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Abstract

Purpose – Information and communications technology (ICT) offers a peculiar twenty-first century conundrum, as it offers both a cause and solution to rising carbon emissions. The growth in the digital economy is fueling increased energy consumption while affording new opportunities for reducing the environmental impacts of our daily lives. This paper responds and builds on Patrignani and Whitehouse's overview of Slow Tech by providing examples of how ICT can be used to reduce energy. Encouraging examples are provided from the field of energy and buildings and implications for wider society are raised.

Design/methodology/approach – This paper builds on the previous overview "The Clean Side of Slow Tech", based on a comprehensive knowledge of literature of the latest developments in the field of digital economy, energy and sustainability.

Findings – This paper provides clear and encouraging signs of how ICT can be used to contribute to sustainability through controlling systems more efficiently, facilitating behavioural changes and reducing energy consumption. Future challenges and recommendations for future research are presented.

Originality/value – This conceptual paper presents the latest research into the use of ICT in energy reduction and offers cautious, but encouraging signs that while the environmental impact of ICT must not be overlooked, there are benefits to be had from the digital economy.

Keywords Slow Tech, Digital economy, Green ICT, Smart buildings/cities

Paper type Conceptual paper

1. Introduction – the rise in the digital economy

There is increasing consensus around the need to tackle climate change. The UK is leading the way with the 2008 Climate Change Act that enshrines legally binding and ambitious targets for greenhouse gas emissions, specifically a reduction of at least 80 per cent by 2050. Meeting these targets is going to require substantial changes at all levels of society, yet it is often difficult to know where to begin. Much is made of the increasing impact of air travel, for example, yet, as Patrignani and Whitehouse observe, current global aviation emissions are approximately 2 per cent, the same as information and communications technology (ICT) or the digital economy (James and Hopkinson, 2008). Yet, as things currently stand, this sector attracts nothing like the attention the aviation sector does. In stimulating debate and future innovations in research, this special section is a welcome addition.

In their paper, Patrignani and Whitehouse draw attention to the range of environmental impacts affecting, and effected by, ICT, notably the production, use and

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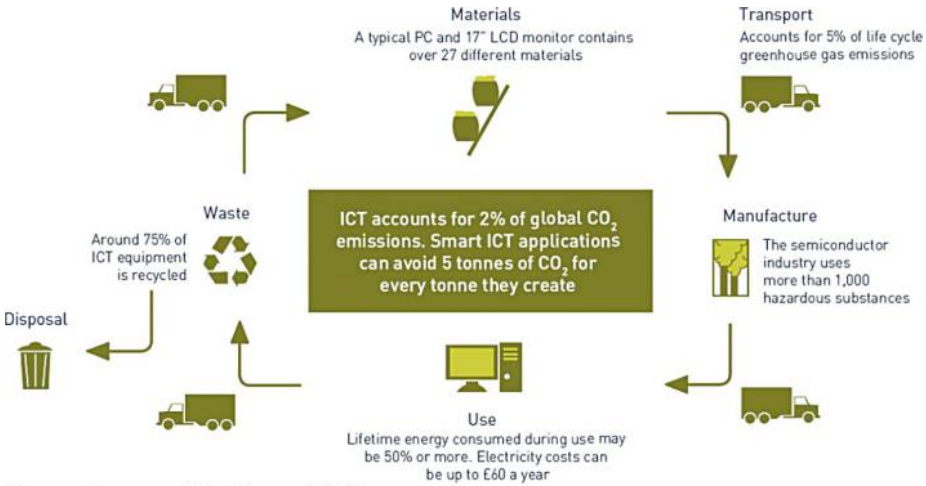
disposal of ICT. James and Hopkinson (2008), in their thorough examination of sustainable ICT, unpick the lifecycle of ICT as follows (see Figure 1).

Notwithstanding these significant environmental impacts though, increasing faith is being placed in technology to actually reduce our carbon footprint, and not just the impact of ICT itself. Latest research in to the digital economy, for example, SMART 2020: enabling the low carbon economy in the information age (2008), has highlighted the potential opportunities for ICT to facilitate a step change in a more sustainable world in terms of both technical enhancements and user engagement. Improvements, for example, in power transmission and distribution, industrial energy use and transportation as a result of innovations in the digital economy could "deliver savings five times larger than the total emissions from the entire ICT sector in 2020" (2008, p. 10). This response paper considers the rise in the digital economy and provides encouraging examples from the field of energy and buildings as to how the digital economy can be an enabler for low-carbon lifestyles.

