

Clarification about datafication

Reflections on the impact of datafication for e-government research

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ABSTRACT

Research in the e-government domain is strongly rooted in the era of digitalization. Digitalization in this paper is about the use of digital technology to improve existing government processes and procedures. The implementation of digital services has been one of the main areas of digitalization of government the last two decades. Now a new era is emerging, the era of datafication. Datafication is already touching on public administration, if we look for example at the implementation of “smart cities”.

The transformational promise of datafication is high. According to prominent experts we will witness drastic changes in economy and society the coming future. Although this promise has yet to be delivered, we want to discuss the meaning of datafication for e-government research. This effort is made because of concerns that the impact of datafication on government is somehow underestimated by researchers.

In this paper we first look at the differences between digitalization and datafication and try to get an understanding of the future impact of datafication for government. To further address the impact of datafication on e-government research, we undertake two activities: 1) we examine e-government theoretical models, 2) we review recent literature review studies on smart city research, where smart city is in our view a manifestation of datafication in public administration.

Using these findings we try to find some answers to the question whether datafication is just a new phase in e-government research, or are we shifting to a new paradigm?

Keywords

Digital transformation, e-government, digitalization, datafication, smart city, paradigm shift

1. INTRODUCTION

If e-government is, in essence, about putting the “e” into government, we are now witnessing a time where the “e” is definitely put into society. We quantify our personal lives, we connect things on the Internet, we use big data analytics to take better business decisions, we let robots come out of the factories and enter our daily lives, our cars drive themselves with intelligent navigations and sensors, we can pay worldwide with bitcoins, etcetera, etcetera.

The innovative power of digital technology, caused the chairman of the World Economic Forum (WEF) to declare the Fourth Industrial Revolution, after the revolutions caused by steam and water power, (1784) electricity and labor division (1870) , automation and mass production (1969) (Schwab, 2016). Together with the WEF also other prominent experts are painting a picture of digital revolution and transformation of society. To name a few: the information philosopher Luciano Floridi explains how the “infosphere is reshaping human reality” (2014), consultant Peter Hinssen declares that “digital is no longer a novelty, but the new normal” (2010), MIT researchers Erik Brynjolfsson and

Andrew McAfee (2014) paint the image of “the second machine age, the age where digital engines will transform society and economy”, and last but not least, Cukier and Mayer-Schoenberger (2014) who discuss “the rise of big data, and how it is changing the way we think about the world”.

Ignoring the sometimes hyped-up tone, it seems that something drastic is happening. Some, like this author, might have a déjà-vu. The same feeling and excitement was around twenty years ago, with the rise of the world wide web and the enthusiastic introduction of e-commerce business models. Like the private sector in those days, also public sector was willing to embrace the opportunities of the new technology and it was a matter of time when government agencies would turn into an Amazon or eBay.

With the label e-government many plans and projects have seen the light, mainly in areas where governments deliver services to citizens and businesses (Hazlett & Hill, 2003), and areas of back-office collaboration between government organizations. (Bekkers, 2007).

Although the transformational promise of e-government was high, current evidence shows that institutional change of government in the Western economies has been surprisingly low. Fountain (2001), one prominent e-government scholar, recently stated: *“Research on e-government typically focuses on disruptive technologies and their presumed transformational effects on government. Yet the Internet and associated technologies are more than two decades old, and even cursory observation demonstrates that institutional change in government is often painstakingly slow”*.

Fountains conclusion corresponds with the author own observations as consultant and researcher when it comes to e-government in the Netherlands, a European country known as a relative front-runner in the use of digital technology in society and economy in

general, and government in particular. Most government front- and back-offices have implemented digital technology to modernize, but their fundamental structure and functioning remained more or less the same.

If e-government has been about the digitalization of existing government processes and procedures, how does e-government relate to the coming era of datafication, being the driving force behind the disruptive transformations proclaimed by the WEF and others? And what will this mean for e-government research? Will datafication be just another new phase in the evolution of e-government, or will datafication be perceived as the start of a new wave of transformations, and are we witnessing something like a Kuhnian paradigm shift? (Hancké, 2009).

