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Effect of the COVID-19 pandemic on public managers' attitudes toward digital transformation☆

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ABSTRACT

The COVID-19 pandemic has induced a process of digital acceleration and has likely changed the attitudes of local public managers toward information and communication technology (ICT). While this attitude change has been reasonably argued, it has not been systematically measured. This study narrows this gap by measuring the attitudes of public managers before and after the outbreak of the COVID-19 pandemic. Overall, this study finds that the pandemic has led public managers to be more confident in the capacity of ICT to help cities achieve their economic, social, and environmental goals and respond to challenges. Both explicit and implicit measures confirmed attitude changes. The explicit measures also indicated that the change in public managers' attitude toward ICT was similar to their change in attitude toward scientific progress and greater than their change in attitude toward other issues that have played a major role during the pandemic, namely, climate change, citizen participation, and privacy.

1. Introduction

The pandemic generated by the SARS-CoV-2 coronavirus (COVID-19) has dramatically changed people's lives and possibly their minds [1–3]. Central to this change has been the digital acceleration that has occurred during the pandemic [4–6]. This has involved effort and difficulties, but it has allowed us to maintain our activity and social relationships while facing the spread of the virus and staying apart to save lives [1,7–9].

The experience of the pandemic has likely changed people's assessment of information and communication technology (ICT) and its capacity to respond to the economic, social, and environmental challenges of modern societies [10]. This change in attitude, if any, should be favorable and may lead to the maintenance or acceleration of digital transformation in the future [11,12]. However, as reasonably expected, this positive shift in attitudes has yet to be systematically measured.

People's minds are complex, and the pandemic has had a significant effect. This unprecedented, naturalistic event has aroused interest in the possible causes of the pandemic and how we have responded to it. This has highlighted the possibly insufficient amount of attention modern societies have paid to scientific progress [13], climate change [14], the role of citizens in public life and public decisions [15], and the individual rights of people [16]. While we can expect people to have developed a more favorable attitude toward ICT, we do not know if attitude change has actually occurred or, if it has, if the change is larger or smaller than the change in attitudes toward science, climate, citizen participation, and privacy. This study narrows this research gap.

This study was informed by the perceptions of public managers involved in smart city initiatives in municipalities in Spain. This research context was chosen for a variety of reasons. Firstly, many Spanish cities and towns were in the midst of implementing smart city initiatives when the COVID-19 pandemic began, which helped them to respond to the pandemic [6]. This study was informed by the perceptions of public managers involved in smart city initiatives, in municipalities, in Spain. Secondly, the pandemic generated an unprecedented digital acceleration in municipalities, drastically modifying public employee-government and citizen-government relations to make them essentially virtual [6,11]; Agostino, Arnaboldi & Diaz Lema, 2021). Thirdly, public managers will participate in future decision-making in local governments and in the establishment of priorities for the use of

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public resources. They could, therefore, contribute significantly to the digital transformation of cities. Lastly, we incidentally studied the attitudes of public managers toward digital transformation immediately before the pandemic, which gave us an opportunity to compare pre- and post-COVID-19 outbreak attitudes. This prudently implies that our research may capture the causal effect of the pandemic on attitudes.

Specifically, this research aims to respond to the following research questions:

RQ1. Has the pandemic led to a more favorable attitude of public managers towards ICT?

RQ2. Is the degree of change in attitudes toward ICT greater or lower than the degree of change in attitudes toward other issues that have played a major role during the pandemic? Specifically, science, climate change, citizen participation, and privacy.

RQ3. This research measures attitude change explicitly and implicitly. Is there a relationship between implicit and explicit measures of attitude change?

The response to these research questions matters, as previous research suggests that many public managers have usually considered technology as having secondary importance. While recognizing the influence of ICT on efficiency, some public managers seem to be less confident in the capacity of digital technologies to respond to major societal challenges of cities [17,18].

This research has theoretical and managerial implications. On a theoretical level, it contributes to the literature on ICT by providing systematic evidence of the effect of the pandemic on the salience that public managers grant ICT in relation to other issues that have also played a major role during the pandemic. It also contributes to theories about attitudes by adding evidence to the scarce literature on the effect of naturalistic events on attitudes and the links between explicit and implicit measures of attitude change. On a managerial level, our findings are indicative of whether local public managers are willing to maintain or reinforce their digital efforts in the near future, which could be important in explaining the digital transformation of cities in the coming years.

The remainder of the paper is structured as follows. Section 2 presents the theoretical background of this research. Section 3 describes the research method. Section 4 presents our findings. The final section provides a discussion of the findings, implications for research and practice, and avenues for further research.

2. Theoretical background

2.1. Smart cities and digital transformation: a contextual perspective

This study focused on the attitude change of public managers toward ICT in the context of digital transformation in which smart city initiatives were being implemented. The related (although different) concepts of ICT, smart cities and digital transformation are discussed below. Overall, we argue that, in our research context, a holistic view of both smart cities and digital transformation prevails, leading us to consider attitude changes toward other issues that are inherent to these concepts and have played a major role during the pandemic: science, climate change, citizen participation and privacy.

Our study participants were public managers who had actively participated in smart city initiatives in different municipalities in Spain. Spain is no newcomer to smart city initiatives. Cities like Barcelona and Santander have led this change, and many cities have followed suit [19]. This is important, as the response of governments to the pandemic has been strongly based on their previous efforts in this area [6]. Spain is, therefore, an appropriate setting in which to address our research questions. Our contribution is timely, as many municipalities in Spain have engaged in smart city innovation in recent years.

ICT broadly refers to a diverse set of technological tools and resources used to transmit, store, create, share, or exchange information [20]. ICT has had a major role in urban innovation [21]. However, urban studies paid little attention to the link between ICT and urban innovation until the late 1990s, when some influential works were published [21–23]. Since then, a great deal of research has explored this link [24]. Simultaneously, cities all over the world have begun to implement ICT to support urban innovation and sustainability by fostering innovation projects and initiatives [24]. This movement has been favored by the proliferation of technological innovations in the ICT sector, which have opened up new possibilities to address cities' goals and challenges [25,26].

While different labels have been used to refer to this movement (e.g., digital cities, intelligent cities), the term "smart cities" is the most commonly used. Mora, Deakin and Reid (2019, p. 56) conducted a bibliometric study of smart city literature and concluded that there is "little agreement about what a smart city is and what needs to be done in order to make a city smart." According to them, smart city views are divided into those that focus on technology and those that adopt a human-centric, people-driven, holistic perspective. The technological perspective conceives of smart cities as a massive use of technological solutions (mostly ICT-related solutions) in the urban environment. It has been argued that this approach can produce tensions related to sustainability, privacy and democracy, and may be inattentive to the local diversity and socio-political dimensions of cities [27].

The holistic perspective recognizes the crucial role of ICT as a fundamental enabler for smart cities, but also emphasizes the process and outcomes of ICT-related innovations. The process of implementing ICT-related innovations is viewed as being grounded in participatory governance and open innovation, and should consider the unique characteristics of each city [24]. It is stressed that ICT-related innovations are designed to meet local development needs, be they of a social, economic or environmental nature [28].

In the present research, we adopt a holistic perspective in which smart cities are viewed as places that strive to become smarter in the sense of making themselves more efficient, livable, equitable and sustainable [28] by focusing on the utilization of ICT within an accessible, integrated infrastructure [29]. A smart city is therefore understood as an aspiration/ambition [30], instead of in its current stage of maturity. Nam and Pardo [30] argued that when a smart city is viewed in terms of intentions/ambition, the label smart city represents urban innovation, which refers not just new ideas but new practices.

A limitation of the concept of smart cities is that it is not entirely clear what smart city innovation means. A related concept, digital transformation, has been proposed as a succinct and inspirational statement about what smart cities need to implement. This concept conveys that change in cities should be radical (transformative) and leveraged by digital technologies [31]. The word "transformation" emphasizes that the traditional transition from analog to digital processes must evolve toward a more holistic transformative approach of digital government [32]. Gong and Ribiere ([33]; p. 10) define digital transformation as "a fundamental change process enabled by digital technologies that aims to bring radical improvement and innovation to an entity [e.g., an organization, a business network, an industry, or society] to create value for its stakeholders by strategically leveraging its key resources and capabilities." This definition involves two key aspects: digital technologies and significant changes.

When focusing on governments, the digital transformation of cities is understood as the use of new digital technologies that enable major governance improvements and influence all aspects of citizens' lives [34]. While Reis et al. [34] use the term "government," we use the term "governance" to emphasize that digital transformation includes the networking of actors, such as providers, local businesses and citizens. It also includes the exchange of data and the analysis and conversion of that data into actionable information used to evaluate alternative options, make decisions and initiate activities [35].

Holistic perspectives also prevail in recent discussions of the digital transformation of governments. Mergel, Edelmann and Haug (2019, p. 12) define digital transformation as "a holistic effort to revise core

processes and services of government beyond the traditional digitization efforts. It evolves along a continuum of transition from analog to digital to a full stack review of policies, current processes, and user needs and results in a complete revision of the existing and the creation of new digital services." They view digital transformation as more comprehensive than the mere digitization of processes and services, involving cultural, organizational and relational changes.

Similarly, Schot and Steinmueller [36] suggest that digital transformation involves socio-technical system transformation, which is very different from simply developing new radical technological solutions. For instance, more sustainable mobility in cities requires the confluence of ICT-related innovation (e.g., companies dedicated to the provision of mobility services using ICT capabilities), other technological developments (e.g., more durable electric car batteries), government policies (e.g., promoting charging points for electric vehicles) and cultural changes (e.g., car sharing vs. car ownership, reduction of mobility). They argue that socio-technical system transformation is about discontinuous change in all elements of the configuration (i.e., skills, infrastructures, industry structures, products, regulations, user preferences and cultural predilections), which makes system transitions difficult. It involves social innovation, since the focus is on many social elements and their relations with technological opportunities.

