statements about choices that can be made and / or should be made in the light of the eWaste problem outlined above, and can be described as a "set of the right questions".

Faced with the enormity of the task, and the power of corporations and market forces, the most elementary choice facing individuals in the ICT industry is the question "what can I do?". The answer to this question is not straightforward. In the following paragraphs this and a number of other questions will be addressed. In each paragraph IFIP's position on a variety of aspects is presented and substantiated. We begin, as we must, with the main actor, ICT Industry:

5.1 ICT Industry

Leaders in the ICT industry, and researchers working within the ICT industry, should take note that:

I. **IFIP's position is that the ICT industry should move rapidly to adopt sustainability practices in line with the UN Development Goals 9 and 12.**

   This should not be a choice but an obligation.

II. **IFIP's position is that the ICT industry should not create devices that over-use precious resources, and are destined to be rapidly disposed of either in landfill or third-country eWaste dumps. The ICT industry has a choice not to do this.**

Taking responsibility for the impact upon the environment of resource procurement and disposal should be fundamental to ICT product design and planning.

III. **IFIP's position is that shifting from the linear economy that assumes infinite and perpetual growth, to a circular economy in line with the reality of planetary boundaries, must be a guiding and urgent principle for the ICT industry.**

5.2 Authority / regulator

IV. **IFIP's position is that policymakers / regulators should enforce the international policies that regulate electronic waste. For example, the Basel Convention should be enforced rigorously, and policymakers should require companies to take responsibility for the disposal of their products, adopting the 'polluter pays' principle. Other incentives include:**
    - EU WEEE Directive, national WEEE regulations
    - Extended Producer Responsibility (EPR)
    - EU's EcoDesign directive

Classification markers of how environmentally friendly a device is - such as those already appearing on washing machines, refrigerators, heating systems and so on, or, for example, when buying a house, should be introduced for laptops, smartphones, tablets, and other electronic devices.

In general, policymakers / regulators should introduce stricter guidelines, enforcing what are currently ambitions, goals and targets.

5.3 ICT professional

V. **IFIP's position is that an ICT professional should have sufficient professional and environmental understanding to make the right choices when designing, developing, implementing, operating or managing software / hardware.**

Having sufficient professional and environmental understanding is a general requirement for ICT professionals. However, in respect of eWaste, this must (newly) include a range of additional responsibilities concerning the procurement, use and disposal of hardware:

- Procurement
    - When procuring new hardware, a fair and sustainable value chain, expected use-life, producer warranty, and upgradability and repairability should all be factors in decision-making.
- Use
    - Hardware should - where possible - be made to support extended use-life, rather than contribute to a rapid disposal and upgrade cycle. Care and maintenance of hardware to extend its life, through the long-term availability of spare parts and upgrading components, rather than the entire machine

may be good strategies. Software upgrades should support the extension of use-life, rather than shortening it.

- End-of-life
  - When use-life has come to an end, refurbishing and upcycling should be considered before recycling.

The constraint of course is that also an ICT professional may not be in a position to decide upon the design etcetera. This means that a condition for making this work is to have professional and environmental understanding not only embedded in the codes of ethics of societies of professionals but also in companies' policies. And to have a work environment that is supportive of putting these policies into practice.

VI. IFIP's position is that ICT professionals have a choice to educate / inform users on the issues concerning eWaste.

Users should be informed about the resources used in a device, its longevity, and what will happen to it when its use-life is over. If the creator of such devices does not (sufficiently) inform the users, ICT professionals have a choice to do this, for instance via research papers and publications. In order to be able to do this, there should be no legal liability when publishing such results. Such information should be as clear as possible, avoiding the opaque technicalities, for example, such as complex nutritional information on some food packaging.

5.4 User

Both individuals and organizations can be in the role of user.

VII. IFIP's position is that users should at least have a choice of more environmentally friendly devices, and that they should be conversant with the resource use and end-of-life plan for whatever devices they purchase.

VIII. IFIP's position is that it supports the possibility to empower users in such a way that they can ensure all their devices are properly and ethically recyclable, make use of recycled resources, and do not contribute to pollution.

For example, if a mobile phone shop carries a range of devices from different companies, it should give the user clear information about which device is the least, and which the most recyclable, which device has end-of-life or 'take-back' arrangements, where the resources for the device are sourced, etc, in a similar manner to the best examples of detail concerning ingredients, nutrition, and other information on food products. This means that policies / regulations / legislations should allow for this and also the technology / devices should make this possible. Users should be aware of the consequences of their purchasing choices.

IX. IFIP's position is that users should inform themselves about the various environmental aspects (resource use / disposal) of the devices they are using.

While ICT professionals and ICT industry have a choice, or actually an obligation, to educate / inform users, these users have a choice, or also perhaps an obligation, to inform themselves.

This can be by simply reading the information provided or asking for information if that is not provided. A condition to help users is the availability of "a set of the right questions".