In some areas of the public sector there is already evidence that something digital new is happening. See all the attention the concept of “smart city” is receiving. A smart city means in this context a datafied city, or a *datapolis*, in the words of Meijer (2015). Also in other areas of government data driven policies are being developed and implemented, most of them labelled as “smart”: smart policing, smart health, smart mobility etcetera. At the same time, e-government scholars and practitioners are still very much entangled in further digitalization of government processes and procedures. See the initiatives around e-government 2.0 related to open and transparent government (Vintar ,2010), and the implementation of national digital infrastructures, enabling more vertical and horizontal integration of government services (Layne & Lee, 2001).

With respect to the current challenges e-government practice and research is facing, the e-government community needs to be aware of the new dynamics and impact of

datafication for government. This essay is a call to action, and must be read as a contribution to this suggested debate.

In this paper we will advance two arguments:

- First, there are significant differences between digitalization and datafication. Datafication is about totally different dynamics and impact, compared to digitalization. The transformative characteristics of datafication might impact both the strategic position of government in society, as well as the functioning of government organization.
- Second, attention of e-government scholars for the new phenomenon of datafication is growing, but still relatively limited. In order to understand and meaningfully discuss datafication, new concepts are needed. It is questionable if the “old” e-government concepts related to the digitalization of government, can be conceptually stretched enough to be useful to discuss datafication for government.

This paper is organized in the following sections: after this introduction we proceed with 2) the concept of datafication and differences between datafication and digitalization, 3) examination of e-government models, 4) review of current e-government studies examining smart city, and 5) conclusions and further discussion.

This paper is written from a pragmatic philosophical stand-point, using both the academic and the practitioner background of the author. The strategy used in this paper - discussing

the present (achievements) of digitalization versus the future promise of datafication. – has of course its restrictions. It sounds like comparing “apples and pears”, as a Dutch saying goes. For the sake of our arguments, we have to take this risk.

2. DATAFICATION vs DIGITALIZATION

From a length measurement used by the ancient Egyptians and Mesopotamians, the word digit has become an important verb in modern society. In the Oxford English Dictionary (1989), digitization refers to *“the action or process of digitizing; the conversion of analogue data (esp. in later use images, video, and text) into digital form”*.

Digitization can be understood in a broad manner, meaning the full range of software-driven processes –all the way from datafication and computation to prediction, display, communication and action- that allow increasingly smart machines to intervene in the world (Olleros & Zhegu, 2016). Under the umbrella of digitization, we like to distinguish in this paper between digitalization and datafication, as two specific technologies and methods, both with their own dynamics and impact.

A historical-technical oriented introduction, based on an industry report from Ericsson (2014) might give some first impressions. Digitalization started in the 1950’s, when the computer, telecom and semi-conductor industries originated. Since then, the world has seen an explosive growth of the computer (“IT inside”) and telecom (“mobile” inside) industry, where just lately the semi-conductor industry gained momentum because semi-conductors are the fundament for all kind of smart infrastructures, like smart cities, smart

mobility, smart health etc. Nowadays chipsets are in everything, be it your phone, watch, sneaker, blouse, car, bicycle, light etc. The combination of computer, telecom and semiconductor technology seems to create a “perfect storm” for all kind of innovations, impacting economies and societies. This is illustrated by the following graph:

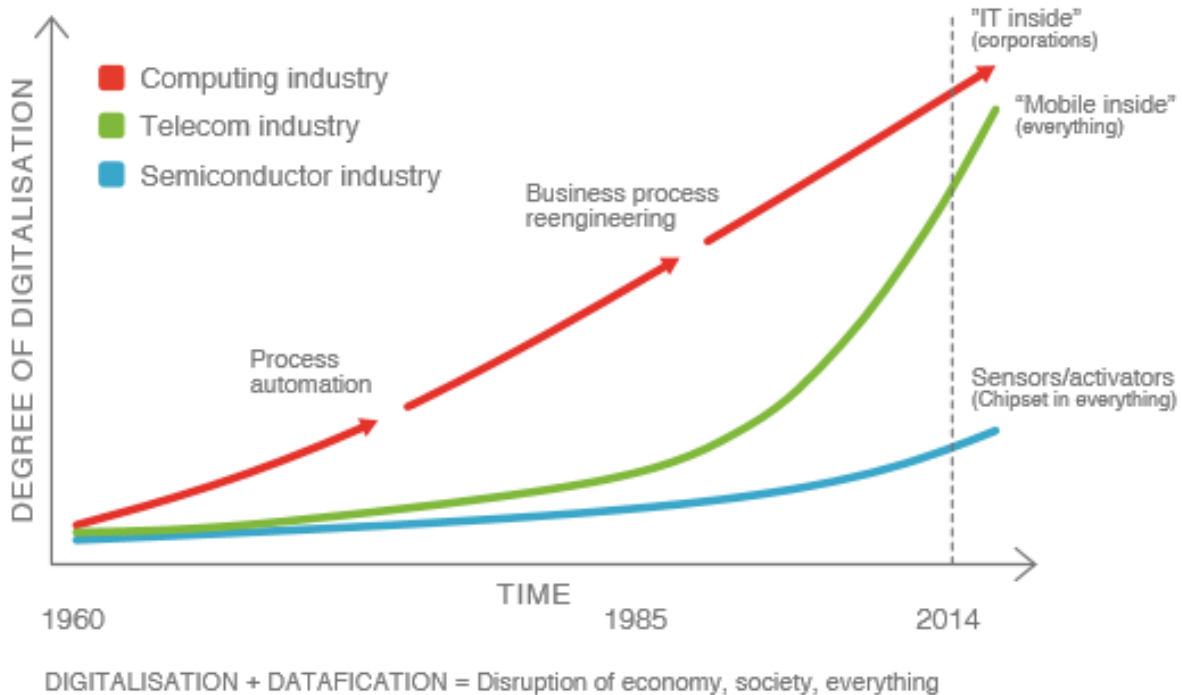


Figure 1

Ericsson (2014): the technical history of digitalization and datafication

In organizational terms, digitalization was about the conversion of analog information into digital formats, physical procedures into digital procedures, adding new online channels to the traditional desk counter, telephone and post mail etc. (Ericsson 2014, Brennen & Kreis 2014, Layne & Lee 2001). Datafication on the other hand, refers to the growing amount of captured data (internal; or external big data), combined with the

exponential growth of computing power, relatively cheap devices that can be used and connected, and smart algorithms and software (Lohr 2015, Cukier & Mayer-Schoenberger 2014). Where digitalization is mainly associated with dynamics within an organization, datafication crosses the organizational dimension, by creating an "infosphere", to be defined as *"the whole informational environment constituted by all informational entities (thus including informational agents as well), their properties, interactions, processes and mutual relations"*. (Wikipedia, 2016).

Datafication is a relatively new phenomenon compared to digitalization. The essential differences can be summarized as follows (Ericsson, 2014):

	Digitalization	Datafication
Content	Embedded knowledge	Unembedded knowledge
Functionality	Digital only	Interaction digital and physical world
Scope	Process automation	Mass customization
Governance	Corporate control over value chain	End-user control over value chain
Analytics	Data analytics based on sampling	Data analytics based on quantification
Industry	Complementary products	Maker culture, augmented manufacturing
Economics	Platform economics	Unfinished products and platforms
Impact	Productivity improvement in organizations	Fundamental changes for individuals, organizations, economies and societies

Table 1

From Ericsson(2014): digitalization vs. datafication

This paper is not the place to go into all of the details of the comparison, but it is obvious that different dynamics are at work, with different impacts.

Datafication will change the strategic landscape for government organization, as the necessity for new managerial capacities in order to handle these issues effectively. At the same time we might also expect changes in the strategic landscape of government itself because of the new road society is taking. Steve Lohr (2015), New York Times technology reporter, uses the word “data-ism” to illustrate this road: *“it is a transformative way of measuring and seeing, born of improved methods of analyzing data of all kinds, from browsing histories to GPS locations to genomic information. Powerful algorithms, as well as machine-learning software and artificial intelligence — technologies that can sense and communicate — are at its core. More important, data-ism “a point of view, or philosophy, about how decisions will be — and perhaps should be — made in the future.”* (p. 3).

