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From Digital Government to Digital Governance: Are We There Yet?

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Abstract: This paper focuses on the knowledge problem of economics by discussing its current status in light of digitalization. This problem highlights the paradox of not having the necessary knowledge to take an economic decision, but pretending to have it and act, hence questioning the legitimacy of governmental decision-making and its impacts on the economy. Current technological developments are challenging this problem. Big Data has been a neglected phenomenon when it comes to its impact on the nature of knowledge and the decision-making processes associated with it, and it is easy to think that Big Data solves this problem. This research gap is evaluated by re-visiting the knowledge problem and evaluating whether the knowledge problem can still be valid in the digital era. The digital governance issue has been largely covered by literature in terms of technical possibilities. However, the main challenge is not the technical one, but rather how to create governance structures to involve people in decision-making processes, and at the same not fall into the trap of the knowledge problem. The sustainable transition from digital government to digital governance is a transition from a technical structure to multiple processes on different levels, and these processes have their own limits.

Keywords: digital government; digital governance; knowledge; digitalization; governance; big data

1. Introduction

There are 5.11 unique mobile users as of January 2019, 4.39 billion unique users of the internet, and 3.48 billion users of social media [1] and the trend is increasing. At the same time, there is a shift from lack of information to a plethora of information, which can be observed when one has a quick look at the plethora of content posted and re-posted on social networks—a phenomenon described by Alvin Toffler with the term "information overload" [2]. This information overload and its challenges for firms and scientific research gave rise to the emergence of data science and data scientists. This overload is also the case for governments and their interaction with the digital sphere. Governments try to tackle this challenge by making use of big data sets on various topics [3]. Governments of the United States of America, the United Kingdom, and most members of the European Union already collaborate with IBM to handle Big Data in policy-making, and notably countries like South Korea, Singapore, and Japan already started their Big Data initiatives to gather and analyze Big Data from public institutions and agencies in order to formulate policies [4]. With the emergence of new technologies enabling to process data in big volumes, varieties, and velocities, governments have a new instrument to formulate their policies and address its citizens' needs. Often relying on big and complex data sets to take policy measures, governments may not only be restricted by technological constraints and errors of spurious causalities, but they may also intervene in the free market order to a much larger extent than the "analogue" central planners. In this context, the impacts of digital governments on individuals can be both a curse and a blessing [5]: It can be a blessing, because through digitalization people may have

more power to change government policies directly. Digitalization can help entrepreneurs establish and run a business with much less bureaucracy and practically no paper work. Digitalization also makes it possible for governments to take policy measures on public health, climate, traffic, and similar issues with more data in their hand; in addition, personalizing services and increasing transparency can be made possible with digitalization. Nevertheless, it can also be a curse due to the fact that it offers governments a bigger and more condensed space than before the emergence of digitalization for observing citizens and intervening in their lives, decisions, and the free market order that are shaped by their individual will. Digitalized government services can still be inefficient and data security may cause a big problem.

The main problem that challenges governments in addressing their citizens' needs is the knowledge problem, i.e., pretending to have knowledge on the preferences of human beings without actually having it [6]. Hayek [7] points to the fact that "the "data" from which the economic calculus starts are never for the whole society "given" to a single mind which could work out the implications, and can never be so given" (p. 519). This is a problem because "(. . .) in the study of such complex phenomena as the market, which depend on the actions of many individuals, all the circumstances which will determine the outcome of a process, (. . .) will hardly ever be fully known or measurable" [6] (p. 3). In other words, what Hayek referred to as a "scientistic" attitude (which is "decidedly unscientific in the true sense of the word, since it involves a mechanical and uncritical application of habits of thought to fields different from those in which they have been formed" [8] p. 15), is a problematic issue for decision-making processes of governments simply because these are done with knowledge that a government pretends to have. This issue has been on the agenda of economics for a long time, and the debate was organized around two parties supporting either centrally planned economies or free market economies. Despite the knowledge problem, the question of interest regarding the impact of digitalization from a governmental perspective is not a simple binary question of "stop" or "go", but rather how the process of digital governments can be shaped to address human needs, without falling into the trap of the knowledge problem. In this research, the author aims to re-visit the knowledge problem in the context of the new developments and challenges in digital governments. The research question is formulated as follows: what is the status of the knowledge problem in the digital era, especially considering digital governance as a process covering democracy, business, and government structures?

