INTERPRETING DIGITAL GOVERNANCE AT THE MUNICIPAL LEVEL: EVIDENCE FROM SMART CITY PROJECTS IN BELGIUM

Authors

Giovanni Esposito
HEC School of Management - University of Liège
Faculty of Philosophy and Social Sciences - Free University of Brussels (ULB)

Andrea Terlizzi
Institute of Law, Politics and Development (DIRPOLIS) - Sant'Anna School of Advanced Studies

Massimo Guarino
Department of Literary, Linguistic and Comparative Studies - University of Naples L'Orientale

Nathalie Crutzen
HEC School of Management - University of Liège

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Abstract

This article adopts an interpretive approach to investigate how local policy-makers portray and justify their own visions of digital governance initiatives at the municipal level. Our investigation focuses on smart city projects submitted by various Belgian municipalities in the framework of the 'Intelligent Territory' call for proposals initiated in 2019 by the Walloon Region. We use Boltanski and Thévenot's theory of orders of worth and combine quantitative and qualitative content analysis to categorize the different justifications elaborated by municipal governments. The empirical results point to the polysemic nature of the smart city concept and highlight the diversity of opportunities offered by smart city policies according to municipal policy-makers. Overall, our study contributes to the understanding of the varieties of interpretations underpinning the construction of digital governance initiatives. It therefore supports the argument according to which there is no one-size-fits-all approach to smart city policies as local policy-makers may attribute different meanings to them and may formulate place-based ICT solutions to what they perceive as the most pressing problems of their territories.

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1. Introduction

Over the past several decades, the development of Information and Communication Technologies (ICTs) has deeply affected how individuals and organizations think of and behave in government and society. In the field of public policy and administration, there has been a growing debate over digital transformations, defined as the processes of "implementing ICT-enabled government innovations" (Barcevičius et al., 2019: 10). According to an early definition, 'digital government' means the "electronic enablement of all the services provided or commissioned by the public sector" (Bovaird, 2003: 37). Other definitions—such as those provided by the OECD (2003) and the World Bank (2002)—have adopted a normative view of digital government, presenting it as a tool for achieving a more efficient government. This view includes service delivery as well as the relationship between public administration, private sector, civil society, and citizens. The concept of digital government has therefore broadened in scope and now denotes a wide set of activities that is understood as 'digital governance' (Bovaird, 2003; Dawes, 2008; Gil-Garcia et al., 2018)[1].

In this article, we define digital governance as the use of ICTs "to help government to strengthen interactions with citizens and societal actors to solve societal problems collectively" (Meijer, 2015: 199). Digital governance may have both advantages and disadvantages. Interpretations of the opportunities and challenges linked to the adoption of digital governance solutions to policy problems vary. While pessimists contend that the use of digital tools compromises decision-making processes due to oversimplification in data interpretation and modelling, optimists argue that digital governance represents a once-and-for-all improvement for all policy domains. However, there are also those who argue that the use of digital tools should not be seen as a panacea. In other words, digital technologies

[1] In the literature, several scholars do distinguish between the concepts of electronic or digital government (e-government) and digital governance (e-governance). Whereas the former sees citizens as consumers of digital public services, the latter is more widely concerned with the interactions between governmental organizations, civil society, and citizens (Meijer, 2015). However, some scholars and practitioners use the term e-government to refer to both the delivery of services and the interactions between public administration and citizens at different levels (see e.g., Björklund, 2016; Homburg, 2018).

do not automatically improve governance unless a number of conditions are met (Heeks and Bailur, 2007; Manny et al., 2021; Terlizzi, 2021).

The main arguments in favor of the digitalization of governance processes mainly point to improvements in efficiency, quality, effectiveness, accountability, and trust either on the demand side (e.g., digital divide) or on the supply side (e.g., ICT infrastructure, civil servants' ICT expertise) of public sector organizations (Di Giulio & Vecchi, 2021; Meijer et al., 2018). However, research has underlined relevant heterogeneities across countries, highlighting how a wide range of (pre)existing institutional, organizational, and cultural factors drive the speed and breadth of the diffusion of digital technologies in the public sector. Therefore, scholars have increasingly adopted a sociotechnical perspective to study digital transformations, conceiving of digital governance beyond its purely technical innovative aspects (Castelnovo and Sorrentino, 2018; Heeks and Bailur, 2007). It seems that what the technical study of ICT-related innovation policy is overlooking today is the understanding of innovation as a discourse through which policy-makers construct a particular (innovative) social reality in governmental organizations (Terlizzi, 2021). By focusing on the local level of government, this article addresses this gap and advances our understanding of the discourses through which policy-makers justify and construct digital policy realities. In particular, we focus on the smart city, namely an ICT-enabled policy innovation made in urban settings (Nam and Pardo, 2011).

Digital governance is a key defining element of the smart city concept, which has become extremely popular over the last ten years (Bolívar and Meijer, 2016). As the United Nations (2022: 183) point out, "smart cities represent one of the most innovative manifestations of digital transformation at the local level". Indeed, the smart city has become a major leitmotif in local discourses of urban development (Crivello, 2015). Local governments increasingly use smart city programs as policy instruments to overcome a wide variety of place-based (environmental, social, and economic) problems, reflecting what they perceive as the most pressing socio-economic needs of their territories

and populaces (Esposito et al., 2021). However, although the all-encompassing nature of the concept appeals to policy-makers (Lorquet & Pauwels, 2020; Visser, 2019), they may have difficulties in making sense of the opportunities that smart cities can offer to local communities. Policy-makers, practitioners, and academics alike can in fact perceive this concept as nebulous and ambiguous. From one municipality to another, different interpretations of the smart city can coexist: each locality has its own constraints and develops its own understanding based on historical heritage and local context (Desdemoustier et al. 2019).

Therefore, it is important that local governments fully understand the potential of smart city policies, otherwise they risk being influenced by the corporate sector and frame urban problems in a way that favours business-led technological solutions rather than government-led and long-term urban planning (Grossi and Pianezzi, 2017). It is indeed well known that the smart city movement started in 2008 under the impulse of the International Business Machines (IBM) corporation within the framework of the Smarter Planet strategy (Chen, 2022)—a strategy aimed at exploiting IBM's ICTs solutions outside the private sector and promoting their use in municipal administrations. The Smarter Planet was supported by a powerful marketing campaign presenting ICT solutions as the pharmakon of contemporary urban pathologies (e.g. traffic jams, climate change, demographic increase) (Söderström et al., 2014). IBM had in fact realized the importance of exploiting urban technologies and it had identified city administrations as a huge untapped market (Townsend, 2013). To conquer the largest share of this market, IBM provided 100 municipalities over the world with consultancy in the hope that this initial investment will yield returns. This corporate-led approach to smart city development has attracted many criticisms. Most of the latter focus on the fact that this approach influences the way through which city administrations frame urban problems with a view to favour the interests of business elites and technological providers. This has ultimately strengthened the neoliberal economic agenda, promoted by the storytelling activity of private companies which want to secure their market positions (Biesaga et al., 2023; Grossi and Pianezzi, 2017).

Notwithstanding this corporate visioning, governments do have a central role in promoting innovation (Mazzucato, 2018; Mazzucato and Ryan-Collins, 2022), including the design and implementation of smart city development strategies (Mora et al., 2019b). Indeed, governmental organizations provide long-term visions for innovation by crafting discourses and narratives around how creating and improving public value (Mazzucato, 2017), the latter being understood as "a way of measuring progress towards the achievement of broad and widely accepted societal goals" (Mazzucato and Ryan-Collins, 2022: 346). In this respect, recent smart city scholarship has called for efforts to shed light on the policy discourses developed by local governments vis-à-vis their ambitions of territorial and societal development (Clément and Crutzen, 2021, Esposito et al., 2021; Kummitha, 2019). Against this background, this article unpacks the meaning of digital governance initiatives at the municipal level of government in the context of smart city development. It specifically sheds light on the discourses advanced by local governmental actors to justify the development of smart city projects. In particular, we ask: *how do policy-makers justify smart city development at the municipal level?*

To answer this question, we use Boltanski & Thévenot's (1991) theory of orders of worth to categorize the different justifications elaborated by municipal governments about smart city policies in their local context. In doing so, we bring the analytical focus on the agency of municipal governments and, specifically, on the discourses that these governments purposefully develop to make sense of and justify smart city programs within their municipal jurisdictions. We therefore shed light on the variety of beliefs, arguments, and justifications that local governments mobilize when developing smart city policies. Empirical evidence is drawn from the 'Intelligent Territory' call for projects supported by the Walloon Region, Belgium. Initiated in 2019, this call represented a funding opportunity for municipalities wishing to solve municipal problems through the implementation of smart city projects. The projects submitted by municipal policy-makers address a variety of issues and aim to

achieve different policy objectives. Our findings classify the opportunities offered by smart city policies based on the arguments and justifications provided by policy-makers prior to implementation.

The article is structured as follows. Section 2 defines the object of the analysis and presents the analytical framework based on justification theory. Section 3 outlines data and methods, whereas section 4 presents the findings. Finally, section 5 provides discussion and conclusion.

