**Digital Governance and Us:**

**Theory and Multi-Method Examination of**

**Human-Machine-Organization Interactions in Public Service**

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**Scientific background**

**Introduction**

In recent decades, the world has been experiencing extensive digital transformation. Often described as the fourth transformative industrial revolution in human history (Awan, Sroufe, & Shabbaz, 2021), this process is intensifying and accelerating with every year. It abounds with sophisticated technological innovations and information society platforms, which have dramatically altered many aspects of modern life, triggering philosophical discourse on and empirical research into the long-term implications and future directions (e.g., Asgarkhani, 2005; Gil-Garcia, Dawns, & Pardo, 2018). Governments and public administrations are also playing a major role in this revolution, financing finance many of these initiatives, regulating their emergence and operation, and using their outcomes in a variety of fields and domains (Coglianese & Lehr, 2017; Dunleavy et al., 2008). Moreover, the digital revolution is generating new power bases in society with which governments must contend (e.g., virtual communities, cryptocurrencies, international networks of knowledge, etc.). On the one hand, this revolution is redefining old democratic rules and values, but on the other, it is also prompting more government regulations and interventions to safeguard public interests and the public good (e.g., Considine et al., 2022; Moore, 2019). In many ways, it is ultimately redefining the relationships between governments and citizens, and intensifying the adoption of digital tools and technologies aimed at improving public sector performance.

These challenges, and others, are at the core of our study. We maintain that digitization in public management and governance has advanced considerably since its emergence, which coincided with the technological revolutions of the information society in the late 1980s. In its first evolutionary wave, public management was heavily inspired by widespread global market orientations, a strong neo-liberal ideology, and more ambition to increase performance and promote a business-like public sector. This, consequently, placed digitization at the heart of the second wave of changes in public management and governance that occurred in the late 1990s and early 2000s (Dunleavy et al., 2005; Katsonis & Botros, 2015). That, in turn, paved the way for new ideas about algorithm- and machine-based reforms, progress based on interdisciplinary knowledge and technological advancement, and an intensive orientation towards information and big data sources. All of these facilitated greater modernization and faster and more extensive transfer of data among stakeholders, especially between citizens as end-users and bureaucracies. Ideas like artificial intelligence, machine learning, and the metaverse have also become more prevalent in public administration, public management, and governance studies (e.g., Etscheid, 2019; Hudson‐Smith, 2022). Broadly speaking, digitization has become a general power multiplier of the public interest and now plays a major role in building strong nations (Vigoda-Gadot, 2009, 204-5). Above all, it has planted the seeds of a profound cultural and value change in public organizations and government responsibilities.

 However, there are indications that the extent and depth of these digital transformations in public sectors lag far behind the technological developments (Giest, 2017; Hudson‐Smith, 2022). Many citizens face immense difficulties in handling these new digital tools, and in general terms, the exact effects of the digital revolution on individuals such as public servants or citizens, the performance of public organizations as bureaucratic bodies, and the relations between governments and citizens remain unclear. Integrating digital transformation into governance and public management lends new shapes and characteristics to the social relations between all parties involved in the production and consumption of public goods and services. These new forms are also leading to new and serious problems across the human, organizational, and overall policy levels (e.g., increased inequality, lower social mobility, corruption, differentiation in service delivery and outreach, changing nature of public jobs; e.g., Bastida et al., 2021). Current studies on public administration and management tend to suggest general, often philosophical, analyses of these processes, or, alternatively, focus on very specific aspects of the dilemmas, thereby leaving considerable room for more integrative and multi-level models to grow and flourish (e.g., Dunleavy et al., 2008). Our study takes a more holistic view by proposing theoretical and empirical directions for further advancing this field.

**Research objectives and expected significance**

This study seeks to deal with some of these gaps in both epistemological and empirical thinking. We suggest that establishing holistic and integrative theoretical grounds for analyzing and understanding the core mechanisms through which new governance addresses the challenges of the digital revolution is essential for engaging with the complexity of the digital revolution in governance and public management. These challenges include opportunities, threats, barriers, biases, and innovations at the social and political levels, human mental-emotional considerations, and organizational constructs. Our major objectives are thus threefold: (1) to develop a theoretical model for human-machine-organizational interactions in public arenas; (2) to suggest specific propositions for empirical study; and (3) to present a multi-method approach for their analysis. To achieve these goals, we propose a consolidative theoretical framework, with an emphasis on human interfaces between machines and public organizations. We expect that this may improve analysis of these problems and set a comprehensive research agenda for future progress in the field.

