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The Interplay Between Environmental and Digital Policies in European Urban Contexts

A comparative analysis of Barcelona, Geneva, Lyon, and Tallinn

Between promises and reflexivity: how do cities adjust digital tools to their ecological transitions?

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Introduction

Setting the topic

The 21st century has seen technological progress that was never happening before, with a speed of innovation that we can hardly control. It has given rise to a massive use of digital technologies for each of us. At the local level, the cities developed many digital systems to make them smart cities, for example improving mobilities, housing, lighting… Nevertheless, the environmental impact of digital exists and has become a new concern for not only some cities but also the European Union and some states. It has raised reflections between the use of digital to make the city greener (for example, digital sensors for the lighting) and the environmental impact of those digital systems (Laurence Monnoyer-Smith, 2017). Can the digital transition be compatible with the ecological one? Another aspect is also important to consider: the environmental impact of digital is hard to be understood by the citizens because it is not perceptible as the ADEME (Ecological transition Agency of France) said: "As this pollution cannot be seen, we are in the spring of the unthought". Therefore, we will focus on the role of the cities, the closest entities to citizens and we will try to answer this research question:

How do cities adjust their digital tools to their ecological transitions? This study focuses first on the interplay of digital and environmental policies at the European level. Then, we will present a timeline of policies and political shifts at the local, metropolitan, regional and state levels. Finally, this study will go over a table of criteria which we use to build up the typology of each city following an illustrative example. **The purpose of this research is to attribute a typology for any city by completing the table of criteria.**

Key concepts - Based on the participants' reactions during the Webinar of June 8th, 2022 (Table 1).

Green IT	Any digital technology that has undergone a process of environmental-related assessment - through a life cycle analysis (LCA) of its environmental footprint for instance.

IT for Green	When digital technologies (devices, infrastructures, operating systems, etc.) are put at the service of tackling climate change (e.g.: measuring, anticipating, mitigating, …)
Technophile	Any actor with a strong taste for digital innovation and development as a goal per se.
Climate resilience	Implemented strategies allowing for an efficient adaptation to climate change effects, so their disruptive dimension is avoided and, ideally, prevented.

Methodology

In this study, we have mainly followed qualitative research methods. First, we have led exploratory interviews with institutions or associations, mostly French ones (Les Interconnectés, l'Institut du Numérique Responsable INR…) to get some basic information on what has been done at the European and French levels but also what are the role of the cities and which European cities can be interesting for our study. We also got our first contacts for the potential cities. At this moment, we did not have a clear idea of what would be our criteria for the cities.

The second part of our project consisted of contacting officials from various cities (Barcelona, Strasbourg, Lyon, Tallinn, Tartu, Geneva, Oslo, Malmo…). We prepared three parts to explore in our future interviews with the cities; the first part on the shift in digital policies in the last ten years and the factors of those shifts, the second one on practical aspects of the digital department (budget, human means, organization…) and the last one on various policies implemented by the cities and the potential obstacles. Thus, according to the answers that we got, we started to get a first insight of the cities. Then, with the specificity that appeared for each city and the facility to access new contacts for some of them, we decided to focus our study on those four cities: Barcelona, Tallinn, Lyon and Geneva. Finally, we succeeded in interviewing more than 20 scholars and local actors.

The third part was allocated to academic research but also press articles, official documents, websites… in order to confirm with more robust sources what we have learnt

during the interviews and to confront the theory with what it has been said in the interviews. After this work, we built up a table for our functional analysis and our typology for the cities.

The last part consisted of a round table where officials, associations, and searchers discussed our results and they gave us their feedback and reviews. That way, we were able to write this final report!

Framing the Topic at the European Scale

The environmental policy at the EU level, before including digital development goals

The purpose of this section is twofold. First, we aim at providing an overview of the development and main components of the environmental policy in the European Union. This involves the historical evolution of the environmental acquis, the principles and laws involved in environmental policy. Secondly, we aim to do so to better understand what comes next in our study: with the EU's environmental policy in mind, we want to see how it fits with its digital policy.

First and foremost, we found it important to provide an overview of the conceptual and regulatory framework in which our study has evolved. Namely, we meant to do so by looking at environmental and digital policies at the European level. In what follows, we therefore present the main principles, laws, and policies important to consider on these matters. The information displayed results from an extensive literature review about it.

Regarding the European Environmental Policy, it constitutes a set of principles mainly embodied in its constitutional framework – this is, in several articles of the TFEU. Historically, they have been incrementally coined and institutionalized in the so far seven Environmental Action Programmes (EAPs) (Selin & Van de Veer 2015 -b), along major institutional events that deepened the EU construction (Wurzel et a l. 2016), as well as according to the development of environmental international law (Halvorssen 2012).These principles are meant to provide a direction on how the environment is to be understood and how our interactions with it must be framed. They can be listed as follows: sustainable development, subsidiarity, proportionality, a high level of protection and improvement of the quality of the environment, precaution, preventive action, proximity (i.e.: environmental damage should as a priority be rectified at source, polluter-pays, integration of environmental concerns across policy fields, sincere cooperation between member states, and equal treatment

and legal certainty (Langlet & Mahmoudi 2016, Morgera 2012). While some principles are more ambitious than others in terms of environmental considerations, they all are the object of extensive literature presenting the actors, institutions, and mechanisms -e.g. financial ones- allowing for their implementation (Ibid.).

The literature also develops on how and why those principles are at the core of the EU's environmental policy. Namely, such a policy is coined in a set of frameworks and directives. Thematically, they extendedly cover major cases of environmental fields, which are air policy, water policy, waste management, chemicals management, agriculture and fisheries, biodiversity, as well as climate change and renewable energy (Selin & Van de Veer 2015 -a). While some of these policy fields are intrinsically environment-related, other include environmental principles in an integrative way but without inherently adopting an environmental perspective; rather, they endorse productivist or commercial views – such as the Common Agricultural Policy or the Common Fisheries Policy – which partly accounts for their failures so far, environmentally speaking (Ibid.). These frameworks and directives are all transposed in EU member states' national laws, some also including the EFTA countries (Switzerland among them, of which we will be talking about). Though, they are unequally implemented, and, in some cases, the implementation gap still remains very high because of unequal capacities and different policy agendas (Ibid.).

Last but not least, given the alarming climate-related situation that the scientific community and, to some extent, the civil society as well have been alerting about, it seems worth mentioning as well the EU's climate policy roadmap. This is registered in the very recent European Green Deal, which widely aims at transforming the society and economy into low-carbon ones in order to reach carbon neutrality by 2050. (Sikora 2021, European Commission 11 December 2019). In addition, the post-Covid-19 context and the need for economic recovery has envisaged the EU Green Deal as a tool for recovery as well to create sustainable demand (Elkerbout et al.2020, Revoltella 2020). In its strong commitment of reducing GHG emissions, the EU aims to do so, among other things, by transforming its industry into a circular one, what is even more interesting though – in the scope of our study - is the EU's vision of the digital and the role it attributes to it, as a key-driver of its just and inclusive sustainable transition (European Commission 11 December 2019). Indeed, it is seen as a tool for "clean" and decarbonized growth, while the EU also shows the concerns of transiting towards a more sustainable digital. Indeed, "*Digital technologies are a critical enabler for attaining the sustainability goals of the Green deal in many different sectors. [...]*

At the same time, Europe needs a digital sector that puts sustainability at its heart. The Commission will also consider measures to improve the energy efficiency and circular economy performance of the sector itself [...]. The Commission will support work to unlock the full benefits of the digital transformation to support the ecological transition.", as written in the EU Commission's communication on the European Green Deal (11 December 2019:9,18).

Hence, in what follows we go on with this short introduction by providing an overview of the EU digital policy. Only then will we be able to tackle our study's topic at its core.

The Digital Policy at the EU level

This section provides an overview of the evolution of digital policies at the European Union level. Special attention has been given to discern 1) whether digital technologies have been used for fighting against the climate change, 2) whether the environmental impacts of digital technologies have been through in the policy making process

Overview of EU digital policy

At the EU level, digital policies have long been drafted and implemented as a tool to push for a liberal single market economic. However, in recent years, as the digital use is more and more omnipresent and frequent, the EU level policies had to take a turn and rethink its usages at a daily and constitutional level (De Gregorio 2021). The rise of information society led by the digital development and transition has profound legal and political implications as it challenges areas such as fundamental human rights (ex. privacy, freedom of speech) and the justification of political control (ex. surveillance for national defence). Thus, in the first quarter of the 21st century, we saw new EU directives, EU regulations, EU agenda as well as EU declarations addressing new challenges led by the use of digital technologies

This part investigates mainly to what extent the rising digital constitutionalism at the EU level has been concerned with the environmental footprint linked to the digital use and to what extend the EU level narrates its digital policies with an environmental undertone. The following paragraphs will mainly explore the Digital Agenda at the EU level with slight touch on EU regulations and directives. It is important to note that, the EU does not have a designated ICT category of regulations and directives. However, many policies and legal

frameworks have strong regulatory effect on digital related use and technology (ex. industrial policy, trade policy, energy policy, to name a few) (Ratcliff et al., 2022).

The digital agenda for Europe was first launched in May 2010 whose major aim was to give a strong impetus to Europe's economy by exploiting the potential of a digital single market both in terms of its economic and social benefits. (European Commission, Directorate-General for Communication 2014). The agenda was based on many quantitative figures and measurements such as the number of jobs in the ICT sector, the percentage of economic growth of the EU digital economy, the weight of productivity growth from ICT sectors against all sectors, to name a few. The policy document has appealed to a betterment of digital infrastructure at the EU level, fiscal and administrative facility for the single telecoms market to reduce the digital divide so as more people can work for or consume the e-commence. (European Commission, Directorate-General for Communication 2014) Thus, retrospectively, the digital agenda from 2010 to 2020 was predominantly oriented to better exploit the promises of economic growth digital technologies might bring. Nonetheless, it would be careless to state that the 2010-2020 digital agenda has no mention of sustainability, yet it was minimal and not substantiated. In the agenda, although it was mentioned that e-invoice should be a valuable and desirable alternative to paper invoice, but the main argument was based on economic concerns–how much money business and public sectors can save if they print less paper invoice. To sum, there was few mentions of the environmental aspects during this period's digital agenda.