2. Interpreting digital governance and the smart city through the lenses of justification theory

The digitalization of the public space has recently had a significant impact on how cities are being perceived and governed (Rijshouwer et al., 2022). Over the last years, smart city innovations, and corresponding digitally enhanced and data-driven governance practices, have been suggested to address urban problems (Luque-Ayala and Marvin, 2015). As a result, the idea of smart city has been increasingly dominating urban governance scripts around the world (Lorquet and Pauwels, 2020; Visser, 2019). It has been introduced as a new paradigm to think of and organize the digital governance and sustainable development of urban areas (Acuto and Parnell, 2016; Viitanen and Kingston, 2014) and, in particular, to exploit ICTs for developing competitive and sustainable cities (Greco and Bencardino, 2014). The United Nations (2015) define the smart city as a city using ICTs to achieve: (1) resource efficient, safe, inclusive, and accessible urban environments; (2) economic growth based on the principles of environmental sustainability and inclusive prosperity; and (3) equal access for all to public goods and high-quality services. As such, as emphasized by Bolívar & Meijer (2016), the notion of smart city is intertwined with that of digital governance, referring here to the use of ICTs by city governments to improve the efficiency and the effectiveness of their action within different policy fields—environment, mobility, economy, urban governance, citizens empowerment, and social welfare (Appio et al., 2019; Giffinger et al., 2007; Gil-Garcia et al., 2018).

Achieving such advantages through smart city innovations is a complex transformational process that involves multiple and interconnected changes at the level of "hard" (e.g. buildings, energy grids) and

"soft" (e.g. human and social capital, urban culture) components of urban systems (Angelidou, 2014). These changes can be grouped into three main categories: technology, human resources, and governance (Meijer and Bolívar, 2016). Whereas the technological dimension brings the focus on the introduction of ICT solutions in urban systems as the key factor for smart city development (Washburn and Sindhu, 2010), the other two dimensions focus on non-technological components and emphasize that digital city governments are not a mere technological matter (Albino et al., 2015). In this respect, the adoption of a context-aware perspective is crucial for fully grasping the broader meaning of this phenomenon (Castelnovo and Sorrentino, 2018). In fact, cities require human capital to enable smart-city-related transition processes (Hollands, 2008; Shapiro, 2006), but also collaborative environments for technology to be correctly integrated and deployed in the urban environment (Torfing, 2016). The smart city concept is therefore multidimensional and consists of several features such as enhancing the quality of life, adopting ICTs in urban systems, focusing on human capital, favouring public value creation, supporting innovation, and reaching a more sustainable territory (Appio et al., 2019; Giffinger et al., 2007; Ibrahim et al., 2018; Ramaswami et al., 2016). Because of such conceptual multidimensionality, "the smart city is a somewhat nebulous idea" (Shelton et al., 2015: 13) subject to different interpretations. It is ambiguous and practitioners often see it as fuzzy, thus attributing different meanings to it (Angelidou, 2014; Anthopoulos, 2017; Kitchin, 2015; Korachi and Bounabat, 2020). Policymakers have therefore developed multiple visions of the smart city concept, ranging from a holistic view—with a broad focus encompassing sustainability and civic participation issues—to a more reductionist understanding which focuses on technological deployment (Mora et al., 2019a).

Consistently with the above-mentioned background, recent scholarship has invited researchers and practitioners to purposefully embrace the polysemic nature of the smart city concept in policy-making. Indeed, since this is a concept that policy-makers can interpret in different ways in different local contexts, it follows that there is no one-size-fits-all approach to smart city policy-making and

city governments can adaptively design and implement smart city strategies that are well-situated in their specific context (Clement and Crutzen, 2021; Nam and Pardo, 2011). These strategies can therefore reflect place-based interpretations that local governments make of their socio-economic contexts (Lu & de Jong, 2019). These interpretations are mostly rooted in a discourse of innovation and in a strong belief in technical solutions to societal problems, such as how to realize and maintain an inclusive, equal, just, and sustainable urban environment (Engelbert et al., 2019). As Esposito et al. (2021) suggest, local governments operating in well established knowledge economy environments characterized by technological as well as human capital abundancy may use smart city programs as instruments to improve civic participation and the quality of urban services. Conversely, local governments operating in less mature economic and technological contexts may use smart city projects to boost economic growth through the creation of digital business.

When it comes to grasping the multiple interpretations held by policy-makers about a given policy issue, Boltanski and Thévenot's (1991) framework has proved to be a powerful theoretical and methodological tool. The framework provides a 'grammar' enabling researchers to unpack the multiplicity of logics co-existing in a policy field (Esposito et al., 2022; Patriotta et al., 2011). Boltanski and Thévenot identify seven orders of worth ('Civic', 'Fame', 'Market', 'Industrial', 'Domestic', 'Inspired', and 'Green') that allow researchers to categorize how actors operating within a given policy domain make sense of a policy issue (Table 1).

[TABLE 1 ABOUT HERE]

We propose to use the orders of worth basis to explain how different local policy-makers make sense of the smart city concept and formulate concrete projects based on their understanding. To provide an example, justifying a smart city policy in economic terms amounts to the stance that money is a relevant measure of worth and ought to be privileged when such policies are evaluated. This is the case, as showed by Tang et al. (2019), of smart city policies designed and implemented by local governments operating in former industrial manufacturing areas transitioning into the new economy

with the ambition to become a hub for high-tech and digital businesses. Within these contexts, policy-makers may argue that economic considerations (or the 'Market' order of worth) should come first. Nevertheless, local governments operating in different socio-economic contexts may take the view that environmental concerns (or the 'Green' order of worth) and social concerns (or the 'Civic' order of worth) should be prioritized no matter what the economic cost. This is the case, for example, of governments operating in local contexts that are economically prosperous and have the ambition of using ICT-enabled innovation to improve issues such as citizens' participation and environmental sustainability of their urban environments (Esposito et al., 2021).

3. Data and methods

Empirical setting and data sample

We choose Belgium as an empirical site because it is one of the highest performing European Union countries in the area of digital policy and smart city development (European Commission, 2018). We particularly choose to study municipalities in the Wallonia region. Since 2015 the Walloon government has adopted Digital Wallonia, consisting of 23 actions in the following four areas of activity: (a) empowering digital enterprises; (b) reforming public administration; (c) strengthening the connectivity and smartness of the territory through better ICT infrastructures; (d) training the Walloon human capital to increase digital literacy. In 2018, the impact of the regional strategy was apparent with 288 smart city projects initiated across the Walloon cities (Vanmarsenille and Desdemoustier, 2018). In 2019, to further boost this positive trend, the regional government launched the call for projects related to 'Intelligent Territory', inviting municipal governments to propose smart city projects within three policy pillars: Energy and Environment, Governance and Citizenship, and Mobility and Logistics. Within the framework of this call, Walloon municipalities submitted 88 smart city projects. Geographically, these projects are distributed between the different Walloon Provinces as follows: 10% in Namur, 13% in Walloon Brabant, 21% in Luxembourg, 26% in Hainaut, and 30% in Liège. We have built our dataset on the basis of the received 88 project proposals. In order to be

properly received, local policy-makers had to fill in a form to identify the nature of their project. For the purposes of this study, the answers provided to question 46 were selected. This question asked about the societal impact expected by the policy-makers after the implementation of their smart city project. We were therefore able to analyze the argumentations that motivate the use of technology in a smart city project to respond to a public problem.

The resulting dataset is made of the following variables: project ID (integer number from 1 to 88), single project name (given by the authors within the attached document proposal), the response text inherent to the item 46, and the assigned theme (three themes were allowed in the application form: Energy and Environment, Governance and Citizenship, and Mobility and Logistics). Eight documents were scanned documents and thus unable to be efficiently pre-processed[2]. In addition, two more projects did not have answers to question 46. Thus, we ended up with a final dataset of 78 documents. Table 2 provides a description of the pre-processed data sample (for details on data pre-processing see the Appendix 1).

[TABLE 2 ABOUT HERE]

Methods and data analysis

Following the interpretivists' call for method pluralism (Bevir and Rhodes, 2021), this study employs a multi-method research design combining quantitative analysis through topic modelling with qualitative coding based on justification theory.

In the first stage, in line with Guenduez & Mettler (2022), we used machine learning to explore the hidden thematic structures across the documents. A quantitative analysis was carried out using a computer and statistical language analysis method. We used topic modelling, which represents a set of valuable tools for detecting latent themes (topics) within a collection of documents (Bishop, 2013). In particular, we made use of Latent Dirichlet Allocation (LDA)—the most common unsupervised

[2]In effect, we tried to convert the 8 scanned pdf in file format *.txt* but the loss of information was too high and thus the resulting text was not understandable.

machine learning technique providing highly interpretable topics on the basis of Bayesian algorithms and Dirichlet probability distributions (Blei, 2012). First, the algorithm has performed a lexical processing of the words used by policy makers. Then, words gathered according to their occurrence and degree of correlation and the algorithm generated different statistically relevant archetypes (Appendix 2 reports the list of the 13 topics each represented by its first most relevant twenty words). To understand the relative importance of each word for a single topic, weights-per-word are also reported[3] (for details on the topic model see the Appendix 1).

