Introduction

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Abstract: This chapter provides the introduction to this 2011 issue of the *Politeia* journal dedicated to the relationship between sustainability and information and communication technologies (ICT) in the long term. It outlines the content of six papers and examines their similarities and trends. Its main themes are built around how social accountability for sustainability in the information society can be enhanced. Although it is feasible to experiment with many of these proposals today, the ultimate success of the application of these ideas will only be identified over time.

Keywords: ICT, Information society, Long-term, Responsibility, Social accountability, Sustainability.

The topics raised in this issue of *Politeia* should be particularly meaningful to the journal's readers, published as it is shortly after the completion of the United Nations Framework Convention on Climate Change (November-December 2011)[1]. They are also germane to the European Union (EU) research and deployment agenda until 2013, part of which focuses on ICT for sustainability in Europe[2]. Over a longer time horizon, the limitation of energy consumption related to computing to the absolute minimum is also about to be investigated[3].

The contributions that follow provide support to these international and European agendas. They demonstrate a clear need to concentrate on the challenges with regard to sustainability of the Earth in terms of both the immediate and the longer-term future as it relates to ICT.

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Background

On Saturday June 4, 2011, two of the working groups of the International Federation for Information Processing (IFIP)[4] set out to explore together the overarching challenges related to social accountability and sustainability in the information society. The workshop that was organised highlighted two main themes. The first was dematerialisation[5] and scarce resources. The second was the societal meaning, discourse and collective decision-making that surrounds sustainability. This workshop led to an exploration of societal and ethical approaches, methods and techniques that can facilitate an improved understanding of sustainability issues, a greater concern for them in the context of ICT, and ultimately action.

The workshop brought together sustainability experts who explored the implications of their work in terms of the field of ICT, and specialists in the field of ICT and society who reflected on the notion of sustainability. All the participants were asked to consider what this meant in terms of social accountability. This cross-disciplinary dialogue and sharing of experiences had the effect of a mutual enrichment of ideas that ranged from the reflective to the applied.

Six of the workshop papers presented are published in this issue of the *Politeia* journal; three are referred to where appropriate at later stages of this introduction, but were not submitted for publication[6].

Details about the workshop

The workshop concentrated on how social accountability can be applied to both current and future activities in the environmental field. It examined various methods, tools and processes to ensure the social accountability of computing in relation to the sustainability issues that are so pertinent to the future of the environment of the planet. The intention was to identify those important challenges that need to be explored in the immediate and longer-term future not only by the IFIP community, but also by society at large. The aim of IFIP's working groups 9.2 and 9.9 was to determine the direction of the next steps to be taken by both groups, individually and together. The two main themes of the workshop are summarised in the following sub-sections.

Dematerialisation and scarce resources

The Earth is threatened by the depletion of its natural resources and by irreversible processes of change due to carbon dioxide emissions. In the absence of timely action, the impact of human activities on climate change may well be detrimental. Economic growth can only continue on a global scale if it is decoupled from the use of both natural resources and services that rely on the environment[7].

The shift towards an information society has been based on the use of increasingly intangible ("immaterial") forms of production and consumption. These developments lead to two sets of concerns. On the one hand, ICT to some extent accelerates unsustainable forms of growth. In parallel, ICT infrastructures increasingly make considerable energy demands. Even while its components are designed to be smaller and smaller, digital hardware is growing in material complexity and makes use of more than half the chemical elements present in the periodic table. It is infeasible to continue to produce *ad infinitum* ICT hardware based on today's material demands. On the other hand, perhaps ICT can play a distinct role in the aim to move towards a carbon-neutral society, and can help to reduce the increasing use of natural resources. ICT's enabling effects, in terms of dematerialisation, can likely be measured, accounted for, and shaped by society.

Societal meaning, societal discourse and collective decision-making

ICT was originally developed with commercial and efficiency purposes in mind. Indeed, its role in scientific, research, industrial and manufacturing innovation is still predominant[8]. However, perhaps ICT could and should become a more effective tool to support major, human-centred endeavours, and be designed to pursue other significant humanitarian values. There are clearly sustainability aspects to today's techno-economic discourse and the way in which it is embedded in innovation policy. Many challenges lie ahead in terms of how ICT can be built to enable continuous development and adaptation to changing values and goals. Ultimately, there are concerns with regard to how tangible human life and societal existence can be sustained in an information society[9].

Six papers contributing to the workshop

Many of the same themes and concerns emerge in the papers that contributed to this workshop, summaries of which follow. Their commonalities and implications for future activity are laid out more explicitly at the end of this introduction.