In relation to the digital constitutionalism, the first 10-year strategy has also called for a better systemic and legal design of user rights, as well as a legal framework for protection for consumers and businesses involved in e-commerce (Ratcliff et al., 2022) Following the first digital strategy, the EU has issued many EU regulations and EU directives to answer the need for new systemic legal framework (ie. Lower prices for electronic communications Regulation (EU) No 531/2012, new regulatory framework on data protection (Regulation (EU) 2016/679 and Directive (EU) 2016/680).

The second Digital Agenda for Europe 2020-2030 launched in 2021 has a more noticeable undertone of a constitutionalised thinking of digital policies. Beyond the perceived role of digital technology in economic development, the EU intends to use it to its sustainable and geopolitical ends (Ratcliff et al., 2022). Partially based on the policy document "Shaping Europe's digital future", the second digital agenda has called for support for green ICT within

EU and with EU's partner countries, and aligning the digital policies with the 2030 UN sustainable agenda (European Commission 2020). Furthermore, it should be instrumental in reaching the European goal of climate neutrality by 2050 (Ratcliff et al., 2022). Specifically, this agenda set out quantitative and measurable goals of the development of sustainable digital infrastructure. As later specified with in the Digital Compass for EU 2030, the production of sustainable semiconductors in Europe should amount to one fifth of the global production by 2030, and the EU is determined to deploy 10 000 climate-neutral highly secure edge nodes (European Commission 2021). The second digital agenda has followed the first one in the sense that it re-emphasised the critical role of digital technologies and the data in guaranteeing and promoting EU's economic prosperity, global competitiveness and job creation and security (Ratcliff et al., 2022). Furthermore, the "European democracy action plan" and "Media and audiovisual action plan" will accompany the digital transition guided by the EU digital agenda to address the issue of speech freedom in the age of the Internet. As we are still at the very beginning of the 2020s, late research work will be necessary to give a retrospective overview of the period 2020-2030 assess all digitally related and enacted EU regulations and EU directives and whether goals have been achieved.

In sum, one notes a gradually increasing awareness of the environmental issues in digital agenda at the EU level even though the main focus of EU level digital policies is still the development of economic growth. In the following parts of this study, we will see how national level and city level have different interpretations and/or vision towards the designing of digital policies.

Assessment: What can be said on the interaction between EU's digital and environmental policies?

From the previous overview of European environmental and digital policies evolution, we can thus affirm that while the EU environmental policy does include and consider the digital, it is not reciprocal in what comes to the EU digital policy. In other words, in the European Environmental Policy, there is a clear interplay between the digital and environmental fields that consists of both conceiving the digital as a tool to tackle global warming (in its predictions and effects) while it is also put at the core of sustainable concerns. Hence, the future growth projected by the EU in its Green Deal consists of an "ecological modernization" (Selin & Van de Veer 2015:47-48, Wurzel et al. 2016:16) in which the digital

and ecological transitions are seen as twin (European Commission, Directorate-General for Education, Youth, Sport and Culture, Finlayson et al. 2022).

As such, we wonder now whether this clear interplay and convergence on digital and environmental policies at the European level does translate into urban contexts as well. This is what we will address along the study that follows, through the four cases of Barcelona, Geneva, Lyon, and Tallinn. As read, we will see that many levels of governance in between and different temporalities show a very different reality.

Timeline: Historical overview of environmental and digital policies evolution

This section will provide elements at the legal standpoint but also at the political one that can explain the major shifts in the digital policies. As read, those elements will be differently presented depending on what seemed more accurate for each city. This means that some were approached chronologically (Barcelona and Tallinn) while others follow a retrospective presentation (Geneva and Lyon), they all follow a thematic focus though.

Barcelona

In what follows we provide an overview of how Barcelona's policies in the fields of the Digital and of the Environment and Climate Change have evolved during the last decade.

Making choices

First, we must specify that we left aside all aspects and considerations regarding the Catalan independentist movement. Despite its omnipresence in politics, we decided not to give it a place in our study. The origin of this decision is two-fold. On the one hand, it would require a too big digression to be accurately tackled and, on the other hand, since our analysis mainly looks at the urban level policies in two concrete fields, we believe that overlooking it does not necessarily bias the results.

Some recent political context

In what comes to Barcelona's politics, the values and objectives knew a major shift when the change of mandate took place in 2015. That year, the left-wing coalition "Barcelona en Comú", with Ada Colau at its head, won the elections in a context of economic crisis that had been deepening since 2008 and more specifically since 2011 (Benach 2015). At the urban scale, this translated into what we can call a housing crisis accessibility. Not only by that time were tourist flows highly abundant, increasing local prices, but also the massive loss of purchasing power, of jobs, and the struggle of refunding the housing mortgages, left many inhabitants in vulnerable situations, many of them even facing the risk of eviction. (Benach 2015, Kotsila et al. 2021) Within such context, social movements and associations organized throughout the city, to reunite common interests, and mutualize resources to gain weight in the face of the real estate sector (Ibid.). One of those initiatives, led by Ada Colau, was the

"Plataforma de Afectados por la Hipoteca" (the Platform of the ones affected by Mortgage), which granted credibility and reputation, first as a social activist, to the one that would furtherly be elected Mayor of Barcelona (Kotsila et al. 2021, Riquelme 2018).

Evolution and interplay between Barcelona's environmental and digital policies

With this pivotal year in mind, we analyzed a series of action plans of the city's digital and environmental policies, dated in years previous and subsequent to 2015. We summarize in what follows the main aspects of these two policies, which evolution in terms of objectives seems to converge over time and, their link, to be apparent at the operational policy level more than in the official documents released by the municipality. Indeed, strong social justice dimensions and other social related questions are most embedded in Barcelona's environmental and digital policies since Barcelona en Comú was elected in 2015. Additionally, these policies do not seem to interweave when separately looking at the environmental and digital city's action plans, since none of them make explicit references to the other. We will come back to their link at the operational policy level, but not before briefly depicting first the evolution of each of these policies.

Barcelona’s digital strategy

Since the arrival of Ada Colau at the head of the government, and of all her politicians team members, what was until then a city both seen and projected as "smart" was to become a city in which technology needed to have a purpose and could not be a goal in itself (Ajuntament de Barcelona 2016, Barcelona Digital City |About Us n.d., Cereceda & de Zárate 2022, decidim.org n.d.). More precisely, technology from the municipality's view has to serve democracy, social inclusiveness, ethical economics, the city's public services as well as it is meant to empower the citizens (Ibid.). Additionally, transparency to ensure trust towards the public institutions as well as to enforce accountability of - especially big - private actors is another major principle of Barcelona's digital policy (Ibid). This comprehensive narrative is crystal clear both in the city's 2016 "Technological Sovereignty" action plan and in the "Barcelona Digital City" website (Ajuntament de Barcelona 2016, Barcelona Digital City |About Us n.d.).

In practice, we notice the application of those principles and objectives in initiatives such as the Barcelona Open Data Portal or through the "Barcelona.Decidim" platform. The former openly makes available extended information on urban realities in an extended variety

of topics. The initial project of making data about the city accessible was first launched in 2011 and was "reframed" into its present form in 2017 ("Faqs | Open Data BCN" n.d). Regarding the "Barcelona.Decidim" initiative, it is contemporaneous to the 2016 city action plan on technological sovereignty (Ajuntament de Barcelona 2016), and it is a clear illustration of a digital tool at the service of direct and participatory democracy (decidim.org n.d.). More recently, it could also be considered as a citizens' empowerment tool since it allowed the participatory budgets initiative launched by the city in 2020; a process in which Barcelona's inhabitants were given the possibility to propose and vote for projects thanks to public financing allocated for that (Ajuntament de Barcelona n.d. -b).

Barcelona's environmental and climate policy

Sustainability and climate change adaptation and mitigation are mainly tackled by the municipality as a need to address or prevent deeper social vulnerabilities (Ajuntament de Barcelona 2021). Indeed, the city's claimed commitment to reduce its climate and environmental impacts as well as to adapt to climate change acute effects endorses a strong social justice focus (Ajuntament + Sostenible n.d, "Ecologia, Urbanisme, Infraestructures i Mobilitat" n.d., Ajuntament de Barcelona 2021, Oficina de Canvi Climàtic i Sostenibilitat 2021). Namely, in all Barcelona's most recent action plans for climate change (Ibid.), the main targeted objectives put the citizens' wellbeing and participation at their core, as well as an increased quality and efficiency of public services.

We also noticed that over time, the city's environmental and climate policy has deepened in awareness, scope, and "encompassiveness". Indeed, the city published a very technically based energy plan in 2002, highly driven by technical innovation on energy to tackle climate change with a strong orientation towards energy efficiency (Ajuntament de Barcelona 2002). The following one, of 2012, is certainly the one linking environmental concerns with a governance digital aspect, by conceiving the city as "smart", though including a diversity of sustainability-related fields too, such as air quality, biodiversity, climate change and energy at once (Ajuntament de Barcelona 2012). The most recent action plan, after the city's climate emergency declaration in early 2020 (Ajuntament de Barcelona 2021), and the one in accordance with the political environmental standpoint mentioned above, is the "Climate Emergency" one (Ajuntament de Barcelona 2021). Finally, an urban planning project under implementation very much illustrative of the city's current climate policy is the

Barcelona "Superblock Project" (Zografos et al. 2020). This could be considered as Barcelona's climate policy at its operational level.

Beyond the documents, a look at the operational level: the interplay between digital and environmental policies

Yet, all the above said, what is the *concrete* link between the digital and the environment in Barcelona's digital policies? Is there one? How has it evolved?

