

WHITE PAPER

DIGITAL TECHNOLOGY AND ENVIRONMENT

*Using the digital transition to accelerate the
ecological transition*

IDDRI



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of CNNum



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Using the digital transition to accelerate the ecological transition



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EDITO



Teresa Ribera (Director of IDDRI). « Why should we turn to digital technologies when, like IDDRI and many others, our goal is to advance the policy debate on sustainable development? It is not just because the ecological footprint of the digital industry needs to be reduced, but also, and perhaps especially, because digital technologies are transforming the ways in which we travel, consume, produce, learn, develop public policies and participate in the public debate. We cannot consider society in 2050 – especially its carbon neutrality – without simultaneously thinking about how we will be living and debating by then, “after” the digital transition. It would be a pity if digital innovations were not used to also contribute to the ecological transition and to new policy practices for sustainable development. For all of these reasons, over the last few years IDDRI has been studying issues at the interface between the digital and ecological transitions, in partnership with digital actors. This is why I am very pleased to see our research, along with that of our partners, summarised in this White Paper. I hope it will help public policy-makers to define strategies and policies to align the two major transitions of the early 21st century. »



Daniel Kaplan (Scientific Advisor at FING) & Renaud Francou (FING-Transitions²). « FING set itself the task of exploring the transformative potential of digital technologies and ensuring that this potential benefits everyone. In 2015, at the end of a foresight exercise, we wrote: “The ecological transition knows where it wants to go, but is struggling to find its way. The opposite is true of the digital transition. Each one needs the other”. This appeal was the starting point for the Transitions² movement, bringing together actors and initiatives that work to connect digital technology and ecology. Because digital technology is one of the main forces for change of our time, it – in other words its companies, specialists and adherents – also has a responsibility in terms of the direction this change takes. Where ecology is concerned, the goal is not simply to reduce the ecological footprint of digital technology, but to determine how it could contribute to



a transition to other modes of production, development and community life. Our collaboration with environmental actors is of great benefit to us. We hope that this White Paper, the outcome of this collaboration, will help actors in the digital industry– and, more broadly, in innovation – to work more consciously and intentionally towards the ecological transition. »



Pascal Canfin (Director of WWF France). « Convinced that the digital revolution and the ecological transition are the two major forces for change of the 21st century, WWF France is currently working to align these two movements to ensure they become mutually reinforcing. With more than 40 years of experience in preventing environmental degradation and building a future where humans live in harmony with nature, we thus work and engage with different actors in the sector that share this vision – start-ups, large companies, think-and-do tanks, associations, etc. We are in fact at a tipping point: digital technologies could either increase our ecological footprint or provide us with opportunities to reduce it and to accelerate the transition. The development of digital tools

is rewriting the rules on a daily basis and questioning our models of society and our requirements in terms of food, travel, heating, protection and information. In this context, we believe the public authorities must address the need to reconcile the digital and ecological transitions as a matter of urgency. These transitions are already being implemented on the ground, but now require stronger public action to accelerate the movement. »



Frédéric Bordage (Founder of GreentIT.fr). « Digital tools are just one of many options for building a desirable future for our children. But their omnipresence means we need to give them special attention. Over the last 15 years, the established community of experts on responsible digital technologies has become convinced that it is possible to create value – whether economic, social or societal – using digital technologies, while reducing their ecological footprint. We are therefore delighted to take part in this process. To our knowledge, this is the first time such strong, complementary views have been merged to jointly propose an operational “toolbox”. In this White Paper, we suggest practical avenues for supporting, improving and disseminating the tools and methodologies developed by actors in the field. The stakes are high and our ambition is equal to the challenge: effectively accelerating convergence between digital technologies and sustainable development; and positioning France as an example to follow in this field. Our dream is of a new Age of Enlightenment centred on the protection of the planet and greater social equity, in which digital technologies play an important role because they are used wisely and judiciously. »



Marie Ekeland and Benoît Thieulin (former members of CNNum). « Having contributed to the Council's research on the convergence of the ecological and digital transitions, we believe it is essential to rethink our models in order to address climate change – which is just one of the “planetary boundaries” that humankind has crossed or is about to cross. Digital tools, which are a combination of science and technology, actors and practices, are radically transforming contemporary society, the way it works, its values and its economy. CNNum believes that this huge digital change needs to integrate ecology into its development, and thus contributed to this White Paper with the conviction that digital technologies can be harnessed to create a more sustainable, fairer economy and society for everyone. »



26 PROPOSALS

TO LAUNCH THE DEBATE

The ecological transition is an inevitable process, a goal to be achieved, yet the pathway there is still unclear. The digital transition is one of the major forces for change of our time, but it lacks any specific objectives. Here, we propose several avenues for harnessing the transformative power of digital technology to support the ecological transition.

A number of reports stress this potential, with some stating, for example, that digital technologies could enable a 20% cut in global CO₂ emissions by 2030.¹ But it is clear that the decades of digitalisation in our societies have also seen the highest increase in our ecological footprint, as shown by the fact that Earth Overshoot Day, the symbolic day on which humankind has consumed all the resources the planet can regenerate in that year,² comes earlier and earlier every year.

The challenge today is using the digital transition to drive the ecological transition. The convergence of these two transitions is not just necessary to accelerate the ecological transition; it is also an opportunity to ensure digital actors become key pillars of the economy of the future, one that is resource-efficient.

To achieve this convergence between the digital and ecological transitions, their respective actors need to develop shared methodologies

and strategies for action in order to reduce the environmental impacts of digital technologies and to capture their innovation potential for the ecological transition. They need to build a common culture. Unfortunately, too few ecological actors tap into the potential of digital technologies, while digital actors seem to think the apparently “intangible” nature of these technologies and their effects in terms of efficiency are enough to make them virtuous. Within companies, local authorities and national administrations, the people in charge of digital matters are different from those responsible for environmental issues, and they seldom work together.