We believe that a holistic perspective of both smart cities and digital transformation could be guiding the strategies and activities of public managers in Spain for two reasons. The first reason has an evolutionary character. From the mid-2000s, many governments in Spain embraced Local Agenda 21 (Rio Declaration on Environment and Development, United Nations, 1992) as an overarching perspective for urban development planning. This approach focused on participatory governance as a method of dealing with sustainability challenges, which were understood in a broad sense as involving the integration of economic, environmental and social issues. In the last decade, the label Local Agenda 21 (LA21) has been virtually abandoned, and the smart city label has emerged. Some networks of cities have been created to progress collaboratively toward realizing the smart city vision (e.g., RECI, INNPULSO). However, the view of urban management as participatory and multidimensional, which is embedded in the LA21 proposal, could remain under the smart city label.

The second reason involves the policies proposed by higher-tiers of government, which tend to have a crucial effect on the strategies and actuations of urban public managers as they provide both guidance/legitimacy and financial support [37]. In particular, funding from the European Union (EU) is essential in supporting many smart city initiatives in Spain both directly (direct calls) and indirectly (e.g., European structural funds that are managed by the Spanish central and regional governments) [38]. The EU has taken on a holistic perspective of digital transformation.

In 2020, the EU proposed the "Strategy on Shaping Europe's Digital Future," which is the overarching framework for the European digital strategy [39]. In 2021, this framework was extended to take into account "the enormous changes brought by the coronavirus pandemic, which has massively accelerated the use of digital tools, demonstrating their opportunities while exposing the vulnerability of our society to new digital inequalities." [40]. Specifically, on March 9, 2021, the 2030 Digital Compass was launched by the [41]. In it, the Commission laid out a vision for the digital transformation of Europe's economy and society by the end of the decade. Building on the 2030 Digital Compass, on September 15, 2021, the Commission introduced a governance framework to reach the digital targets in the form of a "Path to the Digital Decade" [42].

From a holistic perspective, ICT is a crucial component of digital transformation but not the only one. Accordingly, this study considers attitudes toward ICT and other components of digital transformation that have proved relevant during the pandemic. These components could be present in public managers' minds and could affect their decisions. For instance, if attitudes toward ICT are found to have improved but not as significantly as attitudes toward privacy or climate change, this may suggest that public managers will not necessarily prioritize ICT-related investments in the future.

2.2. Attitudes and attitude changes

This research studies changes in attitudes. Bohner and Dickel (2011, p. 392) define attitude as "an evaluation of an object of thought," where "attitude objects comprise anything a person may hold in mind, ranging from the mundane to the abstract, including things, people, groups, and ideas." Albarracin and Shavitt [43] define attitude change as a movement from one evaluative category to another (e.g., favor to higher favor or disfavor). This movement may occur whenever people process information with the result of forming an evaluation of an object of thought [44].

Attitudes guide information processing and influence behavior. From the very beginning, Allport [45] suggested that attitudes determine what people see, hear, think, and do and provide a method "for finding our way about in an ambiguous universe" (p. 806). Empirical research tends to confirm that attitudes predict different types or aspects of behavior (for a review, see Ref. [46].

Conceptualizations of attitude differ in the extent to which they describe attitudes as being dynamic and constructed gradually or stored in memory [44]. For instance, Visser and Mirabile [47] view attitudes as an array of summary evaluations stored in memory. Contrarily, Conrey and Smith [48] suggest that attitudes are time-dependent evaluations rather than static things that are stored in memory. When attitudes are viewed as a fixed evaluation and stored permanently in memory for retrieval when needed, attitude change is difficult to explain. When attitudes are viewed as constructs based on temporary considerations, such as a person's mood at a specific time, they are a permanently changing and enigmatic entity. Attitudes are likely partly memory-based and partly constructed on the fly [43].

Recent perspectives on attitudes and attitude change tend to adopt a holistic perspective in which attitudes form and change due to interrelated factors that operate on three levels: personal, social, and sociohistorical [43]. Firstly, on a personal level, individual values, goals, and emotions influence attitudes and attitude change as they evolve. Secondly, on a social relationships level, culture, membership and reference groups, social media, and persuasive messages affect attitudes [49]. Lastly, unique events that occur in a sociohistorical context, including economic, sociopolitical, climatic, and health-related occurrences, affect attitudes and attitude change. As suggested by Bohner and Dickel [44]; the holistic perspective combines the strengths of static and dynamic/context-dependent approaches to consider both stable and situationally variable aspects of attitudes.

This research aims to improve our understanding of how the sociohistorical level affects attitude change by studying the effect of a unique event, the COVID-19 pandemic, on public managers' attitudes toward the digital transformation of cities. Several recent studies have demonstrated that unique and historic events influence attitudes. Roos et al. [50] found that the election of Barack Obama to the US presidency (i.e., a person of color (POC) occupying a high-status position) positively affected attitudes toward POC in the US. Milojev et al. [51] found that the 2007–2008 global financial crisis affected political attitudes in New Zealand. Other researchers [52,53] have demonstrated the significant effects of hurricanes (and other naturalistic events) on political and social attitudes. However, empirical studies on the effect of changes that occur at the sociohistorical level on attitudes are relatively scarce [43].

2.3. Information and communication technology and the COVID-19 pandemic

In most countries, the pandemic has led to long periods of lockdown, the radical reduction of human contact outside the immediate family, and the popularization of the term "social distance" [1]. It has imposed a

sudden shift from face-to-face and analog interactions to the digital sphere. Some examples include a significant increase in food delivery and the use of e-commerce retailers, social media, and remote working platforms [11,12]. This shift has been facilitated by digital technologies [54,55], which have also helped control the spread of the virus through the development of smartphone apps [5,56].

Global Internet protocol traffic, which is usually used as a proxy for data flow, grew up from about 100 gigabytes per second in 2002 to 88,000 in early 2020. As the pandemic spread over the course of 2020, traffic generated by teleworking, videoconferencing, digital entertainment and other applications increased, resulting in an estimated 100,000 gigabytes of traffic per second [57]. Some satellite operators providing broadband connectivity in Europe and the Americas experienced traffic growth of up to 70%, especially in remote and rural areas [58].

Recent studies have addressed the transformative potential of COVID-19 to normalize the use of digital technologies for most forms of human interaction, including education, work, friendship relationships, healthcare, entertainment and leisure, procurement, and citizen–government interaction [10,54,59–61]. Barnes [10] suggests that COVID-19 has radically transformed many aspects of human life and global society, both now and for many years to come.

Similarly, Dwivedi et al. [1] contend that the information systems sector is one of the key industries that has delivered real change and positively affected both industry and society during this crisis. They argue that without technology and the use of information systems, the pernicious effects of the virus would likely have been more pervasive, with deeper economic and social repercussions. However, they also recognize that the long-term, transformational impact of the accelerated migration to digital stemming from the pandemic is unknown.

While the positive effects of the use of digital technologies during the pandemic seem to be indisputable, some difficulties and weaknesses have also been reported in the emergent literature on COVID-19. Carroll and Conboy [62] point out that organizations have been forced into an accelerated adoption of technology in an unprecedented and time-pressured manner, which has involved serious difficulties. Similarly, Faraj, Renno, and Bhardwaj [12] suggest that factors such as insufficient infrastructure, lack of digital literacy, and interoperability limitations have hampered the digitalization of work processes. Fletcher and Griffiths [63] contend that less digitally mature organizations have particularly suffered during the lockdown.

In the context of the pandemic, local governments, as service providers, have had to adopt new forms of remote working and provide public services using digital technologies (Agostino, Arnaboldi & Diaz Lema, 2021; [6,64,65]. The pandemic has forced local public managers to rely heavily on digital technologies to mitigate many of the pervasive societal impacts of the virus [6]. They have had to undertake a digital acceleration process and completely rethink their business models to make them less physical and more virtual [66]. For example, Agostino, Arnaboldi, and Diaz Lema (2021) describe how Italian museums have had to reinvent themselves to deliver online services through social media. Some experiences have failed due to a lack of knowledge and have had to be redirected. Initially, several museum directors focused on educating users and enlightening them about the past, what they understood to be the museums' mission. Later, they observed that the level of citizen engagement was low and realized that they had neglected their role as a source of entertainment. Some museum directors did not want to use platforms, such as Zoom, Microsoft Teams, or Google Meet, as these risked downgrading the quality of artwork visualization. However, as people, universities and schools had all begun using these platforms, many museums adopted them.

According to the OECD [6]; digital acceleration has occurred to ensure that service delivery remains uninterrupted despite crucial changes in the contextual conditions. Much of this activity has involved digitalizing public services. Digital identity and access to and sharing of data and notification systems have been part of this digital acceleration. Some of these aspects reflect an extension of activities that may have already been in place, whereas others represent a more significant shift. The OECD [6] reports several cases that show the shifting of services to online platforms and the creation of new services to respond to societal needs (e.g., moves to telehealth/online medical consultations; supporting public sector employees with remote working practices; providing schools with online resources and guidance to undertake distance learning and working with a range of actors to provide smartphones, tablets and Internet access to disadvantaged students; supporting small businesses in switching to e-commerce).

