Can we believe in a green information and communications technology?

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Abstract:
Information and communications technology seems to have come at the right time in response to issues related to sustainable development. It allows for a "mastery of mastery", as advocated by the philosopher Michel Serres in The Natural Contract. Nowadays however, it seems to be at the service of economic growth alone. ICT firms are waiting for the market to adjust to what they know how to do, while consumers are waiting for products and services with features that a trusted third party has certified as "green"; and public authorities are expecting these firms to come up with technical solutions.

In 1990, digital technology barely existed.[1] Seven years later, there were more than a million websites. Alluring talk was heard about a "new", "immaterial", "information-based" economy. information and communications technology (ICT) would lead to "mastering mastery", as advocated by Michel Serres.[2] It has even been said that *"The planet's salvation, social cohesion and the return to growth in a new form seem to be related to the success and speed of this revolution."*[3]

In 2007 however, Gartner Consultancy estimated that ICT accounted for 2% of greenhouse gas emissions worldwide, as much as civil aviation. This statistic disturbed this industry, which argued that concentrating on these 2% meant forgetting that ICT could propose solutions for reducing the remaining 98%. The global potential of this reduction would be 15% by 2020.[4]

These figures have often been cited by public authorities even by NGOs. Are they sound? This article claims that they are not for one major reason: they rely on engineering scenarios based on taken-for-granted social, economic and political hypotheses. Environmental issues are addressed like a sectoral problem without being integrated into something bigger, thus obfuscating the forces driving consumption and production. The GeSI report recognizes this weakness, namely that it did not take rebound effects into account, since they were supposedly too difficult to bring into a model: *"The calculated abatement results in this report do not include rebound effect*" (p.54).[4] An interdisciplinary analysis of the positioning of stakeholders has raised this difficulty and shed light on the determinants of ICT trends.[5]

On the one side, ICT; on the other, sustainable development

The question of a "green" ICT crops up at the interface between digital technology and sustainable development. Seen from afar, the relations between the two seem obvious. After all, MIT's report to the Club of Rome pioneered the work on digital models, which have come into much wider use since then. Furthermore, the Earth is constantly under observation by a swarm of satellites; globalization could not have happened without ICT; etc.

For all that, digital technology and sustainable development have been constructed with few interconnections between them. This holds for international negotiations, ministries, regulations and even NGOs. At the 1992 Earth Summit in Rio de Janeiro and, too, at the United Nations Conference on Sustainable Development in Rio in 2012, ICT was scantly mentioned. Likewise, negotiations and ministerial meetings on regulations for the information society never broached the environmental question. On the contrary, in the gray literature from the disciplines of economics and technology, the idea was burgeoning that growth could be "dematerialized" or "decoupled" from its environmental footprint, and that ICT would provide major leverage for doing so. The Lisbon Strategy adopted by the European Union in 2000 called for massively using ICT for "green growth" (already mentioned by the Nora-Minc report in 1978).

Household electronic equipment

In France, more than one out of two persons has a smartphone, and three out of four telephones purchased in 2014 were smartphones.[(6)] Furthermore, 90% of French households own a personal computer; 90%, a land-line telephone. In addition, 92% have a mobile telephone; 83%, access to the Internet; and 35%, a tablet computer (a fast growing percentage). The most widespread combination is the threesome computer-tablet-smartphone (30%, +5%), followed by the twosome computer-smartphone (29%). Only 11% of households have none of this equipment.

The most frequently mentioned uses of the smartphone have been for browsing on the Internet (55%, +3%), downloading applications (48%, +4%), geolocalization (42%) and viewing videos (34%). Instant-messaging is used by 32%. These uses are more widespread among 12-17 year-olds. The rate of use increases with income and education. The Paris region and urban areas are more fond of digital technology than rural areas.