The decoupling of economic growth from environmental impacts and from the use of natural resources is an important means to support sustainability argue Lorenz Hilty, Wolfgang Lohmann and Elaine Huang in their overview of *Sustainability and ICT*. They outline three approaches to the use of ICT in the service of sustainability: Environmental Informatics, Green ICT, and Sustainable Human-Computer Interaction (HCI). Discussed in the context of the Jevons paradox[10], Hilty and colleagues conclude that it is a combination of both efficiency and sufficiency strategies which is the most effective way to stimulate the kinds of innovations that will free up ICT's potential to support sustainability. The authors examine in some detail the character of first-order, second-order and third-order effects of ICT. The undesirable implications of these three types of effects need further theoretical and empirical examination and – ultimately and more importantly – resolution. Today, the third-order effects of ICT are particularly under-explored. It is they which need to be investigated in order to design sufficiency strategies for sustainability, strategies aimed at reducing the continuous consumption of scarce resources.

Indeed, aiming for "a bit less" is Marc van Lieshout's preoccupation in his assessment of a sustainable information society. Citing earlier work by Hilty[11], he explains the impact of these three orders of effects of ICT. In positive terms, the first-order effects are the direct effects of ICT (the "greening of ICT") and the second-order effects involve the impact of ICT on other domains ("greening through ICT"). However, most challenging of all to identify and quantify are ICT's third-order (or rebound) effects. It is these unanticipated consequences which may nullify the potential benefits of ICT in terms of sustainability: this is because people and organisations continue to modify their behaviour. As a result, they introduce additional impacts on the environment. These third-order effects might be countered by using the perspectives of innovation theory. Taking such a position focuses on the role that users, consumers and citizens can play in spreading and adopting beneficial behaviour: here, van Lieshout draws attention to a number of Dutch and British examples of slacktivism[12]. Finally, he makes a plea for more empirical research, particularly into the third-order effects of ICT.

In *Challenging the Pursuit of Moore's Law: ICT Sustainability in the Cloud Computing Era*, Norberto Patrignani, Mikael Laaksoharju and Iordanis Kavathatzopoulos investigate the sustainability of ICT from an environmental perspective. Patrignani and his colleagues explore three stages of the ICT life cycle: manufacturing, operating ICT and electronic waste. The authors raise awareness of both the contemporary and future challenges to environmental sustainability. They look at such current trends as the way in which cloud computing, handled by large data centres, might increase power consumption and have effects on climate change: this is despite the fact that some companies are currently aiming to decrease the environmental footprint of their installations. Profoundly concerned about these risks, the authors propose that setting up ICT stakeholders' networks could help in the investigation of possible strategies to address these sustainability challenges.

Patrick Wäger's focus is on scarce metals. To encourage a more sustainable governance of scarce metals, interventions are needed that occur on different societal levels involving a range of stakeholders at multiple points along the scarce metals life cycle. According to Wäger, involvement by consumers, companies, states, and the international community are all necessary. ICT creates a demand for scarce metals from primary resources, and yet also has the potential to enable a more sustainable governance of scarce metals. The extent of the demand for these metals will depend on progress in the development of new materials and technologies that are based on alternative, more abundant resources. The role of ICT as an enabler of sustainable governance of scarce metals can be described in at least three ways. It facilitates sophisticated simulations of possible future demand

and supply[13]. It provides materials-related life cycle data for primary and secondary supply chain evaluation and certification such as that supplied by the ecoinvent Centre[14]. Finally, it can both manage and monitor more sophisticated recovery processes needed for the end-of-life of complex products.

In the context of the development of public policies on ICT for dematerialisation, Giovanna Sissa examines what can be done most effectively to plan, monitor and assess policy results. Drawing on the work of the Organisation for Economic Co-operation and Development[15], Sissa examines the development and monitoring of relevant policy. Politicians, she suggests, have to "*create framework conditions to incentives for a more economical use of material and energy*". Stakeholder participation can help trigger appropriate environmental and social policies and monitor them. Citizens are able to play a constructive role in both policy implementation and assessment, and particularly the monitoring of ICT-based dematerialisation policies. Here, "*[t]he main challenge is how the individual and collective behaviors can transform themselves to shape a more sustainable society*". A "collective situational awareness" about energy consumption can take various forms: influencing consumer decisions, accessing real-time environmental information, and anticipating societal developments.