The rest of the paper is structured as follows. Section 2 provides an overview of the concepts associated with digital governments. The review of the literature was done by analyzing recent contributions that highlight the relationship between information and communication technologies and their implications for markets and governments. Section 3 discusses the knowledge issue from the perspective of economic theory with a focus on the emergence and dissemination of new knowledge, and re-visits of the knowledge problem in the light of the recent technological developments. This section starts with an overview of the knowledge problem in the economic literature, with a particular focus on the Austrian/evolutionary school of thought in economics; it then analyzes the knowledge problem with the findings of Section 2. Section 4 provides a conclusion.

2. Literature Review

The emergence of information and communication technologies and their implications for markets has been on the agenda of economists for a long time. Dholakia and co-authors [9] focused on the impact of the internet on markets and compared the introduction of the railways, the electric grid, the telephone system, and the highway system with the introduction of the internet. These milestones in the history of world economy constitute infrastructural innovations. According to Dholakia and co-authors [9], all of these infrastructure innovations shaped the markets both in terms of existing and new market practices. They identified that the internet shaped markets by reducing transaction costs and agency costs and creating network externalities. As stated in the introduction, 4.39 billion unique internet users seem to create large network externalities—in fact, to such an extent that almost

every sector of the economy, including traditional sectors, are using the internet in one way or the other. Even though the initial consideration of reducing transaction as well as agency costs had certain impacts, the character of transactions and principal-agent relations also change in the digital era. Considering not only these infrastructure innovations but also innovations that have been enabled or triggered by these, it can be said that the development of new technologies led to a co-evolution of the technological and the institutional frameworks, where both of them are based on the growth of human knowledge [10]. The importance of institutions, and in particular institutional quality, have been addressed by a number of scholars such as Acemoglu and Robinson [11] and Glaeser, La Porta, Lopez-de-Silanes, and Shleifer [12]. Acemoglu and Robinson [11] analyzed how countries can achieve sustained economic growth by observing the political and economic institutions. The authors divide government structures into inclusive and extractive ones. Whereas "inclusive economic institutions (. . .) are those that allow and encourage participation by the great mass of people in economic activities that make the best use of their talents and skills" [11] (p. 144), extractive economic institutions are those in which a small group of people are exploiting the rest of the population and are "designed to extract incomes and wealth from one subset of society to benefit a different subset." [11] (p. 76). In this framework, the authors support the view that the quality of institutions shape how technological change occurs, and refer to inclusive institutions having a greater innovative capacity. Glaeser, La Porta, Lopez-de-Silanes and Shleifer [12] deliver the empirical evidence for the fact that by the accumulation of physical and human capital over time, institutions in an economy improve.

In other words, neither humanity nor technology stopped at the point of the emergence of internet; rather, digitalization continued to challenge both technologies and institutions in ways one could not imagine before. To be more precise, this co-evolution imposed systematic changes in the emergence, the transfer, and the accumulation of knowledge, especially tacit knowledge [10,13,14] which is not only hard to capture, but also vital for creating and keeping a competitive advantage in the free market economy. Some authors, such as Jeremy Rifkin, claim that digitalization is resulting in an economic system which is enabling goods to be potentially free [15]. He argues that innovations in capitalist economies are enabling efficiency gains in such a strong way that production of knowledge has near-zero marginal costs, enabling a potential for goods to be free and workers to be unemployed. Anderson opposes this argument [16] by pointing to the fact that the law of scarcity does not diminish in the digital era, referring to the argument of Carl Menger that the value of a good does not come from the costs of production but from the value of the final product. In other words, the value of the final product depends on the profitability that it promises to the entrepreneur who creates that product [16]. In addition, Rifkin [15] does not provide any answer on the role of entrepreneurs in his explanatory framework. Anderson [16] argues that production does not occur out of the blue, and that the role of the entrepreneur in creating new goods will continue to exist and will not be replaced by non-profit organizations or sharing economies.

