The expert's view

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In the project *Trace of ICT: Information technologies and waste management*[ii], you worked on an early case of connected objects, RFID tags. What did the project consist of?

We were interested in the paradox that characterises RFID tags and their specific use in waste management: the risk of generating new waste when the aim is to manage existing waste better. The RFID tag, almost invisible, is often inseparable from the object into which it is incorporated. When the latter reaches the end of its lifecycle, it risks being disposed of with the RFID tag that identifies it. In this case, the tag in turn becomes waste. RFID tags raise the issue of their recyclability because of their small size (difficult to see) and because of the difficulty of separating tags from the objects that embed them. In glass bottles for example, the RFID tag is melted into the mass, which makes it impossible to recover.

This paradox at the origin of the project became an increasing issue in relation to the Internet of Things, which envisions a society where any object can be identified remotely.

The issue arose as much from the point of view of the supply of raw materials as of their recovery.

The project also revealed a fairly significant lack of interest in the issue among manufacturers. The tendency of manufacturers was to highlight the strengths of RFID rather than its weaknesses and to transfer the problem of its environmental impact to their customers. Scientists were more aware of the issue and were interested, for example, in the dematerialisation of RFID tags (tags without antennas or chips). This project led to the publication of a book in 2012[iii] and the coordination of an international workgroup on digital traceability with all stakeholders.[iv]

You also work on controversies linked to smart techs. Why – how – does a controversy arise? How can we remedy it?

The controversy surrounding a new technology is in fact a mode of public, informal technological assessment that is complementary to the formal techno-scientific assessment provided by •••

i https://www.anses.fr/en/content/presentation-anses (last retrieved: 28/06/2021).

ii In French, Trace de TIC: https://journals.openedition.org/terminal/1801?lang=fr (last retrieved: 28/06/2021). This interdisciplinary research project was based on collaboration between sociologists from Télécom Paris (Campus Sophia Antipolis) and industrial engineering researchers from Mines Saint-Etienne (Campus G. Charpak Provence), and it was supported by the ADEME. The project looked at the potential of RFID technology in waste management and its ecological viability.

iii DRAETTA Laura, DELANOË Alexandre, *RFID, une technologie controversée : ethnographie de la construction sociale du risque*, Collection Mondialisation, Hommes et Sociétés, ed. Lavoisier, 2012

iv This workgroup, which was a thinktank within the Observatory for Responsible Innovation, included manufacturers, regulators and academics in the ICT sector. Members of this thinktank have been working on how this promising RFID technology can be deployed in a responsible manner to address privacy, health and environmental issues. The workgroup held a colloquium in Paris and produced a position paper.

••• institutional expertise. It raises new doubts and concerns which widen the field of representations of the proposed technology.

We often hear the call to 'do more educating'. But this 'lack of knowledge' image is inappropriate. It has been shown, with supporting data[v], that people concerned by a new technology are often fully informed and exposed to techno-scientific communication. Education is not necessarily the remedy for stopping or preventing controversy, since it risks answering questions that have not been asked and not answering the right questions.

While not a miracle solution, bringing all the stakeholders to the same table is already progress. The difficulty lies in identifying the relevant stakeholders, which is often where things go wrong, because it is done from the perspective of the promoters, whether industrialists or institutions. Often, citizens are seen only as consumers, and rarely as citizens, and are left out.

Ignoring a controversy has serious consequences. It creates mistrust of the promoters of new technologies. Also, questions that emerge during a controversy will return if unanswered and fuel a new controversy. Controversy is an unanswered question.

v Bucchi M. & Neresini F., 2002, *Biotech remains unloved by the more informed*. Nature, 416: 261.
Raimi K. & Carrico A., 2016, *Understanding and beliefs about smart energy technology*. Energy Research & Social Science, 12: 68-74.

"This paradox [of more environmental impacts created by a technology used to limit environmental impacts] became an increasing issue in relation to the Internet of Things, which envisions a society where any object can be identified remotely.

Laura Draetta

A very recent study submitted for review in 2021[8] that assesses the embodied carbon footprint of IoT devices finds that their heterogeneity makes it very difficult to estimate the absolute carbon footprint of the production of IoT devices, with worldwide results ranging from 22 to 1,124 MtCO2-eq/year in 2027 depending on the deployment scenarios (see figure p. 15) – by way of comparison, the global carbon footprint of ICT production in 2020 lies between 281 and 543 MtCO2-eq.[9]

The study underlines that these trends are in conflict with the Paris Agreement, even in the case of deployment of the simple devices scenario ("*likely to generate concerns after 2030*"[10]). The same study underlines that the IoT meets several conditions that encourage the development of rebound effects, creating "*a fertile ground for rebound effects*"[11].

The future that is emerging for the IoT is thus one of an impressive acceleration in the production and use of connected objects, with a resulting increase in the environmental impacts associated with it. As we have seen, this multiplication of impacts comes on the one hand from the impacts related to the manufacture of connected objects and on the other from the impacts related to the use of these connected objects, but also from the

8 Pirson T., Bol D., *Assessing the embodied carbon footprint of IoT edge devices with a bottom-up life-cycle approach*, 2021
9 Freitag C., Berners-Lee M., Widdicks K., Knowles B., Blair G., and Friday A., *The climate impact of ICT: A review of estimates, trends and regulations*, 2021
10 Pirson T., Bol D., *Assessing the embodied carbon footprint of IoT edge devices with a bottom-up life-cycle approach*, 2021, p.12
11 *Ibid.*, p.13

processing of data and the use of network infrastructure and devices that need to be added to the equation.

Conclusion

The IoT is expected to rocket in the years ahead, yet the benefits it promises will not come without environmental burdens, which are still being overlooked. In the meantime, the few life cycle assessments on IoT devices point out the risk of worsening the current environmental situation; they often conclude by stating the critical need for more life cycle analyses to ensure that decision-making processes focus on the benefits of the IoT without transferring impacts and causing the potential savings to backfire. There is therefore a pressing need to consider the overall environmental benefits and costs in a multicriteria approach and to limit impact transfers when designing an environmentally friendly smart device.

As more and more connected devices are manufactured, we have also seen that each device contributes to scattering some materials used to manufacture these devices, which are often not recyclable[12] (**to learn more, see our case studies on raw materials, e-waste & circular economy**). Moreover, the anticipated huge rise in both the number of connected device units and data traffic underlines the need to set priorities and limits to ensure that the IoT will not be a hindrance to achieving the objectives of reducing environmental impacts, such as global warming, that it will stay in line with the Paris Agreement and not in conflict with it. But also to reduce the depletion of resources that are limited and critical; and finally, to address health and geopolitical sovereignty issues.

Currently, most designers of connected objects do not take the environmental impact into account when designing the objects – or at least not systemically – sometimes even when these objects are intended to reduce humanity's environmental footprint. Eco-design may be a first prerequisite to limiting the environmental impacts of the IoT, but regarding the ongoing exponential rise of the IoT, even if eco-designing connected objects is a necessity will it be sufficient to limit climate change and critical raw material depletion?

Our recommendation section outlines some recommendations for a digital evolution for the IoT which is compatible with the Paris Agreement and the Green Deal.

12 https://www.environnement-magazine.fr/recyclage/article/2015/12/01/46697/quelle-fin-vie-pour-les-puces-rfid last retrieved: 04/06/2021; https://staceyoniot.com/sustainability-is-the-elephant-in-the-iot-room/ last retrieved: 08/07/2021

Simplified vision of environmental impacts related to the IoT