In the final chapter of this journal issue, Iordanis Kavathatzopoulos highlights how closely related are the three topics of sustainability, ICT and ethics. Problem-solving in each of these domains depends on a number of the same preoccupations, principles and methods: he shows how similar are the problems in each sphere. To approach sustainability appropriately, Kavathatzopoulos argues, it is absolutely necessary to examine the issues from the perspectives of ICT and ethics, and the same is necessarily true for the other two subjects. They are interdependent: to consider one in isolation from the other two might be at best pointless and, at worst, impossible. He reinforces the need for critical examination of the effects and impacts that ICT can have on sustainability and human behaviour, and identifies modern interpretations of classical philosophy and thought that may prove to be helpful. Examples include the work of Castoriadis[16]. While Kavathatzopoulos hypothesises about possible answers to the challenges of sustainability and ICT, his approach is oriented towards a focus on human interaction and process. Indeed, he provocatively suggests that "*[r]eady-made answers cannot be found and any solution proposed is easily contested*". What is core is that constructive and lasting solutions to these problems are often found more effectively through group discussions and problem-solving.

Common threads and observations

Starting from an immediate focus on environmental issues, including the use of raw materials and rare resources, the papers in this journal issue broaden the range of their concerns to include a number of behavioural, ethical, social and societal challenges that are all pertinent to sustainability.

Five of the papers – those by Hilty *et al.*, Patrignani *et al.*, Sissa, van Lieshout and Wäger – draw on the growing analysis of first-, second- and third-order effects with regard to sustainability over the past several years[17]. Each of these highlights the difficulties of predicting third-order effects and ascertaining their implications. Kavathatzopoulos writes of similar concepts but without using the same terminology.

Whereas some of the papers focus on concepts and analysis, research and study (such as Hilty *et al.* and Wäger), others bridge the gap between analysis and user empowerment and user involvement (for example, van Lieshout and Patrignani *et al.*), and yet others (like Sissa) tend towards activism. This shift towards engagement was also very much a focus of at least three other presentations made during the workshop itself[18].

Pro-actively, Kavathatzopoulos, Patrignani *et al.*, Sissa and Wäger remind us of the need to involve a range of stakeholders, and particularly one that extends beyond academics and researchers. Two examples – those of a stakeholders network provided by Patrignani *et al.*, and a tentative governance structure described by Wäger – are interesting in their complementarity.

The commonalities of at least two other papers (by Patrignani *et al.* and Kavathatzopoulos) lie in their concern for the planet and the well-being of future generations whom they count among the stakeholders to be involved in discussions and dialogue. The focus on the ethical aspects of people's activities, and the very explicit involvement of people in problem-solving, is particularly taken up by Kavathatzopoulos, but was also a principal orientation of the three other presentations at the workshop[19].

This concentration on a micro level of action is important, yet it is also crucial to be aware of the "framing" conditions highlighted by Sissa and Wäger whether, for example, these involve legislation, standardisation or certification. These are power-coercive modes of change whereas many of the other solutions put forward in this journal issue are nearer to rational-empirical or normative-re-educative methods (Chin and Benne, 1985: 44-45).

Past, present and future orientations

Looking back in history can help us to understand the growth and development of ICT. Clearly, it is important to understand where any technology development is in terms of its lifecycle in order to hypothesise about or predict its downstream implications. Planning for the future is also imperative. Both foresight exercises and future studies can be helpful in this regard. Future actions are feasible at each of the stages of the lifecycle of ICT: whether manufacturing, use and re-use. Here is just a glimpse of three examples.

First, there needs to be attention to the use of raw materials. With his call for action –most specifically on what he calls "elements of hope" – Diederan appeals for attention to "managed austerity" which calls for:

> a transition from growth in tangible possessions and instant, short-lived luxuries towards growth in consciousness, meaning and sense of purpose, connection with nature and reality and good stewardship for the sake of next generations[20].

Second, a focus on hardware is important. With regard to research and design, at least two innovative ways of designing hardware are underway. Recycling-by-design implies that engineers take the environment into account as a fundamental design factor. Open hardware is based on a tenet that new solutions are more likely to emerge if and when knowledge is freely exchanged in collaborative communities – this could equally well be valid for the design of sustainable solutions[21]. Hence, some of the challenges that humanity has to face in the future may require a leap in the concept of research: from single nodes concentrated in independent research centres towards a network of nodes in which a range of collaborative research centres become highly connected.

Third, there is a tendency to consider the new directions in which human beings might move vis-à-vis sustainability as being highly rational. However, we human beings are often strangely perverse in our orientations: despite rationality, evidence and the momentum of increasing research findings, it is imperative that we work towards understanding authentic levers for the protection of the planet for future generations. An understanding of the psychology and mechanics of human behaviour; the paradoxes that exist between intent and action; unanticipated consequences; learning from failure and negative examples; and the intensive efforts that it takes to manage change – whether from the field of organisational theory and behaviour, psychology, philosophy or sociology – are all raised in this journal issue.