Even though the growth of human knowledge has been exponential in the age of digitalization, how human beings process information and transfer it into knowledge remains as a constraint [10,17] and relying on quantitative measurements with "scientistic" theories does not improve this constraint [8]. Nevertheless, digitalization is a reality occurring regardless of whether one observes it on the governmental level or a certain market segment level. According to Valenduc [18], we can identify four aspects of digitalization that we can observe regardless of the analyzed market segment. These are, first, the fact that digitalized information can be seen as a strategic economic resource; second, that a different tempo and nature of industrial revolutions can be observable; third, that the relation between employment and technology is subject to discussion; and fourth, that there is a change from flexible working practices to virtual working practices. These four categories challenge government and governance practices in various ways.

Almost simultaneously to the remarks of Dholakia and co-authors [9], the question regarding the impact of the internet has been widened to include government practices by Lucke and Reinermann [19]. The authors focused on the issue of how government practices will be influenced by the development

of new technologies, in which they provided a definition for electronic government by referring to it as a way of governing with the help of information and communication technologies. Given the fast and unpredictable development of technology lately, this is a very narrow definition, which does not reflect the full picture. The emergence of non-predictable novelties challenges governments in ways that were not predicted and not predictable previously. From the contemporary perspective, electronic government or digital government is observed as a part of the digital governance concept together with the business aspects and the aspects associated with political decision-making. In other terms, whereas electronic government is a structure consisting of government practices by using information and communication technologies to enable interactions on government-to-citizen, government-to-government, and government-to-business levels [20], electronic governance is more of a process involving multiple stakeholders [21], through which the direction, the form and the extent of internet activities can be determined [22].

A new technological development that is both enabling the generation of previously unavailable knowledge, and at the same time challenging information processing constraints of humans, is the emergence of Big Data. Gartner [23] defines Big Data as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation". Tian [24] adds high-value and high-veracity to this list by pointing out to both chances (being able to be converted into a competitive advantage) and challenges (biases, noises, and abnormalities in the data). In an interview with Pauleen [25], Davenport points out how unfortunate the term "Big Data" is, since the "big" part is often the most insignificant of the problems associated with this concept. According to Davenport, it is not the bigness of the data but the unstructured nature of it which is the source of all problems anyone who is working with Big Data is facing.

Big Data aims to integrate the hitherto separated digital, physical, and biotechnological sectors of knowledge generation [26]. Nevertheless, how this integration occurs and becomes useful depends on the epistemic status of the technologies that are used within this context, as pointed out by Symons and Alvarado [27]. The authors explain this issue by introducing path complexity as a concept. Analyzing Big Data with software programs necessarily involves writing conditional "if/then" codes, and for Big Data the number of conditional statements and the corresponding codes increase exponentially, leading the number of paths to be tested to vastly increase. Symons and Alvarado [27] emphasize that the epistemic limits of the software used to analyze Big Data can lead to potential abuses of it and to "scientistic" predictions in the sense of [8]. For Stjernfelt and Lauritzen [28], Big Data can pose a challenge for individual users as it enables "quick and targeted access to the weak spots of each individual user" (p. 80). Chen and Hsieh [5] identify three main challenges of Big Data for digital government. These are, first, the issue of governance, i.e., how "digital government" can be transformed to "digital governance". This has both internal and external aspects; the internal aspect is to create a data-driven decision-making culture on the governmental level, whereas the external aspect is the governance of different stakeholders in order to integrate different data sources. Both seem to be problematic since a data-driven decision-making culture (regardless of the objectiveness of the data) can result in an outcome that is not desired by politicians. It is possible that politicians have a different agenda than people, or may not want to implement certain policy measures. If a data-driven decision-making culture would be implemented, this may result in choices of people differing from those of politicians in charge, leading them to change their policies or agendas. A second challenge of Big Data for digital government is Big Data implementation. The implementation needs talents to be acquired, but the scientists who are able to work with Big Data are limited as put forward by a recent report of IBM [29]; technologies to be used are not mature enough and resources to acquire talents and technologies are also limited. Third, risk management remains a challenge for digital government. This component consists of privacy issues and security issues.