**Detailed description of the proposed research**

The digital trio in governance: Theoretical foundations

At the core of our theoretical framework stands the idea that digitization in governance and public management involves a threefold interaction between humans, machines, and organizations. This idea challenges the conventional thinking of various disciplines and builds on two separate but complimentary streams of research. The first is the extensive field of Human-Machine Interactions (HMI), which has expanded as the digital revolution has progressed in modern societies. Many studies suggest philosophical, moral, technological, and psychological aspects of how individuals interact with machines and the implications of those interactions for society (e.g., Borch & Hee Min, 2022; Favela, 2019; Kettel & Tonurist, 2020, ). Much of the literature on HMI is technological in nature and rooted in (social) engineering, and HMI is largely overlooked in public administration literature. We will follow Reid and Gibert (2022), who recommended extending the impact and examination of this HMI knowledge across diverse subjects to benefit all people. The second field to which we seek to contribute is strategic management, organizational and policy which tends to focus on organization-machine interactions (e.g., Bretschneider & Wittmer, 1993; Fedorowicz et al., 2018). We suggest that when these lines of thinking are integrated with knowledge on human-organization interactions (e.g., in organizational behavior or cognitive and applied psychology), they may foster a more comprehensive framework for the role of the digital revolution in public spheres. A further outcome may be the emergence of a hybrid and interdisciplinary sub-field, related to the human-machine-organization trio, and an aspiring new cluster of theories and ideas.

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Figure 1 about here

 Figure 1 presents our conceptual framework, which includes several building blocks that are closely interrelated. As a starting point, we take the existing structural conditions that characterize the public sector and emphasize its uniqueness and centrality for modern nations over and above the private or the third sector (i.e., organizational structure, culture, and the socio-political environment in which the public sector operates). The opportunities and challenges for change in governance and public management are rooted in the development of new digital and information technologies that may help improve the management and effectiveness of the public sector. When public administrators become more aware of these developments, they may also become more open to initiating and adopting new forms of digital transformation that coexist with and benefit the interests of individuals, organizations, and the public. This complex process involves both organizational aspects and personal and psychological mental-emotional models (e.g., Hattke et al., 2020; Vigoda-Gadot & Meisler, 2010). Both individuals and organizations in public spheres may be affected by the special environment in which public administrators operate. To understand the relationships between the multiple levels and sheer volume of actors in digital-era government, a more detailed and integrative model is needed that specifies the mutual impacts and rationalizes them in a way that can foster not only theoretical progress but also concrete empirical development.

As Figure 1 illustrates, digital transformation may be regarded as an exogenous factor that is intensifying over the years. Its impact on our lives is dramatically increasing, not only with natural technological advancement, but also due to external events such as the outbreak of the COVID-19 pandemic (Dunleavy et al., 2005; 2008; Shen et al., 2022) and other global crises such as international conflicts, the global terror threat, and environmental hazards (Clark & Albris, 2020). Greater digitization heavily affects public policies and strategies, and rapidly translates into managerial practices at the organizational and street levels. The COVID-19 global crisis exemplifies how digital platforms can be used by governments, in this case to deal with the pandemic. But at the same time, it also illustrates how the same technologies can create quite troubling problems related to privacy, human rights, citizens’ trust, and other impacts on democratic values (e.g., Cheng et al., 2020; Mizrahi et al., 2021). We therefore argue that in such circumstances, interactions between humans, machines, and organizations deserve special attention, which may be advanced by looking more closely into human interfaces. This human interface is comprised of two major elements, namely individuals’ perceptions of and their emotions towards digital governance. These constructs, which are the results of digital governance transformations, are built on stakeholders’ perceptions of the Digital Governance Footprint (DGF) and their Mental and Emotional Models (MEMOs). The next sections elaborate further on the meaning of these notions and how they are integrated within our proposed model.

Towards integration: Exploring human-machine-organization interactions

The theoretical framework developed in this study addresses three major questions. First, what are the barriers and biases that may influence the mechanisms of digital transformation in public organizations, and how do they relate to the outcomes and performance of these organizations? Second, what is the nature of the interactions between machines, humans, and organizations, and how do they relate to public management practices, policies, and stakeholders’ perceptions of the Digital Government Footprint (DGF)? Third, how do the complex mechanisms of human-machine-organization relations influence public sector performance both in terms of outcomes and processes?

 As suggested in Figure 1, digital governance transformation yields specific public policies and strategies that are adapted to the digital age, whilst simultaneously prompting the development of public management practices that adhere with such policies and strategies. Both of these – the policies and strategies, and the management practices – are the major factors that affect human interfaces with digital governance. They mold stakeholders’ perceptions and shape a subjective view of the DGF that later affects organizations, and more specifically the individuals relating to them. This relationship may operate solely through stakeholders’ perceptions of the DGF or may be mediated by Mental and Emotional Models (MEMOs). Consequently, and within this framework, we develop three main concepts and then analyze the relationships between them. These concepts are (1) digital governance transformation, (2) perceptions of the Digital Government Footprint (DGF), and (3) Mental and Emotional Models (MEMOs). These concepts will allow us to progress along the empirical pathway for testing the propositions stated below.