Fortunately, many local governments in our research context, Spain, were immersed in smart city initiatives when the pandemic began [19]. This did not necessarily guarantee the quality of all digital transformation processes at the municipal level. As suggested by previous research on smart cities, the process of digital transformation has been uneven, with many public managers completely convinced of the necessity of the digital transformation of cities and others adopting ICT and related technologies because it is fashionable and promoted by higher tiers of the government [67]. In general, however, when COVID-19 began, governments were better prepared for digital acceleration than they would have been a few years earlier [6].

What has not yet been investigated is the extent to which the pandemic has influenced local public managers' perceptions of the role of digital technologies in responding to city challenges and related pandemic-driven issues. It could be reasonably argued that previous ICT-related efforts by cities have laid the foundation for a positive response to the pandemic [6], which should lead to a positive change in public managers' attitude toward ICT. However, obstacles and weaknesses found during the pandemic may also have negatively affected attitudes.

Governments, like other organizations, have been forced into the accelerated introduction of technology, which has involved serious difficulties [12,62,68]. Added to these difficulties is the functional fragmentation of governments into specialized departments, which poses coordination challenges for government communication with the public through social media [69]. These obstacles might limit governments' ability to completely digitalize their work, leading to discouragement and negative attitudes toward digital transformation.

Anessi-Pessina et al. [70] suggest that the pandemic has been particularly demanding for public managers, remarking on the salience of their engagement with digital processes. Under normal circumstances, digitalization can rely on artificial intelligence algorithms that are capable of self-correcting and adjusting to normal changes in patterns [71]. However, the rapidity, scope, and scale of the pandemic have highlighted the importance of both human expertise and the continued necessity for human intervention in highly digitalized processes [72]. Similarly, a lack of citizen engagement in smart city initiatives has been detected in previous research (e.g. Ref. [73]), which indicates that there are many challenges for public managers [70,74–76]. A significant amount of effort is, therefore, necessary, which could discourage policymakers and managers.

In sum, we can expect that public managers' awareness of ICT may rise due to the pandemic. However, we also have to recognize that some difficulties and challenges may have negatively affected.

2.4. Other issues that have played a major role during the pandemic

ICT has played a major role in people's lives and government activities during the pandemic. However, other related issues have also occupied the minds of public managers and the general public. This research addresses changes in attitudes toward both ICT and other issues that have played a major role during the pandemic. These issues were chosen after a review of the emerging literature on the impact of COVID-19 in our lives (e.g., Refs. [1,13–16,77]). While we focused on aspects related to ICT, we also paid attention to social and environmental aspects, which are inherent to the holistic perspectives of smart cities and

digital transformation. Governmental responses to the COVID-19 in the form of initiatives/actions and the redefinition of strategies were also analyzed [6,39–42]. Considering ICT in comparative terms allows us to understand the relative importance of changes in attitudes towards ICT. This approach is necessary because public resources are limited, and ICT-related investments may compete with other possible priorities.

Specifically, we argue that he pandemic has led people to focus on not only the virus and its impact on people's lives but also other threats that could affect global human health and well-being, particularly insufficient scientific progress, climate change, privacy, and lack of citizen-centricity in government decision-making [13–16,1577]. Below we justify our choice in more detail.

Scientific progress. Cooper and Nagel [14] argue that the pandemic and the US's failure to control it have a lot to do with an enduring and entrenched ethos of dismissing scientific knowledge in the country. The rapid dissemination of COVID-19 across the globe demonstrated that our knowledge was neither sufficient nor deployed quickly enough to avoid the epidemic. However, scientific progress based on collaborative efforts has been critical to the pandemic response [13]. According to OECD [6]; the pandemic has amply illustrated that innovation and previous investments in knowledge and technology are fundamental to a government's ability to respond to abrupt changes. Thus, we can expect that public managers' awareness of science and scientific progress may rise due to the pandemic.

Climate change. Cooper and Nagel [14] emphasize that the pandemic is related to inattention to sustainability issues. Approximately three-quarters of emerging human pathogens, including viral outbreaks like SARS-CoV-2, are transmitted from animals to humans [78]. The likelihood of such transmission increases when the natural habitats of animals are disrupted by deforestation and when humans and animals are brought into increasingly close contact in urban settings [79]. Cooper and Nagel [14] observed that US politicians devoted more attention to the environment after the start of the pandemic.

From a different perspective, COVID-19 lockdowns have led to a number of temporary positive environmental side effects (reduced global emissions, cleaner air, less noise) [80]. While COVID-19 lockdowns are unsustainable in the long term due to obvious social and economic drawbacks, they have illustrated that a more desirable, low carbon resilient future is possible. This raises the question of whether there are more sustainable ways of achieving these benefits in a more planned, more inclusive and less disruptive way [77]. Some cities have focused on climate change–related initiatives during the COVID-19 crisis. The OECD [6] reports that Bristol decided to transform parts of its Old City into fully pedestrianized zones. Milan implemented a similar initiative to maintain the reduction in the city's air pollution that accompanied lockdown measures by expanding cycling and walking spaces over roads. It is thus logical to conclude that public managers' awareness of climate change may have increased due to the pandemic.

Privacy. Some authors have stressed that the response to the COVID-19 pandemic has increased privacy concerns [16,81]. The shift to working remotely seems to have increased surveillance of the home [12]. Some companies collect data that are processed by algorithms that classify the activity of employees as productive or not, alerting managers when the latter occurs [82,83]. Another issue is the surveillance of people in public spaces. During the pandemic, some governments have started using smartphone location data to assess how citizens are complying with lockdown restrictions and to enforce these restrictions. As these apps collect precise location data, social interactions, and personal details stored on devices, they embody privacy risks [12,16,84]. Thus, we can expect that public managers' awareness of privacy may rise due to the pandemic.

Citizen participation/involvement. Similarly, the pandemic has also highlighted the importance of citizens playing an active role and their digital and non-digital involvement in the service cycle [6,70,85]. For instance, the pandemic has created the need for new services for vulnerable people (e.g., those living in rural spaces, the elderly, and the unemployed), with many community groups working with local governments to implement these services quickly. These might provide shopping assistance for elderly people or remote companies to those living alone. Some governments have relied on open calls or dedicated programs to seek solutions to identified problems raised by the pandemic. For example, in Italy, "Innova per l'Italia" was a call by the government to companies, universities, public and private research centers, associations, co-operatives, consortia, foundations and institutes to increase the production of personal protective equipment [6]. There has also been a growing emphasis on the idea that no one should be excluded from the benefits of economic and technological progress [86]. While the concept of digital divide is not new [87], it has been argued that shifts to digitalization, as in the case of telehealth, have increased the digital divide and left marginalized populations with even more limited access to crucial services [2,12,88]. Thus, we can expect that public managers' awareness of citizen participation may rise due to the pandemic.

The issues considered above are present in the EU digital strategy, which has been influenced by the pandemic [39–42]. Reducing the gap between the EU and global leaders in R&D investment and achieving climate neutrality are major priorities. Technology is expected to improve the daily lives of every European citizen (e.g., all key public services should be available online in 2030, and all citizens will have access to their e-medical records) and simultaneously improve businesses (e.g., three out of four companies will likely employ cloud computing services, big data, and artificial intelligence) and the planet (e.g., climate neutrality). Privacy is also a major concern. It is recognized that the benefits of digital solutions to our lives are coupled with risks and costs (e.g., control over personal data, malicious cyberactivity that threaten our personal well-being or disrupt our critical infrastructures). The strategy also stresses stakeholder participation.

3. Method and data

3.1. Research context

This research measures changes in the attitudes of public managers toward the digital transformation of cities as a consequence of the COVID-19 pandemic. Our research context is that of policymakers and public managers who actively participated in smart city initiatives in different municipalities in Spain.

In Spain, a complete lockdown was established between March 14, 2020, and April 28, 2020. People had to remain at home except for specific essential reasons, such as acquiring food or medicine, going to work (when strictly necessary), or attending emergencies. The restrictions also included the closure of non-essential retailers, such as bars, restaurants, discos, coffee shops, and cinemas. On April 28, the Easing of Lockdown Plan for Spain was declared, consisting of four phases in which confinement limitations were gradually removed. However, on October 25, 2020, the Council of Ministers again established a "state of alarm" (although this time with less stringent measures), which included a curfew from 23:00 to 6:00, the prohibition of travel between provinces and regions, and the limitation of gatherings to up to six people who do not live together.

3.2. Methodological approach and data collection

One strength of this study is its use of implicit measures of attitude change, determined by comparing responses provided before and after the COVID-19 outbreak. This option was possible because, incidentally, in the last months of 2019 (i.e., before the pandemic), we conducted a study on smart city initiatives in Spain. One hundred and forty-three public managers participated in this first study. These respondents were selected because they were highly knowledgeable about a specific smart city initiative that had been implemented in their cities.

To identify these experts, we first identified two networks in cities

whose specific purpose was to work collaboratively to achieve the smart city ambition: RECI (Spanish Network of Smart Cities) and INNPULSO (an acronym meaning "boosting innovation" in Spanish). RECI was composed of 81 municipalities and INNPULSO of 72. We achieved a formal agreement with the former network and an informal agreement with the latter. Network orchestrators promoted the questionnaire among their members. An email was sent to the town council, which included a link to an online questionnaire. Follow-up phone calls were conducted (up to three times if a response was not received). This process yielded 97 complete responses. We also searched for additional evidence of interest in smart cities beyond networks, such as municipalities participating in events and initiatives linked to ICT-enabled innovation, or describing themselves on their websites as being interested in developing and implementing smart city initiatives. This process yielded 46 complete responses.