To get an idea where this “data-ism” is taking society, we like to end this paragraph with the future perspective painted in “The Online Manifesto” (Floridi et al, 2012): *“The deployment of information and communication technologies (ICT’s) and their uptake by society affect radically the human condition. Insofar as it modifies our relationships to ourselves, to others and the world”* (p. 7).

3. DATAFICATION in EGOVERNMENT CONCEPTS

In e-government research there is usually not so much appetite for opening the black box of technology. To cite Yildiz (2007), in his overview of e-government theory: *“Basically, technologies come and go. Technology is just a means to achieve e-government, which is a fundamental change in the way government do business with the stakeholders of government information and services. Certain technologies do not fundamentally define what e-government is or will be”* (p. 655).

Towards this more or less minimalistic technological perspective are others, like Orlikowski & Iacono (2001) and Nylén and Holström (2015), who, on the contrary, advocate the examination of the characteristics of ICT artifacts and technology. We favor this position, because to us, not only does technology matter when it comes to public sector changes (Pollitt, 2010), it also matters what kind of technology is at play. Other characteristics of ICT's induce other kinds of changes and transformations. In e-government research social constructivist views are popular, emphasizing the impact of political and organizational factors on the use of ICT's, but often downplaying the intrinsic characteristics of technology.

What brings datafication the research of e-government? The domain of e-government research is hampered by theoretical fragmentation, according to Bekkers and Meijer (2016). Also, there is no conclusive definition of what e-government exactly is (Yildiz, 2007). Aware of this conceptual and meta-theoretical handicaps, we examined two models considered by Yildiz (2007) at the heart of e-government research: Fountains (2001) technology enactment framework and Layne and Lee (2001) model of four stages of e-government evolution ("the mother" of most e-government stage models). In addition we also reviewed the more recent model of Digital Era Governance (Margetts and Dunleavy, 2006), a critique or addition to New Public Management.

Overlooking the examined e-government concepts, we get a rather pessimistic opinion about the conceptual ability to deal with datafication. Of course our opinion is only based on the models discussed, and there might be other models offering more conceptual ability. Still we suggest conceptual work to be done, to get datafication right in the context of e-government research.

In Fountain's framework, the most important theoretical distinction in the conceptualization of technology, is the distinction between "objective" and "enacted technology". Following this argument, datafication may be considered as an objective technology. When touched upon by government organizations this technology becomes enacted and starts serving its purposes. To us this puts datafication in the category "come and go". How Fountains framework deals with the transformative power of datafication is to be seen, since its foundations are mainly rooted in the concept of digitalization and since there is no specific conceptualization of the role and impact of data in this framework. It looks at technology as something existing outside organizations, and then to be implemented and used within organizations. Datafication might change this rather dualistic perspective of "inside-outside". Today this is already happening, if we look at open data-initiatives, making it hard to tell whether the technology (and data) are inside or outside the organization.

Another pivotal model in e-government research is Layne and Lee's four stages-model (2001). This model presents the evolution of e-government, building on specific digitalization technologies, in particular web based applications. The model defines four different stages, cataloguing, transaction, vertical integration, horizontal integration. Most Western governments have implemented the transaction stage. More (vertical and horizontal) integration of government services seems on the way, since government are making serious efforts to implement national digital infrastructures (one-stop portals, authentication systems, citizen and business mailboxes, base registries, secure communication networks etc.). For example in the Netherlands such an infrastructure, called the Generic Digital Infrastructure (GDI), is being implemented at national, regional and local level, supported by legal measurements to enforce compliance. More or less

identical programs are taking place in other countries, like France, Estonia and Denmark (Mulder & Henning, 2016). Layne and Lee never claimed eternal life for their model. Although we assume their model fits the further evolution of digitalization of government, when it comes to vertical and horizontal integration, we question the models adaptability to conceptualize datafication. Conceptual moderation of the model seems necessary.