After having detected the number of topics, we analyzed the dominant topic for each document[4]. The latter unveils further insights about the relation between documents and the topic they belong to. Table 3 shows the percentage of documents (i.e., project proposals) represented by each topic with respect to the total amount of documents in the dataset (see also Appendix 3).

[TABLE 3 ABOUT HERE]

In the second stage of the analysis, a qualitative interpretation of the results of the topic model was carried out. More specifically, a second in-depth reading of the call for projects was performed to give meaning to the topics generated by the algorithm and to attach labels to each of them (topic labelling). During this stage, the 13 topics obtained through the LDA-driven quantitative analysis were used as the basis for a qualitative analysis of the project texts adopting Boltanski and Thévenot theory as interpretative framework. We coded LDA topics according to Boltanski and Thévenot's orders of worth as follows[5]: market (topics #2, #9, and #11); domestic (topics #0, #6, #8); industrial (topics #1, #7, #10, and #12); green (topics #4 and #5); civic (topic #3) (Figure 1). This made it possible to clarify and understand the different motivations and argumentations of Walloon local policy-makers and to define the justificatory arguments developed by them.

[3]As stated by Sievert & Shirley (2014: 65) relevance is a "weighted average of the logarithms of a term's probability and its lift", where *lift* is the ratio of a term's probability within a topic to its marginal probability across the corpus.

[4]For *dominant* we mean the topic with the highest probability to predict a given document. The whole table related to the dominant topics for each document is available upon request.

[5] Note that some topics have been merged due to overlapping patterns (see Appendix 1 Figure A2)

[FIGURE 1 ABOUT HERE]

4. Findings

Local policy-makers have mostly provided justifications according to the market (35%), domestic (22%), and industrial (22%) orders of worth. Green and civic justifications were less present in the material (14% and 8% respectively). Table 4 provides a sample of the most relevant quotes from the coded material exemplifying how municipal policy-makers portray their own vision of the smart city.

[TABLE 4 ABOUT HERE]

The market justification: Improving attractiveness and strengthening local development

Several municipalities base their vision of the smart city on the desire to increase economic activity in their area. Various policy-makers have indicated their willingness to mobilize new technologies to promote the local and circular economy in their territory. For example, in a project proposal, the importance of digital technologies in encouraging citizens to 'buy local' is emphasized. The smart city is seen as an engine of growth for small businesses. Strengthening local trade and short circuits allows a more sustainable development of the territory. This type of initiative gives a boost to local businesses and promotes local economic development. From a practical point of view, some of these municipalities have expressed their enthusiasm for the development of digital platforms for local commerce. These platforms encourage citizens to visit local shops by including incentives and gamification.

The domestic justification: Strengthening social links and the communal identity

According to some Walloon municipalities, local development should be achieved through smart city policies that strengthen the local fabric. Here too, digital platforms can be developed. These platforms are pointed out for their role in facilitating interactions between sport and cultural associations (on the one hand) and citizens (on the other). This type of initiative can also strengthen relations between different associations with a view to facilitating the sharing of equipment or public spaces. Overall,

policies of this type mobilize technology to make local life more dynamic, improve social cohesion, and encourage the dynamics of mutualization.

Some municipalities are aware of the complexity of the global challenges and the mobilization required of everyone to meet them. To effectively initiate a sustainable and intelligent transition and to provide answers to these challenges, they feel it is necessary to strengthen the communal identity of their territory. These municipalities see digital technologies and smart city policies as an opportunity to modernize themselves and increase the sense of belonging of their population. In concrete terms, it is possible to simplify the interaction between civil society, politicians, and public administration by setting up digital applications and platforms.

The industrial justification: Improving energy consumption, safety, mobility, and access to services

Several projects have focused on the implementation of intelligent tools to automate and optimize energy infrastructure. Policy-makers point to positive economic and environmental externalities behind these initiatives. For example, the installation of intelligent thermostatic valves on radiators in municipal buildings makes it possible to automatically turn off the heating when these spaces are unoccupied at night or on the weekends. Some devices also allow for a better understanding of the energy consumption of certain buildings and, subsequently, to raise awareness among their occupants.

In some cases, smart city policies and new technologies are highlighted for their ability to address safety issues. For example, the installation of sensors at certain strategic locations on the banks of a river, subject to occasional flooding, makes it possible to prevent flooding by sending an automatic signal to the relevant policy-makers and services. According to several municipalities, digital technologies also offer a solution to traffic jam problems. In concrete terms, a possible solution to such problems is to divide urban areas into limited-time parking zones and through an intelligent signalling system to inform car drivers of the parking time available to them.

Other municipalities have underlined problems about public service access for citizens. For example, some rural areas have a large surface area that does not allow public transport operators to offer

adequate services to the population. These municipalities find solutions to these problems in digital technology and smart city policies by setting up multimodal platforms. The idea was put forward to set up an application that would make it possible to find the appropriate mode of transport according to citizens' needs.

The green justification: Reducing CO2 emissions and the environmental footprint

Some municipalities want to fully engage in reducing the environmental impact of their community's actions by improving air quality. Digital technologies can help reduce CO2 emissions in a number of ways. For example, an app can help understand people's habits and provide personalized advice on how to reduce their environmental impact. To make this more enjoyable, serious game processes can be used. In concrete terms, it is a question of making an environmental approach attractive by setting up a system of trophies, monitoring progress, or comparing results with other users. Another type of initiative highlights the usefulness of platforms as facilitators of a local collective self-consumption dynamic. In this case, the municipality is acting to promote the co-production and consumption of sustainable energy within its territory. The application connects different residents who wish to invest in an ecological and mutualisation dynamic at the neighbourhood level.

Some municipalities focus their vision of the smart city on the contribution of digital technologies to environmental projects. Digital technologies facilitate the involvement and awareness of citizens behind projects with positive environmental impacts for their territory. Some projects aim to simplify soft mobility modes. For example, one project aimed to regenerate footpaths that, over time, have become unused. Thanks to an application, citizens can list them, and even create new routes, in order to help the municipality bring them back to life and refresh them. Citizens are directly involved in making a change by sending information to the local authority. Other projects also focused on processes to make it easier to use a bicycle for travel. These projects generate behavioural changes and involve citizens in environmentally positive actions.

The civic justification: strengthening the links between public administration and citizens

Some project proposals highlight the role of smart city policies in improving the links between public administration and citizens, such as using digital technologies to simplify communication. The use of digital tools as an interface between citizens and the administration makes the latter more accessible to the former by strengthening their relationship and improving transparency. In some municipalities, the implementation of digital and interactive notice boards was also envisaged to reduce a potential digital divide. These projects promote a direct link between the administration and the citizens, simplify administrative procedures, and promote better cohesion in the territory.

5. Discussion and conclusion

As we explain below, our findings firstly shed new light on the polysemic nature of the smart city concept showing that local governments can adaptively use smart city projects as instruments to overcome multiple place-based environmental, social, and economic problems. Secondly, our study provides policy-makers and practitioners with evidence-based categories that can help them to re-appropriate the smart city concept more easily in order to design and implement technological solutions to what they perceive as the most pressing problems of their territories and populaces.

A polysemic policy instrument to address multiple societal issues

Digitalization is seen as a tool for achieving better governance in that the use of ICTs in the public sector makes it possible to improve efficiency, quality, effectiveness, accountability, and trust (Terlizzi, 2021). However, how policy-makers perceive and make sense of these advantages in diverse contexts is a matter of empirical investigation. This article aimed at contributing to the literature on digital governance and smart cities by empirically investigating how local policy-makers (differently) portray the opportunities offered by the use of digital technologies in city governments. Consistently with recent research (Esposito et al. 2021), this article shows that smart city projects can be understood as policy instruments designed and implemented by local governments to achieve a

variety of environmental, social, and economic goals. Our findings particularly show that policy-makers justify the development of smart city projects at the municipal level on the basis of different orders of worth. The market, domestic, and industrial orders of worth are mobilized to a larger extent than green and civic orders of worth. Within the market order of worth, smart city projects are seen as instruments to boost local economic development, whereas within the domestic and industrial orders of worth these projects are respectively used to strengthen social bonds across members of the local community and to improve the efficiency of urban service provision. When smart city projects are justified based on green and civic orders of worth, policy makers tend to prioritize respectively the ecological preservation of urban environments and the collaboration between citizens and public administrations. Thus, our work provides evidence on the polysemic nature of smart city policies (cf. Béland and Cox, 2016; Cino Pagliarello, 2021). In our case, multiple interpretations of the smart city concept were facilitated by the regional design of the call for tenders as city-level policy-makers were to provide project proposals in the application form within different policy fields (energy and environment, governance and citizenship, and mobility and logistics). Adding to previous research in this area (Desdemoustier et al., 2019; Mora et al., 2019; Pam & Nardo, 2011), we argue that there is no one-size-fits-all approach to smart city development and city-level policy-makers may purposefully attribute different meanings to ICT-enabled innovations by formulating smart city policies that appeal to different orders of worth and address different societal issues.