2. Innovative applications of ICT – energy and buildings

In discussing the use of ICT, Patrignani and Whitehouse correctly point to the increasing impact data centres are having. They are the invisible footprints of ICT needs, hidden away like landfill, "out of sight, out of mind". Yet, it is also easy to overlook the actual footprint of the basic equipment itself and the opportunity presented by simple measures such as switching-off desktop computers. Research into energy use in non-domestic buildings, for example, has shown that the behaviour of users wastes around 30 per cent of energy in their buildings (Brown *et al.*, 2012). In a recent field trial of individual energy use in offices, Murtagh *et al.* (2013) show that energy use in office computing contributed approximately 30 per cent of energy demand in the European service sector over the past decade, yet research by Mulville *et al.* (2014) has found that much of the information technology (IT) office equipment is under-utilised and left on overnight. In our own research at De Montfort University, we found that over 20 per cent of overnight consumption was due to IT equipment and lights being left on overnight.



Source: James and Hopkinson (2008)

Figure 1.
Lifecycle/impact of ICT

The chart below (see Figure 2) shows the daily "spikes" of usage, the high constant base load and the reduction achieved in the base load shown by the drop for two days below the black line (a reduction of 20 kWh from 100 to 80 kWh = 20 per cent).

The digital economy offers significant potential to contribute to carbon reduction targets within buildings, for example, through more "intelligent" systems of managing the energy demand of the building. The SMART 2020 report boldly proclaims, "better building design, management and automation could save 15 per cent of North America's building emissions" (2008, p. 9). The term "digital economy" has been used to encompass a range of disciplines, from SMART controls for buildings to the personal equipment we all use daily. But "digital economy" refers also to the wider social applications of ICT, notably the Internet, social media and the smartphone. The Internet has transformed our interconnectivity, our sense of place and access to knowledge and each other. Building on these Web 2.0 principals, that is, user-generated content and collaboration, there are increasing examples of social media to connect and mobilise people for collective action such as the ability of people to self-organise photographs on Flickr, contribute their knowledge on shared documents such as Wikipedia and engage in social activism (Shirky, 2008). Twitter has been credited with everything from Obama's 2008 election victory (Zhang *et al.*, 2009) to the Arab Spring (Ghonim, 2012).

Increasing research is under way to explore the technical side of using mobile phones as consumption feedback devices, and increase energy awareness, for example, at The Institute of Pervasive Computing in Zurich (Lehrer and Vasudev, 2010). Less research has been done to utilise the social media and collaborative potential of Web 2.0 and smartphones. Two examples are illustrative; the Social Computing Research Centre at Lincoln has explored the use of Twitter and energy visualisation tools to share information in the workplace (Foster *et al.*, 2010). Lehrer and Vasudev (2011) have also explored the role of social media applications to help users track their consumption and engage with their peers activities (Lehrer and Vasudev, 2011)[1].

Differences remain though between research that points to the potential of social media to have an impact (for example Lehrer and Vasudev, 2010) and those that have actually attempted an intervention in the real world (Crowley *et al.*, 2014). Crowley *et al.* (2014), for example, have linked up their building management system to Twitter, enabling building users to received targeted messages querying consumption. In their study, this resulted in an encouraging 26 per cent reduction in energy use.

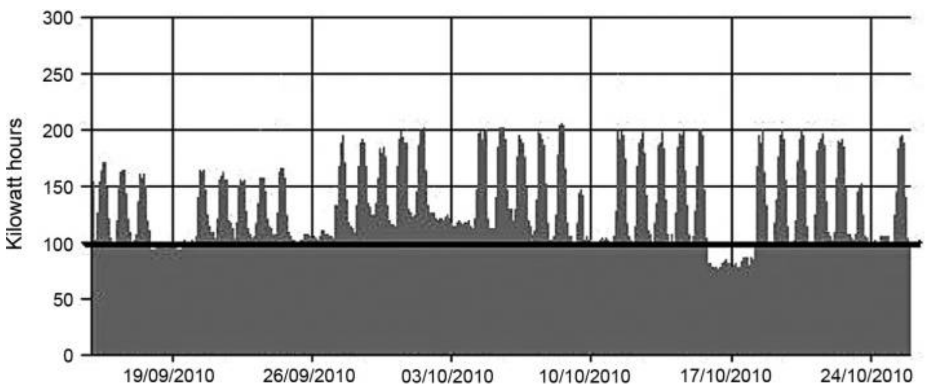


Figure 2.
Queens Building baseload 1-18 October 2010

Clean ICT then may be technology that facilitates behaviour change – more efficient management of our energy, our buildings and transport networks, and even cities. New applications are emerging around management of domestic appliances and home energy systems as a result of the UK government making a policy commitment for all homes to have SMART meters by 2020. SMART meters refer, firstly, to the installation of meters that will take automatic meter readings and send them directly to a utility company. This removes the need to have someone to read a meter manually, and also provides the utility companies with accurate consumption data. This technology secondly enables more dynamic, regular and, in many cases, real-time feedback. Through the installation of either simple wireless transmitters on the electrical cable coming in the building, or through more sophisticated "smart" meters – live electrical data can be sent to a display units that present the consumptions to the resident in a range of formats. Much research has been undertaken by Oxford's Environmental Change Institute into the best ways to re-connect people to energy through the use of systems that show the price, unit-cost or CO_2-cost through a live feed or half-hourly metering, and what effects this had had on the building users (Darby, 2010). The findings showed that whilst feedback offers potential in reducing consumption, between 5-15 per cent on average (Burgess and Nye, 2008), any conclusions are limited because the implementation of SMART metering at the household is in its infancy and varies greatly, depending on the type of feedback (Darby, 2010).