A few pioneers are already working at the interface between the two transitions. Investors and entrepreneurs of all types – start-ups, large companies, citizens' groups – are currently using the power of digital technology to provide new environmental solutions. Authorities and administrations are testing these solutions and opening up their data to foster the emergence of such innovations. Companies, experts and associations are working together to reduce the environmental footprint of digital equipment and to design more responsible digital solutions. They are inventing ecodesign

¹ *System Transformation. How digital solutions will drive progress towards the sustainable development goals.* Global e-sustainability initiative, 2017.

² <http://www.overshootday.org/>.

tools for products and services, which are the missing link between the search for positive environmental impacts and the creation of economic value, and – beyond that – are promoting their responsible design to integrate the other pillars of sustainable development, especially digital accessibility and privacy.

Armed with the experience of these pioneers and in order to build on this momentum, the Institute for Sustainable Development and International Relations (IDDRI), the Fondation Internet Nouvelle Génération (FING – New Generation Internet Foundation), GreenIT.fr and WWF France joined forces to contribute to discussions on actions that the public authorities – at both the national and local levels – could take to ensure the digital transition becomes a driver of the ecological transition. We have benefited from the contributions of a number of actors, especially the Conseil National du Numérique (French Digital Council) and the Transitions² network.

This White Paper is the result of this new collaboration. Its goal is not to summarise all existing proposals, but rather to launch the debate on the most appropriate measures, to encourage counterproposals and complementary proposals, and to provide input for public authorities wishing to take action or to consolidate existing actions. It seeks to open a new policy agenda.

Whatever the proposals adopted, public actors will need to accompany them with a positive narrative that simultaneously mobilises the ecology and digital innovation communities, which are all too often disconnected today. A narrative of the future that is neither techno-utopian, suggesting that digital technology and ecology always go hand in hand, nor technophobic, implying that these transitions are irreconcilable.

DIGITAL TECHNOLOGY AND ECOLOGY: TWO TRANSITIONS THAT NEED TO BE ALIGNED

Before discussing courses of action for the public authorities, we believe it is important to highlight three messages from research and from the experience of practitioners working to align the ecological and digital transitions.

Digital contributions are not limited to ecological optimisation or “smart” solutions

Digital technologies – and their myriad mobile applications, sensors, connected objects, meters and smart grids – can provide many opportunities for meeting environmental challenges. They can be used, for example, for better observation and real-time monitoring of the state of our planet, the air we breathe, our forests, fish stocks and fishing fleets. They can also be a powerful tool for optimising energy, food or mobility systems. For instance, they provide the means of adapting street lighting to real population requirements, locating leaks in water distribution networks, improving traffic fluidity, and providing real-time information about mobility solutions available to users. They contribute to better energy network functioning, to greater penetration of renewables, and to peak load management. They can help to optimise waste collection, and the use of inputs in agriculture, etc.

Many industrial actors have already adopted digital technologies to optimise existing systems and to make them “smarter”. But optimisation, though important, will not be enough to meet the ecological challenge of reducing our consumption of energy and other scarce resources by a factor of four or five, if not more, in the next few decades. Moreover, optimisation is often analysed as an increase in productivity resulting in multiple rebound effects, in other words an increase in volumes produced through a reduction in prices and the diversification and renewal of product ranges. Digital technology therefore needs to be viewed from another angle, as a force for change in terms of practices, the very nature of products and services, organisations, economic models and interaction between actors. If digital technologies play such a prominent role today, it is because they provide new ways of sharing knowledge, and new service production and consumption models.

The dynamics of digital “disruption” can be harnessed for the ecological transition. The seeds of this can be seen in several fields. For example, digital technologies are fostering the development of short food supply chains, with La Ruche qui dit Oui!, or Optimiam and Too Good To Go, which connect consumers with local businesses to enable them to more effectively sell off their perishable goods. These technologies help to integrate goods into sharing systems: freecycling with Recupe.net, for example, or lending with Mutum. They facilitate crowdfunding for renewables or agroecology, through platforms such as Enerfip or Collectivity. In terms of knowledge sharing, Open Food Facts gathers information about the processing methods, origins and labelling of different food products. Another example is Open Source Ecology, the “Global Village Construction Set”, a platform providing blueprints for the “50 different industrial machines that it takes to build a small, sustainable civilization with modern comforts”. Digital technologies are also helping to combat planned obsolescence, like Spareka, a platform selling spare parts connected to a community of repairers. Shared places of work, production and leisure are emerging, and contributing to the reactivation of common goods, which is central to the ecological project. This disruption is particularly visible today in the field of mobility, with the growing popularity of carpooling, carsharing between individuals, remote meetings to replace physical travel, and – in the future – autonomous vehicles.

Using digital technologies for the ecological transition does not just imply promoting smart agriculture, smart grids or smart cities, which are generally based on existing actors in their respective sectors. It also means using their disruptive potential and their capacity to challenge existing actors and to transform the dominant models, rather than simply optimising them.

Digital technologies are not intrinsically “good” or “bad” for the environment

The ambiguity of the environmental impacts of digital disruption is particularly obvious for mobility. The autonomous vehicles of the future could be shared and thereby complement the existing range of public transport options; or they could remain the private property of individuals who will take advantage of the higher level of comfort to live further and further away from their place of work and to turn their backs on public transport. In the future, our towns could be full of “zombie” cars driving around empty waiting for their owners to leave work and go home. Depending on the scenario, automation could either halve or double energy consumption for mobility.³ More generally, depending on the way in which the new products and services delivered by digital technologies are designed and used, and directed and regulated by the public authorities, they will either facilitate or, on the contrary, obstruct the ecological transition. The future is not written, but it is being written today.

³ <http://www.iea.org/publications/freepublications/publication/DigitalizationandEnergy3.pdf>.