Government-led smart city policies

Since the beginnings of the smart city movement in the early-2000s, the corporate-led approach to smart urban development has fostered a "technology-led urban utopia" (Hollands, 2015: 61) empowered by global technology providers and their ambition for profit maximization, rather than a genuine interest in improving public value (Mora et al., 2019b). In a corporate-led approach, ICTs and corporate profits are the primary driving forces shaping smart cities (Grossi and Pianezzi, 2017). Conversely, in a government-led approach the quest for public value and progress towards the

achievement of broad and widely accepted societal goals is the key driver of the innovation process (Mazzucato and Ryan-Collins, 2022). In this approach, governmental organizations at different levels provide long-term visions for innovation by crafting discourses around how technology can create and improve the public value (Mazzucato, 2017). By developing further this government-led approach to smart city development, this article has provided several government-led visions of smart city policies based on the empirical investigation of the 'Intelligent Territory' call for proposals initiated by the Walloon regional government in 2019 as part of its digital governance strategy. Based on Boltanski and Thévenot's order of worth theory, our analysis has particularly identified five justifications for smart city development.

The market and industrial justifications are dominant in our analysis, as policy-makers have often mobilized innovation discourses centred on arguments of local economic development (market) and of efficiency improvements of urban service provision (industrial). However, this is different from a corporate-led approach as the key actor is the local government shaping the business environment for local enterprises and directing urban innovation towards economic and efficiency objectives. As argued by Mazzucato and Ryan-Collins (2022: 346), markets can be "co-created by the private and public sectors, rather than being created by the former and 'fixed' by the latter". In this respect, governments can adopt a 'market-shaping' - rather than a 'market-fixing' - role and direct public policy actions in socially desirable directions.

In bringing the focus on strengthening social bonds across members of the local community, Belgian governments have also prioritized domestic justifications of smart city development. Moreover, we also found green and civic justifications prioritizing respectively environmental objectives and collaboration between citizens and city governments. The presence of the green order of worth echoes the literature showing that the smart-city policy discourse has embraced ecological considerations. However, this scholarship also shows that the ecological approach to urban development is often tokenistic and leaves aside wider environmental concerns such as climate justice and biodiversity (see

e.g., Biesaga et al., 2023). Further research is needed to deepen the study of how the environment is considered in smart-city governmental agendas.

One should not forget that digital governance refers to the use of ICTs "to help government to strengthen interactions with citizens and societal actors to solve societal problems collectively" (Meijer, 2015: 199). Therefore, the smart city innovation projects presented in this paper can be broadly seen as digital governance initiatives which, based on our findings, local governments can introduce with different objectives in mind: either to boost local economic development (market) and to improve the effectiveness of urban service provision (industrial) or to strengthen social bonds across members of the local community (domestic) as well as to promote the ecological preservation of urban environments (green) and the collaboration between citizens and public administrations (civic). Overall, by unpacking the variety of smart city policy visions that are shaped within municipal jurisdictions, this paper supports the idea that there is no one-size-fits-all approach to digital governance policies as governmental administrations can actively attribute their own meaning to these policies by approaching technology as a means to solve different societal problems—rather than an end *per se*.

We are aware of the limitations of our study as our results are based on project proposals prior to their implementation. This means that we are not able to claim whether the smart city projects we have analysed have effectively achieved the societal objectives stated in the proposal texts. We are not able to say to what extent the smart city projects proposed by municipal governments are effectively aligned with and reflect the ambitions of local needs. To achieve this, more in-depth and process-tracing research is needed in order to unpack how governmental actors (e.g. elected officials, government bureaucrats, and civil servants) develop smart city policy visions in conjunction with citizens. It would be important to understand the formation of networks of public, private, and civic actors, and the process through which they develop relational ties with a view to develop a truly bottom-up smart city program that sustains social change and promotes the public interest.

References

Acuto M and Parnell S (2016) Leave no city behind. *Science* 352(6288). American Association for the Advancement of Science: 873–873. DOI: 10.1126/science.aag1385.

Albino V, Berardi U and Dangelico RM (2015) Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology* 22(1): 3–21. DOI: 10.1080/10630732.2014.942092.

Angelidou M (2014) Smart city policies: A spatial approach. *Cities* 41: S3–S11. DOI: 10.1016/j.cities.2014.06.007.

Anthopoulos L (2017) Smart utopia VS smart reality: Learning by experience from 10 smart city cases. *Cities* 63: 128–148. DOI: 10.1016/j.cities.2016.10.005.

Appio FP, Lima M and Paroutis S (2019) Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting and Social Change* 142: 1–14. DOI: 10.1016/j.techfore.2018.12.018.

Barcevičius E, Cibaitė G, Codagnone C, et al. (2019) *Exploring Digital Government Transformation in the EU - Analysis of the State of the Art and Review of Literature*. Luxembourg: Publications Office of the European Union. DOI: 10.2760/17207.

Béland D and Cox RH (2016) Ideas as Coalition Magnets: Coalition Building, Policy Entrepreneurs, and Power Relations. *Journal of European Public Policy* 23(3): 428–445. DOI: 10.1080/13501763.2015.1115533.

Bevir M and Rhodes RAW (2021) All you need is … a network: the rise of interpretive public administration. *Public Administration*. DOI: 10.1111/padm.12817.

Biesaga M, Domaradzka A, Roszczyńska-Kurasińska M, et al. (2023) The effect of the pandemic on European narratives on smart cities and surveillance. *Urban Studies*: 1–21. DOI: 10.1177/00420980221138317.

Bishop CM (2013) *Pattern Recognition and Machine Learning*. New York: Springer.

Björklund F (2016) E-government and moral citizenship: the case of Estonia. *Citizenship Studies* 20(6–7): 914–931. DOI: 10.1080/13621025.2016.1213222.

Blei DM (2012) Probabilistic topic models. *Communications of the ACM* 55(4): 77–84. DOI: 10.1145/2133806.2133826.

Bolívar MPR and Meijer AJ (2016) Smart Governance: Using a Literature Review and Empirical Analysis to Build a Research Model. *Social Science Computer Review* 34(6): 673–692. DOI: 10.1177/0894439315611088.

Boltanski L and Thévenot L (1991) *De La Justification. Les Economies de La Grandeur*. Paris: Gallimard.

Bovaird T (2003) E-government and e-governance: Organisational implications, options and dilemmas. *Public Policy and Administration* 18(2): 37–56.

Castelnovo W and Sorrentino M (2018) The digital government imperative: a context-aware perspective. *Public Management Review* 20(5): 709–725. DOI: 10.1080/14719037.2017.1305693.

Cino Pagliarello M (2021) Unpacking ambiguity in ideational change: the polysemy of the 'Europe of Knowledge'. *West European Politics* 0(0): 1–22. DOI: 10.1080/01402382.2021.1918429.

Clement J and Crutzen PN (2021) How Local Policy Priorities Set the Smart City Agenda. *Technological Forecasting and Social Change* 171: 120985. DOI: 10.1016/j.techfore.2021.120985.

Crivello S (2015) Urban Policy Mobilities: The Case of Turin as a Smart City. *European Planning Studies* 23(5): 909–921. DOI: 10.1080/09654313.2014.891568.

Csukás MS and Szabó RZ (2021) The many faces of the smart city: Differing value propositions in the activity portfolios of nine cities. *Cities* 112: 103116. DOI: 10.1016/j.cities.2021.103116.

Dawes SS (2008) The Evolution and Continuing Challenges of E-Governance. *Public Administration Review* 68(8): S86–S102. DOI: 10.1111/j.1540-6210.2008.00981.x.

Desdemoustier J, Crutzen N and Giffinger R (2019) Municipalities' understanding of the Smart

City concept: An exploratory analysis in Belgium. *Technological Forecasting and Social Change* 142: 129–141. DOI: 10.1016/j.techfore.2018.10.029.

Di Giulio M and Vecchi G (2021) Implementing digitalization in the public sector. Technologies, agency, and governance. *Public Policy and Administration*: 1–25. DOI: 10.1177/09520767211023283.

Engelbert J, van Zoonen L and Hirzalla F (2019) Excluding citizens from the European smart city: The discourse practices of pursuing and granting smartness. *Technological Forecasting and Social Change* 142: 347–353. DOI: 10.1016/j.techfore.2018.08.020.

Esposito G, Clement J, Mora L, et al. (2021) One size does not fit all: Framing smart city policy narratives within regional socio-economic contexts in Brussels and Wallonia. *Cities* 118: 1–14. DOI: 10.1016/j.cities.2021.103329.

Esposito G, Terlizzi A and Crutzen N (2022) Policy narratives and megaprojects: the case of the Lyon-Turin high-speed railway. *Public Management Review* 24(1): 55–79. DOI: 10.1080/14719037.2020.1795230.