*Digital governance transformation* is the process of creating, adjusting, and adapting various technologies in public agencies in order to improve internal management processes and external outcomes, such as services to citizens and relationships with other stakeholders (Giulio & Vecchi, 2022). It is a process of moving from traditional government to new, innovative, and digital-based forms of e-government and digital governance by deploying new initiatives promoting n a broader technological-business orientation in government. Studies suggest that this process of digital governance transformation is related to a complex set of variables, some of them not necessarily related to technology (e.g., the nature of the target population, the proxies used for technology assimilation, regulatory policies, etc.; e.g. Matus & Veale, 2022). It is further argued that “the introduction of new technologies by governments is always mediated by organizational, institutional, legal, ethical and social factors” and that “digital technologies may transform virtually every process, system and structure of government, resulting into redefinition of responsibilities and work routines of public officials” (Liva et al., 2020, 502). Digital governance transformations may be affected by a small set of social, organizational, and political factors that are relevant to a specific environment. These may include (but are not limited to) openness to change and innovation in a specific culture or organization, power distance, uncertainty avoidance, long- versus short-term orientations (e.g., Hofstede et al., 1990), governments’ policies on the planned adaptation of new technologies, organizational climate, and knowledge-sharing norms and regulations. Clearly, virtual media and internet networks are significantly extending and accelerating digital transformations in government using megadata sources for both constructive and less constructive goals. These studies stress the machine-organization axis while marginalizing the human aspects of the mental models and emotions of the individuals involved in such dynamics.

*Stakeholders’ perceptions of the Digital Governance Footprint (DGF)* isdefined as the stakeholders’ perceptions of the digitization of governance. It refers to stakeholders’ attitudes towards a variety of technologies, systems, and tools that involve digitization and are used in or by the public sector. Individuals’ perceptions of these include attitudes and behaviors related to the digital government landscape and its importance in the provision and consumption of public services and goods. We argue that perceptions of the DGF may be used as both a conceptual tool for intellectual thinking and as a useful empirical vehicle for advancing the field. In fact, the idea of the DGF draws substantially from the environmental studies idea of the ecological footprint (e.g., Wackernagel & Rees, 1996; Wackernagel et al. 2006) and its use in public policy arenas (e.g., Collins & Flynn, 2015; Gottlieb et al., 2012). These studies seek to measure the impact of humans on their environment by means of their use (and misuse) of environmental resources in day-to-day life. For example, Gottlieb et al. (2012) demonstrate how the ecological footprint can be related to the citizenship behavior of high school students, and other studies suggest methodologies to measure it and evaluate its impact on other populations (e.g., rural and urban residences) and on organizational and governmental policies (Collins & Flynn, 2015). We believe that the idea of the DGF has much to offer to our understanding of the e-government era (Dunleavy et al., 2005) as an independent perceptual and cognitive measure of humans’ interaction with the digital government world. It reflects a collective and subjective perspective on the meaning of digital governance for end users and on the impact of technology on humans and their environment. As much as humans leave their footprint on the environment, governments may well also leave a technological footprint on humans and the environment. Thus, perceptions of the DGF may be best conceptualized as a five-tier model consisting of stakeholders’ views on: (1) *knowledge* about digitization in government, (2) *understanding* digitization in government, (3) *accepting* government digitization as an essential tool for policy and management, (4) *implementing* knowledge about government digitization and using digital tools, and (5) *disseminating* *knowledge* about government digitization to others. We will argue that perceptions of the DGF may be assessed in regard to various digital infrastructures. In the broadest terms, perceptions of the DGF may be understood as a concept that places humans at the center of the digital transformation by focusing on their reaction to government digital transformations. In that sense, perceptions of the DGF differ from digital transformations themselves and offer an innovative understanding that focuses on the subjective views of public stakeholders on the use, spread, and centrality of technology in public spheres. All of these aspects of DGF will be included in our study, with the goal of proposing testable ways to assess them.