Beyond these indirect positive or negative impacts, every digital device has a direct impact on the planet: the use of non-renewable resources with varying degrees of scarcity, different types of pollution that play a part in biodiversity loss, contribution to climate change, etc. These direct impacts occur throughout the life cycle of electronic equipment: extraction of raw materials, transformation into electronic components, use and end-of-life. For example, 32 kg of raw materials are needed to produce a microchip weighing 2 g.⁴ Moreover, owing to the lack of appropriate processing, it is estimated that 70% of the heavy metals found in North American landfills are from the electronic equipment that will decompose there for hundreds of years.⁵ Not to mention data centres all over the world, which alone account for around 2% of global greenhouse gas emissions, in other words as much as all air traffic.⁶

Aligning the transitions: a shared responsibility

Digital technologies are not intrinsically good or bad for the environment. They are what we make of them. Using digital technologies for the ecological transition is the responsibility of all actors, both private and public, working in the digital or environmental sectors. They have the responsibility to communicate and to work together to advance their core activities, practices and strategies.

Private digital actors need to assume the responsibility that comes with the important role they play in the evolution of the whole economy, in all areas of society. Rather than contributing to the perpetuation of a development model based on the steady acceleration of obsolescence cycles, the over-exploitation of resources, the capture of attention and of ever-growing volumes of data, they should seriously consider the direct and indirect ecological impacts of their activity, and focus some of their innovative capacities on the search for true “ecological disruptions”, innovations that make a real, profound and sustainable contribution to changing the direction of our systems of production, consumption, and mobility, among others. Some actors are beginning to do this, but it is the sector as a whole that needs to organise itself in order to communicate, with all stakeholders and public authorities, on its environmental strategy; a strategy that requires the sector to go beyond simply evaluating its potential contribution to the ecological transition, and to take action to realise this potential.

⁴ *The 1.7 Kilogram Microchip: Energy and Material Use in the Production of Semiconductor Devices*, United Nations University, Eric Williams, 2002, <http://pubs.acs.org/doi/abs/10.1021/es025643o>.

⁵ *Computers, E-waste, and Product Stewardship: Is California Ready for the Challenge*, 2001, Report for the US Environmental Protection Agency, Region IX, page 13.

⁶ Gartner Group, 2007, <https://www.gartner.com/newsroom/id/503867> GREENPEACE INTERNATIONAL, How dirty is your data? A Look at the Energy Choices That Power Cloud Computing, Avril 2011.

For their part, private ecological actors – companies or associations –, need to raise their game when it comes to digital technologies: gauging the importance of data, building on people's digital practices in order to act, and harnessing the positive power of disruption (collaboration, coproduction, open sourcing, etc.).

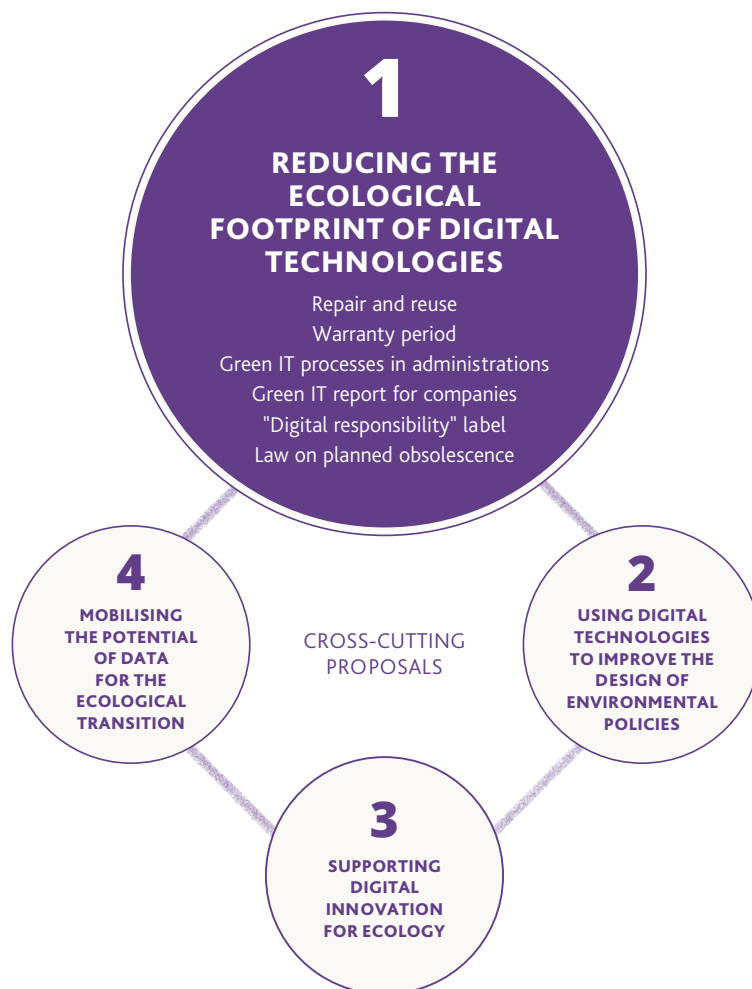
Finally, the public authorities need to act. They face four challenges, which we will develop in the rest of this document:

- establishing the incentives and sectors needed to reduce the direct impacts of digital technologies, and to themselves be exemplary in this field;
- using digital tools to improve the design of their environmental policies;
- improving their innovation support systems to steer digital technologies towards the resolution of environmental problems;
- harnessing the potential of data for the ecological transition.

CHALLENGES



CHALLENGE 1



1

REDUCING THE ECOLOGICAL FOOTPRINT OF DIGITAL TECHNOLOGIES

The digital industry is not an intangible one. The manufacturing and use of digital equipment and infrastructure requires a massive amount of non-renewable natural resources, some of which are extremely rare. The extraction of these resources and their transformation into electronic components is by far the main source of environmental impacts,⁷ followed by end-of-life pollution. To make a mobile phone, for example, 60 different metals are required, only around 20 of which can currently be recycled, and only 16% of mobiles are collected for reprocessing.⁸

Although digital technologies can help other sectors to reduce their ecological footprint, the issue of reducing the footprint of the digital sector itself needs to be tackled head-on. To use the current terminology, IT for Green is not an excuse to neglect Green IT. Many initiatives have already been implemented to this end. Electronic equipment is subject to EU regulations aimed at limiting the use of dangerous substances and improving their end-of-life collection and processing. Labels have emerged to facilitate the purchase of digital equipment that is more environmentally friendly throughout its life cycle.⁹ For the last 10 years, companies such as those in the Club Green IT have initiated real strategies to develop their procurement policies, and to extend the life of their equipment, especially by guaranteeing its reuse. They are now moving up a gear, adopting responsible design processes for their digital services.