More than in the official documents, this link is to be found "in the ground". This is, at the daily operational policy level of the city. Though the remark may seem obvious, the digital is everywhere. And, while the city does not want to make "digitization" a goal in itself, digitalization throughout the city and within its public administration is unquestionable. To name a few marks of it, in Barcelona the digital clearly serves the city's ecological transition, as seen through sensors for data collection, portals and the city council's communication and participatory websites, it serves as well as a guarantor of governmental transparency, by law and through platforms ensuring transparent and democratic governance of the city. Digital tools, as an operational aspect of the city's governance, are therefore widely used, including in its environmental dimension.

Some limitations

The previous analysis deserves some criticism though. First, methodologically, the most recent policy documents have been the object of a more exhaustive study than the oldest ones. Second, insufficient information on Barcelona's public expenditure on digital and environment/climate initiatives was collected to provide consistent insight and was therefore excluded from this final report. Third, and lastly, the relationship and interactions among municipal departments in charge of digital and environmental questions would have deserved more attention as well. These are aspects that remain to be studied more in depth.

In what comes to the Geneva case, the findings on the recent digital-environmental policies evolution is displayed in a retrospective way, starting from today and then providing insights on the city ' recent background. The same will go as for Lyon.

Geneva

Geneva today:

Today the City of Geneva wishes to become a digital city through a gradual digital transition. The city emphasizes that this digital transition should be well-throughout so that it will be done properly in a way that guarantees inclusivity, citizen participation and innovation. Digital transformation in the City of Geneva is both a tool and an objective – this use is not an end. Acknowledging the great potential of the rapid development of digital technology, Geneva wishes to seize these opportunities for its own development. Thus, the city has placed great hope on digital transformation that will help the government to better provide services to its citizens. However, the city realized that digital transformation has its uncertainties and thus it needs to take actions to minimize the negative impacts of this transformation, which includes the environmental impact of digital usages. To put it differently, the city is aware of the fact that this transformation has and will continue to have a profound impact on all aspects of the local society, and efforts shall be made to exploit its potential to improve everyday's life at all levels.

The city of Geneva, thus, while keeping in mind the energy and environmental impacts of the digital devices, aims for a more ethical, transparent, safe and sustainable city through this promising technology. Other societal objectives include inclusivity, accessibility and autonomy for every inhabitant within the city. More specifically, the city has 4 major axes for its digital transformation: 1) responsible digital use, 2) digital inclusivity, 3) digital innovation and creativity, and 4) transformation of administration with digital technology.

What interests us the most is the axis of responsible use of digital technologies. The city of Geneva has a comprehensive understanding of being responsible. Under this umbrella term, the city pushes for green IT, data privacy and protection and digital governance. For green IT (also termed as the ecological impact of digital devices), the city believes that the public sector should develop, share and lead sustainable and environmentally friendly uses of digital technologies. For example, one should try to extend the life of their digital device; one should try to recycle or upcycle used devices. Those approaches have a strong undertone of circular economy.

Historical trajectory:

Looking back to what makes today's digital transformation in Geneva, we found a pivotal year during the mandate of Sami Kanaan as the mayor of Geneva. From June 2018 to May 2019, the mayor, on several occasions, raised the public awareness of the significance and the potential of digital transition, and aligned those digital ambitions with the established societal values of the city.

Putting Sami Kanaan's advocacy into political and administrative context, emphasis and credits shall also be given to the Administration Council from 2015-2020. For this legislative unit, four city-wide goals were set out: 1) welcoming city, 2) committed city, 3) innovative city, and 4) ecological city. For the ecological agenda, the city set out specific objectives for 7 major aspects of daily urban life (Table 2) (Ville de Genève 2016). In 2016, the notion of building a smart city was mentioned officially within the Administrative Council by Sami Kanaan and it was later integrated in the city's political agenda. Among all the administrative departments under this 5-year legislation, three were the main support of the smart city development: the Department of Culture and Sport, the Department of Urban Environment and Security, and the Department of Finance and Housing. Furthermore, a specific program G'innove has been commissioned to the course of building a smart Geneva. This program (DGIN) is City of Geneva's societal innovation incentive program which was set up in March 2016 which aims to provide financial support to innovative projects. Although this program welcomes projects with public purposes from a wide range of domains, it gives priority to projects that help the ecological transition in the city. Since 2016, 43 projects have been selected and received financial support (Ville de Genève 2021).

Table 2: 7 major aspects of daily urban life in an ecological city

Ecological City
Responsible Mobility
Sustainable Energy Policy
Sustainable Food
Improving Waste Sorting
Green Neighborhoods

Green (bio) Spaces
Provide Education for Sustainable Development

Beyond G'innove, in 2018 the city adopted "Master Plan for Information and Communication Technologies of the City of Geneva 2018-2021". This plan was prepared by the Information and Communication Systems Department (DSIC) which was a municipal service unit under the Department of Finance and Housing (Ville de Genève 2018). This plan was set out as the city realized that 1) there is a noticeable increase of the use of digital technologies within the municipality in the past 15 years, 2) the use of digital technologies have been extended both in quantity, types and also diversity, 3) there is a need to keep up with the fast evolving technological development, and 4) efforts are also needed to regulate the new-coming technologies. Furthermore, the master plan wishes to integrate the digital objectives raised by DSIC with the objectives or projects of other departments. Thus, a noticeable effort has been made in order to make the digital transition permeable within all city level departments. This plan outlines three major strategies for information and communication technologies (ICT): 1) Governance, 2) Applied Portfolio & Development, and 3) Infrastructure & Service Center; and has aligned their strategies with the four major urban objectives of the Administrative Council of 2015-2020. Environmentally speaking, DSIC's stragegies I5 and I6 shall have a strong contribution to the Council's aim for building an ecological city and especially to the sustainable energy policies demanded by the council (Ville de Genève 2018) (Table 3).

Table 3: Alignment of the digital master plan with the city's ecological objectives

TIC master plan 2018-2021	**Administrative Council's city-wide objectives 2015-2022**
I5 Continue and finalize the server platform virtualization program	CA 42 Pursuit of a sustainable energy policy
I6 Align infrastructure components with virtualization strategy	

In May 2019, the city of Geneva coined the definition of digital transition and published its agenda of “Geneva digital city”. In the same month, the city of Geneva signed “Geneva Cities Digital Charter” with other cities within the Union of Geneva Cities (UVG–ville de Geneve, Carouge, Lancy, onex, Vernier, Meyrin) (UVG 2019). This charter set out 7 specific guiding principles of the digital transition. What interests us the most is the third principle which aims for an ecological numerical transition. According to this charter, Geneva Cities acknowledges the fact that digital transition will hurt the ecological situation to a certain extent. Bearing this environmental threat in mind, the union committed itself to a digital transition with environmental awareness. And the union shall favor renewable energies and shall actively respond to the sustainable objectives of the UN agenda for 2030. This charter also supports the development of a circular economy and encourages sharing. Geneva Cities shall see a reduction in electricity consumption, an increase in repair solutions and fight against incessant renewal and programmed obsolescence. And it will resort to recycling in other cases.

In June 2020, the new Administrative Council integrated the digital policy within its legislative and put it under the supervision of the Department of Culture and Digital Transition (it was previously with the Department of Finance and Housing). In 2021, the city adopted the “Master Plan for the Digital Transformation of the Administration 2021-2025”. Beyond the emphasis of having an digital transition for the greater good of the city (innovative projects, modernisation of city infrastructures, improvement of cybersecurity, to name a few), it was once again stressed in the city level policy that digital transition should also comply with our objectives in terms of ecology (DSIC 2021). This digital transition policy sets not only the framework for the 2020-2015 Administrative Council's objectives in terms of digital technologies and their deployment, but also guides the Information and Communication Systems Department (DSIC) for its own and more specific objectives (Table 4).

Table 4: Selection of digital objectives with strong ecological implications by service sector at the city hall

Departments	**Digital objectives with strong ecological link**

General Secretariat Directorate (DSG)	→ Dematerialize the files of the Administrative Council
Department of Finance, Environment and Housing (DFEL)	→ Dematerialize personnel files → Digitize the inventory and management of green spaces
Department of planning, constructions and mobility (DACM)	No obvious link with ecological transition
Department of Culture and Digital Transition (DCTN)	→ Modernize the sites of the institutions; digitize, preserve and promote museum, scientific and library collections; develop virtual exhibitions
Department of Safety and Sports (DSSP)	→ dematerialize administrative fines and access the information databases of the cantonal police
Department of Social Cohesion and Solidarity (DCSS)	No obvious link with ecological transition

This master plan contains not only short-term but also long-term guidelines. An example for short-term guidelines would be a zero-paper municipal council. Since 2020, the City Council has deployed a secure portal with various tools integrated within this platform to facilitate and encourage a paperless governance. It is a great instance when a government body tries to attain both digital and environmental objectives at the same time. In terms of long-term objectives, this master plan has set out several 5-year long guidelines. For example, it outlines a step-by-step process for a better open data society in Geneva.

In short, tracing the past 5 years of the political initiatives raised by the city hall of Geneva, one sees a strong impetus to push for a profound societal change with the digital transition. To put it differently, although the city claims to aim for a digital transition, it is by no means its end goal. Besides, the city is fully aware of the potential risk involved in the deployment of digital technologies in such a societal development and that efforts must be made to exploit its potential yet limit the danger, as we have seen clearly in the environmental aspect.

Quite similar to Geneva' parcourse in the digital-environment interplay in terms of its green IT approach but in another phase of the policy development process, we focus now on the case of Lyon. This follows a retrospective look as well.

Lyon

Lyon Today:

Internal organization

Concerning the internal organization of the city of Lyon, the deputy mayor in charge of digital, Bertrand Maes explained to us that two departments that are interesting for our study:

- the one in charge of ecological transition: they are not operational. Hence, they push for processes and they are in charge of writing the reports….
- the one in charge of the digital, the DSITN (department of information system and the digital transition): they manage their policies concerning green IT and they are operational

We can also find the details of the organization of the city of Lyon in their organigram, appended to this report.