X. **IFIP's position is that it should be encouraged to involve users in the design / development of end-of-life schemes, to ensure recycling and disposal is ethically undertaken.**

Users are not only passive users but are also often people who possess knowledge and can contribute in the design/development of resource-use and recycling in devices. Having a say – if possible, in the design process would be one way to make them more active. Open innovation and participatory design methodologies can be helpful and should be encouraged. Research that helps to bring users' perspective into the design process should be particularly encouraged.

6 Possible actions

IFIP, it's member societies and their members can contribute to solve the "choice problems" addressed above. What can be done:

- Check / promote the presence of professional and environmental understanding
  - in codes of ethics of professional societies
  - in companies' HR policies
- Provide a "set of the right questions"
- Promote the above position statements to the industry, authorities. professionals, and users.
- Increase research of those aspects of the eWaste problem and its potential solutions that are insufficiently addressed and / or that are gaining more and more importance.

7 Annex. References and Bibliography

[Needing tidying up once draft is completed]

[1]StEP White Paper (2014) *One Global Definition of E-waste* Accessed from http://www.step-initiative.org/files/step/_documents/StEP_WP_One%20Global%20Definition%20of%20E-waste_20140603_amended.pdf

[2]Brundtland Commission (1987) *Our Common Future: Report of the World Commission on Environment and Development* http://www.un-documents.net/our- common-future.pdf Para 27

[3]https://www.un.org/sustainabledevelopment/infrastructure-industrialization/

[4]https://www.un.org/sustainabledevelopment/sustainable-consumption-production/

[5]Balde, C.P., Wang, F., Kuehr, R., Huisman, J. (2015). The global e-waste monitor – 2014. United Nations University, IAS-SCUCLE, Bonn, Germany. Available from https://i.unu.edu/media/unu.edu/news/52624/UNU-1stGlobal-E-Waste-Monitor-2014-small.pdf

[6]Balde, C.P., Wang, F., Kuehr, R., Huisman, J. (2015). The global e-waste monitor – 2014. United Nations University, IAS-SCUCLE, Bonn, Germany. Available from https://i.unu.edu/media/unu.edu/news/52624/UNU-1stGlobal-E-Waste-Monitor-2014-small.pdf

[7]CEC. (2016) *Quantitative Characterization of Domestic and Transboundary Flows of Used Electronic Products. Case Study: Used Computers and Monitors in North America.* Montreal,

Canada: Commission for Environmental Cooperation. Accessed from http://www3.cec.org/islandora/en/item/11673-quantitative-characterization-domestic-and-transboundary-flows-used-electronicp. 12

[8]http://www.step-initiative.org/Overview_USA.html

[9]Rucevska I., Nellemann C., Isarin N., Yang W., Liu N., Yu K., Sandnæs S., Olley K., McCann H., Devia L., Bisschop L., Soesilo D., Schoolmeester T., Henriksen, R., Nilsen, R. 2015. *Waste Crime – Waste Risks: Gaps in Meeting the Global Waste Challenge.* A UNEP Rapid Response Assessment. United Nations Environment Programme and GRID-Arendal, Nairobi and Arendal, www.grida.no p. 15 http://web.unep.org/ourplanet/september-2015/unep-publications/waste-crime-waste-risks-gaps-meeting-global-waste-challenge-rapid

[10]Rucevska I., Nellemann C., Isarin N., Yang W., Liu N., Yu K., Sandnæs S., Olley K., McCann H., Devia L., Bisschop L., Soesilo D., Schoolmeester T., Henriksen, R., Nilsen, R. 2015. *Waste Crime – Waste Risks: Gaps in Meeting the Global Waste Challenge.* A UNEP Rapid Response Assessment. United Nations Environment Programme and GRID-Arendal, Nairobi and Arendal, www.grida.no p. 11

[11]Leung, A.O.W., Cheung, K.C. & Wong, M.H. (2015) 'Spatial distribution of polycyclic aromatic hydrocarbons in soil, sediment, and combusted residue at an e-waste processing site in southeast China' *Environ Sci Pollut Res* 22: 8786. https://doi.org/10.1007/s11356-013-1465-8

ITU 2018 Emerging Trends | SDG12 http://news.itu.int/ewaste-growing-challenge/

Krugman 2010 https://www.nytimes.com/2010/10/18/opinion/18krugman.html

Jolly 2014 https://www.nytimes.com/2014/03/27/business/international/china-export-quotas-on-rare-earths-violate-law-wto-panel-says.html?_r=0

Humphries 2013 www.crs.gov

Ferris 2015 https://www.eenews.net/stories/1060011478

WSJ 2016 https://www.wsj.com/articles/chinas-rare-earths-bust-1468860856

Recycling Today 2017 http://www.recyclingtoday.com/article/china-mixed-paper-plastic-scrap-recycling-ban-2017/

Johnson, Tim (April 9, 2006). "E-waste dump of the world". The Seattle Times. Retrieved 2007-03-09.

1. *"Heavy Metals Concentrations of Surface Dust from e-Waste Recycling and it Human Health Implications in Southeast China" (PDF). Environmental Science & Technology. 5 January 2008. Retrieved 27 November 2012.*