Yet it is obvious that progress is still needed. One of the strategic priorities is the life of equipment, which is steadily decreasing: between 1985 and 2015, the useful life of a computer was reduced by a factor of three, falling from 11 to 4 years.¹⁰

To address this worrying trend, it is essential to foster the repair, repairability and modularity of new equipment, the upgrading and reuse of old devices, as well as their recyclability and their actual recycling. Moreover, digital services – in other words all the software and IT materials used to reserve a train ticket, to list stock prices, or to compare product prices, etc. – must also be designed in a more responsible manner. GreenIT.fr and the Conception Numérique Responsable (Responsible Digital Design) group, for example, are developing a methodology and ecodesign tools that have already reduced the energy footprint of a website by a factor of three, while improving user experience. Entrepreneurs will more readily integrate environmental issues right from the design stage of their digital services if they can then make this a business differentiator: to do so, they need to have a recognised system to differentiate their offerings (labelling, certification, consumer information, etc.).

The public authorities can explore many courses of action for bringing digital technologies into the age of the circular economy and to support the ecodesign of digital services. At the national level, these courses of action could be translated into the future roadmap for the circular economy.

⁷ *Les impacts écologiques des technologies de l'information et de la communication*. Ecoinfo, 2012.

⁸ *100 millions de téléphones portables usagés : l'urgence d'une stratégie*. Sénat, 2016.

⁹ EPEAT, Blue Angel, TCO, etc.

¹⁰ *Benchmark numérique responsable*. Club Green IT, 2017.

Courses of action for the public authorities

1. Making France and its territories champions in the repair and reuse of digital equipment, by improving financing for actors in the sector: applying a reduced rate of VAT to their activities, increasing the eco-tax for producers, modulating this contribution according to the degree of eco-design in products, etc.
 2. Extending the warranty for digital equipment to five years, generalising "sustainability" information on these products (environmental footprint, lifespan, reparability, availability of spare parts), and extending it to include digital services.
-
3. Setting an example by consolidating Green IT processes in national and local administrations: in terms of not only equipment (setting objectives on extending their useful life, increasing rates of reuse, purchasing new labelled equipment or refurbished equipment, etc.), but also digital services (responsible design or, failing that, ecodesign, ecological clauses in calls for tenders, etc.). At the national level, this calls in particular for the updating and application of the circular of 3 December 2008.¹¹
 4. Defining a common methodology to evaluate Green IT processes in organisations based on existing research by field actors,¹² and making it mandatory to include a Green IT review in corporate non-financial reports.¹³
 5. Supporting the development – at the French and/or EU level – of a "digital responsibility" label for digital service companies,¹⁴ then making this label a selection criterion in public calls for tenders at the national and local levels.
 6. Mandating the eco-design of public websites and online services as well as those of companies with a turnover of more than 500 million euros, supplementing the legal obligation concerning digital accessibility to which they are already subject.
 7. Reviewing the effective application of the French law on planned obsolescence in order to identify obstacles to its proper application, and making appeals easier by making this provision more widely known.

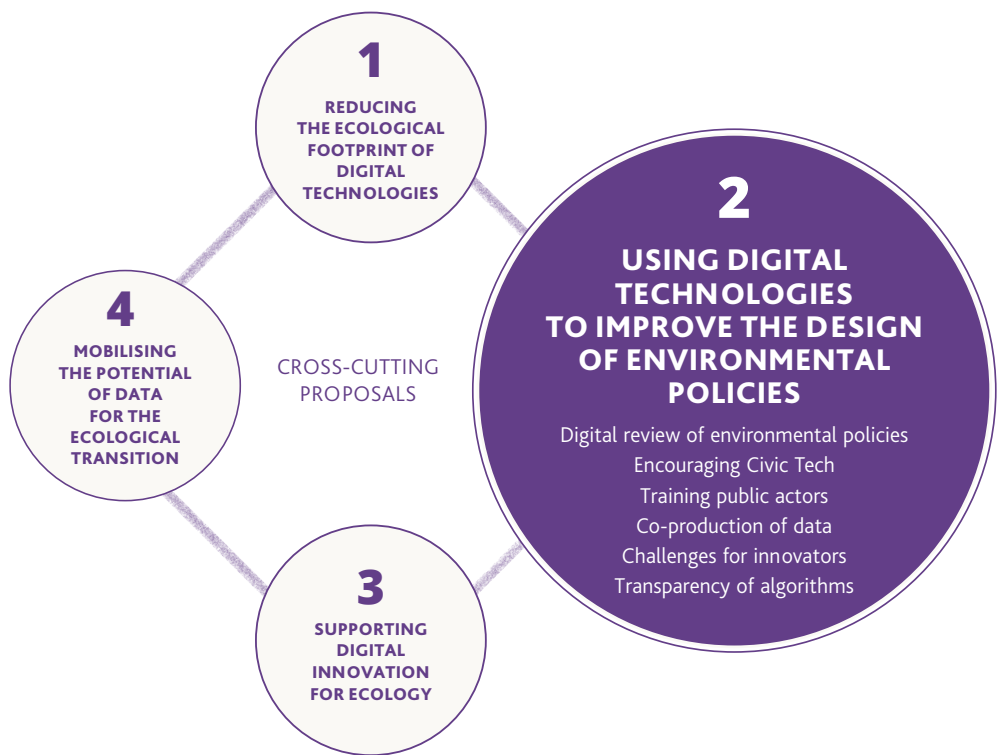
¹¹ <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000020243534>.