Digital policies

For a better understanding of the current digital policies, we will go through a historical trajectory to highlight the shifts and the current actions implemented.

Historical trajectory:

The shift in digital policies at the state level

At the national level, two laws adopted by the French parliament, the law on the digital Republique in 2016 and the REEN law in 2021 reflect the major shift that occurred in France. In 2016, the law on the digital Republique promotes open data, the protection of users' privacy, and social inclusion. In 2021, new concerns are taken into account in the REEN law: 1) the citizens' sensibilization of environmental impacts of digital 2) the

limitation of digital devices renewal 3) promotion of Green IT and less energy guzzlers networks and data centers 4) promotion of responsible digital policies.

Comparison between the two mayor's last mandates of the City of Lyon through official reports

At the municipal level, nine arrondissements compose the city of Lyon. Gérard Collomb, from the socialist party, was the mayor of Lyon from 2021 to 2020. Gregory Doucet, from the Green Party (EELV: Europe Ecologie Les Verts), has succeeded him for a term of 6 years, from 2020 to 2026.

To understand the shift between G.Collomb's mandate and G.Doucet's one on digital policies, we will compare the *Annual Report on the situation in terms of sustainable development in the City of Lyon - 2017* and the one of *2019*, and the reports *Lyon in transition(s)_The sustainable development report* of 2020 and 2021. Then, we will discuss the different elements mentioned in the interviews and confront them with those published in the reports.

In the following table, we will list the different aspects of the political vision on IT and the actions implemented over years. All that information came from official reports published by the city and addressed to citizens. They aim to inform the public about what has been done during the past year. The goal of this table is not to see whether the policies or actions implemented were efficient or whether they are too ambitious (we will see this part later with the interviews and in the next section). We aim to show what are the political will and whether there are concrete actions implemented.

Table 5: comparison table (below)

Year	Report Title	Mayor	Political vision on IT	In practice…
2018	*Report 2017 on the situation in terms of sustainable development*[1] *p.7* *p.25* *p.59* *p.65*	Gérard Collomb	Goals: 1)improving social inclusion 2)developing citizens' participation through digital 3)developing digital as a tool for other policies 4)developing digital employment	2017: On social inclusion: 1)Digital devices installation in senior residences On digital employment: 2)Week on Employment and Digital to present future professional perspectives On citizens' participation: 3)Workshops on digital citizens' participation 2)Digital consultation with citizens
2020	*Report 2019 on the situation in terms of sustainable development*[2] *p.15* *p.31 and 33* *p.70* *p.83*	Gérard Collomb	Goals: 1)improving social inclusion 2)developing citizens' participation through digital 3)developing digital as a tool for other policies	2019: On social inclusion: 1)Digital Inclusion Day On citizens' participation: 2)(2018/2019)Consultation with citizens through digital platforms on the topic"Together, let's talk Climate" in 2018 and a workshop in 2019 at the Hotel de Ville 3)Consultation with citizens on "Nature Peninsula"

[1] *https://www.lyon.fr/sites/lyonfr/files/content/documents/2018-11/Rapport%20D%C3%A9veloppement%20durable%202017.pdf*
[2] https://www.lyon.fr/*sites/lyonfr/files/content/documents/2021-02/Rapport%20d%C3%A9veloppement%20durable%202019.pdf*

2021	*Lyon in transition(s)_ The sustainable development report*[3] *p.43* *p.53* *p.56-57*	Gregory Doucet	Goals: 1)development of the administration's awareness of the environmental issues of digital 2)promoting a systematic Green IT 3)improving the proximity between the city/administration and the citizens 4)developing digital as a tool for other policies 5)developing citizens' participation through digital 6)improving social inclusion	2020: On Green IT: 1) Lyon obtained the mark of 3/5 by the Free Digital Territory Label (TNL) concerning the use of free software and open data. On digital as a tool: 2)100% digital programming of the Equitable Village of Noêl On social inclusion: 3)Digital training organized
2022	*Lyon in transition(s)_ The sustainable development report*[4] *p.57*	Gregory Doucet	Goals: 1)development of the administration's awareness of the environmental issues of digital 2)promoting a systematic Green IT 3)improving the proximity between the city/administration and the citizens 4)developing digital as a tool for other policies 5)developing citizens' participation through digital 6)improving social inclusion	2021: On Green IT: 1)Lyon obtained the mark of 3/5 by the Free Digital Territory Label (TNL) concerning the use of free software and open data. 2)Carbon Footprint of digital demonstrating the importance of the lifespan of digital devices and refurbished equipment On social inclusion: 3) compliance with the General Regulations Accessibility Improvement (RGAA)

[3] *https://www.lyon.fr/sites/lyonfr/files/content/documents/2021-10/Lyon%20en%20transition%28s%29.pdf*

[4] *https://www.lyon.fr/sites/lyonfr/files/content/documents/2022-03/RAPPORT_LYON_EN_TRANSITION_RELATIF_ANNEE_2021_WEB-ok.pdf*

				4)the city of Lyon audited two of its most important sites: Lyon.fr and the website of the 1st arrondissement. 5) A course E-parentalité for youth and parents to improve digital skills

Through this comparison table, different aspects are relevant for our study:

- During G.Collomb's mandate, there was a concern about social inclusion of digital, citizens' participation through digital platforms, the use of digital as a tool, and the use of digital as a source of employment.
- In the current mandate, G.Doucet seems to have the same concern except for the digital as a source of employment. However, news concepts appear with the G.Doucet's mandate: the development of the administration's awareness of the environmental issues of digital, the promotion of a systematic Green IT, and the improvement of the proximity between the city and the administration with the citizens

The factors explaining the political shifts according to the interviews

For our investigation, we interviewed two members of the DSITN (department of information system and the digital transition) Didier Vullierme and Christophe Carré, and the deputy mayor in charge of digital Bertrand Maes.

First, we asked what the differences between the current mandate are and the last one. According to their answers, G.Collomb's political vision consisted of promoting international influence; the watchword was "Proximity, Valorization of data, Efficiency". They mostly saw the digital as a tool and not as a policy by itself. After 2020, with the new mayor G.Doucet, the watchword is " Green IT and Sovereignty" and the environmental impact of digital is a strong concern in the mayor's mandate.

Second, we asked them the possible factors that could explain the shifts. Some reasons were mentioned such as the new young team with digital knowledge and a will to innovate and the awareness of the environmental impact of digital. Moreover, Green IT is directly promoted by the city of Lyon (the Mayor) and not by the digital department. He sees the digital as a policy and not only as a tool. To sum up, the change of mandate seems to have been the major factor in the digital policy shift.

Last but not least, in what follows, the recent evolution of how the interplay between environment and digital-related policies has emerged and evolved in Tallinn is presented. We

found it more appropriate to do so chronologically since the early 2000s were key to understanding the following events.

Tallinn

Historical trajectory

After the fall of the USSR, Estonia sought to develop as a digital nation as a way to catch up economically with Western Europe. E-government and E-governance emblematizes this shift to capitalism and innovative mindsets: all public services are accessible online, citizens vote digitally, and online signatures are the general practice (Brohager Öhrling, 2019).

E-governance is innovative, but also necessary due to the peculiar position of Estonia next to Russia. The 2007 cyber-attacks on government services showed the disruptive potential of hackers and the need for government protection (Ottis, n.d.). To ensure the continuity of the state in case of emergency, Estonia opted for the saving and storage of governmental information on the cloud. Reasons for the adoption of a "government in the cloud" include:

- Cybersecurity, with data centers located abroad in allied countries,
- Ensuring the functioning of the state in a state of emergency no matter the level of physical control over the situation (absent, partial, or full),
- Providing reliable services across borders,
- And the scalability and economic flexibility of such a solution (Solvak, 2020).

The X-Road system was adopted by Estonia in 2001 and provides a Data Exchange Layer between actors. The creation of the Northern Institute for Interoperability Solutions (NIIS) by Finland and Estonia in 2017 enabled its further development abroad. The provision of public services is rationalised through the generalisation and simplification of public-private partnerships (NIIS, 2021).

Jüri Ratas, the Mayor of Tallinn in 2006, was the first to develop the idea of a Green Digital Capital City at the scale of Europe, or in Estonian *Euroopa Rohelise Pealinna*("Tallinn - the European Green Capital 2023," n.d.; *Tallinn Application for the title of European Green Capital 2023*, 2020). Ratas was part of the Estonian Center Party (*Eesti Kerkerakond*), at the

head of Tallinn since 2005. The current mayor, Mihhail Kõlvart, is committed to the pursuit of urban sustainable government and ecological transitions, with the objective to achieve carbon neutrality by 2050 (“Mihhail Kõlvart has led Tallinn towards the European Green Capital of 2023 title,” 2022).

Transportation policies are a key component of both the ecological and digital transformations of Tallinn. They placed the city at the forefront of innovative European cities. Tallinn was the first city to adopt Free-Fare Public Transportation for its residents in 2013(Horton, 2022). Following Estonia’s independence, Tallinn residents relied more and more on private cars as means of transportation (Cats et al., 2017, p. 1092). The adoption of Free-Fare Public Transportation had three main objectives: creating a modal shift from private cars to public transportation, improving the mobility of vulnerable citizens, and creating tax revenue for the city of Tallinn (Cats et al., 2017, p. 1092). This policy also has a striking digital dimension, as citizens used a green card to board (the *ühiskaart*), and new vehicles with sensors for automatic passenger counting (Gabaldón-Estevan et al., 2019, p. 337). Tallinn is currently working on the adoption of a digital transport model that would enable fluid traffic and further urban planning, by modelling the movement of city dwellers and congestion in real time (“Tallinn to adopt a digital transport model,” 2022).