Stjernfelt and Lauritzen [30] point to algorithms used to evaluate Big Data collected from individual users. The authors emphasize that algorithms, defined as a "rule-governed procedure aimed at solving

a class of problems" (p. 30) cannot be objective since they are manmade. They do not need to be objective, fair, or free of biases based on gender, race, political orientation, and similar factors [30]. According to Linkov, Trump, Poinsatte-Jones, and Florin [31], two further aspects that are challenging digital governments are Artificial Intelligence (AI) and distributed ledgers. AI enables machines to acquire and use knowledge in order to make their own decisions, whereas distributed ledgers aim to decentralize information about transactions between an open or a closed network [31]. The authors propose to focus on adaptive strategies for governments in order to identify fears and concerns of people that may be otherwise hard to identify. Mehr [32] clearly points to the fact that AI cannot be a solution to governmental problems (hence also to the knowledge problem, which will be discussed below), but it can emerge as a powerful tool even though there are concerns about it—the issues of privacy, pace, and adoption of digital tools, and whether citizens are able to cope with this pace, whereas Davidson, De Filippi, and Potts [33] support the viewpoint that blockchains are a new type of technologies creating new type of economies. In their systematic literature review, Batubara, Ubacht, and Janssen [34] identify different problems regarding the adoption of distributed ledger technologies for digital governments—these are technological and organizational problems. Linkov, Trump, Poinsatte-Jones, and Florin [31] identify three different strategies for digital governance: (1) a laissez-faire approach without any government intervention or regulation; (2) a precautionary and preemptive strategy from the governmental side, which includes a monitoring of present and future threats to the costs of limiting free enterprises and a free development of the digital economy; (3) a stewardship strategy that finds a mid-point between the first two strategies.

Whereas these strategies mainly influence the "supply side" of digital governance, namely the governmental coordination, the "demand side" is largely influenced by the digital divide. Digital divide does not have a unified definition, but rather describes the phenomenon of unequal access to the internet and its use [35]. Recent studies took a multidimensional perspective on the digital divide and showed that digital gaps exist in social, economic, cultural, and political relationships [35]. An issue associated with the emergence of distributed ledger technologies is the fact that they can create new digital divides when they are used to create a decentralized internet [36]. Stjernfelt and Lauritzen [30] claim that this would be a way of avoiding governmental intervention, but it remains unclear whether such an alternative technology would become the new internet with the same potential and scope as the current internet. Hence, even though technologically speaking there may be some ways of improvements, these are subject to questions of popularity and scope. After all, the internet itself is an infrastructure innovation that became established because of the network externalities it created, and the transaction and the agency costs it reduced [9,37]. Digital divide in the context of digital governance not only matters in terms of access to the internet or the socioeconomic status of the users, but also in terms of digital skills [38]. Digital skills influence the degree of satisfaction from government services; however, current research mainly focuses on the "supply side" of digital governance and ignores to a large extent user-driven and participatory design approaches, in particular regarding socially excluded groups [39]. As found by Helsper and van Deursen [39], inequalities in digital skills, hence the existence of a digital divide, is not likely to disappear in the future; therefore, government interventions are needed in order to close this gap. Helsper and van Deursen [39] emphasize that reducing the inequalities regarding the digital divide can only be meaningful if this is associated with a target such as general well-being or employability. However, this target-setting implies that the institutional setup needs to rely on full knowledge of citizens' preferences and results in a stable outcome [40], both being related to the knowledge problem. According to Giebel [41], multidimensional aspects of the digital divide create knowledge asymmetries that weaken the effectivity of digital governance and possible interventions by the digital government. In this sense, Kiesling's [40] observations remain unchanged for the digital setup—no matter whether the case is an "analogue" government or a digital one, government interventions "rely on the presumption of the existence, knowability, and stability of an optimal outcome" (p. 57). However, the complexity and the contextuality of knowledge affect the assumptions of knowability and stability of outcomes underlying government action. The use of

information and communication technologies for government (and by extension, governance) purposes is evolving towards digitalizing governance as a whole, but mainly technological and organizational challenges dominate the literature, whereas the issue of the knowledge problem has not yet been dealt with explicitly.