¹² Club Green IT proposes a methodology and tools shared by the 12 very large French corporations, both private and public, that are the most advanced in this field. See in particular the Benchmark Numérique Responsable (Responsible Digital Benchmark) supported by C3D, CIGREF and WWF France.

¹³ In the context of the transposition of EU directive 2014/95/EU on the disclosure of non-financial information by companies (which aligns article 225 of the French "Grenelle 2" law of July 2010 as amended by the "Warsmann 4" law of March 2012 at the EU level).

¹⁴ A sectoral label for digital service companies already exists, but does not work; a second one will shortly be studied as part of the "sectoral labels" initiative led by France Stratégie.

CHALLENGE 2



2

USING DIGITAL TECHNOLOGIES TO IMPROVE THE DESIGN OF ENVIRONMENTAL POLICIES

At both the national and the territorial levels, digital technology and ecology are two cross-cutting issues that concern public action in all fields: economic development, housing, mobility, tourism, etc. They affect both the *procedures* for developing this action and its *content*.

The scope of the ecological transition project means that citizens need to be informed, convinced and engaged. The involvement of all "stakeholders" in public policy-making, transparency and accountability are fundamental to this project. Digital technologies are providing new tools to support this effort. One very active digital innovation trend, "civic technology", has thus set itself the objective of encouraging new types of public debate that are more active and inclusive, and have a role to play in the development of ecological transition strategies.

Over and above citizen participation, digital technologies also foster the multiplication and interrelation of actors in a position to contribute, through their initiatives, to the pursuit of shared environmental goals: citizens and groups, start-ups, major global operators, etc. We have seen territories joining forces with crowdfunding platforms to encourage the development of collective environmental initiatives or to coproduce projects through participatory budgeting.¹⁵ Others are calling on citizens to provide new data, such as citizen measurements of air pollution, or cyclability maps on OpenStreetMap.¹⁶

Consequently, even though they still need to set the course, public actors are no longer the only ones with the power to act, the expertise, or even the general interest. Public action needs to do more to mobilise people, to organise ecosystems, and to foster alliances.

Digital technologies also have – or should have – a profound impact on the content of public environmental policies. They produce new tools for action for the public authorities: data, behavioural incentives (nudges), local peer-to-peer platforms for the exchange of energy or goods (gifts, loans, rentals, sales), collaborative mobility systems, shared work and production spaces, and open source projects for a "zero carbon society". However, the lack of a common culture between digital and ecological actors, as previously mentioned, still limits the capacity of digital technologies to contribute to proactive public action on ecological issues. Public environmental protection strategies still do not make sufficient use of digital tools, and the same goes for local or national waste prevention strategies, which rarely harness the possibilities of freecycling platforms, Fab Labs or the Internet of Things, and do not support the development of these new solutions.

¹⁵ *Les usages du crowdfunding par les collectivités locales en France*, Iddri, 2017.

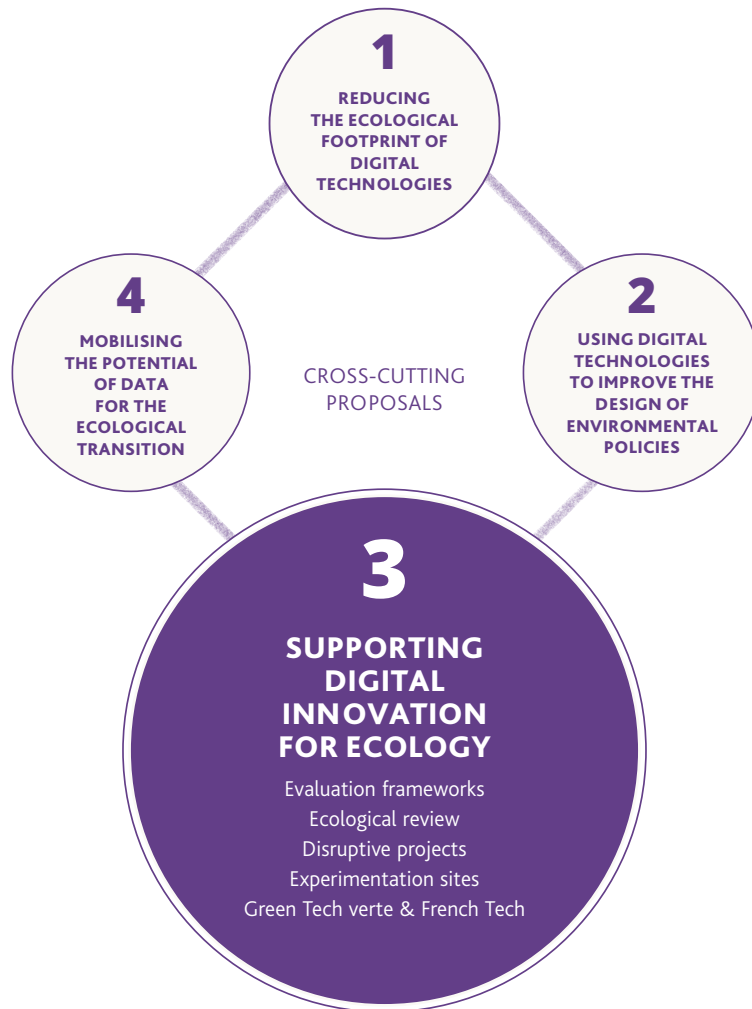
¹⁶ *Crowdsourcing : un mode d'emploi pour les villes*. Iddri, 2017.