> *"The transport model is a digital tool that brings together all available data to help us understand how and when people move around Tallinn. It can help us predict transport problems and understand their causes and enables to make decisions that support the city's holistic development as well as anticipate the impact of those decisions. It is not an survey for a specific project but rather a permanent internal analytical tool that can be used to assess the feasibility and traffic impact of all major infrastructure investments"* Andrei Novikov, Deputy Mayor of Tallinn (“Tallinn to adopt a digital transport model,” 2022)

2018 marks the beginning of the Pollinator Highway project, analyzed deeper in the following section of this report. The *Putukaväil* is a “species-rich meadow-like natural environment, a green corridor between city districts, and a movement corridor for green mobility that passes through 6 districts” (“Pollinator Highway,” n.d.). It reuses pre-existing infrastructures such as high voltage power masts to facilitate the creation of what is referred to

as a city-wide, linear park. Destined for citizens and favoring biodiversity, the Pollinator Highway is anchored in the physical urban structure of Tallinn. Parts of the project include an augmented reality map and nature-based activities for visitors. The Pollinator Highway shows the deep connection the City of Tallinn makes between high tech solutions and the ecological transition.

Tallinn now

In 2020, Tallinn applied for the title of European Green Capital 2023, with a candidacy focused on the association of sustainable development and information technologies(*Tallinn Application for the title of European Green Capital 2023*, 2020). While skimming through the candidacy, one could note the insistence of the City of Tallinn on the Ülemiste business and engineering school TalTech (Former Tallinn Technology Institute) district for both green and digital innovation:

> *In order to introduce scientific and data-driven decision-making, the city will start collaborating with Tallinn University of Technology (TalTech) from 2020 as part of the Future City professorship, which will use computing and research to create solutions for future working and living environments. In addition to the university, Ülemiste City developers and the City of Tallinn, technology giant Ericsson and other companies will contribute to the new professorship. In cooperation with TalTech, the plan is to create Finest Twins, a centre of excellence for smart cities.* (*Tallinn Application for the title of European Green Capital 2023*, 2020)

Tallinn's vision of a green capital should be understood as the combination of the evasive idea of the smart city, combined with carbon neutrality and eco-innovation. The local economy thrives on innovation, encouraged by the municipality.

Eco-innovation is encouraged by Tallinn and recognized at the European scale, through events and policies such as the GreenEst summit and the Tallinnovation contest. The latter aims at finding sustainable solutions for the City of Tallinn, that would foster sustainable urban development and services for a smart city. This emphasis on eco-innovation was proven successful as Tallinn was awarded the title of Green European Capital of 2023. The jury of the European Commission noted the commitment of the city to "a systemic

approach in their transition towards sustainability with interlinked strategic goals for 2035, linked to the UN Sustainable Development Goals" (European Commission, n.d.).

In 2020, Tallinn also launched the Tallinn 2035 development strategy ("Home page | Arengustrateegia Tallinn 2035," n.d.). Parts of the objectives include the city's ambitions of becoming a "Creative Global City" (objective 2) and the "Green Transformation" (objective 4). This reflects the historical narrative of the city as a Green Digital Capital at the scale of Europe, and both digital and ecological goals coexist in the branding of Tallinn.

The plan is a step towards strengthening municipal governance in all local competences. The city affirms that it is taking necessary measures to ensure the ecological transition of its offices, with, for instance, the obtention of the Green Office Certificate in 2019("Acknowledgements for Tallinn City Office, European Green Office," n.d.).

Energy consumption is one of the key topics Tallinn is working on. Indeed, Estonia relies on shale oil as a primary energy source, extracted in Ida-Virumaa County. Shale oil has many ecological consequences, like the emission of Greenhouse Gasses, sulfur oxides, nitrogen oxides and particulate matter (Prause and Tuisk, 2020, p. 168). Electricity production does not exist in a vacuum, and the shift to cleaner energy sources would disrupt the economic life of Ida-Virumaa County. While paperless signatures are seen as a big step towards sustainability by the City of Tallinn, it makes no mention of responsible digital models. The electricity production of Estonia emits more Greenhouse Gasses than other countries and makes the carbon footprint of its IT systems deeper (NIIS, 2021).

Conclusion

The specificities of the Estonian context give Tallinn different incentives for digital and ecological evolutions. The combination of post-soviet liberalisation, economic growth based on technologies and local financial autonomy led the City of Tallinn to have a technophile outlook on its future. The idea of a Green Digital Capital shows the intricacies between Estonia's innovation soft power and ecological transitions.

Tallinn's goal is to use IT for Green to become a European reference on ecological and technological transitions. This thought permeates all areas in the city, from transport policies to candidacies at the European level. Tallinn's insistence on eco-innovation makes it a reference to follow in terms of digital progress, applied to the ecological transition.

Emblematic project: Illustrated typologies through one emblematic project of each city

Barcelona: A buoy to measure the Mediterranean Sea acidification

Though it is a small project, thus not-representative of the scope of an urban policy itself, we believe it well illustrates how the digital and climate concerns can meet throughout a very characteristic Barcelona's governance model. This is the participatory dimension.

Barcelona is a city where citizens' participation in decisional and organizational processes is very salient and worshiped and has been so for a long time. Indeed, both officially throughout public municipal procedures and privately within associations and clubs, Barcelona's citizens are characterized by high participatory rates in widely varied initiatives and projects, from sports to culture, education, food, and environment, but also politics, and the defence of private common interests - such as through neighborhood associations (Ajuntament de Barcelona 2019, Peña-López 2017, Blakeley 2010, Junyent 1994). Therefore, participation is rooted in Barcelona's governance culture, at the essence of what *politics* are. Reciprocally, when important decisions are taken within the municipal public field, the population is all but forgotten. Through consultations or even direct cooperation processes, these are often listened to and included by the local councilors (Ibid.). As said, this is part of the city's commitment to ensure trust between citizens and the government and to build and govern the urban space in an inclusive and cooperative way (Rovira 2019).

A very emblematic participatory procedure that is inherent to the use of the digital is the online participatory platform "Barcelona.Decidim". As a reminder, its creation dates to February 2016 when, inspired by Madrid a year earlier, Barcelona launched a similar participatory platform project to draft its new urban plan in a collaborative way (decidim.org n.d.). At the heart of our study, we looked further into it to see whether any recent initiative linked to it also involved an environmental or climate related measure. The one we selected appeared to us as even more illustrative of Barcelona's participatory policy since it consists of the participatory budget launched in February 2020 by the City Council, where all citizens of each district were invited to make proposals and further vote for them with an overall allocated budget of €30 Million (Ajuntament de Barcelona n.d. -b). Among the proposals submitted, the one that caught our attention was a presented, voted, and finally approved

funding proposal, consisting of installing a buoy near the Port Forum (at the Parc dels Esculls) to measure the progressive acidification of the Mediterranean Sea (Ajuntament de Barcelona n.d. -a).

Through this whole bottom-up and top-down procedure, we considered this case to be illustrative of Barcelona's governance within the scope of the environmental-digital interplay. Indeed, the participatory budget puts the citizen at its core, while the project itself involves a widespread role and use of the digital as a tool (in this case, both in the *means* - the online platform- and as part of the *result* - since its concerns an e-device) and, finally, it illustrates the salient climate change concern that both individuals and the municipality have. The former showed it by the proposal and voting, and the latter by acknowledging it in granting the necessary funds - also conscious of the city's climate emergency declaration of 2019 already mentioned.

As a final word though, we wished to make explicit that Barcelona's waste management policy was first considered as the emblematic case for analysis and presentation. The initial purpose was to assess to what extent such an environmental related urban policy-field involves the use of the digital, regarding Barcelona's digital policy. We believe this is still worth analyzing, eventually in a further study. It could even provide a more consistent example of the typology we displayed here to characterize the interplay between environmental and digital policies of European cities.

Geneva: Journée genevoise D-Tox

As digital transition is both a tool and a goal to the city of Geneva, many projects have been funded and carried out. Apart from the projects that use budgets to create some digital usages (IT for Green) –scanning of parliament documents, monitoring of buildings' energy consumption to name a few, Geneva also has projects that can be noted as Green IT.

In relation to "Cyber world clean-up day", the municipality of Geneva has set an annual D-Tox day. Usually in mid-March, the internal personnel at the city of Geneva and its partners outside are encouraged to clean up the useless file stocked in the internal system and in the clouds, and in the personal phones. This day is not only set to reduce the unnecessary digital use and to alleviate the burden of data centre as a compensating remedy to previous use, but also to raise the general awareness of the environmental impact hiding behind the seemingly immaterial digital service. In the post circulated for this year's D-Tox day event on

the 18th March of 2022, the city provided information on this matter: sending one email has the similar carbon footprint as a lightbulb turned on for three hours. This city has also provided a detailed guideline regarding how to detoxify users' system. For example, one can delete "ok", "yes" message in Short Message Service; unsubscribe from undesired newsletter, check for unnecessary duplication of the same documents, to name a few. The city also provided a site where one can make an approximate calculation of the environmental footprint their activities (digital or not) (Ville de Genève 2022). Besides, a guideline of a day-to-day digital use is also distributed to guide participants how to use stay conscious of the environmental footprint of digital technology on a daily basis.

This day is the emblem of Geneve's digital policy in multiple sense. First of all, the fact that Geneve often aligns itself with the international movement or higher governmental initiatives can be seen from the fact that Geneve makes a strong connection between this project and "Cyber world clean-up day". Second, it encourages a wide participation in the society including the Geneva Chamber of Commerce, the Industry and Services (CCIG) and APRÈS – the social and solidarity economy network. Sami Kanaan–the Administrative Councilor of the City of Geneva–has commented that this D-Tox day is emblematic of the participatory principle demanded by the general digital transition agenda as it involves a wide range of participants (for example, there are 400 companies registered in APRÈS) (Ville de Genève 2022).

Lyon: Refurbished equipment for the administration

In this part, we believe that the project on refurbished equipment for the administration of Lyon would be a good project to detail because it illustrates many aspects specific to Lyon.