3. The Knowledge Problem

3.1. The Knowledge Problem in Economics

Knowledge is the central issue of economic theory [42]; however, not all streams in economic theory have dealt with knowledge explicitly and some even ignore that "the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess" [7] (p. 519). Knowledge was not an issue in mainstream (neoclassical) economics, because the Arrow–Debreu type of equilibrium implies that there is a (theoretical) set of contracts for every date and contingency, through which markets are closed forever [43]. This means that there is no need for an entrepreneur who will make arbitrage profits by buying something cheap and selling it above its cost in order to make a living out of it, as long as every market participant acts in a prescribed way as defined by the contract in each and every contingency and date [43]. The competitive advantage of any entrepreneur, that is his or her own subjective knowledge, diminishes in the equilibrium, because there is no need for any entrepreneur—markets are closed by a certain price vector [43]. Lundvall [44] emphasizes the fact that mainstream economic modeling assumes that individual, rational actors make rational choices; hence, agents are fully informed about the world. Dolfsma [45] observes that many economists of the mainstream approach decided to treat capital as a metaphor for knowledge in their research, or, alternatively, used technology as a synonym for knowledge. This incorrect treatment [45] not only resulted in mainstream economics treating technological innovations as a synonym to knowledge as a capital, but (as a consequence) also to the fact that we can select the best available innovation from a well-defined set of given innovations—ignoring the ambiguous character of innovations, especially product innovations, and instead focusing on process innovations [17]. According to Rizzo and Whitman [46], mainstream economists ignored this knowledge problem because they were tricked by the simple way of modeling in mainstream economics. Mainstream economists only observed "some limited features of the real world, such as the equilibrium reaction of markets to supply or demand shocks, and applied them to the broader problem of substituting government planning for market processes" (p. 909). These difficulties, errors, and ignorance associated with the concept of knowledge in mainstream economics not only has consequences for the theoretical development and treatment of knowledge, but also how policies are formulated by using this problematic view.

The fact that knowledge has not been on the agenda of mainstream economics does not mean that it is not a central issue for economics. According to Spender [47], knowledge is a very complicated issue that did not easily find use and place in economic theory. Whereas the mainstream belief was that decision-making is always about processing information, a counter stream of research focused on moving the theory to an epistemological point of analysis [47]. Policymaking, on the contrary to the mainstream belief, recognized the importance of knowledge in its analysis quite early [48]. As put forward by [44], policymaking refers to the current era as an era of knowledge-based economies; policy formulations and recommendations therefore emphasize creating and keeping a sustainable knowledge base for an economy. Hence, assuming that knowledge is not an important issue for economics because mainstream economics did not integrate it into its framework would only be a naturalistic fallacy [49].

It was the Austrian/evolutionary school of thought in economics that popularized the concept of knowledge and set it at the center of economic theory. This stream of research, which consists of both Schumpeterian disruptive innovation and a Smithian/Hayekian smooth division of knowledge

sub-streams, has the emergence and the dissemination of knowledge as its common denominator across different sub-streams [50]. Differing from the mainstream economics with fully informed agents, the Austrian/evolutionary school of thought in economics assumes ignorance is the starting point of learning and knowledge generation [44]. Hence, knowledge is subjective, dispersed, and emergent rather than being exogenously given, or chosen from a well-defined set of alternatives [17]. In modern day economics, the concept of knowledge is mainly associated with Hayek [40]. The knowledge problem, as briefly described in the introductory part, has been very visible throughout the whole research of Hayek. In [7], he argues that the main problem of the economy is not the allocation of given resources, but the "utilization of knowledge not given to anyone in its totality" (p. 520). Nevertheless, it is not the planning but the emergent results of human interaction through which a decentralized coordination of economic activity occurs, that is through prices and market processes [40]. One important remark of Hayek in [7] is that the "data" that are the basis of the economic calculus can never be given to a single source as a whole—emphasizing that knowledge itself is more than scientific data.