Courses of action for the public authorities

1. Conducting – at the national level and in each territory – a “digital review” of environmental policies: : plans climat, agendas 21, programmes de prévention des déchets, plans de déplacements, etc. La revue aurait pour objectif de s’assurer que ces stratégies exploitent le potentiel du numérique tant dans leur élaboration que dans leur contenu. À l’image des stratégies mobilité ou déchets qui peuvent exploiter les nouvelles solutions apportées par l’économie collaborative. Par ailleurs, des acteurs issus du numérique devraient être associés à la définition de toute nouvelle stratégie publique environnementale.
2. Launching an innovation and experimentation programme on civic technology for the ecological transition. The projects supported would connect the companies or groups that develop these tools to the ministries, public establishments or territorial authorities that use them to associate stakeholders with the development of ecological transition strategies.
3. Training public ecological actors in digital technologies to familiarise them with digital solutions and to guarantee they use these in the design and content of environmental policies. This exposure to digital technologies should concern the initial training of public officials as well as their continued training.
4. Supporting data co-production projects for the ecological transition. Co-production between researchers, professionals and amateurs has already produced some spectacular results for biodiversity and energy. The public authorities should support such projects, providing them with their own data – like the local authorities that share cadastral databases with OpenStreetMap –, or contributing to their financing..
5. Leveraging innovators, especially in the territories, by giving them ambitious challenges¹⁷ and calling on them to propose disruptive solutions (“everyone an energy producer by 2030”, “0% private cars”, “100% reuse or recycling of goods”). These challenges are an effective way to galvanise stakeholders and to identify and connect actors that do not know each other.
6. Improving the transparency of calculation systems in smart cities. “Smart cities” make it possible to optimise resource management by means of automated data processing. It is essential that the public authorities and citizens are involved in the governance of these tools in order to control the effects produced by algorithms, as with journeys recommended by mobility applications and their cumulative effect on the territory.

¹⁷ Like the PACA Lights initiative, launched in 2014 by the Provence-Alpes-Côte d’Azur Region: <http://pocalights.tumblr.com/>

CHALLENGE 3



3

SUPPORTING DIGITAL INNOVATION FOR ECOLOGY

The French government and local authorities have successfully developed numerous public mechanisms to support digital innovation and to structure this sector: French Tech; major national or territorial innovation programmes for autonomous vehicles, the industry of the future or smart cities; calls for projects and awards for digital innovators; business incubators, etc. But these mechanisms are often blind to environmental issues. Although they readily tout positive environmental prospects, these are never discussed in any depth and there is no system to measure their impacts, which are generally just anticipated by-products, and rarely constitute objectives underpinned by specific actions. Thus, in the “Industry of the future” programme launched in 2015 with the goal of modernising industrial facilities and transforming their economic model using digital technologies, the environmental impact of this new industrial model is rarely addressed. There is still limited data on the environmental impacts of these technologies and industries and the public authorities make little or no connection between digital developments and environmental challenges.

A small number of commendable public mechanisms are attempting to decompartmentalise digital innovation and ecological innovation, such as Green Tech Verte at the national level or the Greenconcept operations conducted by the Occitanie region in collaboration with ADEME, and “Ecoconception web” (Web ecodesign) led by the Agence Economique Régionale Bourgogne-Franche-Comté (Bourgogne-Franche-Comté regional economic agency), again with the support of ADEME. But these mechanisms are uncommon and still modest in scale.

Moreover, innovators at the interface between the digital and ecological sectors still come up against a number of obstacles. One of these is that the leaders of such projects – just like investors and incubators – are unfamiliar with ecodesign methods and tools, and are therefore unable to assess and improve their environmental impact or any rebound effects. Admittedly, this type of assessment is difficult, especially for projects that are both emerging and innovative, which lack the resources to conduct “life-cycle analyses” that are often complex. Yet suitable methods exist that are far less demanding than life-cycle analyses;¹⁸ they are simply used seldom, if at all, especially in France. And these methods are even less effective as a common language that can be used by both innovators and their interlocutors, beginning with investors.

Another problem is that innovators seeking to develop new solutions for mobility, water or energy networks, or waste prevention, need to collaborate with the public authorities. Like the developers of commuter carpooling or freecycling platforms, they need the public authorities to tell citizens about their solutions, to test them, and even to contribute to their financing.¹⁹ Unfortunately, it is difficult for innovators to develop this kind of partnership since the public authorities see them as competition for the public services and traditional private actors, and fear failure, despite the fact that failure is central to the innovation process. The public services could and should take advantage of the new solutions driven by digital technologies.

¹⁸ Ecolizer, EPIE, ESQCV, Benchmark Numérique Responsable, Greenconcept pre-diagnostic model, etc.

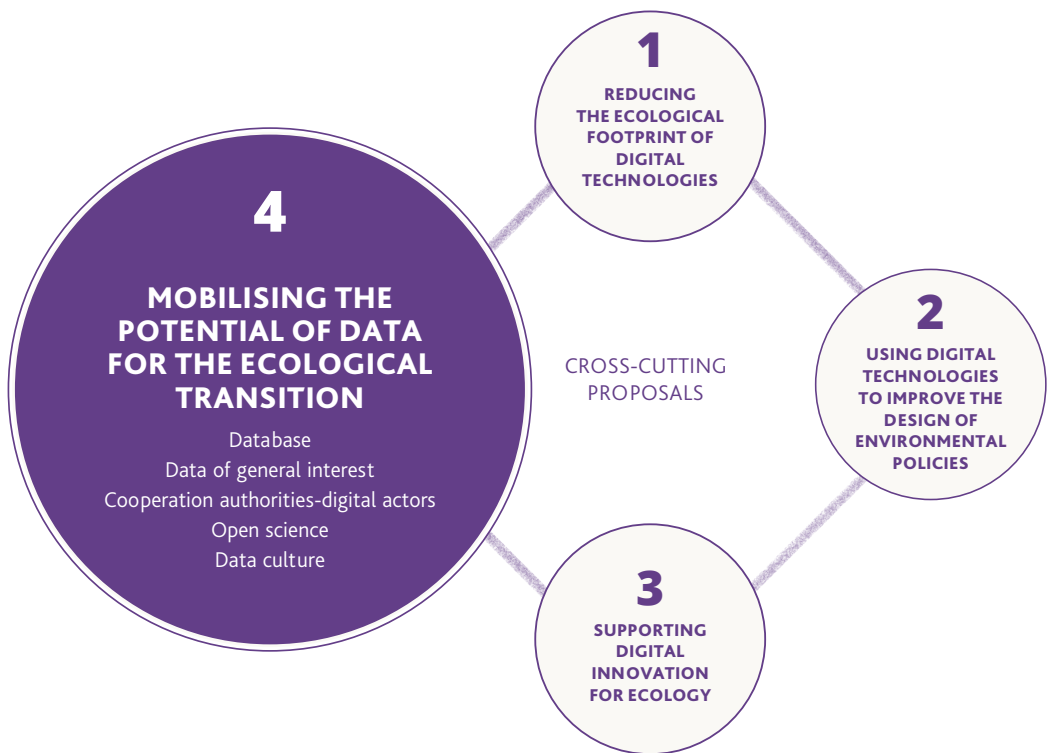
¹⁹ *L'économie collaborative, réservoir d'innovations pour le développement durable. Synthèse du projet PICO, 2016; Les nouveaux acteurs de la mobilité collaborative : des promesses aux enjeux pour les pouvoirs publics. Iddri, 2016.*