European Commission (2018) *Digital Economy and Society Index (DESI), 2018 Country Report Belgium*. Luxembourg: Publications Office of the European Union.

Giffinger R, Fertner C, Kramar H, et al. (2007) City-ranking of European Medium-Sized Cities. *Konferenzhomepage: www.ifhp2007copenhagen.dk, Kopenhagen, Dänemark, EU*. Available at: http://hdl.handle.net/20.500.12708/103386 (accessed 31 August 2021).

Gil-Garcia JR, Dawes SS and Pardo TA (2018) Digital government and public management research: finding the crossroads. *Public Management Review* 20(5): 633–646. DOI: 10.1080/14719037.2017.1327181.

Greco I and Bencardino M (2014) The Paradigm of the Modern City: SMART and SENSEable Cities for Smart, Inclusive and Sustainable Growth. In: Murgante B, Misra S, Rocha AMAC, et al. (eds) *Computational Science and Its Applications – ICCSA 2014*. Cham: Springer, pp. 579–597. DOI: 10.1007/978-3-319-09129-7_42.

Grossi G and Pianezzi D (2017) Smart cities: Utopia or neoliberal ideology? *Cities* 69: 79–85. DOI: 10.1016/j.cities.2017.07.012.

Guenduez AA and Mettler T (2023) Strategically constructed narratives on artificial intelligence: What stories are told in governmental artificial intelligence policies? *Government Information Quarterly* 40(1): 101719. DOI: 10.1016/j.giq.2022.101719.

Heeks R and Bailur S (2007) Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government Information Quarterly* 24(2): 243–265. DOI: 10.1016/j.giq.2006.06.005.

Hollands RG (2008) Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City* 12(3): 303–320. DOI: 10.1080/13604810802479126.

Hollands RG (2015) Critical interventions into the corporate smart city. *Cambridge Journal of Regions, Economy and Society* 8(1): 61–77. DOI: 10.1093/cjres/rsu011.

Homburg V (2018) ICT, E-Government and E-Governance Bits & Bytes for Public Administration. In: Ongaro E and Thiel S van (eds) *The Palgrave Handbook of Public Administration and Management in Europe*. London: Palgrave Macmillan.

Ibrahim M, El-Zaart A and Adams C (2018) Smart sustainable cities roadmap: Readiness for transformation towards urban sustainability. *Sustainable Cities and Society* 37: 530–540. DOI: 10.1016/j.scs.2017.10.008.

Kitchin R (2015) Making sense of smart cities: addressing present shortcomings. *Cambridge Journal of Regions, Economy and Society* 8(1): 131–136. DOI: 10.1093/cjres/rsu027.

Korachi Z and Bounabat B (2020) Towards a Frame of Reference for Smart City Strategy Development and Governance. *Journal of Computer Science* 16(10): 1451–1464. DOI: 10.3844/jcssp.2020.1451.1464.

Lorquet A and Pauwels L (2020) Interrogating urban projections in audio-visual 'smart city' narratives. *Cities* 100: 102660. DOI: 10.1016/j.cities.2020.102660.

Lu H and de Jong M (2019) Evolution in city branding practices in China's Pearl River Delta since

the year 2000. *Cities* 89: 154–166. DOI: 10.1016/j.cities.2019.01.026.

Luque-Ayala A and Marvin S (2015) Developing a critical understanding of smart urbanism? *Urban Studies* 52(12): 2105–2116. DOI: 10.1177/0042098015577319.

Manny L, Duygan M, Fischer M, et al. (2021) Barriers to the digital transformation of infrastructure sectors. *Policy Sciences*: 1–41. DOI: 10.1007/s11077-021-09438-y.

Meijer A (2015) E-governance innovation: Barriers and strategies. *Government Information Quarterly* 32(2): 198–206. DOI: 10.1016/j.giq.2015.01.001.

Meijer A and Bolívar MPR (2016) Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences* 82(2): 392–408. DOI: 10.1177/0020852314564308.

Meijer A, Bolivar MPR and Gil-Garcia JR (2018) From E-Government to Digital Era Governance and Beyond: Lessons from 15 Years of Research into Information and Communications Technology in the Public Sector. *Journal of Public Administration Research and Theory*: 1–6.

Mazzucato M (2017) Mission-Oriented Innovation Policy: Challanges and Opportunities. *UCL Institute for Innovation and Pubic Purpose*: 1–39.

Mazzucato M (2018) Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change* 27(5): 803–815. DOI: 10.1093/icc/dty034.

Mazzucato M and Ryan-Collins J (2022) Putting value creation back into "public value": from market-fixing to market-shaping. *Journal of Economic Policy Reform* 25(4). Routledge: 345–360. DOI: 10.1080/17487870.2022.2053537.

Mora L, Deakin M and Reid A (2019a) Combining co-citation clustering and text-based analysis to reveal the main development paths of smart cities. *Technological Forecasting and Social Change* 142: 56–69. DOI: 10.1016/j.techfore.2018.07.019.

Mora L, Deakin M and Reid A (2019b) Strategic principles for smart city development: A multiple case study analysis of European best practices. *Technological Forecasting and Social Change* 142: 70–97. DOI: 10.1016/j.techfore.2018.07.035.

Nam T and Pardo TA (2011) Smart city as urban innovation: Focusing on Management, Policy, and Context. In: *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance - ICEGOV '11*, New York, New York, USA, 2011, p. 185. ACM Press. DOI: 10.1145/2072069.2072100.

OECD (2003) *The E-Government Imperative*. Paris: OECD e-Government Studies, OECD Publishing.

Patriotta G, Gond J and Schultz F (2011) Maintaining legitimacy: controversies, orders of worth, and public justifications. *Journal of Management Studies* 48(8): 1804–1836.

Ramaswami A, Russell AG, Culligan PJ, et al. (2016) Meta-principles for developing smart, sustainable, and healthy cities. *Science* 352(6288): 940–943. DOI: 10.1126/science.aaf7160.

Rijshouwer EA, Leclercq EM and van Zoonen L (2022) Public views of the smart city: Towards the construction of a social problem. *Big Data & Society* 9(1): 1–12. DOI: 10.1177/20539517211072190.

Shapiro JM (2006) Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital. *Review of Economics and Statistics* 88(2): 324–335. DOI: 10.1162/rest.88.2.324.

Shelton T, Zook M and Wiig A (2015) The 'actually existing smart city'. *Cambridge Journal of Regions, Economy and Society* 8(1): 13–25. DOI: 10.1093/cjres/rsu026.

Sievert C and Shirley K (2014) LDAvis: A method for visualizing and interpreting topics. In: *Proceedings of the Workshop on Interactive Language Learning, Visualization, and Interfaces*, Stroudsburg, PA, USA, 2014, pp. 63–70. DOI: 10.3115/v1/W14-3110.

Söderström O, Paasche T and Klauser F (2014) Smart cities as corporate storytelling. *City* 18(3): 307–320. DOI: 10.1080/13604813.2014.906716.

Tang Z, Jayakar K, Feng X, et al. (2019) Identifying smart city archetypes from the bottom up: A content analysis of municipal plans. *Telecommunications Policy* 43(10): 101834. DOI: 10.1016/j.telpol.2019.101834.

Terlizzi A (2021) The digitalization of the public sector: A systematic literature review. *Rivista*

Italiana di Politiche Pubbliche / Italian Journal of Public Policy 16(1): 5–38. DOI: 10.1483/100372.

Torfing J (2016) *Collaborative Innovation in the Public Sector*. Washington, DC: Georgetown University Press.

Townsend AM (2013) *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*. New York: WW Norton & Company.

United Nations (ed.) (2015) *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations; A/RES/70/1.

United Nations (2022) *E-Government Survey 2022: The Future of Digital Government* (UUN United Nations (2022) E-Government Survey 2022: The Future of Digital Government. New York, New Yorked.). New York, New York, USA: United Nations.

Vanmarsenille DB and Desdemoustier J (2018) *Baromètre 2018 - Stratégie et Projets Smart City En Blegique*. Liège: Research Report, Smart City Institute.

Viitanen J and Kingston R (2014) Smart Cities and Green Growth: Outsourcing Democratic and Environmental Resilience to the Global Technology Sector. *Environment and Planning A: Economy and Space* 46(4): 803–819. DOI: 10.1068/a46242.

Visser R (2019) Posthuman policies for creative, smart, eco-cities? Case studies from China. *Environment and Planning A: Economy and Space* 51(1): 206–225. DOI: 10.1177/0308518X18765481.

Washburn D and Sindhu U (2010) Helping CIOs Understand 'Smart City' Initiatives. *Smart City* 17.

World Bank (2002) *The E-Government Handbook for Developing Countries*. Washington, D. C.: World Bank.