*Mental and Emotional Models (MEMOs)* are suggested as another construct for representing human interfaces, one that could play a mediating role between perceptions of the DGF and organizational outcomes. Mental and Emotional Models are widespread in behavioral sciences and are influential when considering human reactions to various life events. Since the emergence of the technological and digital revolution, they have played an even more important role, and the interest in such models for dealing with machines is on the rise (e.g., Forster et al., 2019; Krak et al., 2022). The MEMO approach is based on the idea that citizens and other stakeholders who consume and use public goods and services become dominant players in a digital sphere and respond to perceptions of the DGF. The responses may vary across a large scale of attitudes and behaviors, which depend on personal mental models and on the emotions of public stakeholders (e.g., uncertainty, anxiety, anger, fear, alienation, frustration, kindness, fairness/equity, solidarity, satisfaction, trust, happiness, etc.). Studies combining cognitive psychological theories with knowledge in engineering and computer science use mental models and emotions to explain human-machine interactions. Such studies (e.g., Jain, Kumar, & Kumar, 2019; Prabhu et al., 2022) lay the foundations for our argument, as they illustrate which emotions may be important (e.g., happiness, anger, sadness, and fear) as well as in what cases, fields, and services they are relevant (e.g., transportation, healthcare, welfare, and security). These studies, and many others, empirically demonstrate the centrality of individuals’ cognition and emotions and how they may be used to explain digital governance outcomes and performance. They imply that many attitudinal, dispositional, and behavioral reactions are subject to emotional interpretations, and explain how these may affect various public values (e.g., exit/withdrawal, voice/participation, neglect, loyalty, engagement, ethical behaviors/corruption, participation in decision making (PDM), and public service motivation (PSM)). Our study will attempt to map the mental and emotional landscape for dealing with digital governance and propose ways to empirically test it and its outcomes. The goal is to contribute to the prospering field of government performance in the digital age (e.g., Giest, 2017; Rocheleau, 2007).

Furthermore, the mental and emotional responses of individuals to the rise of machines and digitization may additionally depend on previous personal experiences, and on socioeconomic conditions such as education, income, gender, and age. The public management literature usually studies human-machine and organization-machine interactions in the context of e-government, yet it mainly looks at structural-organizational parameters and socioeconomic conditions (e.g., Kassen, 2018; Lee & Kim, 2017). It is much less attentive to the cognitive-psychological or sociopsychological aspects of e-government. Consequently, studies in these fields very rarely refer to mental models and emotions as important determinants of the processes of digital transformation. We argue that to fully understand the interactions between humans, machines, and organizations, we need to focus on individuals’ interpretations of the public digital/technological sphere not only in terms of their perceptions of the DGF, but also in terms of their mental and emotional responses.

The interactive process: Rationale and logic

What is the evolvement process in digital transformation and what impact does it have on policies, practices, individuals, and organizations in the public sphere? Undoubtedly, such evolvement faces barriers and biases that may influence its progress and affect the performance and effectiveness of people, agencies, and bureaucracies. One way to deal with this issue is to analyze digital transformation as a type of reform that most, if not all, public agencies around the globe have had to face in recent decades. If analyzed as a type of reform, digital transformation in government may use ideas rooted in New Institutionalism theory. Studies suggest that most of these reforms share many similarities (Mizrahi & Tevet, 2014; Pollitt & Bouckaert, 2004) and are thus subject to a generic analysis. In their seminal research, Pollitt and Bouckaert (2004) induce from their comparative study a schematic model of public sector reforms that depicts the main forces and players in such processes and the interactions between them. They point to (1) *socioeconomic forces*, including global and technological forces, (2) the *political system*, including citizens’ expectations and new political ideas, (3) the *administrative system*, which involves both policy planning and policy implementation, and finally (4) *chance events*, representing unexpected events such as innovations or crises and emergencies. All these factors interact with each other and influence decisions at the highest level regarding certain reforms. Yet, this is essentially a structural model that overlooks individuals’ reactions and other personal and personality factors. We suggest that these may be important variables for explaining public sector reforms in general, and especially when dealing with digital transformation as a major borderless reform with global, cross-sectorial, and cross-organizational implications. Thus, we suggest that systematically incorporating other models that deal with reforms should integrate both organizational-structural factors and individual-mental/emotional factors into one coherent theory.

Through the prism of the institutionalism perspective, processes of institutional change begin when existing policies and institutions create negative policy feedbacks such as ineffectiveness and stakeholder dissatisfaction (Mizrahi & Tevet, 2014). Such feedback may emerge due to new technoeconomic revolutions and the impact of transnational forces or due to government failures and transformation of the political culture. Negative policy feedback is a prerequisite for such change to emerge, but another important condition is that the lock-in effect is relatively weak. This means that pro-status quo players and forces either do not exist or they are too weak to lock in the existing policy and block change. In reality, these forces are often very strong, meaning that there are significant barriers to change, and the literature offers various ways to overcome them (Hacker, 2004). This line of thinking is, again, quite structural in nature. As such, it marginalizes human/individual parameters, which are valuable inputs that may complement the explanations.