To avoid ambiguity, the questionnaire referred to a specific innovation project chosen by the respondent. The first part of the questionnaire stated, "Please choose a recent (and completed) service innovation project in which you were strongly involved and respond to all the questions in this questionnaire while thinking about the project you have chosen." The questionnaire also asked for a brief, open description of the project. Some of the projects described by the participants were as follows:

- Safe school routes. After a detailed study with the help of a university, the concept of a "safe route" was defined. Sidewalks, pavement, lighting, bridges, shops, and so forth were assessed. A survey was carried out with parent representatives and school students to learn about their mobility preferences. Vertical and horizontal signs, changes to urban furniture, three smart pedestrian crossings, and 3D crossings were designed. We are going to buy Bluetooth wristbands for students, sensors, and software so that parents know when their children arrive at school.
- Participatory aging. The project ensures the inclusion of the elderly in the use of digital public services through the development of services that are accessible through mobile phones based on open data from the town council. This project encourages the elderly to access citizen participation, age actively, and get involved in their communities.
- Citizen security app. This is an app that brings the local police service closer to citizens and groups (commerce, vulnerable groups) bidirectionally (local police to citizens and vice versa). This is a free public alert service.

In July 2020 (i.e., five months after the lockdown), we conducted a second survey to assess changes in public managers' attitudes towards digital transformation. The questionnaire was structured as follows. First, we reminded public managers that they had participated in a research project a few months prior and asked them to answer some additional questions. Second, we reminded them that they had provided us with answers about a specific smart city initiative and reminded them of the specific name they gave the initiative. Finally, we asked them about their degree of agreement with two statements referring to the smart city initiative and, subsequently, five statements referring to how their attitudes had changed since the pandemic. The first two statements were previously introduced in the first questionnaire (among many other questions). We expected that, after so much time had passed since the first survey, busy public managers might not notice the repetition of the questions. No participant indicated that they noted that the questions were repeated. The questionnaire yielded 63 complete responses (response rate = 44.05%).

The profile of the respondents was not significantly different in the first and second questionnaires. Participants reported various professional roles, including chief innovation officer, ICT coordinator, head of transparency and the open government group, chief business development officer, and chief strategic projects officer.

We did not have to use an artificial experimental setting for our purposes. The COVID-19 pandemic is a natural phenomenon that has radically reframed traditional ways of working, socializing, shopping, and providing and receiving services. The pandemic has, therefore, acted as a natural breaching experiment that has brought ICT and digital transformation to the fore [12].

3.3. Measurements

Attitudes and attitude changes may be measured explicitly or implicitly. Explicit measures are the most traditional measures of attitude and attitude change. They consist of self-report scales that directly ask a participant to assess an attitude object by providing a numeric response on single or multiple items [89,90]. While self-report scales of attitude have been broadly used and have proven very useful [91–93], they have some weaknesses. In particular, people may try to hide their attitudes in order to present themselves positively, and attitudes may not be open to introspective access [94]. Implicit measures try to overcome the limitations attached to explicit measures. While participants may respond to a survey or perform a task that permits them to infer their attitudes or attitude changes, they are unaware of how their responses will be used to measure attitudes.

Implicit measures of attitude have been mostly used in socially sensitive contexts, such as discussions of race [95]. As people may be reluctant to respond honestly to direct questions referring to their racial attitudes (e.g., "Do you like European Americans more than African Americans?"), implicit measures have been developed. For instance, in the Race Attitude Implicit Association Test, a subtle task is performed by respondents to discover if they associate positive words more quickly (unconsciously) with European Americans than with African Americans [96]. Implicit measures of attitude are also useful in providing access to unconscious mental associations that are difficult to assess with direct, self-report measures. While self-report (explicit) measures reflect conscious attitudes, indirectly assessed (implicit) evaluations may provide access to unconscious attitudes [97]. However, implicit measures of attitude have been accused of being artificial and of not providing the true measure of attitude [98].

The distinction between implicit and explicit measures originally gave rise to a debate about which measure reflects a person's true attitude [98]. Current thinking treats implicit and explicit measures as complementary rather than as competitors [99]. Explicit measures of attitude are expected to be predictive of the behavior when resources used for cognitive control are high, whereas implicit measures are expected to be predictive when these resources are low (e.g., time constraints, competing cognitive demands) [99]. Consequently, this study used both explicit and implicit measures of attitude change.

Specifically, explicit measures referred to five aspects explained in the previous sections: ICT, scientific progress, climate change, privacy, and citizen participation. Measures aimed to measure how much the importance that the participants attached to these issues had increased as a result of the pandemic [100]. Public managers were asked to rate how much they agreed or disagreed with statements on an 11-point scale, with 0 indicating strong disagreement and 10 indicating strong agreement. The specific statements included in the questionnaire included the following:

The COVID-19 has made me give more importance to …

- *ICT* (encoded as ICT)
- *Science and scientific progress* (encoded as science)
- *Climate change mitigation and adaptation* (encoded as climate)
- *Privacy* (encoded as privacy)
- *Citizen participation* (encoded as citizen)

The implicit measure of attitude was computed as the difference between the degree of agreement perceived pre- and post-COVID-19, based on two statements that referred to the extent to which the focal smart city initiative chosen by participants in the first study had helped to respond to the economic, environmental, and societal goals and challenges of the municipality. A scale from 0 to 10 was also used. The specific statements included in the questionnaire were as follows:

- *The implementation of this smart city initiative helps the municipality meet economic, social, and environmental goals that go beyond improvements in costs and quality of service* (encoded as goals).
- *The implementation of this smart city initiative helps the municipality move toward meeting the main economic, social and environmental challenges* (encoded as challenges).

4. Findings

4.1. Explicit measures of attitude change

All statistical analyses were performed using STATA 16 (StataCorp LLC). Descriptive data for explicit measures of attitude change are reported in Table 1.

Overall, our respondents indicated that COVID-19 had largely affected their awareness of the importance of the factors considered, with results ranging from 6.777 for privacy to 8.777 for ICT. Privacy is an increasing concern for public managers. It seemed, however, to be less prominent when compared to the benefits offered by ICT.

As many respondents provided relatively high scores (above 5) for attitude change measures, the Shapiro-Wilk Test, and the Skewness and Kurtosis Test indicated that most of our data were not normally distributed and required nonparametric analyses. Both tests yielded a p-value of 0.000 for ICT, science, climate change and citizen participation. As an exception, the tests did not yield sufficient evidence to say that privacy is non-normally distributed (p = 0.1447 for the Shapiro-Wilk Test, and p = 0.1874 for the Skewness and Kurtosis Test). Consequently, Spearman's rank-order correlations were used to analyze the data, instead of the more usual Pearson product-moment correlations. Spearman's correlations for the explicit measures of attitude change are reported in Table 2. Correlations ranged from 0.0645 (for science-climate) to 0.7509 (for ICT-science).

Due to non-normality, scores for the explicit measures of attitude change were compared using the nonparametric Wilcoxon signed rank-sum test. Results indicated that there was a significantly more prominent change in attitude toward ICT than in attitude toward climate (p = 0.000), citizen engagement (p = 0.000), and privacy (p = 0.000). Similar results were found when comparing changes in attitudes toward science and toward the environment (p = 0.000), citizen participation (p = 0.000), and privacy (p = 0.000).

However, non-significant differences were found when comparing changes in attitude toward ICT and toward science (p = 0.2829). This result is interesting, as the item "science" implicitly involves elements that are crucial to the pandemic response (e.g., vaccine research), and respondents attached similar salience to ICT and science. It seems that participants tended to assimilate ICT and science, which seemed to work as a unique construct in public managers' minds. The change in attitude towards climate was shown to be significantly different from the change in attitude towards privacy (p = 0.1277) and citizen participation (p = 0.7276). The change in attitude towards privacy was significantly lower than the change in attitude towards citizen participation (p = 0.0343).

Table 1
Explicit measures of attitude change.

Item (more importance given to …)	Obs.	Mean	Std. Dev.	Min.	Max
ICT	63	8.777	1.689	0	10
Science	63	8.650	1.705	0	10
Climate	63	7.047	1.590	0	10
Privacy	63	6.777	1.475	3	10
Citizen	63	7.079	1.516	0	10

Note: Obs. = Observations; Std. Dev. = Standard Deviation; Min. = Minimum; Max = Maximum.

Table 2
Spearman correlations between explicit measures of attitude change.

	ICT	Science	Climate	Privacy	Citizen
ICT	1				
Science	.7509*	1			
Climate	.1571	.0645	1		
Privacy	.2721*	.2652*	.3262*	1	
Citizen	.1541	.1504	.4592*	.3993*	1

Notes: ICT = Information and Communication Technology; * Significant at 0.05 level.

4.2. Implicit measures of attitude change

The comparison of pre- and post-COVID-19 scores for the specific smart city initiative, which provided an implicit measure of attitude change, was performed using the Wilcoxon signed-rank test for paired data. The results, reported in Table 3, revealed a statistically significant difference between pre- and post-COVID-19 responses. Specifically, respondents perceived that the smart city initiative contributed significantly more to municipal goals (z = 3.108; p = 0.0025) and challenges (z = 3.528; p = 0.000) in the post-COVID-19 questionnaire. This leads to an effect size of 0.2627 for contribution to goals and 0.3118 for contribution to challenges, indicating a medium effect size [101].