3. Future challenges and concerns: are we getting any SMARTer?

This brief overview of ICT applications being used for behaviour change initiatives in energy and buildings has provided some encouraging signs. Savings of between 5 and 25 per cent have been achieved through ICT initiatives. Yet, a note of caution remains, the jury is still out on whether the installation of sophisticated ICT control and monitoring systems may actually drive up the consumption in buildings. SMART technology, be it in buildings, transport or cities, presents for many a business an opportunity to simply sell more stuff! Slow Tech presents an interesting challenge to this trend where, in fact, simple behavioural controls (such as simply switching-off the equipment when finished using it) may be more effective.

Patrignani and Whitehouse present a challenging set of research questions for the Slow Tech movement at the end of their paper. No easy answers exist, as it seems there is an insatiable desire amongst consumers for ICT. To that end, the following question is posed, that is "whether or not clean ICT can facilitate behaviour change in users without ever becoming a contradiction in terms?"

Note

1. For a comprehensive examination of these issues, please see Bull *et al.* (2013).

References

Brown, N., Bull, R., Faruk, F. and Ekwevugbe, T. (2012), "Novel instrumentation for monitoring after-hours electricity consumption of electrical equipment, and some potential savings from a switch-off campaign", *Energy and Buildings*, Vol. 47, pp. 74-83.

Bull, R., Irvine, K., Rieser, M. and Fleming, P. (2013), "Are people the problem or the solution? A critical look at the rise of the smart/intelligent building and the role of ICT enabled engagement", *ECEEE Summer Study Conference Proceedings, 5A-079-13*, *Hyeres*, pp. 1135-1145.

Burgess, J. and Nye, M. (2008), "Re-materialising energy use through transparent monitoring systems", *Energy Policy*, Vol. 36 No. 12, pp. 4454-4459.

Crowley, D., Curry, E. and Breslin, J. (2014), *Leveraging Social Media and IoT to Bootstrap Smart Environments. Big Data and Internet of Things: A Roadmap for Smart Environments*, Springer International Publishing, London, pp. 379-399.

Darby, S. (2010), "Smart metering: what potential for household engagement?", *Building Research and Information*, Vol. 38 No. 5, pp. 442-457.

Foster, D., Lawson, S., Wardman, J., Blythe, M. and Lineham, C. (2010), "Watts in it for me? Design implications for implementing effective energy interventions in organisations", *CHI 2012, Austin, Texas*.

Ghonim, W. (2012), *Revolution 2.0*, HMH, New York, NY.

James, P. and Hopkinson, L. (2008), "Sustainable ICT in further and higher education", Jisc, available at: www.jisc.ac.uk/media/documents/publications/rptgreenictv1.pdf (accessed 6 December 2014).

Lehrer, D. and Vasudev, J. (2010), "Visualizing information to improve building performance: a study of expert users", *ACEEE Summer Study on Energy Efficiency in Buildings*.

Lehrer, D. and Vasudev, J. (2011), "Evaluating a social media application for sustainability in the workplace", *CHI2011*, Vancouver, 7-12 May.

Mulville, M., Jones, K. and Huebner, G. (2014), "The potential for energy reduction in UK commercial offices through effective management and behaviour change", *Architectural Engineering and Design Management*, Vol. 10 Nos 1/2, pp. 79-90.

Murtagh, N., Nati, M., Headley, W., Gatersleden, B., Gluhak, A., Imram, A. and Uzzell, D. (2013), "Individual energy use and feedback in an office setting: a field trial", Energy Policy, available at: http://dx.doi.org/10.1016/j.enpol.2013.07.090

Shirky, C. (2008), *Here Comes Everybody*, Penguin, London.

Zhang, W., Johnson, T., Seltzer, T. and Bichard, S. (2009), "The revolution will be networked", *Social Science Computer Review*, Vol. 28, pp. 75-92.

Further reading

SMART2020 (2008), "Enabling the low carbon economy in the information age", available at: www.smart2020.org/_assets/files/02_Smart2020Report.pdf (accessed 6 December 2014).

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1. Riccardo Mangiaracina, Alessandro Perego, Giulio Salvadori, Angela Tumino. 2016. A comprehensive view of intelligent transport systems for urban smart mobility. *International Journal of Logistics Research and Applications* 1-14. [CrossRef]