In addition to Fountain and Layne and Lee we addressed a more recent model, the Digital Era Governance model. This model is posed by Margetts and Dunleavy (2006), suggesting a (quasi) paradigm shift from New Public Management (NPM) to Digital Era Governance (DEG), in the sense that “ *digital change effectively requires a new macro-theory of public sector development, and radically different mindset, culture and characteristic patterns of organizational governance*” (p. 6). Margetts and Dunleavy foresee distinctive new waves of technology, inducing new public sector reform and transformation, embedded in wider societal modernization. Their first wave of DEG (2002-2010) corresponds with the heydays of governments implementing Internet based technology and developing digital services. Their second wave of DEG (from 2010) is an outcome of the advent of the social web, where social networks offered new communication channels for governments, but also new platforms for public discussion and engagement. In terms of the DEG-model, we might anticipate a new DEG wave, based on datafication, from 2015 onwards. However, this might be too simplistic, since the basic foundations of the DEG-model are rooted in driving forces like re-integration, needs-base holism and digitalization.

4. DATAFICATION in E-GOVERNMENT STUDIES

Recently some overviewing studies have been conducted, looking from the perspective of e-government to smart cities. For the purpose of this paper we consider smart city as a manifestation of datafication. Of course, datafication is more than a smart city and vice versa. However, these studies offer some interesting views on how datafication is perceived from an e-government perspective.

Obvious, although its growing popularity, defining the term “smart city” is not easy. To get an impression of the variety in definitions, we like to distinguish between two perspectives: one is the perspective of smart urbanism, dealing with issues like urban planning, economic development, ecologic growth (Meijer & Bolivar 2015, Anthopoulos & Reddick, 2016). The other is the digital perspective, where a smart city can be defined as “an intelligent organism” (Chourabi et al, 2016), *“that develops an artificial nervous system, which enables it to behave in intelligently coordinated ways. The new intelligence of cities, then, resides in the increasingly effective combination of digital telecommunication networks (the nerves), ubiquitously embedded intelligence (the brains), sensors and tags (the sensory organs), and software (the knowledge and cognitive competence)”* (p. 2290).

In this paper we reviewed three studies. First a study of Anthopoulos and Reddick (2016), that examines two interesting research questions: the first -retrospective- question, addresses the theoretical capacity e-government research provides to define smart city. The second -prospective- question is about the evolution of e-government research and

the ability to provide the appropriate theoretical capacity to deal with smart city challenges. The other studies we have reviewed examine the concept of smart city from an e-government perspective: 1) a study by Meijer and Bolivar (2016), looking into the concept of smart city governance, 2) a study by Chourabi et al (2016), examining the factors contributing to smart city projects. Both studies contribute to further conceptualization of the smart city concept.

A first, more general, finding comes from the study of Anthopoulos and Reddick (2016). Based on an assessment of scientific e-government journals and smart city journals, these researchers come to the important finding, that smart city research has developed more publications about e-government, compared to the number of articles about smart city in e-government journals. The set of articles retrieved from the e-government journals was unexpectedly short, compared to the fact that the term smart city appears in almost all e-government calls for papers in prestigious e-government conferences (Anthopoulos and Reddick, 2016). This corresponds with the ambition of Meijer and Bolivar (2015), who try to conceptually bridge the e-government and the smart city domain. As Meijer and Bolivar (2015) state: *“Researchers from the field of e-government studies are starting to become interested in governance of the city level and scholars interested in urban governance are becoming interested in technology, but a fruitful connection between these disciplines requires that concepts are clarified and repositioned in theoretical perspectives”* (p. 3).

On the search after commonalities between e-government research and smart city research, Anthopoulos and Reddick (2016) identified the following subjects:

- the e-government role in smart city, with e-government being part of a broader modernization context;
- local government policy making using smart city tools;
- the role of government ICT investments contributing to smart city development;
- ICT government challenges in smart cities, (big data, open data and crowd-sourcing, standardization);
- engaging local community, with issues like digital citizenship and social capital engagement in policy and decision making.

Overlooking all these topics, there is common ground to start between e-government research and smart city research.