Digital government transformation is also continuously nurtured through the new digital technologies that are developed and promoted by global digital and tech firms. These new technologies constantly generate expectations and pressures on public administrations to make use of them across the board. However, the specific ways in which these technologies are deployed depend primarily on existing organizational characteristics (Chakravorti et al, 2020; Galvin et al, 2021). These include micro-level characteristics such as organization type and climate, internal politics, and the internal labor market (Kane et al, 2017; Vigoda-Gadot, 2007; Westerman et al, 2011), and macro-level characteristics such as NPM practices, globalization, political and civic culture, and socioeconomic forces (Waller & Weerakkody, 2016). The interactions between such new technologies, which are constantly infused into public spheres, together with the organizational characteristics of public realms create the practices and ideas that define the digital transformation. Thus, a key research challenge is to identify patterns of interactions between technology and organizations that lead to specific practices in digital transformation. For example, a highly centralized organization will most likely adopt technologies that enable control but will be less favorable towards technologies that encourage inclusion and enable participation in decision making.

Digital transformation of performance: The human interface and perceptions of the DGF

Digital governance transformation influences and shapes both public policies and strategies, and public management practices and performance (Exmeyer & Hall, 2022; Manoharan, Melitski, & Holzer, 2022). Ultimately, such policies and managerial practices are expected to reconfigure the relations between individuals and government and affect the unwritten social contract with citizens. The magnitude and scope of such public policies and managerial practices is largely reflected in stakeholders’ perceptions of the Digital Government Footprint (DGF). When it comes to identifying patterns of relations between humans, machines, and organizations, perceptions of the DGF play a central role as a reflection of major public stakeholders’ views regarding digital transformations in governance and in public management.

According to our model, stakeholders’ perceptions of the DGF may be affected by governments’ policies and strategies, and by the public management practices resulting from those policies. These perceptions may be related to cultural diversity and should be examined through the lens of various types of populations (e.g., elderly people and younger generations, minorities, and marginalized people). Perceptions of the DGF are also expected to affect public sector performance in terms of both outcomes and processes. This may affect both individuals and organizations across the public spheres in many ways. For example, public organizations may respond to the nature of the perceptions of the DGF within their internal environment, or to the nature of the perceptions of the DGF in other organizations with whom they interact and collaborate. In addition, perceptions of the DGF may affect individuals within those organizations, as well as other individuals such as citizens, contractors with public agencies, and other public stakeholders. Hence, perceptions of the DGF may affect public sector performance in two major dimensions: (1) the effectiveness and fairness of managerial processes, and (2) the quality and quantity of public services and goods that the government provides. According to Vigoda-Gadot and Mizrahi (2014), public sector performance includes processes and outcomes which are both subject to change in the digital sphere of governance. While the NPM approach, inspired by neo-liberal ideas, tends to focus on outcomes such as effectiveness and efficiency (Mizrahi, 2017), research in the past two decades has highlighted the importance of variables and values related to the managerial process as the main determinants of citizen-government relations (Gil-Garcia, et al., 2018; Meijer & Boon, 2021). Such values include the parameters of accountability, responsibility, fairness, transparency, participation in decision making, and representation, all of which are increasingly affected by conventional media, social media, and other digital interfaces. Together, these may have a strong impact on citizens’ evaluations of government performance, satisfaction, and public trust in government (Criado & Villodre, 2021; Vigoda-Gadot & Mizrahi, 2014). As a result, digital transformation that yields good managerial processes clearly has the capacity to lead to improved public sector performance, but can do so only through the human interface. Perceptions of the DGF largely reflect these human connections. They put greater emphasis on process variables, placing them above outcome variables, which may help explain performance and provide guidelines for how to improve that performance.

We therefore argue that successful digital transformation may create more positive views among a variety of stakeholders towards the DGF. These may then increase both organizational and individual indicators of government outcomes and performance in terms of processes and results. However, we also expect that such relations and impacts may vary depending on individual, structural and cultural parameters. More positive perceptions of the DGF have the potential to lead to improved performance because they may indicate that individuals are adjusting and accepting the digital reforms in government as an inherent part of governments’ responsibilities to improve services and public goods. Digital technologies may increase transparency, enable effective participation in decision making, improve accountability mechanisms and establish fairness in the relations between the public sector and citizens.

However, an important missing link in this relationship is individuals’ *mental and emotional* *reactions* to digital government transformations and to perceptions of the DGF. In the next section, we suggest that mental and emotional models (MEMOs) may help better understand the interactive relations of the trio. We will argue that MEMOs mediate the relationship between stakeholders’ perceptions of the DGF and organizational outcomes.