In four years, the time spent on the Internet has risen from 13 hours/week to 18. There were thrice as many commercial websites in 2015 as in 2009. Another growing use is for administrative procedures. Meanwhile, 59% of the French resort to the Internet for the news (+10% since 2012), a percentage still behind television's. The percentage of persons who think that having access to the Internet is "very" or "rather important" rose from 54% in 2009 to 65% in 2015 (72% in the Paris region). Each French household owns, on the average, 99 electric or electronic devices or appliances: 450 kg per household.[(7)]

The digital infrastructure's environmental impact

Data on the ecology of the digital infrastructure are numerous (hundreds of references), disparate (scope, methodologies, etc.) and insufficient (far from covering the whole field). I can but provide an overview herein.[8]

ICT accounts for between 5% and 10% of electricity consumption worldwide.[9] In France, this figure is about 14% (in other words: the electricity produced by seven nuclear power plants), not to mention 5% of greenhouse gas emissions.[10] Worldwide consumption grew by 6.6% per year from 2007 to 2012. In France, this rate has been approximately 10%/year: a growth of 635 kWh per household per year between 1990 and 2005 — thus canceling the energy gains thanks to improvements in household appliances (refrigerators, etc.) during this period.[11]

ICT's principal use of the energy it consumes is for manufacturing (devices, networks and terminals). In contrast, this equipment, at the end of its life cycle, usually has but a slight incidence on energy consumption.

As for its "material nature", ICT represents 30% of worldwide demand for silver, 12% for gold, 30% for copper and up to 80% for ruthenium and indium.[12] Some industries, such as the mining of coltan, have stoked wars. Temporary shortages have occurred. Given the risks to supply lines, the European Commission has classified the metals used by ICT as *"critical raw materials"*.[13]

Electronic wastes in France are growing from 3%-5% per year: 1.7 million tonnes were put on the market in 2015 (*i.e.*, 166 times the weight of the Eiffel Tour). Out of the 35% of these wastes that are collected, 80% of the materials in them are "recuperated", the remainder being sent to dumps or incinerated. This represents an actual recycling rate of less than 30%, assuming that the recycling is done in compliance with regulations. Only 1% is reused.[7]

A final point: toxic chemicals are incorporated in ICT products (fire retardants, phtalates, hexavalent chromium and beryllium) or are used to make them (solvents, acids, heavy metals and volatile organic compounds).

The positioning of stakeholders

The stakeholders actively advocating a "green" ICT fall into one of five categories: manufacturers, distributors, environmentalist organizations, public authorities and consumers.

These manufacturers try to follow the regulations, which they have often helped draw up: the EU directives on energy-using products (EuP), on the restriction of hazardous substances (RoHS) and on e-wastes (WEEE). By going farther than these regulations, they are moving toward energy efficiency. This has several positive effects, such as longer battery ranges. Meanwhile, eco-design (like in Fairphone) has been pushed onto the sidelines inside (and outside) big firms.

The business model preferred by both distributors and manufacturers revolves around recycling: recuperation, destruction and the production of secondhand raw materials for the purpose of bringing new products onto the market. As a consequence, the reuse of equipment has also been pushed out onto the sidelines. Novelty attracts customers, thus fostering commercial obsolescence. Electronic devices are technically capable of lasting three to four times longer than their current life cycle of 18 months. For businesses, "green" is not a sales argument… but could become a discriminating factor if consumers wanted it to be.[14]

What about NGOs? Greenpeace has targeted manufacturers, in particular HP and Apple, and undertaken actions against their exporting of e-wastes to poor lands. As it has shown, the Internet, were it a country, would rank as the world's fifth consumer of electricity. This NGO has also pushed, somewhat successfully, the major users of host servers (Facebook, Google, etc.) toward using energy from renewable sources. The WorldWide Fund for Nature (WWF) has formed a partnership with Orange Group for environmentally assessing the latter's products. France Nature Environment has been advocating the implementation of the aforementioned WEEE directive. Focusing on the issue of

accelerated obsolescence, Friends of the Earth is demanding guarantees for longer product life cycles and calling for legally obligating manufacturers to continue making spare parts for their products.