Table 1. Description of Boltanski & Thévenot's orders of worth

Orders of worth	Description of orders of worth
Inspired	The realm of creativity and 'art'. In this order of worth, what is most valued is that which is passionate, emergent, spontaneous, and inspired. The creative journey, with its ups and downs, its moments of elation, and its subsequent feelings of doubt and suffering, is what life 'is all about': an adventure, an endless horizon of mystery, and a discovery. The journey is the end, not the means. Moments of 'genius' are unpredictable and unexpected: They appear in flashes and sparks. Actors in this order of worth are repulsed by habit and shun routines. They dream, imagine, take risks, and 'live'.
Domestic	The realm of the 'family' in its symbolic sense. In this order of worth, what is valued is that which is firm, loyal, selfless, and trustworthy. Hierarchy and tradition play central roles. Superiors are informed and wise and must care and nurture those who are lower in the hierarchy. Great importance is attached to one's upbringing, as upbringing and good manners reflect where one 'comes from'. The priority of actors in this order of worth is on preserving, protecting, and nurturing the unit (family, guild, group, etc.) to which one belongs, as without this unit, one is nothing.
Fame	The realm of fame and popularity. In this order of worth, what is valued is that which is visible, famous, influential, fashionable, and recognized. The worth of actors is determined by the opinion of others. To be banal, unknown, or forgotten is shameful. An 'undiscovered' genius is a contradiction, as a genius cannot be genial if not known. All means for achieving fame and recognition are sought after and legitimate.
Civic	The realm of duty and solidarity. In this order of worth, what is valued is that which is united, representative, legal, official, and free. Individuals in this order of worth accede to worth by freely joining and being part of a collective, their individual will be subordinated to the general will, that which seeks the common good, the good of all. Leaders are elected and valued because they represent the aspirations of the masses. To place individual interests ahead of collective interests is anathema in this order of worth. One for all, and all for one.
Market	The realm of money and the market. In this order of worth, what is valued is rare, expensive, valuable, and profitable. The law of the market prevails, and actors deemed worthy are those who know how to take advantage of it and reap its rewards (e.g., wealth). Wealth is an end, and individuals with dignity in this order of worth are 'detached from the chains of belonging and liberated from the weight of hierarchies'. This gives them the ability to judge market opportunities objectively, unemotionally, and thus 'win'.
Industrial	The realm of measures and efficiency. In this order of worth, what is valued is precise, functional, professional, productive, efficient, and useful. An order of worth where technological objects and scientific methods take centre stage. Optimization and progress are noble pursuits. All forms of 'waste' are frowned upon. Actors in this world are professional, hardworking, focused, and thorough. Perfection is to be found in the optimally functioning system (whether mechanical, technological, or human).
Green	The realm of nature. In this order of worth what is valued is natural, sustainable, ecological, and environmental-friendly. An order of worth where nature is respected, environmental conservation is considered to advance the general good of humanity, and biodiversity is preserved, without the need to find social or economic functionality. Worthy objects are ecosystems and worthy subjects fit their way of life to the objectives of nature conservation.

Source: Cloutier and Langley (2013); Lafaye and Thévenot (1993)

Table 2. Description of the data sample

	Max (per document)	**Mean**	**Std. Dev**	***Tot***
Tokens[6]	211	32.03	31.80	2,498

#	**Theme**	**Number of documents**
1	Governance and Citizenship	35
2	Mobility and Logistic	22
3	Energy and environment	21
	Missing	10
	Tot	**78**

Table 3. Topic relevance with respect the full data sample

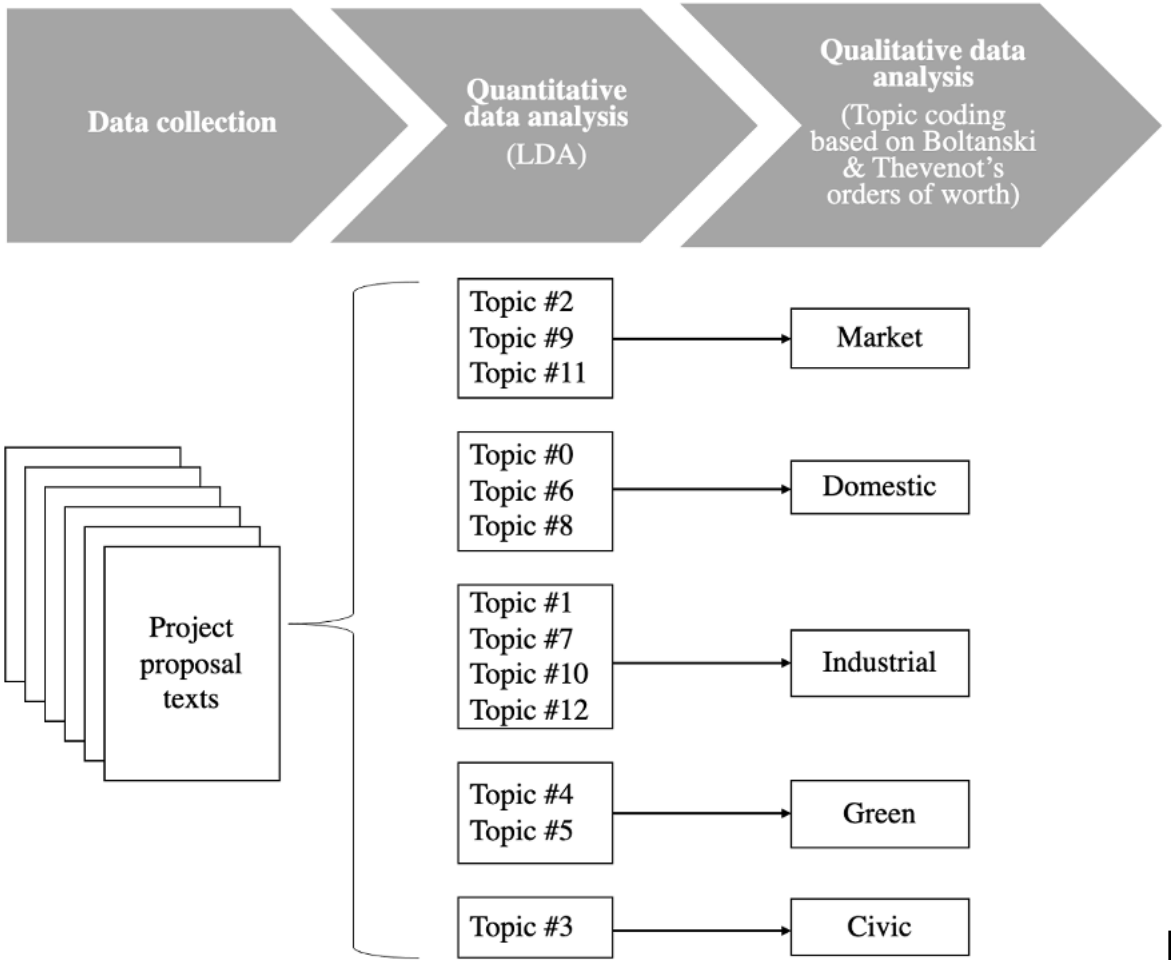
Topics ID	**Abs. Freq.**	**Rel. Freq.**
11	16	21%
0	11	14%
9	8	10%
5	7	9%
3	6	8%
10	5	6%
12	5	6%
1	4	5%
4	4	5%
2	3	4%
6	3	4%
7	3	4%
8	3	4%
Total	**78**	**100%**

[6] Tokenization is the process of splitting each text into a set of sentences and sentences into a set of words, the so called "word-tokens". In natural language processing, tokens are hence the minimal lexical unit of a sentence.

Table 4. Orders of worth: Sample quotes

Orders of worth	**Quotes**
Market	*Buying local is a real societal challenge […]. In this perspective, digital technologies are perceived as a facilitator in the daily life of citizens, but also as a real engine of growth for small businesses* (Doc. #12) *The objective is to […] provide an easy-to-use technology that convinces people to buy local* (Doc. #46)
Domestic	*[The smart city represents] a general evolution [that places] the citizen at the heart of the commune* (Doc. #38) *[The projects would] make it possible to rebuild a town where citizens (and families) want to live (as a brake on the rural exodus)* (Doc. #64)
Industrial	*[Smart city projects] will reduce the communal energy consumption and will make the users aware of their energy management* (Doc. #9) *30% of vehicles circulating in the city centre are looking for a parking space. This generates a lot of traffic. An innovative parking solution could reduce this traffic and thus make our city more pleasant for all its users* (Doc. #2)
Green	*The project will contribute to a better management of the territory and its resources. It can be replicated on other territories […] and can become a reference tool to encourage or reinforce environmental policies* (Doc. #47) *The project contributes to the implementation of a sustainable mobility, allowing to meet the climatic and environmental stakes* (Doc. #45)
Civic	*[The project] improves the trust between citizens and public institutions* (Doc. # 34) *[The project] improves proximity [of public administration] to the citizen* (Doc. #30)

Figure 1. Research design



Appendix 1: Data and methods

Data sample

The set of documents was preprocessed according to the following steps:

1. Text normalization and punctuation removal. Exclusion of words made of less than 3 characters.
2. Stop words removal[7].
3. N-grams detection: we checked for bigrams occurrences in order to find sequences of two contiguous elements from a string of tokens (words). All the tools needed for these tasks were taken from the Gensim-python framework (Rehurek and Sojka, 2011) [8].
4. Lemmatization using the pos_tagger pipeline of *Stanza*, the Natural Language Processing provided by the Stanford University NLP group (Manning *et al*., 2014; Peng *et al*., 2020). We only used Noun, Adjective and Verbs PoS tags, that is to say the most relevant tags for topic detection.
5. Exclusion of hapax legomena (words with absolute frequency in the corpus equal to 1)

The topic model

The idea underlying the theoretical framework of the LDA is that each topic is represented as a probability distribution over words in the given vocabulary, while each document (*d*) is thought as a probability distribution over a given number of (latent) topics (*K*): the LDA is thus a generative model meaning that each document is generated by words and latent topics through a Bayesian process (Blei et al., 2003; Blei, 2012).