The first step of the project consists of a footprint carbon evaluation to raise awareness among the administration and to be the starting point to evaluate the effectiveness of the future digital policy. The footprint evaluation realized in 2019, *Bilan Carbone Numérique de la Ville de Lyon* shows that the digital footprint is due to:

- 80 % manufacturing footprint
- 16% energy consumption

- (The rest is due to the exchanging data and stocking data)

We should keep in mind that the results were impacted by the pandemic context.

The second step was to implement new Green IT policies such as the project on refurbished equipment for the administration. According to the interviews with the DSI members and the deputy mayor in charge of digital, the city of Lyon aims to be a model for citizens and the private sector. They want to show that it is possible to implement new Green IT policies.

However, the city is facing many challenges as the interviewees explained to us. The city does not have the legal competence to impose refurbished equipment on private companies. The only possibility is to encourage them by telling them that the City of Lyon works with companies that promote sustainable and green policies. Moreover, there is an internal issue: the DSI has not presented its action plan (the interview was carried out in January 2022) yet to Bertrand Maes (deputy mayor in charge of digital). The DSITN claimed that they waited for the refurbished market to be set up. Finally, the city does not have the financial means to implement financial incentives for citizens to encourage them to purchase refurbished equipment. It would more the role of the state according to Bertrand Maes. They can only guide the citizens' purchases by developing the refurbished market. Members from the DSI added that there are maybe more financial means than before, but it lacks human means.

According to our contact at the DSITN, this project is in progress so far, and “the Metropolis of Lyon has just notified a public contract in the form of a central purchasing office allowing local authorities in the metropolis to obtain reconditioned equipment”.

Through this project, we can notice many aspects specific to Lyon. First, the city of Lyon depends on its collaboration with the Metropolis (as we have seen in the introduction part on multi-level governance, the Metropolis concentrates much more competencies than the city). Second, the city cannot implement policies and rules for the private sector, it is not a legal competence that it got. Third, the city does not have enough financial means to financially encourage the citizens to purchase refurbished equipment. Here again, it seems to be the role or the competence of the State. Finally, the city can only act on its administration and be a model for the private sector and the citizens.

Why are the citizens not taking an active part either in this project? Either by asking for more actions or by being an actor of the change for example?

Bertrand Mahes (deputy mayor in charge of digital of Lyon) answered this question: “Green IT does not interest citizens. It is something new and even among green, parties it is not their favorite subject. For me, it is a priority.”

Tallinn: The Pollinator Highway

The Pollinator Highway is a project the City of Tallinn has been developing since 2018. The idea came from an already existing movement corridor used by insects and pollinators, from bees to butterflies (“Pollinator Highway,” n.d.). The project spans through six districts of the city, in which the city repurposes abandoned buildings and infrastructures to turn them into “bearers of light, greenhouses, climbing towers or observation platforms covered in vines” (“From Grey to Green: The Pollinator Highway of Tallinn as an Innovative Concept for Bringing Nature Back to the City,” n.d.). The Pollinator Highway is partly funded by European or Trans-Baltic initiatives, such as the external project ‘B.Green’ from 2020 to 2022.

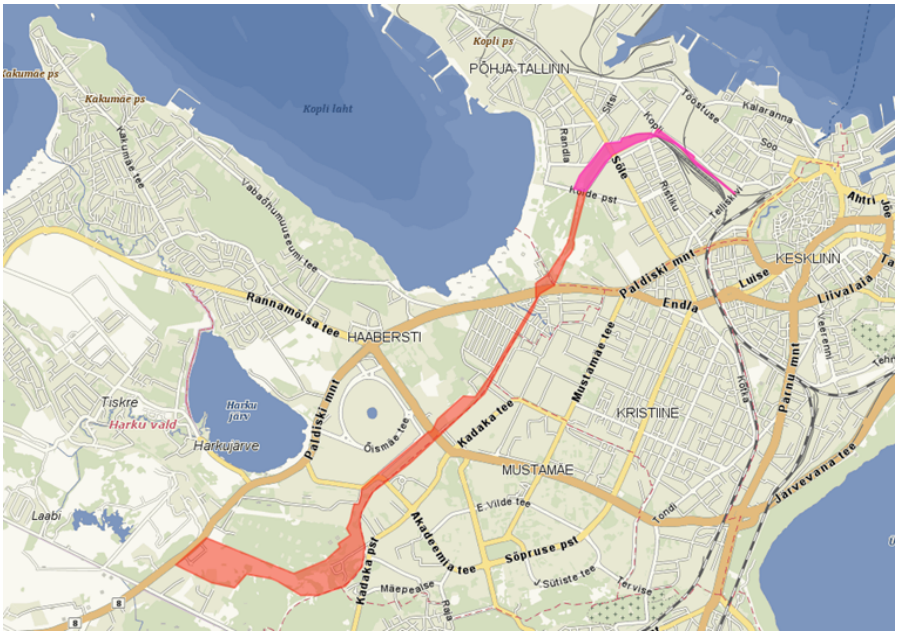

Figure 1: Inventory area, source: kaart.delfi.ee

The goal of the Pollinator Highway is to be a city-wide linear park that goes through the different ecosystems of the City of Tallinn. It will host activities for residents and an

environment favorable to urban biodiversity. More than half of the corridor hosts mixed-uses pedestrian and bicycle lanes to ensure soft mobilities are encouraged through the project (Project Augmented Urbans, 2020). Other infrastructures involve the use of an augmented reality app, significant of Tallinn's commitment to the use of technology in its ecological transition.

The introduction of high technology for residents, in conjunction with a measure that aims at favoring biodiversity questions the interconnectedness between digital and ecological transitions in Tallinn. A corridor for insects and a park for citizens does not require the introduction of innovations to be attractive. The idea of repurposing previous infrastructures and burying the high voltage power lines is essential to the project, making the city greener than its usual grey. It is also interesting to see that the Pollinator Highway is led by the Spatial Design Competence Center of the Tallinn Strategy Unit, however funding comes from supranational institutions and initiatives. The state is disengaged from the ecological transition in its capital city. While defending and encouraging urban biodiversity, the Pollinator Highway still has a technophilic outlook on its goal. It highlights the close relation Tallinn draws between technology and ecological transitions.

The role of Multi-Level Governance: Assessing drivers and limitations of multi-level governance systems

This part is meant to provide further insight on how our case studies can or do shape their respective environmental and digital policies. All embedded in systems of multi-level governance (MLG), and being the lowest of those levels, their competences are sometimes sharply framed or their voices and interests overlooked at broader levels. On the contrary, though, in some cases they can also play pioneering roles, steering the scope of objective's ambitiousness or calling for public institutions' exemplarity.

Barcelona

In the case of Barcelona, the city is part of a MLG system that comprises - from broader to narrower - the national level (Spain), the regional one (Catalonia), the provincial one (Province of Barcelona), and the Metropolitan one (Metropolitan Area of Barcelona - AMB). In addition to it, also come into play, and needs consideration, the European level (EU) and, to some extent, the international level (especially when it comes to international environmental law). Because Spain is a decentralized country, a broad set of competencies is granted to the regions which, for instance, have also the power to legislate - as we will see.

Overview of the city's competencies and assessment of the environmental and digital policies

To give a brief overview of how competences are shared, we may say that according to the European subsidiarity principle - already presented -, many competencies are granted to Barcelona's city council scale. These are, to name a few, urban planning, the maintenance of the urban space (cleaning, aesthetics, green spaces, ...), or waste management. On the contrary, for instance, a competence over which Barcelona has been struggling to govern is the (social) housing policy, which falls into the national and regional scales (Blanco et al. 2020:32). Furtherly, for a matter of efficient logistics, mobility falls into the metropolitan scale, being managed by the AMB entity.

In what comes to the policies addressed in our study, many levels of governance play a role in defining Barcelona's digital and environmental political standpoints. Environmentally and climate-related, the city is highly driven by the Paris Agreements' objectives (Ajuntament de Barcelona 2021) besides its own specific political views, already mentioned. Still internationally, the climate city' emergency awareness is mainly based on IPCC's reports,

directly cited in Barcelona's released documents (Ibid.). Barcelona also narrowly follows the regional level, beyond being doubtlessly in accordance with the national one (Fernández et al.2018). For instance, in the 2017 Catalan Law on climate change, said to be highly ambitious in scope and objectives (Torres 2018, *LLEI 16/2017, De L'1 D'agost, Del Canvi Climàtic* 2017), we found similarities with the subsequent Barcelona's Climate Emergency Action Plan. On the other hand, Spain's environmental policy is most in accordance with the European Union's one (Juarez 2020, Fernández et al.2018, La Moncloa 13/03/2017), in terms of principles more than scope - since the country is still well-known for its wide implementation gaps in environmental law ("Infringement Cases - Legislation - Environment - European Commission" 2022).

Digitally, at the national level, the approach to the Digital differs from Barcelona's. Indeed, while Spain's digital policy is more in accordance with the European one, the other parallel regards the regional and the city levels, mainly in what comes to the transparency principle and the interrelated will to strengthen the institutions by increasing the trust towards them (Rovira 2019, *LLEI 19/2014, Del 29 De Desembre, De Transparència, Accés A La Informació Pública I Bon Govern.* 2014). While this is, partly, implemented through the "govern obert" (open government) initiative, it was also registered in the 2014 Catalan Law on Transparency, following the two-fold principle of public information and of good governance (Ibid).

Some limitations

Lastly, some limitations can be advanced regarding this part, and they are mainly two-fold. First, we overlooked the role and participation of Barcelona in international networks and events; this was decided as being out of the scope of our study, though it seems important to remind that the MLG systems works in both-ways: top-down and bottom-up, and international networks are thus essential bottom-up ways for cities' voices to be heard. Second, the provincial and metropolitan scales were also left aside for a lack of capacity to properly tackle them. Yet, we believe further research about them could be revealing since many initiatives depart from these scales of governance.

In Spain, the digital approach is different from one level of governance to another. Let's see now if Geneva is more in line with its upper levels of governance.