As for public authorities, the support for, and regulation of, digital technology (e-health, e-learning, etc.) have, as pointed out, been kept separate from sustainable development and environmentalism. The EU's framework program *"i2010: Information society and the media working towards growth and jobs"* views ecology only from the angle of energy efficiency (in particular of cars and a smart transportation infrastructure).[15] The European Commission has adopted a position close to manufacturers'. As much can be said about the French government. One report, though mentioning ICT's environmental impact, drew the conclusion that this industry provides many opportunities for moving toward the ambitious objective set by France for curbing energy consumption.[10]

Stakeholders who want or claim to support environmentally friendly products are turning toward consumers;[16] but the latter have a weak grasp of the issues under debate. The first issue that the public spontaneously mentions in relation to ICT's environmental impact is electromagnetic waves; wastes ranks second. Electronic devices at the end of their life cycles, since they are recognized as being special, are stocked rather than being thrown out like run-of-the-mill objects. Another often mentioned issue is energy consumption, but comments about it are still vague. ICT is usually said to be too technically complicated to form an opinion about it. When asked what a "green" ICT could be, the first answer is a product running on solar power. Although the opinion is often voiced (not without contradictions) that ICT cannot be "greened", the belief holds steady that engineers will come up with solutions. A final point mentioned about the relation between digital technology and the environment is the idea of simpler, sturdy, repairable devices. ICT's functionality is hardly brought under question. Digital devices and applications are now familiar, seemingly indispensable, like a limb on the body that we cannot do without.

Conclusion

The main argument advanced by the Smarter 2020 report is substitution, *i.e.*, replacing physical with "immaterial" goods and services.[4] However it fails to be very convincing upon scrutiny. A closer look at the examples cited (videoconferencing, e-commerce, e-paper or telework) discovers that this argument depends on trends in uses, both individual and collective.[17] But the uses are growing, in line with the objective of public policies (in favor of an e-administration, for instance) and with the strategies of major ICT players, who do not want to sell less. As expected, rebound effects are occurring.

Stakeholders do agree on setting a framework for a "green" ICT based on three criteria (materials, energy, toxicity) and three strategies (reduction, substitution or prohibition). But their opinions about priorities diverge. Which of these parties is ready to reconsider its needs? Sellers? Consumers? Underprivileged social classes tend to think that changes should mainly burden those who have the means, since, relatively speaking, this would have the most impact. The counterargument easily turns Malthusian: true, the wealthy consume more, but since there are more of the poor, everybody's lifestyle has to change. This difference also crops up at the international level between North and South.

All of this shifts responsibility about. Firms are waiting for the market to adjust to what they know how to do, while consumers are waiting for products with features that a trusted third party has certified as "green"; and public authorities are expecting firms to find the technical solutions.

Given what mostly amounts to engineering scenarios that are remotely connected with any consideration of the trends under way in contemporary societies, believers in a “green ICT” will very likely be disappointed. The analysis and conclusions presented herein can, to a large degree, be transposed to similar problem areas: “green” cars, “green” airplanes, etc. The “greening” of our society often comes down to a set of technical arrangements with no bearing on the economic and social trends that are, in fact, the driving force and with which our fellow-citizens are fully familiar. On the contrary, the prescriptions and recommendations made to the public — consume “more” for the economy but “less” for the planet — rings in their ears like contradictions of those of us who are standing at the crossroads. The risk looms that our fellow-citizens come to feel betrayed and withdraw any confidence that they might have had.

Notes

(1) This article has been translated from French by Noal Mellott (Omaha Beach, France). The translation into English has, with the editor’s approval, completed and updated references.

(2) Michel SERRES, *Le Contrat naturel* (Paris: Éditions François Bourin, 1990); English translation by E. MACARTHUR & W. PAULSON: *The Natural Contract* (Ann Arbor, MI: University of Michigan Press 1995).