4.3. Relationship between explicit and implicit measures of attitude change

To study the relationship between explicit and implicit measures of attitude change, we first grouped the data. Data was reduced for conceptual and practical reasons. A conceptual reason was that the items used in the questionnaire reflected broader conceptual categories in respondents' minds. Two questions referred to science and technology aspects, and three to social concerns. A practical reason was the need to accommodate the analysis according to the relatively reduced number of observations. Non-normality in our data led us to use kernel regressions, which require higher sample sizes than OLS regressions [102].

We assessed the internal consistency of the measures created using Cronbach's alpha [103]. Firstly, explicit measures of attitude change were grouped into two categories representing summative variables: technology and social. Items referring to ICT and science were grouped under "technology" (α = 0.9199). Items referring to energy transition, privacy, and citizen engagement were grouped under "social" (α = 0.8181). In this way, we measured the extent to which the pandemic had increased the importance that public managers place on technological vs. social issues.

Table 3
Implicit measures of attitude change pre- and post-COVID-19.

Item	Obs.	Mean	Std. Dev.	Min	Max
Contribution to goals (pre-COVID-19)	63	7.634	2.127	1	10
Contribution to challenges (pre-COVID-19)	63	7.507	1.882	1	10
Contribution to goals (post-COVID-19)	63	8.333	1.402	3	10
Contribution to challenges (post-COVID-19)	63	8.317	1.412	2	10

Note: Obs. = Observations; Std. Dev. = Standard Deviation; Min. = Minimum; Max = Maximum.

Secondly, the two implicit measures of attitude obtained before COVID-19 (i.e., goals and challenges) were synthetized to create a new variable: "pre-COVID-19 perceived contribution" (α = 0.8902). Similarly, "post-COVID-19 perceived contribution" was created (α = 0.8636). Implicit attitude change was measured as the difference between both perceptions. Descriptive statistics of the composite measures of attitude change are reported in Table 4.

Some supplementary control variables that could affect the link between explicit and implicit measures of attitude change were included in the questionnaire. Firstly, the level of usage and visibility of the smart city initiative during the pandemic was considered. It is likely that participants attached higher scores to smart city initiatives that had increased in use and visibility during the pandemic, as these had demonstrated their value to people [104]. This variable was measured by using two items:

- During the pandemic, this service has been used more.
- The pandemic has made this service more visible.

Secondly, some variables representing the profile of the respondent and her/his municipality were considered: gender, professional experience (years), politician vs. technician, and population of the municipality. Descriptive statistics for control variables are reported in Table 5.

The response to use and visibility items was highly uneven, highlighting the fact that not all smart city initiatives had been more used and more visible during the pandemic. For instance, some smart initiatives aimed to improve the experience of visiting the center of the city had reduced its use and visibility during the pandemic (e.g., smart parking, smart bus stops). After confirming the internal consistency of both items (α = 0.9165) a new summated variable was created and encoded as "notoriety."

Spearman correlations between the new created variables are reported in Table 6. Overall, they were weak, which indicated that there was not a strong relationship between the explicit and implicit measures of attitude change. A remarkable strong negative link between the implicit measure of attitude change and the pre-COVID-19 score attached to the smart city initiative was found. It seems to be a rational finding as municipal managers that attached high pre-COVID-19 score had less margin to manifest their positive attitude change in the post-COVID-19 questionnaire.

To analyze all possible links between implicit and explicit measures of attitude change, we conducted a series of nonparametric kernel regressions, with "implicit attitude change" as the outcome variable. Due to requirements of kernel regressions in terms of sample size, we introduced a maximum of three independent variables in each regression [102]. We used 500 bootstrap replications. Results are reported in Table 7.

The model that best fit the data is model (5) (R-squared = 0.7720). In this model the contribution of the smart city initiative perceived pre-COVID-19 was shown to have a strong, negative and significant effect on implicit attitude change (β = −0.5793; α = 0.004). Technology was shown to have a positive, significant influence on implicit attitude change (β = 0.3177; α = 0.043). Lastly, the professional experience of the local public manager was shown to have a positive, significant effect on implicit attitude change (β = −0.0447; α = 0.016).

Table 4
Descriptive statistics of composite measures of attitude change.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Technology (quest. 2)	63	8.714	1.633	0	10
Social (quest. 2)	63	6.968	1.308	1	10
Pre-COVID-19 perceived contribution (quest. 1)	63	7.571	1.906	1	10
Post-COVID-19 perceived contribution (quest. 2)	63	8.325	1.320	2.5	10
Implicit attitude change	63	.7619	1.588	−2	4.5

Note: Quest. = questionnaire; Obs. = Observations; Std. Dev. = Standard Deviation; Min. = Minimum; Max = Maximum.

Table 5
Descriptive statistics for control variables.

Control variables	Obs.	Mean	Std. Dev.	Min.	Max
Use	63	5	3.565	0	10
Visibility	63	5.365	3.409	0	10
Gender (woman = 1)	63	.396*	.493	0	1
Professional experience (years)	63	21.015	9.098	1	42
Politician/technician (pol. = 1)	63	.174**	.382	0	1
Population	63	79,795	126,869	1186	791,413

Note: Obs. = Observations; Std. Dev. = Standard Deviation; Min. = Minimum; Max = Maximum; Pol. = Politician; * 25 women; ** 11 politicians.

Table 6
Spearman correlations: composite measures of attitude change and control variables.

	Implicit Attitude change	Pre-contr.	Technology	Social	Notoriety
Implicit Attitude change	1				
Pre-contr.	-.7698*	1			
Technology	.0458	.0926	1		
Social	-.0445	.0388	.1300	1	
Notoriety	.0987	-.1075	-.1023	.3171*	1

Note: Pre-contr. = Pre-COVID-19 perceived contribution; * Significant at 5% level.

5. Discussion

The digital acceleration induced by the COVID-19 pandemic is an opportunity for scholars and practitioners to observe how the mindsets of public managers have changed over a short period and to speculate as to how these experiences might affect future policies. This study investigated the effect of an unprecedented, naturalistic event (i.e., the COVID-19 pandemic) on the attitudes of public managers toward ICT and related factors that have played a major role during the pandemic. Overall, our findings indicate that the pandemic has led public managers to be more confident in the capacity of ICT to help cities achieve their economic, social, and environmental goals and respond to challenges.

Both explicit and implicit measures supported attitude change. Explicit measures of attitude indicated that the change in public managers' attitude toward ICT was greater than their change in attitude toward other social issues that have been important during the pandemic (e.g., climate change, privacy, and citizen participation). While the attitude of public managers toward these important issues changed positively during the pandemic, the degree of attitude change was lower than it was for ICT. Only the positive change in attitude toward science and scientific progress was similar to the change in attitude toward ICT.

We found that respondents strongly associated technology-related issues (i.e., ICT and scientific progress), and social issues (i.e., climate change, privacy, and citizen participation). Overall, the change in attitude toward technology-related issues was greater than the change in attitude toward social issues, which is an interesting result. This finding suggests that the prominent role that technology has played in relieving the harmful effects of the pandemic was recognized by our respondents.

We also found a significant link between implicit changes in attitude toward the focal smart city initiative and the explicit changes in attitude toward technology, and the professional experience of the respondent.

Table 7
Determinants of implicit attitude change toward technology: Results of nonparametric kernel regressions.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	coef. (p-value)	coef. (p-value)	coef. (p-value)	coef. (p-value)	coef. (p-value)	coef. (p-value)	coef. (p-value)	coef. (p-value)
Pre-contr.	-.6880 (.000)**	-.7375 (.000)**	-.7300 (.000)**	-.6705 (.000)**	-.5793 (.004)**	-.6978 (.000)**	-.7287 (.000)*	−6921 (.000)**
Tech.		.2846 (.058)*	.1998 (.162)	.2566 (.065)*	.3177 (.043)**	.2684 (.058)*	.2248 (.104)	.3785 (.058)*
Social			.089 (.960)					
Gender				.0897 (.748)				
Exper.					.0447 (.016)**			
Politician						-.6882 (.017)**		
Popul. (log.)							-.0458 (.612)	
Notoriety								.1183 (.078)*
R^2	.6259	.6773	.7251	.6940	.7720	.7087	.6891	.7324

Note: Pre-contr. = Pre-COVID-19 perceived contribution; Tech. = Technology; Exper. = Professional experience (years); Popul. (log.) = logarithm of population; * Significant at 5% level; ** Significant at 10% level.

This result is interesting as professional experience is highly correlated with age, and older people could be, in general, more skeptical toward the potential benefits of ICT-related innovation (e.g., Ref. [105]. Probably older people, who tend to be more reluctant to change, need to experience intensely the value that ICT may contribute, which has occurred during the pandemic.

These findings have important implications for research and practice and provide avenues for further research.

5.1. Implications for research

This research contributes to ICT literature. There is some controversy regarding the possible influence of the pandemic on perceptions of ICT's capacity to face societal challenges and its implications for the near future. Most researchers argue that ICT has been crucial to overcoming some of the pernicious effects of the pandemic, which should lead to more favorable attitudes toward ICT (e.g., Refs. [1,5]. However, some researchers have reported difficulties in accommodating the accelerated digitalization that has occurred during the pandemic, which could discourage public managers (e.g., Refs. [12,62]. This research provides systematic evidence of a favorable change in attitudes, showing that the positive implications of digital acceleration during the pandemic are dominant in public managers' minds.

Several contributions to the literature on attitude change are also provided. Firstly, the relationship between explicit and implicit attitude change has been shown to be controversial. Studies of attitude change that have used both explicit and implicit measures have produced mixed results [106–108]. Some studies have shown parallel variation in both metrics, whereas others have demonstrated explicit but not implicit attitude change, and vice versa. We contributed to this literature stream by providing evidence of a significant link between implicit changes in attitude toward the focal smart city initiative and explicit changes in attitude towards ICT and science. However, it should be noted that the link we found is weak and only marginally significant when the number of years of professional experience of the public administrator is not considered.