Geneva

The contextualisaion of the city of Geneva's digital policy should be done vertically in a relative and referential way. Switzerland is a relative decentralised country. Unless specifically stated as federal competences like military defence, foreign diplomacy, cantons and municipalities have a high degree of autonomy, particularly in areas such as education, healthcare and social policies. However, one sees a strong continuity, coherence and cross-reference between the policy design between different levels of governance. Thus, the main focus of the impact of multi-governance on the city level digital policy should be more on the interraletion rather than ana anlysis of competence. The three different level of governments have enacted different digital policies since the century turn, but it was not until the end of the 2010s, that we see a strong emphasis and consideration of environmental problems related to digital technologies with in the drafting of digital policies.

In 2018 the federal government adopted "Digital Switzerland" strategy which mentions that it is necessary to reduce the ecological consequences of digital technologies to an acceptable level (Confédération Suisse 2018). "Digital Switzerland" strategy is revised at least one very two years. The current version (accessed June 2022) the updated version gave out a more detailed objective regarding Green IT and what federal government suggests as possible action (Chancellerie fédérale 2022). Among the principal objectives, it is said that the country should reduce the environmental footprint of digital uses as well as energy consumption in general. The federal governement is conscious of the fact although digital transition is intrumental for Switzerland to reach its environmental objectives. However, it should by counterproductive if the energy and material consumption necessitated by the information and communication technologies (ICT) increase at the same rate as the contribution of these technologies in reducing energy and material consumption in other domains. Thus, a comprehensive thinking and design of the digital use is necessary to enable an efficient and targerted deployment of digital techonologies so as to reduce the total energy and material consumption. The action plan accompanied demands an optimised use of digital resources, the construction of a efficient energy supply system, and sustainble and efficient use of energy, to name a few.

At the cantonal level, again in 2018, the canton of Geneve arranged a public consultation for setting the goals and orientations of digital policies from February 28 to

March 31, 2018 (Barclay 2018). This consultation was set out as the canton wishes to seize the opportunity offered by the rapidly developing digital technologies while controlling the potential riskes associated with these technologies. Thus, the Council of State of the canton has commissioned a drafting of a cantonal digital policy given the current digital challenges. The canton launched this online public consultation to involve its citizens within the policy making process. Over 8000 people visited the online site for consultation and the canton received 153 new proposals. Reviewing this public consultation, one sees an emerging awareness of the environmental footprint implied by digital technology. For example, one of the reactions towards the canton's wish to simplify its administrative process and provide more services digitally, is that the government should take the environmental impact of the data storage system. Similary, one of the positive reception of the cantonal initiative to encourage more political participation through digital technology claims that this method is partially desirable as it is a environmentally friendly way to reach such political end(Republique et Canton de Geneve 2018) .

In June 2018, the canton adopted « une politique numérique pour Genève » ("a digital policy for Geneva") which is not an action plan but a list of objectives and principles. Within this policy document, the canton mentioned the necessity of aligning the digitial transition with the ecologial transition as the constant and continuing use of digital technologies have serious environmental implication. Digital devices, as mentioned in this digital policy, are built with a lot of rare material and mineral, are fed by a lot of energy, are dependent on frequent compenent replacements. Furthermore, the environmental impact goes beyond the administrative boundary of the canton. Thus, even though it is endenibal that digital technologies can help the canton to fight against climate change through increasing buildings' energy efficiency, for example, one has to stress the importabce of the digital sustainability in a global sense. In 2020, the canton of Geneve pubished « référentiel de compétences et de culture numérique » ("reference of skills and digital culture"). It is very inspiring to see how the canton addressed the emvironmental issue of digital technology from an educational perspective as it claims that through education, all students should be able to measure the cost of energy and the environmental impact of the digital transition (Republique et Canton de Geneve 2020).

Going back to the city-level digital policy at Geneva, the current policy is very much in line with and anchored within the federal and cantonal framework, especially the "Digital

Switzerland" strategy and the “a digital policy for Geneva”. We see a cross reference of similar objectives and ideas. It should be noted that this similarity is not a post-rationalisatio or a pure coincidence. The city of Geneva has stated that their policies can be seen as a part of the greater political framework on this matter both cantonal-wise and national-wise.

Thus, unlike Barcelona, Geneva follows the same trends than the federal and cantonal. Yet, is it the case of Lyon?

Lyon:

In the case of France, the State is still centralized and few competencies are allocated to the cities. All the cities’ competencies completely depend on the national law. That way, it has created a gap between the national laws and what is happening in practice at the local level (Pourquoi la décentralisation à la française ne marche pas ?, 2022). However, the State tried in 2014 to allocate more power to the municipalities by creating Metropolises. The new Metropolises group together several municipalities. Therefore, they concentrate more power compared to the municipalities themselves. Yet, the proximity between the Metropolises and the citizens is still challenged (Marcou, 2015) and the city remains the most appropriate entity to connect citizens with democracy. For example, the competencies of the Grand Lyon (Métropolis of Lyon) and the City of Lyon are very different (Website of Grand Lyon, 2022 & Ville, Métropole de Lyon, qui fait quoi ? - Lyon Capitale, 2022):

Grand Lyon’s competencies are more important. For example, they are in charge of water, sewage, waste management, and the environment… while the City of Lyon has to manage the PLU (Urbanism Local Plan), social and cultural competences, security…

In his interview, he underlines different points interesting to contextualize the city of Lyon:

- There is **“no debate about Green IT with other collectivities”.**
- To him, **the city of Lyon is aligned with the Metropolis.** For example, it is the Métrople that will sign for purchase contracts of refurbished digital equipment. Then, the City of Lyon will take the equipment from there.
- The city of Lyon can be in **contradiction with the national political vision** (for instance in the case of the 5G) or **following** the state like for the REEN Law (2021)

(Law for reducing the environmental impact of digital). However, the law lacks enforcement.

Through the example of Lyon, we can see the limits of the city's competencies and how it can be dependent on the Metropolis. The city may also have a political standpoint strongly opposed to the state's one.

Thus, Lyon is in line with the Metropolitan approach on digital but not always with the State. What about Tallinn?

Tallinn

Vertical comparison between level of government

Estonian multi-level governance relies on three scales: the municipalities, or councils, regional areas known as counties, and the state. At the council level, local governments can form rural municipalities or city districts on their territory ('Local Governments in Estonia' n.d., 12). They deal with local matters and have tax autonomy: citizens register where they live and pay taxes to the council they belong to. This is the basis of the Free-Fare Transport Policy of Tallinn. As the residents pay taxes in the Capital City, they benefit from fee exemption. Councils are the only locally elected level of government in Estonia. Their competences include land use and planning, allocation of local budget, and they can issue local regulations. The counties deal with broader regional urban development, environmental concerns and can supervise local governments on certain taxes. They are state administrative units, without significant independence or distinct elections ('Local Governments in Estonia' n.d., 12).

The Estonian state supervises the broad digital policies and framework of public agencies. It made the choice of the X-Road framework for E-Governance in 2001, and has helped develop and implement it abroad (Tomor et al. 2019). The X-Road infrastructure is currently represented by NIIS, and several of its features are designed for user and environmental efficiency alike. As an example, Estonian infrastructures must respect the once-only principle: they should only ask for personal information of citizens once. Then, the data is safely stored for later used, eliminating unnecessary duplicates that take more space in data centers than necessary. From our interview with Ville Sirviö, the current CEO of NIIS,

we know that the association is committed to the reduction of the carbon footprint of X-Road and conducted its assessment (NIIS 2021). This report analyzed the chain of emissions produced by the system, and applied it to the cases of Finland and Estonia. The Estonian carbon footprint is much higher than that of Finland, and this conclusion is drawn from the reliance on shale oil for energy generation (NIIS 2021, 59). As a conclusion: X-Road can be a digitally and environmentally sound solution, but contextual dependencies nuance its potential.

Historical attachments and city branding

Still, Estonia carries the weight of its recent historical context. The Soviet Union influences the ecological imaginary of Tallinn, through the rejection of scarcity and embracement of technological utopianism (Krivý 2021). Urban planning has been influenced by the democratic transition and membership of the European Union, with the Tallinn Creative Hub established in a former Soviet power plant (Krivý 2021, 238).

Similarly, the rejection of the Soviet influence gave way to new aspirations, and the governance of Tallinn is heavily inspired by neo-liberal tendencies. In 2019, Estonian president Kersti Kaljulaid said “Estonia is running its country like a tech company”, showing the attachment to the country’s digital ecosystem and spirit of entrepreneurship (Brohager Öhrling 2019, 6). Tallinn strikes by the independence it gives to the private sector, seen as one of the country’s strengths. As Toomas Türk mentioned during our webinar, the interactions between the public administrations and the private sector, particularly IT companies, is a key influence for the Multi-Level Governance in Estonia.

Conclusion

What can be done at the local scale depends on the levels of governance of each country and their organization; Tallinn and Lyon have fewer competencies and power than Barcelona and Geneva. Thus, some cities are more independent in their policy implementations than others. Moreover, the fact that upper levels of governance are not in line with the local political standpoint may be an obstacle to local policies.