The study conducted by Meijer and Bolivar (2015) looks into smart governance, where the study by Courabi et al (2016) looks into designing a smart city. Both studies address impact, but in a different way. Meijer and Bolivar (2015) address the transformational impact of different concepts of smart governance. See table:


<p>Low transformation</p>  <p>High transformation</p>	smart city governance	making the right policy choices and implementing these in an effective and efficient manner. In this way smart governance is only an attribute that is associated to governmental management of a city whenever the city is promoting itself as smart.
	smart decision-making	using new technologies to strengthen the rationality of government by using more complete – and more readily available and accessible – information for governmental decision-making processes and the implementation of these decisions
	smart administration	a new form of electronic governance that uses sophisticated information technologies to interconnect and integrate information, processes, institutions, and physical infrastructure to better serve citizens and communities
	smart urban collaboration	the widespread adoption of a more community-based model of governance with greater connectivity being facilitated by new technologies.

Table 2

Based on Meijer and Bolivar, 2015:
conceptualization smart city Governance

The different conceptualizations of smart governance give an impression of the possible impact of what we have called “datafication”. The classification of Meijer and Bolivar (2015) shows that this impact is much more encompassing than what digitalization did to governments. Datafication will also touch on the core-business of policy making and decision making, because of the availability of new data sources and smart tools. This time the transformation is not only about front- and back-office, but also about the mayor’s office. The implementation of dashboards in governments boardrooms is one example, another is the introduction of smart algorithms in decision making, as is happening in some private technology companies already (BBC, 2014).

Reviewing literature on smart city projects, Chourabi et al (2016) identified eight clusters of relevant factors, with a distinction in two different levels of influence. See table:


<p>Low influential</p>  <p>High influential</p>	Outer factors (5)	governance, people and communities, natural environment, infrastructure, and economy
	Inner factors (3)	technology, management, and policy

Table 3

Based on Chourabi et al (2016)

Factors influencing smart city design

The researchers expect all factors to have a two-way impact in smart city initiatives (each likely to influence others and to be influenced by others), at different times and in different contexts, some factors being more influential than others.

The study also looks into challenges of every factor. The eight identified factors will invite for more research, is our observation as consultant, because each of the factors defined will trigger a need for more facts and figures. City managers working on smart city will run into a variety of issues: new procurement procedures, human resource management to attract scarce and highly trained personnel, internal and external networks for collaboration, business case for infrastructure investments etcetera. Here “best-practice” research providing quantifications might help.

Looking at these studies, we see there is growing, but limited research on smart cities from the e-government perspective. E-government scholars did not find the way to smart city research yet, as much as smart city research reached out to e-government. This is an important and critical observation, since the studies examined here also expect a transformational impact on cities because of datafication. Especially the studies of Anthopoulos and Reddick (2016) and Meijer and Bolivar (2015) look into this topic.

The study of Chourabi et al (2016) is very helpful in addressing all the factors involved in smart city projects. This will help city management, especially with more research on best-practices and quantifications.

5. CONCLUSIONS and FURTHER DISCUSSION

Datafication is a rather new phenomenon, with a transformative promise. It is about the transformation of economies and societies, and will affect both the strategic position of government within society, as well as the functioning of the organization of government itself. e-Government concepts and research are strongly rooted in the era of digitalization. The concept of digitalization is radically different than the concept of datafication. Where digitalization is mainly about improving existing processes and procedures in organizations with digital technology, datafication is a much more an invasive phenomenon, with all kinds of impact on society and economy.

Looking at the findings in this paper, we see there is growing, but limited research on smart cities as the manifestation of datafication from the e-government perspective. E-government scholars do not find the way to datafication research yet. This is a critical observation if we look at the transformative impact anticipated in several studies. (Meijer & Bolivar 2015, Anthopoulos & Reddick, 2016). Datafication will matter the coming years, one way or another, and it will impact government.

E-government scholars have to be prepared that current e-government concepts might lack the ability to deal with datafication. The three models discussed in this paper - Fountains technology enactment framework, Layne and Lee's four stages of e-government evolution, Margetts and Dunleavy Digital Era Governance - all seem to have their limitations when it comes to conceptualizing datafication.