Hayek emphasizes the basic difference between information and knowledge in [51]. According to him, information is objectively available in a system and once it is perceived by individuals and processed in their own cognitive models, it turns into subjective knowledge. Dosi [52] specifies this distinction by mentioning that information entails codified and certain propositions, whereas knowledge entails cognitive categorizations, capabilities to interpret information, tacit (non-codified) skills, and problem-solving capabilities that cannot be reduced to algorithms. Kiesling [40] mentions that the distinction between knowledge and information became very central for the development of the economic thought in the last century, even though modern information theory did not pay much attention to this [53]. Rizzello and Spada [54] believe that this differentiation is useful for understanding market dynamics, since one's competitive advantage is based upon his or her own subjective knowledge. This can be an alert entrepreneur who simply makes use of arbitrage, a Schumpeterian entrepreneur who makes new combinations of things, or it can be an innovator who notices a way of introducing a new good to close a market gap which he or she recognizes [17]. According to Erkut [17], a "nano dimension" builds the starting point of any evolutionary economic model, which is the dimension of perception—where an economic actor perceives the objectively available information in a system with his own cognitive model. The "nano dimension" precedes the "micro dimension", in which knowledge generation occurs—the author delivers an explanation of how generation of knowledge occurs by using recent neuroscientific findings and showing parallels between knowledge generation in the human mind and on the marketplace in the Hayekian framework. The introduction of a "nano dimension" also means that knowledge generation is necessarily subjective, highly based on how an economic actor perceives his surroundings and tries to categorize the events in his surroundings based on his previous experiences—implying that in an economic system, the subjective knowledge of every economic actor can be turned into his/her unique competitive advantage [17].

In the view of Thomsen [53], we can differentiate between two dimensions of the knowledge problem, which are the dimensions of complexity and contextuality [40]: complexity is associated with the difficulties of coordinating plans due to the dispersed and subjective character of knowledge, whereas contextuality is associated with the fact that knowledge relevant for coordinating plans is either tacit, created during the market process, or inarticulate. Both dimensions point to the subjective, dispersed, imperfect, local, tacit, and contextual character of knowledge in comparison to information, and as Thomsen [53] argues, the problem is not only about the use of existing dispersed knowledge, but also the discovery of hitherto unavailable knowledge—the latter, in turn, becoming the potential competitive advantage of the discoverer. As is observed by North [55], "the world we live in is non-ergodic—a world of continuous novel change; and comprehending the world that is evolving entails new theory, or at least modification of that which we possess" (p. 16); therefore, any economic system that is driven by subjective knowledge and the introduction of novelties is necessarily non-ergodic, and this makes the results of interactions among economic agents

non-pre-determined [40,56]. This discussion around the knowledge problem boils down to the issue of why economics is not like physics and should not be treated as a physical system.

Hayek mentioned the knowledge problem in his Nobel Memorial Prize Lecture in 1974 [6] by giving an explicit explanation of why economics is not like physics, and what kind of consequences this observation has. His main proposition is that economics is not like physics, meaning the methods that are useful for physics cannot be used for economics, especially for formulating policies and addressing people's needs by these policies [6]. He justified his claim with three different reasons. First, he mentioned that economics deals with complex phenomena and calls everything that is not measurable "irrelevant". While for physics everything that is relevant is directly observable and measurable, it is not the same for economics, which deals with complex market phenomena. Second, he emphasized that economists generally make very general predictions, but cannot generate concrete results due to the fact that unlike physical sciences economics has to deal with essential complexity, i.e., the fact that not only individual elements have to be considered, but also how they are connected to each other in an economy. Third, he addressed the issue that the necessary information cannot be gathered because of the dispersed, subjective nature of knowledge and because economists cannot know all the pieces of information that are necessary determinants of the market order.

The Nobel Memorial Prize Lecture of Hayek [6] remains to be a useful source for both understanding the limitations of economic models and their possible consequences for policy-making. As observed by Carson and Coyne [57], Hayek's work emphasizes that economic planning means getting rid of the market process and replacing it with political power and processes; these two alternatives of market processes and political processes address the allocation problem in different ways, and by doing this political power requires a certain authority both to impose its plans and to cope with unpredictable outcomes of its intervention. The authors conclude that in the Hayekian framework political planners cannot solve the knowledge problem since they get rid of the market. This is, by any means, relevant for today's perspective on digital governance, since the digital sphere offers an even bigger space for governments to intervene. The question that will be evaluated in the following is whether the digital era solves the knowledge problem that neither mainstream economic discipline nor political planning was able to solve.