Mental and Emotional Models (MEMOs): The missing link for integration?

As Figure 1 postulates, we propose that when people are confronted with the implications of digital transformation in governance (e.g., perceptions of the DGF), they process and filter them through their mental-emotional models (MEMOs). Mental models are rooted in cognitive psychology, and their principal assumption is that individuals reason by trying to envisage the various possibilities that are compatible with what they know or believe (Craik, 1943; Byrne, 2005). In many complex situations, such as dealing with complex digital environments, individuals picture a scenario or moving mental images and react accordingly.

Moreover, mental models are frequently associated with emotions (e.g., Thornton & Tamir, 2017). It is argued that mental models create emotions among individuals and trigger responses that are highly relevant to a variety of public services and to governments’ outcomes. For example, Jain, Kumar, and Kumar (2019) demonstrate how emotions can be detected by automatic facial recognition and suggest that these applications are highly useful for clinical and behavioral purposes. Prabhu et al. (2022) more specifically point to several emotions as central to any process of HMI (e.g., happiness, sadness, anger, surprise, fear, disgust, etc.). Thus, the process of reacting to a challenging digital environment is very likely to depend on MEMOs. Note, however, that studies on emotions from a more psychological perspective disagree about the existence of the basic emotions that are fundamental to such reactions (e.g., Ortony, 2022). Nevertheless, there is no disputing that technology arouses emotions, and that emotions resulting from mental models are relevant to any situation where individuals play a central role in society. Digital governance is undoubtedly one of these arenas, with manifold optional situations for interaction.

Recently, Gomez and Whyte (2021) used a survey-based experiment to test the aftermath of cyber operations on individuals within international environments. They found that the assumptions of the “cyber doom” narrative are misleading and that the impact of novel environmental circumstances on opinion formation is shaped by the individuals’ embeddedness in modern digital society. Consequently, they argue that long-term exposure to any invasive development mitigates the emotional response associated with it, normalizing novel threats over time. They further suggest that the unique characteristics of a development (i.e., web-technology proliferation) are important in opinion-formation, as the sensitivity to digital threats to the polity is grounded in personal threat-sensitivity. Their recommendations to policymakers are to examine the outcomes of new technologies closely, as public responses to new national security threats may be manifested through the lens of prevailing social and political narratives (p. 1137). These findings further strengthen the idea that MEMOs are essential in order to better understand the impact of digital governance on public organizations’ outcomes and on individuals operating in their surroundings. Individual filters may intervene in the processes of policy and managerial formation and implementation, creating biases and barriers, but also opportunities, depending on the personalities involved.

Following this rationale, we argue that MEMOs are an essential part of the human interface construct. They lead individuals to rethink their previous perceptions of the DGF and to react based on that rethinking. Such reactions and responses are then used by decision makers to reshape public policies and public managerial practices. They are adjusted using stakeholders’ interpretation of policies, their knowledge and understanding of them, and the extent to which they are willing to accept them and export or transfer them elsewhere. Yet the relationship between stakeholders’ perceptions of the DGF and outcomes at both the organizational and individuals’ level might be mitigated through human interfaces. The mental models and emotions of those involved in such processes are thus crucial here.

**Inside the black boxes: Propositions**

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Figure 2 about here

The idea of digital human-machine-organization interaction is at the heart of our study and calls for a closer look into the model’s black boxes. Figure 2 presents a more detailed version of our model as presented in Figure 1, in which various elements of each building block are expanded and interrelated. Obviously, what we postulate here is an initial proposal meant to highlight several competing relationships. Alternative propositions that emerge from Figure 2 and that will be developed in the main study are:

*P1: Digital government transformation, organizational outcomes, and individual reactions are subject to changes in the social, organizational, and political environment.*

*P2: Digital government transformation affects public policies and strategies (e.g., decentralization, downsizing, debureaucratization and cutting red tape, collaboration, and privatization).*

*P3: Digital government transformation affects public management practices (e.g., human resource management practices, performance measures, service quality, leadership, and teamwork).*

*P4: The human interface is based on stakeholders’ perceptions of the digital government footprint (DGF) and on the mental and emotional models (MEMOs) of individuals. These mediate the relationship between digital transformation in government and public organizations’ outcomes and performance.*

*P5: Public policies and strategies, and public management practices mediate the relationship between digital governance transformation and the human interface (stakeholders’ perceptions of the DGF and MEMOs).*