Courses of action for the public authorities

1. **Fostering the creation and dissemination – in incubators and among innovators and investors – of evaluation frameworks for innovations with ecological impacts.**²⁰ This could take the form of financing for training programmes on these tools. The goal is to help digital actors to anticipate the positive and negative environmental impacts of projects, and to better analyse the development potential of projects designed with the central goal of producing positive ecological impacts.
2. **Conducting – at the national level and in each territory – an “ecological review” of digital innovation programmes, on autonomous vehicles or the industry of the future, for example, to ensure they integrate environmental issues on more than just a superficial level. Public financing of the most important projects should be conditional on the existence of an evaluation of their positive and negative, direct and indirect environmental impacts.**
3. **Making room in these programmes for innovative projects focusing on the production of “radical” environmental impacts, that are not only profound (“factor 4”, “zero emissions”, “zero waste”, “positive energy”), but also far-reaching (they can be scaled up) and long-term (they are robust with “rebound effects”). One requirement would be that these projects undertake to measure their impacts and to publish data on these measurements.**
4. **Creating – in both urban and rural areas – digital and ecological experimentation sites to accommodate innovators wishing to test their solutions and to work closely with the public authorities, and ensuring experience sharing between these sites. The Territoires d’Innovation Grande Ambition (High Ambition Innovation Sites), the Territoires à Energie Positive (Positive Energy Sites) or those that will sign ecological transition contracts with the government could host such projects. These sites should also increase the number of incubators, calls for projects and, more generally, innovation support mechanisms at the interface between the digital and ecological transitions.**
5. **Bringing together actors from Green Tech Verte and French Tech –making sure the former is not simply an appendage to the latter and that, on the contrary, it disseminates its ambition and its environmental competences– and inviting Green IT actors to join them. Launching joint initiatives and calls for projects.**

²⁰ The Pôle Eco-conception (Eco-design Centre) proposes an eco-socio-design approach, the Conception Numérique Responsable (Responsible Digital Design) group advocates a responsible design process, and FING provides the Innovation Facteur 4 (Factor 4 Innovation) framework that simultaneously describes the “business model” and the “impact model” of innovations. These tools are all aimed at producing disruptive eco-innovations whose significant positive environmental impacts are linked to the radical nature of design choices regarding technical aspects and the economic model.

CHALLENGE 4



4

MOBILISING THE POTENTIAL OF DATA FOR THE ECOLOGICAL TRANSITION

Data is now one of the key “raw materials” of human activities. It contributes to monitoring and measuring activity, supports decision-making and public debate, facilitates modelling and exploration of future scenarios, and helps to develop new services. Individual data generally has little value: it is its combination with other data that makes it valuable, hence the importance of fostering the circulation of data to maximise its utility. The potential for the reuse of data beyond its original production context underpins open public data policies, as well as the development of big data. It also explains why it is necessary to protect personal data against any (re)use to which individuals have not consented.

The potential of data for the ecological transition is already being harnessed in many specific fields. Biodiversity measurements are thus largely based on the contribution of thousands of amateurs to databases such as eBird. Where energy is concerned, this co-production of data has produced maps of the most suitable roofs for solar panels, and the sharing of production and consumption data can facilitate the management of networks or identify ways to reduce individual consumption. Further to its public debate on the energy transition, Nantes Métropole created a data observatory, while Enedis and GRDF will provide consumption data for households equipped with Linky and Gazpar smart meters. Where mobility is concerned, data sharing supports multimodal information systems such as Optimod'Lyon, and co-production platforms such as OpenStreetMap produce a range of maps on the “cyclability” of different towns.

Legislation has now taken into account the importance of data and its sharing, especially in France, through the notion of data of general interest in the French Digital Republic bill.²¹ As regards the environment, the European directives on environmental and geographical information call for even greater openness of information on the environment, and the recent French laws on the energy transition and green growth or on biodiversity include provisions on compulsory data sharing. Aware of the importance of this issue, the French Ministry of Ecology appointed a general data administrator in 2016.²²

However, with regard to environmental challenges, it is still difficult for many actors – from start-ups to territorial authorities, associations and researchers – to obtain the data they need, especially when this data is held by private actors or sometimes even by public actors. They constantly require access to data that has not yet been published, in order to develop products and economic models (such as mapping for autonomous vehicle projects) or to guarantee transparency in a given sector (such as data on mining rights or environmental impact studies). Data is central to power issues which may oppose those who define and produce this data, those who do or do not have access to it, and those who do or do not know how to use it. This is why new developments are needed to harness the potential of data for the ecological transition.

²¹ <https://www.economie.gouv.fr/republique-numerique-ouverture-donnees-d-interet-general>.