3.2. The Knowledge Problem and Digital Governance

In the following, the author will concentrate on the propositions of Hayek [6] in "The Pretence of Knowledge" and will question whether these propositions still hold, or whether the digital era solves the knowledge problem. To the author's knowledge, there are no contributions that directly address this question. However, interpretations of the knowledge problem in different contexts remained on the agenda of the Austrian/evolutionary economic school of thought. The contributions of Rizzo and Whitman [46], Pasquale [58], Kirzner [59], and Lehmann-Waffenschmidt and Erkut [60] are four relevant approaches which have discussed the knowledge problem. Pasquale [58] analyzes the knowledge problem by pointing to the fact that we are at a new age of central planning, in which large corporate entities collect Big Data to influence people's lives in various ways. The author focuses on different visions of the relation between power and large technology corporations, and states that law can act as a way of balancing and neutralizing the power of these large corporations when and where needed. Kirzner [59] re-visits the knowledge problem described in [7] by arguing that making use of the dispersed knowledge in the most efficient way cannot be transformed into a problem of finding the most efficient allocation of a society—meaning societal planning is not able to address Hayek's problem by its very character, since it can only damage spontaneous market forces that are capable of solving the knowledge problem. Rizzo and Whitman [46] focus on the issue of legitimacy in new paternalistic interventions. The line of argumentation that the authors provide is in a way similar to the context of digitalization and digital governance. The authors argue that paternalistic policy-making cannot solve the knowledge problem because policymakers in this case do not possess "all the relevant information about individuals' true preferences, their cognitive biases, and the choice contexts in

which they manifest themselves" (p. 910); in this way, paternalistic interventions to free markets can even deliver worse outcomes than the outcomes of the market processes without interventions. Finally, Lehmann-Waffenschmidt and Erkut [60] discuss soft paternalistic policy-making in the context of shock-coping and come to the conclusion that the knowledge problem is not solved by nudging either. However, the authors draw the conclusion that two fields that are promising to come close are making use of the subjective well-being of individuals as the relevant target-setting and using nudging as a self-management tool. A closer look at these approaches shows that the knowledge problem is perceived as formulated by Hayek; therefore, the contribution of Chen and Hsieh [5] remains as a useful source for identifying the main challenges for digital government and comparing them with the propositions of Hayek [6].

The first proposition of Hayek [6] is that economics cannot observe and measure everything that is relevant. It can be the case that something that is measurable may not be important, and at the same time something that is not measurable may be important. Therefore, the question of interest boils down to whether we can observe and measure everything that is important. Scientists' knowledge on issues is certainly limited, and unlike physics, there is no general law of economics that tells what all variables to measure are and how they can be measured. This is what Humphreys calls "epistemic opacity" [61] (p. 37): "a process is epistemically opaque relative to a cognitive agent X at time t just in case X does not know at t all of the epistemically relevant elements of the process". This fact has not changed due to the complex nature of economic phenomena. In their systematic literature review, Al-Sai and Abualigah [62] list a number of factors which build the technological challenges for Big Data use in digital governance. These are the limited capabilities of IT and infrastructure, security and legislation issues, lack of Data Scientists, compatibility issues, lack of control, lack of use of data management tools, and the fact that the growth of Big Data precedes the modeling and analyzing of it. This means that whereas we can measure even more variables than before, we cannot say that we are measuring everything that is relevant—simply because unlike physics economics lacks general laws of nature, and this is due to the nature of economy as a case of organized complexity, referring to the fact that "(. . .) the whole not just exceeds but transcends the parts. For this reason, complex systems scholars often refer to social outcomes as generated from the bottom-up. Hence, the term self-organization has become widespread within complexity research. Self-organized systems can produce cooperative, robust outcomes, but they can also spiral into chaos. We need to understand how to encourage the former and guard against the latter" [63] (p. 3). Not only did this nature remain as it is, but also the challenge of "no single scholarly or scientific discipline [having] the resources to respond to the questions and challenges posed by the rise of Big Data" emerged, as said by Symmons and Alvarado [27] (p. 2).