As a minimum, taking a lifecycle approach to many of the sustainability challenges currently facing society can lay out more clearly the needs and benefits in terms of long-term future planning. Beginning to look ahead with a longer-term perspective is vital[22].

The relationship between ICT and the environment is, however, far from being a simple one since it involves profoundly human beings. The Earth is a closed system, and ultimately the manufacturing of goods from a finite supply of raw materials poses grave concerns. Even if it is possible to claw back savings in terms of energy through ICT, it is hard – with the abundance of so many online systems and services – to predict what will help to reduce consumption and what will not. Moreover, the tendency towards flagrant consumerism so prevalent throughout the late twentieth century and the first decade of the twenty-first, would indicate that many people today are not immediately motivated to consume less even when the products and services are less tangible than they were previously. A degree of awareness of many of the potentially negative impacts of progress and growth is not necessarily yet reflective of the current and long-term threats to the Earth, the environment and humankind.

The relative ease with which large numbers of people in developed countries are able to live in a home complete with electricity, central heating and hot running water, and the capacity to consume them, has conditioned many individuals’ expectations for the future regardless of whether the product or service is tangible or intangible. However, many billions of people throughout the globe continue to live in poverty and without a number of basic privileges: the implications of a shift in their growing expectations for wealth and well-being needs to be understood and implications calculated. Clearly, such challenges affect all parts of the globe and have implications for the planet as a whole. Today is not too soon to start to explore the implications for all our futures and those of all future generations.

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Notes

[1] http://unfccc.int/2860.php. Accessed 23 December 2011.

[2] European Commission, 2011.

[3] http://ec.europa.eu/information_society/events/cf/bud11/item-display.cfm?id=5460. Accessed 23 December 2011.

[4] IFIP is a large, international computing association which was founded more than fifty years ago. Its members consist of the computing associations of close to fifty countries. Much of IFIP's daily activity is composed of the work of technical committees. These committees cover a range of subjects (for example, information systems; and security and privacy protection in information processing systems). Technical committee 9 focuses on the relationship between computers and society. Working group 9.2 on social accountability and computing is one of this technical committee's nine working groups, and has been operating for three decades. Working group 9.9 on ICT and sustainability is also part of the same technical committee, and was set up in 2005.

[5] Dematerialisation and substitution are defined in the following terms by the 2010 OECD Information Technology Outlook: "Dematerialisation and substitution: Advances in ICTs and other technologies facilitate the replacement of physical products and processes by digital products and

processes. For example digital music may replace physical music media and teleconferences may replace business travel" (OECD, 2010a: 194).

[6] The unpublished papers are *A Survival Kit for Resilient Citizens in the Information Society* by Julie Cameron, Info T.EC Pty Ltd., Australia; *Protecting Children Online: Developing Sustainable Technologies* by Catherine Flick and Penny Duquenoy, Middlesex University, United Kingdom; and *Using Internet Interfaces and Social Media for Fostering Behavioural Change* by Magda Hercheui, Westminster University, United Kingdom.

[7] In terms of ecology, activities such as the cleansing of air and water, the absorption of all kinds of waste, and regeneration of soil are all called services, more specifically, ecosystem services.

[8] European Commission, 2010.

[9] See for example, the May 2010 IFIP working group 9.2 conference on *Converging Technologies: Brain, Body and Being* at http://www.ctc-2010maribor.org/. Accessed 23 December 2011.

[10] This economic argument suggests that technological efficiency on its own will not lead to sustainability.

[11] Hilty *et al*, 2009, for example.

[12] This term, which merges the words slacker and activism, and its implications, has both its supporters and its critics.

[13] Knoeri *et al*., 2011.

[14] ecoinvent Centre, 2009.

[15] OECD, 2010b; 2010c.

[16] Curtis, 1997; Klooger, 2005.

[17] Caroama and Hilty, 2009; Hilty *et al*., 2009.

[18] See note 6 above.

[19] See note 6 above.

[20] Diederen, 2009: 11.

[21] See, for example, the Arduino community: http://www.arduino.cc/.

[22] See, for example, "What's your vision for Digital Futures – How will the future look like?": http://blogs.ec.europa.eu/digital-agenda/whats-your-vision-for-digital-futures-how-will-the-future-look-like/. Accessed 23 December 2011.

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