Typology:
Characterization of cities' digital-environmental policies relationship

Building a Functional Analysis for a consistent comparison

Table 6: The functional analysis and its criteria

	Barcelona	**Geneva**	**Lyon**	**Tallinn**
Legislation				
National Law on Climate Change	**YES**	**YES**	**YES**	**YES**
Local Law on Climate Change (regional)	**YES**	*to be found*	**NA**	**NA**
National law on digital policy	**YES**	*to be found*	**YES**	**YES**
Local law on digital policy (regional)	**NO**	**YES**	**NA**	**NO** *(following national guidelines)*
Municipal standpoints: political views				
Climate awareness	**YES**	**YES**	**YES**	**YES**
Technophile	**NO**	**YES**	Not the priority	**YES**
Reflexivity upon digital technology's environmental impacts	**NO**	**YES**	**YES**	**NO**

IT for green	**YES**	**YES**	**YES**	**YES**
Green IT	**NO**	**YES**	**YES**	**NO**
Social/inclusive IT	**YES**	**YES**	**YES**	**YES**
The digital as a goal	**NO**	**YES**	**NO**	**YES**
The digital as a tool	**YES**	**YES**	**YES**	**YES**
Top-Down consideration of citizens' participation for digital issues	**YES**	**YES**	**YES**	**YES**
Bottom-up/spontaneous citizens' participation for digital issues	**YES**	*To be found*	**NO**	*To be found*
Self-recognition as Smart City	**NO**	**YES**	**YES**	**YES**
Viewed as a Smart City	**YES**	**YES**	**YES**	**YES**
Projected as a Smart City	*Contested*	**YES**	*Not the priority*	**YES**
Major shift in the past 10 years on the environmental aspect?	**YES**	*to be found*	**NA**	**YES**
Major shift in the past 10 years on the digital aspect?	**NA**	*to be found*	**YES**	**NO**
Governance: Municipal competences on traditional urban sectors				
Housing	**NO**	**YES**	**NO**	**YES**
Mobility	**NO**	**YES**	**NO**	**YES**
Waste	**YES**	**YES**	**NO**	**YES**
Water	**YES**	**YES**	**NO**	**YES**
Energy distribution	**YES**	**YES**	**NO**	**NO**

Urban planning	**YES**	*to be found*	**NO**	**YES**
Digital related initiatives	**YES**	**YES**	**YES**	**NO**
Local fiscality as a resource	**YES**	**YES**	**YES**	**YES**
Municipal administrative organization				
Transverse climate policy	**YES**	**YES**	**YES**	*To be found*
Transverse digital policy	**NO**	**YES**	**YES**	**YES**
Interaction between environmental and digital related departments	**NO**	**YES**	**YES**	**YES**
Dedicated human means to climate policy implementation	**YES**	**YES**	**YES**	**YES**
Dedicated human means to digital tools and services	**YES**	**YES**	**YES**	**YES**
Dedicated economic means to climate policy implementation (budget over …)	**YES**	*To be found*	**YES**	*To be found*
Dedicated economic means to digital tools (budget over …)	**YES**	**YES**	**YES**	*To be found*
Realized projects so far, linked to digital and/or environmental policy				
Targeting the internal management of the government	**YES**	**YES**	**NO**	**YES**
Regulating or directly affecting the operations of private companies	**YES**	**NO**	**NO**	**NO**

Directly impacting citizens' everyday life	**YES**	**YES**	**NO**	**YES**
Involving strong implementation of digital tools in urban governance in general	**YES**	**YES**	**YES**	**YES**
Involving strong use of digital tools in the ecological transition	**YES**	**YES**	**YES**	**YES**
Time horizons: Political projection				
Climate policy horizon within the next 30 years	**YES**	**YES**	**YES**	**YES**
Digital policy goals in general	**NA**	**YES**	**YES**	*To be found*
Green IT policy goals	**NO**	**YES**	**YES**	**YES**

NA: Not applicable or resources not available

Displaying a typology between the four cases in an Analytical Compass, based on the previous Functional Analysis table

Table 7: Typology

		CITIES' OBJECTIVES	
		Digital Development	**Climate awareness and sustainable development**
URBAN ACTIONS	**Digital means (= digitalization)**	TECHNOPHILE CITY *Tallinn*	IT FOR GREEN *Geneva* *Barcelona* *Lyon*
	Ecological Transition	GREEN IT *Lyon* *Geneva*	(*TOWARDS*) CLIMATE RESILIENT CITY *Geneva* *Lyon* *Barcelona*

General description

The construction of this typology follows a two-fold goal. One is at the core of our study's results; namely, characterizing the interplay of environmental and digital policies in the four cities studied. The other aims at nuancing between what "urban policies" refer to, by distinguishing the official commitment of urban governments from their actual actions. So the difference resides between the political sphere in which official documents are formulated and released - what we called the "cities' objectives" - and the operational level at which policies

are monitored and implemented - what is called "urban actions". Then, within these two levels, are considered our two policies of interest - digital and environmental ones.

Detailed analysis

As a result, we obtain a categorization where four variables emerge, that we labeled "Technophile", "IT for Green", "Green IT" and "Climate Resilient City" (all terms defined introductorily). According to the previous functional analysis that allowed us to thoroughly assess the existing relationship between digital and environment policies in our cities, we came to the conclusion that one city is not necessarily characterized by one variable, as you can see in the typology displayed.

Namely, **Lyon and Geneva** fall into three categories out of four, since they are both engaged in an adaptation and mitigation of climate change effects and of a technological development, though this must both be sustainable (i.e.: Green IT) and contribute in achieving the ecological transition (i.e.: IT for Green). Therefore, innovation and digital development are not a goal per se for these two cities -being thus excluded from the "technophile" category. It is interesting to note that **Tallinn** presents the exact opposite situation, falling into this latter category and not the others, since its policies clearly show a will and tendency to drive innovative digital development. Though the city has many environmental-related initiatives and objectives, as the "Pollinator Highway" project shows, we found them not to be consistent and/or encompassing enough to establish that the city is driving an ecological transition as such, nor that clear-headed climate and environmental concerns play a big role in its released documents. Finally, the case of **Barcelona** shows a digital development that is taking place, though it must strictly serve purposes such as the ecological transition one (thus the "IT for Green" label).

At last, we wished to draw your attention to ***the "climate resilient city" category***, and its qualification "towards" to indicate its ongoing dimension. Indeed, it would be inaccurate to say that Barcelona, Lyon, or Geneva are already resilient cities. Rather, both their claimed objectives and current initiatives make us think that their climate resilience is in the making. Hence, a lot remains to be done in terms of scope and efficiency of the actions they implement but also in the citizenry's sensibilization - in the thinking *and* the behavior. We thus believe this temporal dimension is a specificity of our typology, since it allows us to introduce a hypothesis of what comes next, and a similar assessment in a decade might show a very different picture.

Main limitations

Overall, we acknowledge that some critics may arise out of this typology. One the one hand, we could say that only four European cases are surely not enough to depict the global picture of digital-environmental interplay of policies in urban contexts. Thus, further studies are needed to get a broader understanding of the current situation in a context where the ecological transition is a necessity and the digital one a reality.

Moreover, some may also say that this typology does not present enough contrast given that one same city may fall into several categories. Is that a lack of consistency of the typology itself or does it simply reflect how we proceeded within the scope of our study? Namely, departing from studying the cases and later seeing how a categorization could be drawn out of it.

Finally, during the round table, it was suggested to implement a kind of scale for each criterion and not a radical ‘Yes’ or ‘No’. We believe that it would make our functional analysis more accurate but for this present study, we must deal with the time allotted.

General Conclusions

We have observed the interplay between digital and ecological policies at the European level has emerged recently. Concerning European cities, they are not following the same EU's trends. While some of them are roughly synchronous with the EU digital policies (Lyon or Geneva), others are still considering digital development as one of their priorities (Tallinn) or they have not yet considered it as an environmental issue (Barcelona). Many factors can explain those differences and our timeline helps us to distinguish them during the last years. Finally, we have built up a functional analysis (table of criteria) to establish the final typology. It can be used for any city… Finally, the project that we have chosen for each city illustrates what has been said in the functional analysis.

Besides the typology, many aspects are worth keeping in mind! We have seen that traces of digital uses are everywhere, thus it is hard to have any policy without digital implications. Moreover, cities are important actors in ecological transition. Cities have either interpreted vague policies for digital/ecological transition, or they have taken their initiatives. Hence, there is still incoherence in how digital tools are considered. Often seen as key to monitoring the ecological transition, digital policies are not always questioned about their environmental footprint.

Further studies can be interesting to testify whether our typology is relevant or more typology should be added to enrich the spectrum!

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Typology

We provide here a self-evaluation tool for politicians and local councilors to assess how the cities they work for link and relate their environmental and digital policies. Aiming for simplicity, we built a grid based on our functional analysis table in which every cell is to be answered in a yes/no answer basis.

We believe that a more consistent assessment of the interplay between these two policies could be realized through a more nuanced grid though, involving a spectrum of answers - for instance, for the "human resource" criterion, providing a scale of quantitative indicators could be envisaged (e.g.: between 1 to 5 employees, between 6 to 10, 11 to 15, 16 to 20, more than 20). This remains a work to be done, eventually in a future project.

	City/ies assessed			
Legislation				
National Law on Climate Change				
Local Law on Climate Change (regional)				
National law on digital policy				
Local law on digital policy (regional)				
Municipal standpoints: political views on environmental and digital stakes				
Climate awareness				
Taste for digital innovation				
Reflexivity upon digital technology's environmental impacts				
IT for green				
Green IT				

Social/inclusive IT				
The digital as a goal				
The digital as a tool				
Top-Down consideration of citizens' participation for digital issues				
Bottom-up/spontaneous citizens' participation for digital issues				
Self-recognition as Smart City				
Viewed as a Smart City				
Projected as a Smart City				
Major shift in the past 10 years on the environmental aspect?				
Major shift in the past 10 years on the digital aspect?				
Scope of autonomy: Assessing governance *Municipal competences on traditional urban sectors*				
Housing				
Mobility				
Waste				
Water				
Energy distribution				
Urban planning				
Digital related initiatives				
Local fiscality as a resource				

Municipal administrative organization				
Transverse climate policy				
Transverse digital policy				
Interaction between environmental and digital related departments				
Dedicated human means to climate policy implementation				
Dedicated human means to digital tools and services				
Dedicated economic means to climate policy implementation (budget over …)				
Dedicated economic means to digital tools (budget over …)				
Realized projects so far linked to digital and/or environmental policy				
Targeting the internal management of the government				
Regulating or directly affecting the operations of private companies				
Directly impacting citizens' everyday life				
Involving strong implementation of digital tools in urban governance in general				
Involving strong use of digital tools in the ecological transition				
Deployment of the 5G				
Robots in the city / urban space				
Time horizons: Political projection				
Climate policy horizon within the next 30 years				
Digital policy goals in general				

Green IT policy goals				