*P6: MEMOs (e.g., anxiety, anger, fear, alienation, frustration, kindness, satisfaction, happiness, EI, etc.) mediate the relationship between stakeholders’ perceptions of the DGF and organizational outcomes (e.g., performance, efficiency, effectiveness, economy, individuals’ intentions to exit/withdraw, voice/participation, neglect, loyalty, ethical behavior, PDM, PSM, and other democratic values).*

These propositions are presented in a form capable of including a variety of relevant variables. As the study progresses, they may be formulated in more specific ways. For example, based on the qualitative stage, we may recognize additional variables worthy of examination and comparison across cases. Based on the preliminary surveys and (lab) experiments, we may change some of the propositions to adhere with mid-term findings. The value of the current model is in dealing with the specific measurable variables of each building block. The interdisciplinary orientation of our study is further evidenced by these propositions. Hence, our propositions and the following design for testing them may potentially contribute not only to public administration and public management, but also to psychological, political, sociological, administrative, business and managerial, technological, and environmental fields. Yet the real challenge is integrating the accumulated knowledge into a holistic view where the science of governance and public management may be the major beneficiary. To meet these goals, we propose a multi-method strategy backed by both qualitative and quantitative analysis. The next section seeks to better explain these methodologies.

**Research design and methods**

The methodologies available to carry out these tasks are many. Digitization in governance and in public management is developing rapidly and interacts with public stakeholders in many areas and junctions of daily life. We will focus on several methods that are, in our view, the most promising and will be most beneficial to us in this five-year project: (1) process-tracing qualitative analysis, (2) comparative case studies, and (3) surveys, surveys-experiments, and laboratory experiments.

*Process-tracing methodology* is usually defined as the systematic examination of diagnostic evidence selected and analyzed in light of research questions and hypotheses posed by the investigator (Collier, 2011; Mahoney, 2010; Ricks and Lui, 2018). Process tracing is an analytical tool for drawing descriptive and causal inferences from diagnostic pieces of evidence – often understood as part of a temporal sequence of events or phenomena. By engaging closely with cases and accumulating fine-grained case-specific data, process tracing can make decisive contributions to diverse research objectives such as (a) identifying novel political and social phenomena and describing them systematically, (b) evaluating prior explanatory hypotheses, discovering new hypotheses, and assessing these new causal claims, (c) gaining insight into causal mechanisms, and (d) providing an alternative means – compared with conventional regression analysis and inference based on statistical models – of addressing challenging problems such as reciprocal causation, spuriousness, and selection bias. Thus, we intend to employ qualitative tools that can strengthen causal inference in small-N designs based on the matching and contrasting of cases–designs. Such a strategy has great value for studying human-machine-organization interactions, but its contribution to causal inference urgently needs to be supplemented by within-case analysis. Hence, the process tracing methodology can be applied for the purposes of within-case analysis of the initial stage of digital transformation and perhaps also its impact on policy formation and management practices. Furthermore, by choosing various representative cases on the basis of inter-sector and international comparisons, we will be able to identify general patterns of relations between organizational characteristics and the adoption of digital technologies in the public sector.

*Comparative case studies* will be used to examine social, political, and cultural differences in the human-machine-organization interactions. These may be valuable for better understanding the differences between nations, cultures, and societies when it comes to dealing with the digital governance challenge. It may also contribute by facilitating a comparison between different public agencies, sectors within governments, and the federal-state-local differences. This methodology has been developed and applied in the context of comparative public administration (Pollitt & Bouckaert, 2004; Raadschelders et al., 2015). Fitzpatrick et al (2011) present the results of a content analysis of 151 comparative public administration articles from 2000 to 2009. They recommend enhanced application of mixed methods, increased use of culture and values as key concepts, and integration of a broad range of social sciences to encourage more students, practitioners, and scholars to think and work comparatively. Our study follows this line of thinking. This comparative approach may be highly valuable as the type of machines (technology), humans (social groups), and organizations (a variety of public agencies) differ but are nonetheless intercorrelated. Cases for the comparative analysis will be chosen after careful review of the literature and based on past studies’ results.