Looking at the current research on datafication from the e-government perspective, we also observe a blind spot. Current research is very much about (smart) *governance with data*, in the sense of the impact of data on smart city governance or smart city projects. The topic of *governance of data* seems to be totally overlooked. We see two important issues at stake here. First, in the world of digitalization, governments are more or less “rulers of their own world”. The digital formats used in public sector were defined by government, and implemented in their processes and procedures. With datafication, governments seem to be losing some of this control. Also other parties, companies, individuals, will be collecting data relevant for public policies, but stored in private clouds, and not by default accessible by government. Governments need to avoid a situation – already seen in some areas – where digital oligarchs harvest and monopolize data for their own ends without control of individuals.

An interesting example can be found in the Swiss, where the MIDATA initiative is set up to implement an infrastructure that enables citizens to store their medical data (first medical, in a next phase also non-medical) in a secure place, and re-use it for the public benefit by providing access to the data for medical research. Source: www.midata.coop .

Table 4

Based on www.midata.coop (2016): example of data governance by individuals

Second, the growing combinations of data result in complex, inter-connected systems where coordination or control by individuals is difficult. Citizens whose data are corrupted or wrongly administered, have a hard time to find their way to correct these faults (Prins,

2010). The era of digitalization already created a complex digital landscape in most Western countries, let alone if the era of datafication comes on top of this. Where the first argument is about empowering the state by the use of data allowed by the individual, the second argument is much more about the empowerment of the individual, by organizing control of the data of the state.

We started this paper with the question if datafication is just a new phase in e-government, or if we are witnessing a paradigm shift in the way government and digital technology are related. As always, it is different to discuss such a question when one has to look into the future and compare with present debates. To our opinion things are about to change and e-government research might get ready for this.

To help with further clarification on datafication, we suggest also input from other theoretical domains.

First, the transformative character of datafication conceptually seems to fit within the framework of the theory of (public) governance (Levi-Faur et al 2012, Frederickson & Smith, 2003). This theory is less about government and more about governance. Recent years numerous scholars attributed to this theory, wrestling with the key questions created by the growth of the fragmented state: *“What is government’s role in society? How should this role be fulfilled? Are the new realities of providing public service sufficiently accountable to the democratic process?”* (Frederickson & Smith, p, 209). We suggest scholars also to try to answer these questions, from the perspective of the datafication of society.

Second we like to refer to the theory about Techno-Economic Paradigms (Carlota Perez, 2002). This theory on 'Great Surges of Development' tries to explain successive waves of technological, organizational and institutional rearrangements that historically have resulted in major increases in productivity and product quality, structural changes in production and consumption, and long-term economic growth. In the area of e-government Drechsler (2010) has worked on this subject. This theory might provide a macro framework for e-government and the transition it is facing. It would provide a wider context for understanding of the changes we are about to see in government.

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7. REFERENCES

Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J. R., Leung, S., Mellouli, S., Walker, S. (2012). Building Understanding of Smart city Initiatives. *Lecture Notes in Computer Science Electronic Government*, 40-53. doi:10.1007/978-3-642-33489-4_4

Anthopoulos, L. G., & Reddick, C. G. (2016). Understanding electronic government research and smart city: A framework and empirical evidence. *Information Polity IP*, 21(1), 99-117. doi:10.3233/ip-150371

BBC (2014). Algorithm appointed board director. Retrieved August 05, 2016, from <http://www.bbc.com/news/technology-27426942>

Bekkers, V. (2007). The governance of back-office integration. *Public Management Review*, 9(3), 377-400. doi:10.1080/14719030701425761

Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*.