In this study, we focus on the broad sociohistorical context and recognize the impact of historically significant events on attitudes, which may provide a more situated understanding of attitude formation and change. This research contributes to the paucity of studies on the influence of broad sociohistorical context on attitude change [50–53] and responds to the claim that more research in this area is necessary [43]. We found that a naturalistic event contributed to attitude change and yielded similar or slightly larger effect sizes to those previously found in meta-analyses of field experiments and real-world interventions. Specifically, we found effect sizes of 0.26 and 0.31. In their meta-analyses, Kalinoski et al. [109]; Lemmer and Wagner [110]; and Steinmetz et al. [111] found effect sizes of 0.23, 0.28, and 0.24, respectively. However, much more research is required to achieve supported conclusions on the effect size of naturalistic events.

To the best of our knowledge, no previous research has systematically studied the influence of the COVID-19 pandemic on public managers' attitudes toward ICT and the related topics we have considered. In a related work, Jamison and Wang [104] examined how the pandemic has affected consumer valuation of digital services. They compared consumer valuations pre-pandemic (2017–2018) and post-pandemic and found that valuations were five-times higher in 2020 than they were in 2017–2018.

5.2. Implications for practice

Some controversy exists regarding the attitudes of public managers towards digital transformation. Overall, ICT adoption in city governments is positively viewed as having an impact on organizations and communities [112] and involving more positive effects than negative effects or risks [113]. However, skepticism among public managers towards some ICT-related advancements, such as big data [114] and artificial intelligence [115], has also been reported. Similarly, previous research in the context of smart cities indicates that public managers tend to see ICT as contributing fundamentally to efficiency [17,18], which may grant it a secondary role behind other strategies and actions that are supposed to contribute to the economic, social and environmental goals and challenges of cities. Therefore, our finding that public managers are now more confident in the capacity of ICT to help cities achieve their goals and respond to challenges is particularly important. While recognizing that future behavior is hardly predictable, especially in erratic times [116], attitudes have generally proven to be an antecedent of behavior [46]. Our findings seem to indicate that ICT-related efforts during the pandemic could be maintained and reinforced in the future.

One of the difficulties encountered in the processes of digital transformation of cities has been the lack of leadership within city councils and the lack of motivation of public managers and officials (e.g., Ref. [117]. The attitude change generated by COVID-19 could increase municipal leaders' engagement with digital transformation and public managers' and officials' willingness to follow leaders' guidance. This increased motivation of government employees could make city leaders feel more supported and encourage them to implement more ambitious smart city strategies.

5.3. Limitations and further research

Our data are strengthened by the fact that they were collected prior to and following an unprecedented event: the COVID-19 pandemic. We are aware that our research design cannot control for possible extraneous or confounding variables (i.e., variables other than COVID-19 that could bias our results). As in previous studies on the influence of sociohistorical events (see, e.g. Ref. [50], we acknowledge that our study does not allow us to establish an irrefutable causal link between the intervening real-world event (the COVID-19 pandemic) and the

attitudes measured through the two questionnaires. However, we can reasonably argue that our findings are mostly driven by the fact that COVID-19 has had an unprecedented influence on the use of ICT at all societal levels. Furthermore, the use of two types of attitude change measures (explicit and implicit), which show consistent results, serves to alleviate this limitation.

This study sought responses to three research questions from a specific sample in a specific setting: Spanish public managers involved in smart city initiatives (i.e., Spanish public managers involved in other areas, such as accounting or human resources, are not represented). As suggested by Lee and Baskerville [118]; we cannot argue that our results are generalizable to other settings in which they have not been empirically tested and confirmed (e.g., all public managers in Spain or public managers involved in smart city initiatives in other countries). Another weakness of this research is its limited sample size. Larger sample sizes favor the generalizability of the sample points to the sample estimate [118].

Despite these limitations, our study adds evidence to an emergent body of research that suggests that the COVID-19 pandemic has led to a more favorable attitude of public managers (and the general public) toward ICT. In this way, our study contributes to the development of theory [118]. We see this research as a first attempt to systematically measure the change in public managers' attitudes toward ICT as a result of the COVID-19 pandemic. Further studies could be conducted in other settings to confirm or disprove our findings.

Author statement

All authors. Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing - original draft, Writing – review.

References

[1] Y.K. Dwivedi, D.L. Hughes, C. Coombs, I. Constantiou, Y. Duan, J.S. Edwards, N. Upadhyay, Impact of COVID-19 pandemic on information management research and practice: transforming education, work and life, Int. J. Inf. Manag. 55 (2020) 102211.

[2] N. Livari, S. Sharma, L. Ventä-Olkkonen, Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? Int. J. Inf. Manag. 55 (2020) 102183.

[3] A. Zimmerling, X. Chen, Innovation and possible long-term impact driven by COVID-19: manufacturing, personal protective equipment and digital technologies, Technol. Soc. 65 (2021), 101541.

[4] D. Agostino, M. Arnaboldi, M.D. Lema, New development: COVID-19 as an accelerator of digital transformation in public service delivery, Publ. Money Manag. 41 (1) (2021) 69–72.

[5] W. He, Z.J. Zhang, W. Li, Information technology solutions, challenges, and suggestions for tackling the COVID-19 pandemic, Int. J. Inf. Manag. 57 (2021) 102287.

[6] OECD, The Covid-19 crisis: a catalyst for government transformation? OECD Policy Responses to Coronavirus (COVID-19), OECD Publishing, Paris, 2020, https://doi.org/10.1787/1d0c0788-en.

[7] R. Katz, J. Jung, F. Callorda, Can digitization mitigate the economic damage of a pandemic? Evidence from SARS, Telecommun. Pol. 44 (10) (2020), 102044.

[8] A. Farooq, S. Laato, A.N. Islam, J. Isoaho, Understanding the impact of information sources on COVID-19 related preventive measures in Finland, Technol. Soc. 65 (2021) 101573.

[9] Z. Tang, A.S. Miller, Z. Zhou, M. Warkentin, Does government social media promote users' information security behavior towards COVID-19 scams? Cultivation effects and protective motivations, Govern. Inf. Q. (2021), 101572.

[10] S.J. Barnes, Information management research and practice in the post-COVID-19 world, Int. J. Inf. Manag. (2020), 102175, https://doi.org/10.1016/j.ijinfomgt.2020.102175.

[11] C. Coombs, Will COVID-19 be the tipping point for the intelligent automation of work? A review of the debate and implications for research, Int. J. Inf. Manag. 55 (2020) 102182, https://doi.org/10.1016/j.ijinfomgt.2020.102182.

[12] S. Faraj, W. Renno, A. Bhardwaj, Unto the breach: what the COVID-19 pandemic exposes about digitalization, Inf. Organ. (2021), 100337.

[13] S. Momtazmanesh, H.D. Ochs, L.Q. Uddin, M. Perc, J.M. Routes, D.N. Vieira, N. Rezaei, All together to fight COVID-19, Am. J. Trop. Med. Hyg. 102 (6) (2020) 1181–1183.

[14] D.H. Cooper, J. Nagel, Lessons from the pandemic: climate change and COVID-19, Int. J. Sociol. Soc. Pol. (2021), https://doi.org/10.1108/IJSSP-07-2020-0360 ahead-of-print No. ahead-of-print.

[15] C. Marston, A. Renedo, S. Miles, Community participation is crucial in a pandemic, Lancet 395 (2020) 1676–1678, 10238.

[16] F. Rowe, Contact tracing apps and values dilemmas: a privacy paradox in a neo-liberal world, Int. J. Inf. Manag. 55 (2020) 102178.

[17] C. Manville, G. Cochrane, J. Cave, J. Millard, J.K. Pederson, R.K. Thaarup, B. Kotterink, Mapping Smart Cities in the EU, 2014. http://resolver.tudelft.nl/uuid:1fac0e18-8dd3-406d-86fe-ce1e6a22e90c. (Accessed 20 October 2020).

[18] J.J. Pittaway, A.R. Montazemi, Know-how to lead digital transformation: the case of local governments, Govern. Inf. Q. (2020), 101474.

[19] I. Capdevila, M.I. Zarlenga, Smart city or smart citizens? The Barcelona case, J. Strategy Manag. 8 (3) (2015) 266–282.

[20] UNESCO, Guide to Measuring Information and Communication Technologies (ICT) in Education, UNESCO Institute for Statistics, Quebec, 2009.

[21] M. Castells. The Rise of the Network Society, Blackwell Publishing Ltd, Oxford, 1996.

[22] S. Graham, S. Marvin. Telecommunications and the City: Electronic Spaces, Urban Places, Routledge, New York City, NY, 1996.

[23] W.J. Mitchell. E-topia: Urban Life, Jim—But Not as We Know It, The MIT Press, Cambridge, MA, 1999.

[24] L. Mora, M. Deakin, A. Reid, Combining co-citation clustering and text-based analysis to reveal the main development paths of smart cities, Technol. Forecast. Soc. Change 142 (2019) 56–69.

[25] H. Schaffers, N. Komninos, M. Pallot, B. Trousse, M. Nilsson, A. Oliveira, Smart cities and the future Internet: towards cooperation frameworks for open innovation, in: J. Domingue, A. Galis, A. Gavras, T. Zahariadis, D. Lambert, F. Cleary, P. Daras, S. Krco, H. Muller, M. Li, H. Schaffers, V. Lotz, F. Alvarez, B. Stiller, S. Karnouskos, S. Avessta, M. Nillson (Eds.), The Future Internet. Future Internet Assembly 2011: Achievements and Technological Promises, Springer, Berlin, 2011, pp. 431–446.