*Surveys, survey-experiments, and laboratory experiments* are at the heart of our quantitative analysis. Whereas surveys are a very commonly used method in the discipline, survey-experiments and especially laboratory experiments are less prevalent. Nonetheless, they have become more and more widespread in recent years (Vigoda-Gadot & Vashdi, 2020, part III). They will be essential and useful in our study as they allow close examination of both stakeholders’ perceptions of the DGF and subjective aspects of MEMOs. We will develop appropriate survey tools to assess perceptions of the DGF based on past established experience in applied psychology, organizational behavior, and environmental science that employed Ecological Footprint scales and emotion recognition (e.g., Ortony, 2022). The new tools will be tested for validity and reliability among different public stakeholders (e.g., policymakers, local government managers, citizens). In addition, survey-based and lab-based experiments are needed to gather objective data on individuals’ mental and emotional models as a reaction to digital governance transformations. We will use survey experiments to control for data-driven government impacts on individuals, along with laboratory experimental methods (2x2 classic experiment design) based on one research group and one control group (for every type of stakeholders group), where only the former will be exposed to greater digital transformation impacts). These experiments have previously been suggested and used in the discipline (e.g., Bozeman & Scott, 1992; James, Jilke, & Van Ryzin, 2017) and promoted by laboratories across the world (e.g., at Erasmus University, Netherlands, City University, Hong Kong, Higher School of Economics, Moscow, KDI School of Public Policy & Management, South Korea, and many others). Our contacts and collaboration with researchers in such institutions will help us to develop the study and the experiments. We will focus on identifying different digital practices that may influence perceptions of the DGF and participants’ emotional responses. Additional surveys and survey-experiments will be developed to try to trace the impact of the human interface (DGF and emotional responses) on the organizational processes and outcomes in the forms of performance, perceived performance, and public values. The surveys and the experiments will be developed over the course of the project based on existing knowledge on emotions, emotional intelligence, and other mental-models reported in both psychology-based and behavioral public management-based studies (e.g., Lynn, 1996; Grimmelikhuijsen et al., 2017). Merging the behavioral approach in public management with the idea of digital public management and governance is therefore a promising methodological advance suggested in our study.

**Infrastructure and preliminary results**

The study will be organized around the infrastructures available at the University of Haifa, including the CPMP-Center for Public Management and Policy (<https://cpmp.hevra.haifa.ac.il/index.php/he/>) and the POP-I Lab for the Interdisciplinary Behavioral Study of Public Organizations and Public Policy (<https://sites.google.com/edu.haifa.ac.il/prof-eran-vigoda-gadot/pop-i-lab>). Both the center and the lab have access to human resources (graduate students and technical support), to computerized systems, and to relevant databases (nationally and internationally) that will support our methodologies. The university library will allow us to conduct the literature survey and support the process-tracing and comparative analysis, while the lab will facilitate development of survey-experiments and in-lab experiments of individuals’ MEMOs on technological transformation via case‑developments and exposure to real-time and ongoing events. Preliminary results as to research tools, quality of measurements and theoretical foundations are included in past publications of the PIs (e.g., Levitats et al., 2017; 2019; 2020; Mizrahi, 2017, Mizrahi & Tevet, 2014; Vigoda-Gadot & Mizrahi, 2014).

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**Figure 1: An integrative model of human-machine-organization interaction in public spheres**

Social, Organizational, & Political Environment

Social, Organizational, & Political Environment

**The Human Interface**

**Public Policies & Strategies**

**Organizational Outcomes**

**Mental & Emotional Models (MEMOs)**

Feelings

**Stakeholders Perceptions of the Digital Governance Footprint (DGF)**

Knowing, Understanding, Accepting, Using, Exporting

**Digital Governance**

**Transformation**

**Public Management & Practices**

Figure 2: An integrative model of human-machine-organization interaction in public spheres: An extended integrative model

**Public Policies & Strategies**

* Decentralization
* Downsizing
* Debureaucratization & Cutting Red Tape
* Collaboration
* Privatization

**Stakeholders’ Perceptions of the Digital Governance Footprint**

**(DGF)**

Infrastructures:

* Information Technology (IT)
* Artificial Intelligence (AI)
* Machine Learning (ML)
* Deep Learning (DL)
* Big Data (BD)
* Open Data (OD)
* Cyber/Cyberspace
* Social Media
* Mobile Technologies
* Internet and Metaverse

Tools:

* Bots
* Robots
* Algorithms

**Organizational outcomes**

* Performance
* Efficiency. Effectiveness, Economy (EEE)
* Responsiveness
* Exit/Withdrawal
* Voice/Participation
* Neglect
* Loyalty
* Ethical Behaviors/Corruption
* Participation in Decisions (PDM)
* Public Service Motivation (PSM)
* Democratic and Public Values (Trust, Good Citizenship, Solidarity, Engagement, Fairness/Equity, Accountability, Transparency)

Social, Organizational, & Political Environment

**Mental & Emotional Models (MEMOs)**

* Uncertainty
* Anxiety
* Anger
* Fear
* Alienation
* Frustration
* Kindness
* Satisfaction
* Happiness
* Emotional Intelligence (EI)

**Digital Governance**

**Transformation**

**Public Management & Practices**

* HRM
* Performance Measures
* Service Quality
* Leadership
* Teamwork