[7] Stop words were extended to other irrelevant words as for instance : *plus, autre, autres, ainsi, aussi, aussitôt, tout, tous, toutes, autant, plusieurs, tôt, avoir, être, lequel, laquelle, depuis, cet, cette, celui, celle, ceci, celle, ci, donc, comme, meilleure, via, tous, leurs, amélioration, important, importante, vers, entre, travers, ensemble, vise, visant, notamment, également, application, mettre, permettre, projet, projets, grâce, place, mener, faire, nouveau.* This task, to be thought iteratively, is generally recommended for the fine tuning of the hyperparameters used by the Topic model and described in the next section.

[8] We used the gensim library "simple-preprocess" module for a fast implementation of text normalization, tokenization and stopwords removal, while we used the sub-library Phrases (from the genism models) for bigrams detection; given the small length of text responses, we chose not to look for trigrams.

In particular, as briefly depicted also in Pröllochs and Feuerriegel (2020), the algorithm starts modeling each document *d* with a random variable $\theta_d \in R^K$ from the Dirichlet distribution given by $\theta_d \sim Dir(\alpha)$, where θ_d is the relative proportion of the *K* topics in the document *d*. Then the process draws a random variable $\varphi_k \sim Dir(\beta)$ for each of the *K* topics: accordingly, this step shapes the distribution of *W* terms within the *k*-topic, $k \in K$.

Finally, to detect the probability that a word $w \in W$ belongs to a given topic, the process models for each word a topic random variable $z_w \sim Mult(\theta_d)$ from a multinomial distribution with the relative proportion of the *K* topics within the *d*-document (i.e., θ_d) as a prior and an estimated (scaled) word frequency within each topic $tf_w \sim Mult(\varphi_{z_w})$ from the multinomial distribution.

The model equation is thus the following:

$$P(\theta, \beta, tf, z) = \prod_{d=1}^{|D|} P(\theta_d|\alpha) \prod_{k=1}^{K} P(\varphi_k|\beta) \prod_t P(z_w^d|\theta_d)\, P(tf_w^d|z_w^d). \qquad (1)$$

where it is possible to notice that the bulk of the LDA algorithm consists in the estimations of the parameters φ and θ, i.e., the posterior probabilities of words within each topic (word per topic distribution) and topics relative proportions (topics per document distribution) respectively[9]. Both the parameters are controlled by the Dirichlet priors, or *hyperparameters*, α and β for which we used the default values as described in Blei et al. (2003)[10]. Moreover, given that a fundamental hypothesis of the LDA algorithm is the number of the inferred topics (*K*), consistent with previous researches (Tijare and Rani, 2020; Matsui *et al.*, 2021) we chose the value for which the topic coherence[11], a reliable measure used to determine the readability/interpretability of topics (Newman *et al.*, 2010;

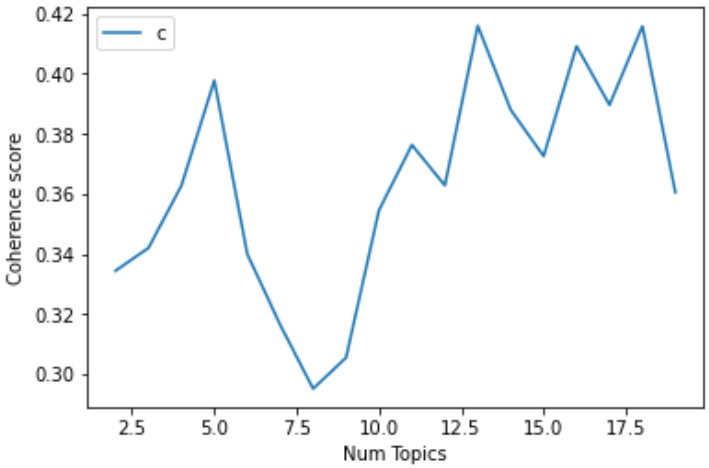
[9] It is worth mentioning that the variational expectation maximation technique (Steyvers and Griffiths, 2007) is used to make the Eq. 1 tractable which is generally not.

[10] In the gensim framework for topic modeling, the default values for alpha and beta are "symmetric". This choice is very consistent whit the related literature (Carron-Arthur et al., 2016; Székely and vom Brocke, 2017; Pröllochs and Feuerriegel, 2020)

[11] There are many coherence measures in the related literature, their main task is to measure how interpretable the topics are to humans. In particular, for this work we used the most common C_v measure, a score for words similarity based on the normalized pointwise mutual information (NPMI) and the cosine similarity (M'sik and Casablanca, 2020).

Mimno *et al*. 2011), is maximized. In Figure A1 the graph shows that for a number of topics equal to 13 the coherence value reaches its maximum with no further and meaningful increments[12].

Figure A1. Coherence value and number of topics



To give evidence for topics specificity (i.e., the absence of overlapping topics), a distance-graph (via multidimensional scaling) (Sievert and Shirley, 2014) showing highly distanced topics (with only three exceptions for topics nr. 4, 9 and 11) is provided in Figure A2[13].

[12] We also checked for the *log-perplexity* scores, which is a measure of how well a probability model predicts a sample, thus confirming the results given by the topic coherence curve. In particular, this is why we chose to discard an optimal number of topics equal to 5 as illustrated by the first local maximum in Fig.2: *log_perplexity* measure, which conversely needs to be minimized with respect to the optimal number of topics, is too high at this value.

[13] There are obviously other models than the LDA for topic analysis but this is still the one gives the most interpretable results compared to other algorithms. This being said, we also checked initially for the Hierarchical Dirichlet Process (HDP) from the genism python library yielding very similar results to those of the LDA (for the sake of brevity HDP results are available upon request).

Figure A2. Distance Graph via multidimensional scaling[14]

[14] However, the purpose of the Figure A2 is merely illustrative. For the sake of clarity and with respect only to the overlapping topics: Topics 1, 2 and 6 in Figure A2 correspond to Topics 9, 11 and 4 in Table 3 (main text) respectively.

Appendix 2: Words-for-topic distribution

Topic #	weighted words (top 20)
0	'0.039*"citoyen" + 0.023*"vélo" + 0.020*"commun" + 0.014*"pouvoir" + ' '0.011*"donner" + 0.011*"communal" + 0.011*"lieu" + 0.011*"acteur" + ' '0.011*"déplacement" + 0.011*"combiner" + 0.011*"impliquer" + ' '0.009*"proposer" + 0.009*"inscrire" + 0.009*"devoir" + 0.009*"action" + ' '0.009*"participation" + 0.009*"centre" + 0.009*"cyclable" + ' '0.009*"création" + 0.009*"bus"'
1	'0.038*"énergie" + 0.027*"énergétique" + 0.022*"consommation" + ' '0.022*"gestion" + 0.018*"effet" + 0.018*"citoyen" + 0.017*"social" + ' '0.017*"cohésion" + 0.017*"dimension" + 0.017*"collectif" + 0.012*"réduire" ' '+ 0.011*"impact_sociétal" + 0.011*"rural" + 0.011*"touristique" + ' '0.011*"accueil" + 0.011*"solution" + 0.011*"diminuer" + 0.011*"lutte" + ' '0.011*"vert" + 0.011*"émergence"'
2	'0.058*"pouvoir" + 0.024*"centre_ville" + 0.024*"économie" + 0.024*"mesurer" ' '+ 0.024*"budget" + 0.023*"qualité" + 0.023*"air" + 0.023*"attractivité" + ' '0.012*"stationnement" + 0.012*"ville" + 0.012*"véhicule" + 0.012*"achat" + ' '0.012*"sein" + 0.012*"accessible" + 0.012*"question" + 0.012*"diminution" + ' '0.012*"impact_sociétal" + 0.012*"améliorer" + 0.012*"bénéficier" + ' '0.012*"commerce"'),
3	'0.034*"accès" + 0.033*"réduire" + 0.029*"information" + 0.023*"améliorer" + ' '0.021*"public" + 0.018*"donnée" + 0.018*"utiliser" + 0.018*"exemple" + ' '0.017*"stimuler" + 0.017*"générer" + 0.017*"citoyen" + 0.015*"contribuer" + ' '0.014*"numérique" + 0.013*"temps" + 0.012*"gratuit" + 0.012*"wifi" + ' '0.012*"internet" + 0.012*"pratique" + 0.012*"utile" + 0.012*"aller"'
4	'0.027*"mobilité" + 0.021*"citoyen" + 0.019*"mode" + 0.019*"personne" + ' '0.019*"véhicule" + 0.018*"émission" + 0.018*"environnement" + 0.014*"local" ' '+ 0.014*"envisager" + 0.014*"électrique" + 0.014*"service" + ' '0.014*"économie" + 0.013*"société" + 0.012*"plateforme" + 0.012*"impact" + ' '0.010*"sécurité" + 0.010*"politique" + 0.009*"pouvoir" + 0.009*"jeune" + ' '0.009*"privé"'
5	'0.053*"citoyen" + 0.022*"offrir" + 0.022*"valider" + 0.022*"contenir" + ' '0.022*"briser" + 0.022*"institutionnel" + 0.022*"écologique" + ' '0.022*"empreinte" + 0.022*"aller" + 0.021*"administration" + ' '0.021*"décision" + 0.021*"communal" + 0.020*"outil" + 0.019*"prendre" + ' '0.016*"commun" + 0.011*"démarche" + 0.011*"réduire" + 0.011*"matière" + ' '0.011*"proposer" + 0.011*"pouvoir"'
6	'0.029*"pouvoir" + 0.022*"outil" + 0.022*"participation_citoyenne" + ' '0.022*"citoyen" + 0.022*"erp" + 0.022*"demande" + 0.022*"processus" + ' '0.015*"territoire" + 0.015*"local" + 0.015*"contribuer" + 0.015*"devenir" + ' '0.015*"lien" + 0.015*"aisé" + 0.015*"politique" + 0.015*"communal" + '