Cukier, K., & Mayer-Schönberger, V. (2014). The Rise of Big Data: How It's Changing the Way We Think about the World. *The Best Writing on Mathematics 2014*. doi:10.1515/9781400865307-003

Digitalization and Digitization. (n.d.). Retrieved August 04, 2016, from <http://culturedigitally.org/2014/09/digitalization-and-digitization/>

Drechsler, W. (2010). Nanotechnology, Governance and Public Management: A Techno-Economic Paradigms Perspective. *NISPAcee Journal of Public Administration and Policy*, 3(2). doi:10.2478/v10110-010-0004-y

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). Digital Era Governance:. doi:10.1093/acprof:oso/9780199296194.001.0001

Floridi, L. (2014). *The 4th revolution: How the infosphere is reshaping human reality*.

Fountain, J. E. (2001). The Virtual State: Transforming American Government? *National Civic Review Nat Civic Rev*, 90(3), 241-252. doi:10.1002/ncr.90305

Frederickson, H. G., & Smith, K. B. (2003). *The public administration theory primer*. Boulder, CO: Westview Press.

Hancké, B. (2009). *Intelligent research design: A guide for beginning researchers in the social sciences*. Oxford: Oxford University Press.

Hazlett, S., & Hill, F. (2003). E-government: The realities of using IT to transform the public sector. *Managing Service Quality Managing Service Quality: An International Journal*, 13(6), 445-452. doi:10.1108/09604520310506504

Hinssen, P., Chellam, M., & Hinssen, P. (2010). *The new normal: Explore the limits of the digital world*. Gent, Belgium: Across Technology.

Layne, K., & Lee, J. (2001). Developing fully functional E-government: A four stage model. *Government Information Quarterly*, 18(2), 122-136. doi:10.1016/s0740-624x(01)00066-1

Meijer, A., & Bolivar, M. P. (2015). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences*, 82(2), 392-408. doi:10.1177/0020852314564308

Meijer, A. (2015). *Bestuur in de datapolis: Slimme stad, blije burger?* Den Haag: Boom bestuurskunde.

Meijer, A., & Bekkers, V. (2015). A metatheory of e-government: Creating some order in a fragmented research field. *Government Information Quarterly*, 32(3), 237-245. doi:10.1016/j.giq.2015.04.006

MIDATA.coop | my data - our health. (n.d.). Retrieved August 04, 2016, from <https://www.midata.coop/>

Mulder E., Henning F. (2016). *International Quick Scan on Compliancy with Generic Digital Infrastructures*. Study report for the Ministry of the Interior of The Netherlands. PBLQ.

Nylén, D., & Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons*, 58(1), 57-67. doi:10.1016/j.bushor.2014.09.001

Olleros, F., Zhegu M. (2016), Digital transformations: An introduction Forthcoming in F. Xavier Olleros and Majlinda Zhegu (eds.) *Handbook of Research on Digital Transformations*, Cheltenham, UK: Edward Elgar.

Orlikowski, W. J., & Iacono, C. S. (2001). Research Commentary: Desperately Seeking the "IT" in IT Research—A Call to Theorizing the IT Artifact. *Information Systems Research*, 12(2), 121-134. doi:10.1287/isre.12.2.121.9700

Perez, C., *Technological Revolutions and Financial Capital* (2002).

Pollitt, C. (2010). Technological Change: A Central yet Neglected Feature of Public Administration. *NISPACE Journal of Public Administration and Policy*, 3(2). doi:10.2478/v10110-010-0003-z

Schwab, K. (2016). *The fourth industrial revolution*.

Prins, C. (2011). *IGovernment*. Amsterdam: Amsterdam University Press.

The Impact of Datafication on Strategic Landscapes". (2014). Retrieved August 4, 2016, from <http://www.ericsson.com/res/docs/2014/the-impact-of-datafication-on-strategic-landscapes.pdf>

The Onlife Manifesto - Being Human in a Hyperconnected Era | Luciano Floridi | Springer. (2015). Retrieved August 04, 2016, from <http://www.springer.com/us/book/9783319040929>

The Oxford Handbook of Governance | David Levi-Faur (eds) | Oxford University Press (2012)

Wikipedia. *Infosphere*. (n.d.). Retrieved August 05, 2016, from <https://en.wikipedia.org/wiki/Infosphere>

Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. *Government Information Quarterly*, 24(3), 646-665. doi:10.1016/j.giq.2007.01.002

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