[26] N. Komninos, Intelligent cities: Variable geometries of spatial intelligence, Intell. Build. Int. 3 (3) (2011) 172–188.

[27] A. Ersoy, Smart cities as a mechanism towards a broader understanding of infrastructure interdependencies, Regional Studies, Regional Sci. 4 (1) (2017) 26–31.

[28] H. Chourabi, T. Nam, S. Walker, J.R. Gil-Garcia, S. Mellouli, K. Nahon, T. A. Pardo, H.J. Scholl, Understanding smart cities: an integrative framework, in: Proceedings of the 45th Hawaii International Conference on System Sciences (HICSS), Institute of Electrical and Electronics Engineers (IEEE), Piscataway, NJ, 2012, pp. 2289–2297.

[29] E. Ismagilova, L. Hughes, Y.K. Dwivedi, K.R. Raman, Smart cities: advances in research—an information systems perspective, Int. J. Inf. Manag. 47 (2019) 88–100.

[30] T. Nam, T.A. Pardo, Conceptualizing smart city with dimensions of technology, people, and institutions, in: Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, ACM, 2011, pp. 282–291.

[31] G. Vial, Understanding digital transformation: a review and a research agenda, J. Strat. Inf. Syst. 28 (2) (2019) 118–144.

[32] I. Mergel, N. Edelmann, N. Haug, Defining digital transformation: results from expert interviews, Govern. Inf. Q. 36 (4) (2019) 101385.

[33] C. Gong, V. Ribiere, Developing a unified definition of digital transformation, Technovation 102 (2021) 102217.

[34] J. Reis, M. Amorim, N. Melão, P. Matos, March). Digital transformation: a literature review and guidelines for future research, in: World Conference on Information Systems and Technologies, Springer, Cham, 2018, pp. 411–421.

[35] D. Schallmo, C.A. Williams, L. Boardman, Digital transformation of business models—best practice, enablers, and roadmap, Int. J. Innovat. Manag. 21 (8) (2017), 1740014.

[36] J. Schot, W.E. Steinmueller, Three frames for innovation policy: R&D, systems of innovation and transformative change, Res. Pol. 47 (9) (2018) 1554–1567.

[37] M. Lockwood, Good governance for terrestrial protected areas: a framework, principles and performance outcomes, J. Environ. Manag. 91 (3) (2010) 754–766.

[38] W. van Winden, D. van den Buuse, Smart city pilot projects: exploring the dimensions and conditions of scaling up, J. Urban Technol. 24 (4) (2017) 51–72.

[39] European Commission, The European data strategy - Shaping Europe's digital future, Available at: https://euroalert.net/publication/674/the-european-data-strategy-shaping-europe-s-digital-future, 2020.

[40] European Commission, Europe's digital decade – questions and answers, Available at: https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_984, 2021.

[41] European Commission, 2030 digital Compass: the European way for the digital decade, Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:12e835e2-81af-11eb-9ac9-01aa75ed71a1.0001.02/DOC_1&format=PDF, 2021.

[42] European Commission, State of the union: path to the digital decade - questions and answers, Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_4631, 2021.

[43] D. Albarracin, S. Shavitt, Attitudes and attitude change, Annu. Rev. Psychol. 69 (2018) 299–327.

[44] G. Bohner, N. Dickel, Attitudes and attitude change, Annu. Rev. Psychol. 62 (2011) 391–417.

[45] G.W. Allport, Attitudes, in: C. Murchinson (Ed.), Handbook of Social Psychology, Clark Univ. Press, Worcester, MA, 1935, pp. 798–844.

[46] L.R. Glasman, D. Albarracin, Forming attitudes that predict future behavior: a meta-analysis of the attitude-behavior relation, Psychol. Bull. 132 (2006) 778–822.