	'0.015*"système" + 0.015*"titre" + 0.015*"suivre" + 0.015*"évolution" + ' '0.008*"gestion"'
7	'0.050*"positif" + 0.038*"impact" + 0.038*"réduction" + 0.026*"commerce" + ' '0.026*"logement" + 0.026*"consommation" + 0.026*"intervention" + ' '0.013*"économique" + 0.013*"citoyen" + 0.013*"sécurité" + 0.013*"inoccuper" ' '+ 0.013*"offrir" + 0.013*"gestion" + 0.013*"relever" + 0.013*"énergétique" ' '+ 0.013*"santé" + 0.013*"commerçant" + 0.013*"complet" + 0.013*"rue" + ' '0.013*"publicitaire"'
8	'0.048*"citoyen" + 0.022*"réel" + 0.022*"vie" + 0.015*"centre_ville" + ' '0.015*"défi" + 0.015*"rural" + 0.015*"cru" + 0.015*"éclairage" + ' '0.015*"démarche" + 0.015*"essentiel" + 0.015*"voir" + 0.015*"voirie" + ' '0.015*"répondre" + 0.015*"sécurité" + 0.015*"besoin" + 0.015*"inscrire" + ' '0.014*"proximité" + 0.013*"communal" + 0.013*"commun" + ' '0.013*"information"'
9	'0.052*"territoire" + 0.017*"pouvoir" + 0.016*"citoyen" + 0.015*"local" + ' '0.014*"numérique" + 0.014*"économique" + 0.012*"politique" + 0.012*"zone" + ' '0.011*"donnée" + 0.010*"devoir" + 0.010*"mesure" + 0.010*"entreprise" + ' '0.010*"petit" + 0.008*"enjeu" + 0.008*"initiative" + 0.008*"souhaiter" + ' '0.008*"population" + 0.008*"répondre" + 0.008*"région" + ' '0.008*"connectivité"'
10	'0.037*"citoyen" + 0.027*"solution" + 0.025*"trafic" + 0.025*"parking" + ' '0.020*"commun" + 0.018*"ville" + 0.018*"stationnement" + 0.018*"vie" + ' '0.015*"pouvoir" + 0.014*"navette" + 0.014*"personne" + ' '0.012*"impact_sociétal" + 0.012*"local" + 0.011*"terme" + 0.011*"gestion" + ' '0.011*"utilisation" + 0.011*"utiliser" + 0.009*"service" + 0.008*"effet" + ' '0.008*"grand"'
11	'0.057*"citoyen" + 0.020*"pouvoir" + 0.018*"impact" + 0.016*"local" + ' '0.016*"eau" + 0.014*"impliquer" + 0.013*"service" + 0.013*"information" + ' '0.012*"mobilité" + 0.012*"objectif" + 0.010*"effet" + ' '0.010*"impact_sociétal" + 0.010*"commune" + 0.010*"énergie" + ' '0.009*"politique" + 0.008*"commun" + 0.008*"communal" + 0.008*"ville" + ' '0.008*"réseau" + 0.008*"but"'
12	'0.031*"citoyen" + 0.021*"service" + 0.015*"usager" + 0.013*"outil" + ' '0.013*"pouvoir" + 0.013*"borne" + 0.013*"centre" + 0.013*"impact" + ' '0.013*"politique" + 0.010*"prendre" + 0.009*"commun" + 0.009*"proposer" + ' '0.009*"financier" + 0.009*"niveau" + 0.009*"meux" + 0.009*"diner" + ' '0.009*"communication" + 0.009*"innovant" + 0.009*"bord" + 0.009*"objectif"'

Appendix 3: List of documents

Document number (project porposal)	Dominant Topic
0	2
1	3
2	10
3	4
4	3
5	1
6	8
7	0
8	0
9	1
10	7
11	0
12	9
13	11
14	12
15	12
16	0
17	9
18	2
19	9
20	12
21	6
22	4
23	9
24	0
25	12
26	2
27	12
28	11
29	5
30	3
31	4
32	11
33	11
34	3
35	5
36	10
37	10
38	0
39	11
40	3
41	0
42	11

43	5
44	11
45	9
46	11
47	6
48	10
49	11
50	10
51	0
52	5
53	9
54	0
55	0
56	11
57	7
58	11
59	5
60	11
61	8
62	0
63	5
64	8
65	4
66	1
67	7
68	11
69	11
70	6
71	9
72	3
73	5
74	11
75	1
76	11
77	9

References

Blei, D. M, Probabilistic topic models, Communications of the ACM 55 (2012), 77-84

Blei, D. M., Ng A. Y., M. I. Jordan, Latent dirichlet allocation, The Journal of Machine Learning Research 3 (2003) 993–1022.

Carron-Arthur, B., Reynolds, J., Bennett, K. et al. What's all the talk about? Topic modelling in a mental health Internet support group. BMC Psychiatry 16, 367 (2016). https://doi.org/10.1186/s12888-016-1073-5

M'sik, B., & Casablanca, B. M. (2020). Topic modeling coherence: A comparative study between lda and nmf models using covid'19 corpus. International Journal, 9(4).

Manning, Christopher D., Mihai Surdeanu, John Bauer, Jenny Finkel, Steven J. Bethard, and David McClosky. 2014. The Stanford CoreNLP Natural Language Processing Toolkit In Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics: System Demonstrations, pp. 55-60.

Matsui, A., Chen, E., Wang, Y., & Ferrara, E. (2021). The impact of peer review on the contribution potential of scientific papers. PeerJ, 9, e11999.

Mimno, D, Wallach, HM, Talley, E, Leenders, M, McCallum, A. Optimizing semantic coherence in topic models. In: Proceedings of the conference on empirical methods in natural language processing. Stroudsburg, PA: Association for Computational Linguistics, 2011, pp. 262–272.

Newman, D, Lau, JH, Grieser, K, Baldwin, T. Automatic evaluation of topic coherence. In: Human language technologies: The 2010 annual conference of the North American Chapter of the Association for Computational Linguistics, 2010, pp. 100–108.

Peng Qi, Yuhao Zhang, Yuhui Zhang, Jason Bolton and Christopher D. Manning. 2020. Stanza: A Python Natural Language Processing Toolkit for Many Human Languages. In Association for Computational Linguistics (ACL) System Demonstrations. 2020

Pröllochs, N., & Feuerriegel, S. (2020). Business analytics for strategic management: Identifying and assessing corporate challenges via topic modeling. Information & Management, 57(1), 103070.

Rehurek, R., & Sojka, P. (2011). Gensim–python framework for vector space modelling. NLP Centre, Faculty of Informatics, Masaryk University, Brno, Czech Republic, 3(2).

Sievert C., Shirley, K. E., Ldavis: a method for visualizing and interpreting topics, in: Proceedings of the Workshop on Interactive Language Learning, Visualization, and Interfaces, pp. 63–70.

Steyvers, M., & Griffiths, T. (2007). Probabilistic topic models. In Handbook of latent semantic analysis (pp. 439-460). Psychology Press.

Székely, N., & Vom Brocke, J. (2017). What can we learn from corporate sustainability reporting? Deriving propositions for research and practice from over 9,500 corporate sustainability reports published between 1999 and 2015 using topic modelling technique. PloS one, 12(4), e0174807.

Tijare, P., & Rani, P. J. (2020). Exploring popular topic models. In Journal of Physics: Conference Series (Vol. 1706, No. 1, p. 012171). IOP Publishing.