(3) P.91 in S. FAUCHEUX, C. HUE & I. NICOLAÏ, *TIC et développement durable. Les conditions du succès* (Brussels: De Boeck, 2010).

(4) Boston Consulting Group, *SMARTer 2020: The Role of ICT in Driving a Sustainable Future*, 243p. (GeSI Global e-Sustainability Initiative, 2012) available at https://cda.iea-4e.org/document/10/gesi-smarter-2020-the-role-of-ict-in-driving-a-sustainable-future.

(5) This article draws on data from the following two books: F. FLIPO, F. DELTOUR, M. DOBRÉ & M. MICHOT, *Peut-on croire aux TIC vertes? Technologies numériques et crise environnementale* (Paris: Presses des Mines, 2012); and F. FLIPO, M. DOBRÉ & M. MICHOT, *La Face cachée du numérique. L’impact environnemental des nouvelles technologies* (Paris: Éditions L’Échappée, 2013).

(6) P. CROUTTE & S. LAUTIÉ, *Le Baromètre du numérique 2016*, 277p. (Paris: CRÉDOC, 2016) available at: http://www.credoc.fr/pdf/Rapp/R333.pdf.

(7) Statistics reported in V. MONIER, A. DEPROUW, M. JOVER & S. CHOUVENC, *Rapport annuel du Registre des déchets d’équipements électriques et électroniques*, p.40. (Angers, FR: ADEME, 2016) available at: http://www.ademe.fr/rapport-annuel-registre-dechets-dequipements-electriques-electroniques-deee-donnees-2015.

(8) For more details, readers may consult the books I have co-authored (*cf.* note 5) or other sources such as the website www.ecoinfo.cnrs.fr or L.M. HILTY & B. AEBISCHER (eds.), *ICT innovations for sustainability* (Heidelberg, DE: Springer 2015).

(9) B. LANNOO *et al.*, “Deliverable 8.1: Overview of ICT energy consumption”, 59p. (Network of Excellence in Internet Science, FP7-288021, 2013) available via: http://www.internet-science.eu/publication/491. M. MILLS, “The cloud begins with coal: Big data, big networks, big infrastructure and big power — An overview of the electricity used by the global digital ecosystem”, 45p., report (Digital Power Group., August 2013) available at: https://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf?c761ac

(10) H. BREUIL, H. BURETTE, B. FLÜRY-HÉRARD (2008), “TIC et développement durable”, 96p., report (CGEDD & CGTI, December 2008) available via: www.ladocumentationfrancaise.fr/var/storage/rapports-publics/094000118.pdf.

(11) Enertech (2008), “Mesure de la consommation des usages domestiques de l’audiovisuel et de l’informatique”, 80p., report on the REMODECE Project for ADEME, EU & ÉdF (Felines-sur-Rimandoul: Enertech, July 2008) available at www.enertech.fr/etude.php?id=76.

(12) According to Umicore, a world leader in recycling, reported by C. HAGELÜKEN & C.E.M. MESKERS, “Mining our computers — opportunities and challenges to recover scarce and valuable metals from end-of-life electronic devices”, pp.623-628 in H. REICHL, N.F. NISSEN, J. MÜLLER & O. DEUBZER (eds.), *Electronics Goes Green 2008+* (Stuttgart, DE: IRB Verlag, 2008).

(13) https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_fr

(14) R. ROCHEFORT, *Le bon* consommateur *et le mauvais citoyen* (Paris: Odile Jacob 2007).

(15) http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:c11328&from=FR

(16) M. DOBRÉ & S. JUAN, *Consommer autrement. La réforme écologique des modes de vie* (Paris: L’Harmattan, 2009).

(17) As Bio Intelligence Service had previously pointed out in (2008), *Impacts of ICT on energy efficiency*, 432p., report to European Commission DG INFSO. September 2008 available at: http://ec.europa.eu/information_society/activities/sustainable_growth/docs/studies/2008/2008_impact-of-ict_on_ee.pdf.