Hayek's second proposition [6] is that economists cannot give concrete results to the problem of organized complexity in the economy. Within the challenges identified by Chen and Hsieh [5] for Big Data in digital governance, one can say that the demand for Big Data implementation still builds a restriction for this issue. Not only is there a shortage of data scientists, but also of technology to analyze Big Data as well as resources to acquire both scientists and technology [5]. Not only is this a problem, but also the fact that economists may pretend to have knowledge without even measuring based on theories, since the attitudes of those who elaborate scientific research also differ regarding Big Data. Kitchin [64] differentiates between different approaches of scientists towards Big Data. The empiricist scientists share the opinion of Big Data replacing theory-driven research, whereas the paradigmatic scientists believe that Big Data is changing the goals of scientific research, but is not replacing theories or theory-driven analysis. The data-driven type of scientists pursues a different path than these two categories and support the view that Big Data is enabling the deduction of theoretical conclusions from empirically observed phenomena on a large scale. What Hayek [6] described as "the confidence in the unlimited power of science" (p. 6) is an even bigger thread for the pretence of knowledge problem today, since measuring and modeling data without theory is gaining speed.

The third proposition of Hayek [6] is that relevant information cannot be gathered. One central issue as a restriction remains epistemic opacity [61]. Apart from this, the emergence of Internet-of-Things remains a step in measuring data from everything that has an on/off switch; but as said, since the economy is an organized complex system, not only the parts that constitute the system have to be measured, but also their relations—and how they perceive the information to generate knowledge—and make sure that what has been analyzed and modeled is not a case of scientistic attitude. Since this is not possible, and neither do many data scientists strive for significance or any kind of model validation, the third proposition also remains unchanged in the digital era. In addition, what [5] refers to as the problems of Big Data governance (data-driven decision-making culture and integration of data sources) remains as further constraints regarding this third proposition.

What do these issues mean from the today's perspective? Hayek' criticism, to a large extent, was based on the *Zeitgeist* of the socialist calculation debate and the Keynesian macroeconomic policies. Even though the criticism has been widely acknowledged, economics still remains a discipline that is based on controlling the society in terms of rational constructivism—planning, designing, and implementing a top-down order of governing the society in our context. This remains on the agenda of economics as it has before; therefore, the digital sphere is yet another field which offers economics and economists to create a space for governmental intervention. The transformation from digital government as a basic electronic structure for digitalizing government services to digital governance as a process of multi-level governance covering democracy, business, and government structure seems to be problematic from the perspective of the knowledge problem. Whether new or emerging technologies can solve this basic but nevertheless central problem of knowledge is subject to question.

4. Concluding Remarks and Future Research

Digital governance as a process consists of the design and use of digital government, digital business issues, and digital democracy—this multifaceted process goes beyond the mere concept of providing government services digitally. It tries to change the nature of establishing and running a business as well as the democratic representation of people. Nevertheless, this process has its own limits. The limits to digital governance may seem to be limits known from the pre-digital era; however, the fact that digital governance is associated with the integration of the hitherto separated digital, physical, and biotechnological sectors of knowledge generation means there are new limitations and new challenges to digital governance, regardless of how "well-meant" a government is.

Re-visiting the knowledge problem of economics considering the recent technological developments shows that the "pretence of knowledge" problem exists as before; but the potential intervention space of governments has expanded immensely due to the integration of the hitherto separated digital, physical, and biotechnological sectors of knowledge generation. This is a problem concerning the abuse of Big Data by governments to describe their own targets as will of people. The author accepts that all governments may not act this way; but it is quite certain that digitalization offers governments a potential to abuse Big Data to set up their own agenda. The knowledge problem exists as before, and new technological developments are bound by the epistemic status of software programs, which are in turn bound by the limited capability of human knowledge. Nevertheless, this observation does not imply a "stop" or "go"-perspective regarding digital government. On the contrary, knowing and understanding the limits of digital government can help decision makers to adjust their policies accordingly. Digital governance can help improve human rights, transparency of governmental organizations, reduce nepotism and corruption, and transfer political decision-making processes from analog to digital; but in its present form, it cannot solve the knowledge problem in economics. It is true that reducing agency and transaction costs and making use of network externalities apply to digital governance, but every digital governance attempt needs to adjust its own processes accordingly, noticing its limits. Future research can therefore focus on how digitalization can be used for direct democracy by considering the challenges of digital government and identifying which aspects people find problematic when considering a transformation towards digital democracy.

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