²² <https://www.ecologie-solidaire.gouv.fr/missions-du-superviseur-general-des-donnees>.

Courses of action for the public authorities

1. **Creating a public database to enable digital actors to analyse their environmental impacts.** These actors require a great deal of data, on the environmental cost of servers or computers, for example, which is difficult to find today or may not be free of charge. It is essential to facilitate access to this data, or even to simplified environmental impact calculators, to enable innovators to ecodesign their solutions. Such mechanisms are already being tested, and ADEME could take charge of them.²³
2. **Extending the notion of data of general interest (in open data) to the key issues of the ecological transition, for both the public and private sectors:** energy production and consumption (production and consumption of appliances, etc.), data on biodiversity, climate, waste collection and treatment, etc. The general data administrator at the Ministry of Ecology needs to be proactive on public data, and must work guide and educate private actors, so that they can adjust to this environment. The administrator also needs to promote data reusability and cross-referencing (standardisation of formats, sharing of data at the right level of granularity, etc.).
3. **Strengthening cooperation between the authorities and digital actors that hold the private data needed for the effective implementation of environmental policy goals.** These actors could be encouraged to set up aggregated data sharing platforms (such as the Airbnb Dataville platform) or data transmission partnerships (such as the agreement between Versailles Grand Parc and the Waze application).
4. **Fostering open science.** Many scientists have been calling for years for an exception to the EU directive on the legal protection of databases in order to enable them to carry out mass processing of information stored in them for research purposes. France is expected to include this exception in its legislation.
5. **Developing a “data culture” to support ecology.** While some organisations are able to read, create, use and communicate data, many others are not, beginning with the public institutions. It is essential to develop this culture within the public administrations in charge of environmental issues through training courses, the development of teaching tools and workshops and common projects. At the national level, this is one of the roles of the data administrator at the Ministry of Ecology.²⁴ The public authorities could also foster the development of this culture within companies and among other environmental actors.

²³ *Technologies numériques, information et communication (TNIC). Guide sectoriel. ADEME, 2012; Outil ecoindex.fr du Collectif Conception numérique responsable.*

²⁴ *Rapport de préfiguration de la fonction de superviseur général des données du ministère de l'environnement. CGDD, 2016.*

CROSS-CUTTING PROPOSALS



Roadmap

Developing a "Digital and ecological transitions" roadmap at the national level and in each territory. This roadmap should list all measures that help to align these two transitions.

At the national level, the Commissariat Général au Développement Durable (Commission on Sustainable Development) and the Agence du Numérique (Digital Agency) could be tasked with its development. Every year, the ministries in charge of environmental and digital issues should report on progress made to a panel comprised of the government and stakeholders, and propose new actions to be undertaken. During this annual meeting, private digital sector representatives should present their own roadmap.

Experience sharing

Creating an "ecology and digital technology" task force, whose goal would be to pool expertise and to facilitate experience sharing between the authorities; it would involve local and national public actors, researchers, private sector actors and civil society.

Education and training

Promoting education and training on responsible digital technologies by creating a digital and environmental information platform. This platform would be responsible for developing kits for teachers, combined training courses in higher education (especially in schools that train digital engineers and technicians or public officials), and certification for continued training. Among other mechanisms, it could naturally use digital technologies as a learning channel.

PRESENTATION OF PARTNERS

IDDRI

Id드리. The Institute for Sustainable Development and International Relations is an independent research institute focusing on the transition to sustainable development. It anticipates and develops the debates on climate, biodiversity, the oceans and the governance of sustainable development, at the international, European and French levels, providing its expertise to stakeholders and building platforms for dialogue between them. For the last four years, IDDRI has been analysing the environmental benefits and challenges raised by the emergence of digital technologies (the collaborative economy, crowdfunding, crowdsourcing, autonomous mobility, etc.), especially in the context of the Transitions² network.



FING. FING is an association whose role is to produce and share new, actionable ideas to anticipate digital developments. Since 2000, FING has been helping large companies and start-ups, territories and policymakers, researchers, creators and social innovators to anticipate the risks and opportunities associated with technologies and their uses. In 2015, FING initiated Transitions² (www.transitions2.net) with IDDRI, ADEME, INRIA, Les Petits Débrouillards and others, to connect actors and initiatives working to harness digital technologies for the ecological transition.



WWF France. WWF is one of the very first independent environmental protection organisations in the world. With an active network spanning more than 100 countries and armed with the support of more than six million members, WWF works to halt environmental degradation and to build a future in which humans live in harmony with nature. Since 1973, WWF France has been working on a daily basis to leave future generations a living planet. With its volunteers and the support of its 220 000 donors, WWF France conducts specific actions to safeguard natural habitats and their species, to promote sustainable lifestyles, to train decision-makers, to support companies in reducing their ecological footprint, and to educate young people.

GreenIT.fr. An established actor in the alignment of the digital and ecological transitions, since 2004 GreenIT.fr has gathered a community of some 30 000 experts, organisations and individuals working to accelerate this transition. We are convinced that responsible digital technologies are a unique opportunity to work together to build a more sustainable world for our children, but also to boost France's influence and economic growth while improving the inclusion of all in a plural society. For 15 years, we have been publishing original studies and operational tools (books, white papers, guides to good practice, checklists, online tools, benchmarks, etc.) which are free, open and widely recognised, to enable everyone to act on a daily basis.



With the contribution of CNNum. The Conseil National du Numérique (National Digital Council) is responsible for studying digital issues, especially the challenges and opportunities of the digital transition in society, the economy, organisations, public action and territories. Its role is to inform and advise the government on the development, implementation and evaluation of public policies and action, to contribute to defining France's positions at the European and international levels, and to produce and publish independent reviews and recommendations. Its members are appointed by a decree of the Prime Minister, on a proposal by the Minister responsible for digital technologies, for a two-year period.

[illegible]

DIGITAL TECHNOLOGY AND ENVIRONMENT

*Using the digital transition
to accelerate the ecological transition*