[47] P.S. Visser, R.R. Mirabile, Attitudes in the social context: the impact of social network composition on individual-level attitude strength, J. Pers. Soc. Psychol. 87 (6) (2004) 779–795.
[48] F.R. Conrey, E.R. Smith, Attitude representation: attitudes as patterns in a distributed, connectionist representational system, Soc. Cognit. 25 (2007) 718–735.
[49] T. Kaya, The changes in the effects of social media use of Cypriots due to COVID-19 pandemic, Technol. Soc. 63 (2020), 101380.
[50] L.E. Roos, S. Lebrecht, J.W. Tanaka, M.J. Tarr, Can singular examples change implicit attitudes in the real-world? Front. Psychol. 4 (594) (2013) 1–14.
[51] P. Milojev, L. Greaves, D. Osborne, C.G. Sibley, Stability and change in political conservatism following the global financial crisis, Pers. Soc. Psychol. Bull. 41 (1) (2015) 127–139.
[52] S.R. Levy, A.L. Freitas, R. Mendoza-Denton, H. Kugelmass, L. Rosenthal, When sociopolitical events strike cultural beliefs: divergent impact of Hurricane Katrina on African Americans' and European Americans' endorsement of the Protestant work ethic, Basic Appl. Soc. Psychol. 32 (3) (2010) 207–216.
[53] L.A. Rudman, M.C. McLean, M. Bunzl, When truth is personally inconvenient, attitudes change: the impact of extreme weather on implicit support for green politicians and explicit climate-change beliefs, Psychol. Sci. 24 (11) (2013) 2290–2296.
[54] S. Singh, C. Prakash, S. Ramakrishna, Three-dimensional printing in the fight against novel virus COVID-19: technology helping society during an infectious disease pandemic, Technol. Soc. 62 (2020) 101305.
[55] R. Bhatia, Telehealth and COVID-19: using technology to accelerate the curve on access and quality healthcare for citizens in India, Technol. Soc. 64 (2021) 101465.
[56] R.K.R. Kummitha, Smart technologies for fighting pandemics: the techno-and human-driven approaches in controlling the virus transmission, Govern. Inf. Q. 37 (3) (2020) 101481.
[57] United Nations, COVID-19 and E-Commerce: A Global Review, UNCTAD/DTL/STICT/2020/13, New York, 2021. Available at: https://unctad.org/system/files/official-document/dtlstict2020d13_en_0.pdf.
[58] ITU, Broadband Development and Connectivity Solutions for Rural and Remote Areas, ITU, Geneva, 2020. Available at: https://www.itu.int/dms_pub/itu-d/oth/07/23/D07230000020001PDFE.pdf.
[59] N. Fernandes, Economic Effects of Coronavirus Outbreak (COVID-19) on the World Economy, 2020. Available at: SSRN 3557504.
[60] D. Griffin, J. Denholm, This Isn't the First Global Pandemic, and it Won't Be the Last. Here's what We've Learned from 4 Others throughout History, 2020. https://theconversation.com/this-isnt-the-first-global-pandemic-and-it-wontbe-the-last-heres-what-weve-learned-from-4-others-throughout-history-136231. (Accessed 1 February 2021). accessed.
[61] E. Gandolfi, R.E. Ferdig, A. Kratcoski, A new educational normal an intersectionality-led exploration of education, learning technologies, and diversity during COVID-19, Technol. Soc. 66 (2021) 101637.
[62] N. Carroll, K. Conboy, Normalising the "New normal": changing tech-driven work practices under pandemic time pressure, Int. J. Inf. Manag. (2020), 102186, https://doi.org/10.1016/j.ijinfomgt.2020.102186.
[63] G. Fletcher, M. Griffiths, Digital transformation during a lockdown, Int. J. Inf. Manag. 55 (2020) 102185.
[64] D.E. Leidner, Editorial reflections: lockdowns, slow downs, and some introductions, J. Assoc. Inf. Syst. Online 21 (2) (2020) 10, https://doi.org/10.17705/1jais.00600.
[65] A. Richter, Locked-down digital work, Int. J. Inf. Manag. (2020), 102157, https://doi.org/10.1016/j.ijinfomgt.2020.102157.
[66] P. Seetharaman, Business models shifts: impact of covid-19, Int. J. Inf. Manag. 54 (2020) 102173.
[67] T.B. Zilber, Y.C. Goodman, High-technology in the time of corona: a critical institutional reading, Inf. Organ. 31 (1) (2021), 100342.
[68] P. Gerli, E. Arakpogun, Z. Elsahn, F. Olan, K. Prime, Beyond contact-tracing: the public value of eHealth applications in a pandemic, Govern. Inf. Q. (2021), 101581, https://doi.org/10.1016/j.giq.2021.101581.
[69] E.S. Zeemering, Functional fragmentation in city hall and twitter communication during the COVID-19 pandemic: evidence from Atlanta, San Francisco, and Washington, DC, Govern. Inf. Q. 38 (1) (2021), 101539.
[70] E. Anessi-Pessina, C. Barbera, C. Langella, F. Manes-Rossi, A. Sancino, M. Sicilia, I. Steccolini, Reconsidering public budgeting after the COVID-19 outbreak: key lessons and future challenges, J. Public Budg. Account. Financ. Manag. 32 (5) (2020) 957–965.
[71] C. Feijóo, Y. Kwon, J.M. Bauer, E. Bohlin, B. Howell, R. Jain, J. Xia, Harnessing artificial intelligence (AI) to increase wellbeing for all: the case for a new technology diplomacy, Telecommun. Pol. 44 (6) (2020) 101988.
[72] M. Kuziemski, G. Misuraca, AI governance in the public sector: three tales from the frontiers of automated decision-making in democratic settings, Telecommun. Pol. 44 (6) (2020) 101976.
[73] I.N. Pašalić, M. Ćukušić, M. Jadrić, Smart City Research Advances in Southeast Europe, International Journal of Information Management, 2020, p. 102127.
[74] Q. Chen, C. Min, W. Zhang, G. Wang, X. Ma, R. Evans, Unpacking the blackbox: how to promote citizen engagement through government social media during the COVID-19 crisis, Comput. Hum. Behav. 110 (2020), https://doi.org/10.1016/j.chb.2020.106380. Article 106380.
[75] J.C. Choi, C. Song, Factors explaining why some citizens engage in E-participation, while others do not, Govern. Inf. Q. 37 (4) (2020) 101524.
[76] A. Alarabiat, D. Soares, E. Estevez, Determinants of citizens' intention to engage in government-led electronic participation initiatives through Facebook, Govern. Inf. Q. 38 (1) (2021) 101537.
[77] C. Howarth, P. Bryant, A. Corner, S. Fankhauser, A. Gouldson, L. Whitmarsh, R. Willis, Building a social mandate for climate action: lessons from COVID-19, Environ. Resour. Econ. 76 (4) (2020) 1107–1115.
[78] R. White, O. Razgour, Emerging Zoonotic Diseases Originating in Mammals: a Systematic Review of Effects of Anthropogenic Land-Use Change", Mammal Review, 2020, pp. 1–17, available at: https://onlinelibrary.wiley.com/doi/epdf/10.1111/mam.12201. (Accessed 1 March 2021). accessed.
[79] A. Afelt, R. Frutos, C. Devaux, Bats, coronavirus, and deforestation: toward the emergence of novel infectious diseases? Front. Microbiol. 9 (702) (2018) 1–5.
[80] A. Sharifi, A.R. Khavarian-Garmsir, The COVID-19 Pandemic: Impacts on Cities and Major Lessons for Urban Planning, Design, and Management, Science of The Total Environment, 2020, p. 142391.
[81] R.A. Fahey, A. Hino, COVID-19, digital privacy, and the social limits on data-focused public health responses, Int. J. Inf. Manag. 55 (2020) 102181.
[82] T. Chamorro-Premuzic, Can surveillance AI make the workplace safe? MIT Sloan Manag. Rev. 62 (1) (2020) 13–15.
[83] U. Gal, T.B. Jensen, M.-K. Stein, Breaking the vicious cycle of algorithmic management: a virtue ethics approach to people analytics, Inf. Organ. 30 (2020) 100301.
[84] J.R. Saura, D. Ribeiro-Soriano, D. Palacios-Marqués, From user-generated data to data-driven innovation: a research agenda to understand user privacy in digital markets, Int. J. Inf. Manag. (2021), 102331.
[85] S.Y. Yu, A review of the accessibility of ACT COVID-19 information portals, Technol. Soc. 64 (2021), 101467.
[86] G. Watts, COVID-19 and the digital divide in the UK, Lancet Digital Health 2 (8) (2020) e395–e396.
[87] C. Srinuan, E. Bohlin, Understanding the Digital Divide: A Literature Survey and Ways Forward. 22nd European Regional Conference of the International Telecommunications Society (ITS), Hungary, 18th-21st September, 2011. https://www.econstor.eu/bitstream/10419/52191/1/672623358.pdf. (Accessed 12 December 2020). Accessed.
[88] Y. Zheng, G. Walsham, Inequality of what? An intersectional approach to digital inequality under COVID-19, Inf. Organ. 31 (1) (2021).
[89] S. Himmelfarb, The measurement of attitudes, in: A.H. Eagly, S. Chaiken (Eds.), The Psychology of Attitudes, Harcourt Brace Jovanovich Data collection, Fort Worth, TX, 1993, pp. 23–88.
[90] A.G. Greenwald, D.E. McGhee, J.L.K. Schwartz, Measuring individual differences in implicit cognition: the implicit association test, J. Pers. Soc. Psychol. 74 (1998) 1464–1480.
[91] D.L. Kasilingam, Understanding the attitude and intention to use smartphone chatbots for shopping, Technol. Soc. 62 (2020), 101280.
[92] A. Silva-C, The attitude of managers toward telework, why is it so difficult to adopt it in organizations? Technol. Soc. 59 (2019) 101133.
[93] S.K. Shah, T. Zhongjun, A. Sattar, Z. XinHao, Consumer's intention to purchase 5G: do environmental awareness, environmental knowledge and health consciousness attitude matter? Technol. Soc. 65 (2021) 101563.
[94] J.A. Krosnick, C.M. Judd, B. Wittenbrink, The measurement of attitudes, in: D. Albarracin, B.T. Johnson, M.P. Zanna (Eds.), The Handbook of Attitudes, Erlbaum, Mahwah, NJ, 2005, pp. 21–76.
[95] D.J.A. Sabin, D.B.A. Nosek, D.A.G. Greenwald, D.F.P. Rivara, Physicians' implicit and explicit attitudes about race by MD race, ethnicity, and gender, J. Health Care Poor Underserved 20 (3) (2009) 896–913.
[96] M.A. Olson, R.H. Fazio, Implicit attitude formation through classical conditioning, Psychol. Sci. 12 (5) (2001) 413–417.
[97] J.C. Brunstein, C.H. Schmitt, Assessing individual differences in achievement motivation with the Implicit Association Test, J. Res. Pers. 38 (2004) 536–555.
[98] R.H. Fazio, M.A. Olson, Implicit measures in social cognition research: their meaning and use, Annu. Rev. Psychol. 54 (2003) 297–327.
[99] A. Roefs, J. Huijding, F.T. Smulders, C.M. MacLeod, P.J. de Jong, R.W. Wiers, A. Jansen, Implicit measures of association in psychopathology research, Psychol. Bull. 137 (1) (2011) 149–193.
[100] T. Dietz, P.C. Stern, G.A. Guagnano, Social structural and social psychological bases of environmental concern, Environ. Behav. 30 (4) (1998) 450–471.
[101] J. Cohen, Statistical Power Analysis for the Behavioral Sciences, Lawrence Erlbaum, Hillsdale, NJ, 1988.
[102] B. Silverman, Density Estimation for Statistics and Data Analysis, Chapman and Hall, London, 1986.
[103] L.J. Cronbach, Coefficient alpha and the internal structure of tests, Psychometrika 16 (3) (1951) 297–334.
[104] M.A. Jamison, P. Wang, Valuation of digital goods during the coronavirus outbreak in the United States, Telecommun. Pol. (2021) 102126.
[105] S. Leek, I. Szmigin, M. Carrigan, Older consumers and food innovation, J. Int. Food & Agribus. Mark. 12 (1) (2001) 71–89.
[106] B. Gawronski, G.V. Bodenhausen, Associative and propositional processes in evaluation: an integrative review of implicit and explicit attitude change, Psychol. Bull. 132 (2006) 692–731.
[107] B. Gawronski, G.V. Bodenhausen, Unraveling the processes underlying evaluation: attitudes from the perspective of the APE model, Soc. Cognit. 25 (2007) 687–717.
[108] W. Hofmann, B. Gawronski, T. Gschwendner, H. Le, M. Schmitt, A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures, Pers. Soc. Psychol. Bull. 31 (2005) 1369–1385.

[109] Z.T. Kalinoski, D. Steele-Johnson, E.J. Peyton, K.A. Leas, J. Steinke, N.A. Bowling, A meta-analytic evaluation of diversity training outcomes, J. Organ. Behav. 34 (8) (2013) 1076–1104.
[110] G. Lemmer, U. Wagner, Can we really reduce ethnic prejudice outside the lab? A meta-analysis of direct and indirect contact interventions, Eur. J. Soc. Psychol. 45 (2) (2015) 152–168.
[111] H. Steinmetz, M. Knappstein, I. Ajzen, P. Schmidt, R. Kabst, How effective are behavior change interventions based on the theory of planned behavior? Zeitschrift für Psychologie 224 (3) (2016) 216–233.
[112] C.G. Reddick, H.A. Frank, The perceived impacts of e-government on US cities: a survey of Florida and Texas City managers, Govern. Inf. Q. 24 (3) (2007) 576–594.
[113] D. Valle-Cruz, J.I. Criado, R. Sandoval-Almazán, E.A. Ruvalcaba-Gomez, Assessing the public policy-cycle framework in the age of artificial intelligence: from agenda-setting to policy evaluation, Govern. Inf. Q. 37 (4) (2020), 101509.
[114] A.A. Guenduez, T. Mettler, K. Schedler, Technological frames in public administration: what do public managers think of big data? Govern. Inf. Q. 37 (1) (2020) 101406.
[115] T.Q. Sun, R. Medaglia, Mapping the challenges of Artificial Intelligence in the public sector: evidence from public healthcare, Govern. Inf. Q. 36 (2) (2019) 368–383.
[116] R. Doyle, K. Conboy, The role of IS in the covid-19 pandemic: a liquid-modern perspective, Int. J. Inf. Manag. 55 (2020) 102184, https://doi.org/10.1016/j.ijinfomgt.2020.102184.
[117] P.H. Hsieh, W.S. Chen, C.J. Lo, An investigation of leadership styles during adoption of E-government for an innovative city: perspectives of Taiwanese public servants, in: Transforming City Governments for Successful Smart Cities, Springer, Cham, 2015, pp. 163–180.
[118] A.S. Lee, R.L. Baskerville, Generalizing generalizability in information systems research, Inf. Syst. Res. 14 (3) (2003) 221–243.