Value Co-Creation and Digital Service Transformation

The case of Denmark

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Abstract:

Public administrations are investing in the digital transformation of their external services and internal administrative processes. More and more, they are using co-production approaches and include different types of stakeholders into these transformative processes to increase service quality and generate public value. In order to understand how co-production is applied, we demonstrate how Denmark has digitally transformed its public service delivery. In this case, co-production was essential in the formulation of the national strategies, and in the implementation of digital services at the decentralized level. This digital transformation has resulted into four main types of public value, namely economic, administrative, societal and citizen value.

Highlights:

- We study the digital transformation of public administrations in Denmark
- We investigate how Denmark created public value through its digital transformation efforts.
- We identify five co-production phases: co-planning, co-design, co-management, co-delivery and co-assessment
- We focus on economic, administrative, societal and citizen value
- We empirically contribute to understand public value and its co-production process

Keywords: Digital transformation, public value, co-production, public service delivery,

public administration, digital strategy, digital policy

1.   Introduction

Public administrations are moving from digitizing single administrative forms to redesigning full processes and services with the goal to digitally transform their operations (see, for example, Mergel et al. 2019). Along this continuum, some public administrations are proceeding faster, while others lack behind in their implementation efforts. This can be due to a lack of a national digital strategy, disjointed efforts across levels of government, lack of funding, or misdirected public management reform efforts (see, for example, Dunleavy et al. 2006).

In those cases, where digital transformation efforts have sped up and countries were successful in implementing digital services for their users, they are ranked high in e-government indexes (e.g., European Commission, 2019; United Nations Department of Economic and Social Affairs, 2018). However, little is known about how they managed to apply a holistic approach to their digital transformation and what the success factors were (Tangi, Janssen, Benedetti & Noci, 2020; Panagiotopoulos et al. 2019; Klievink & Janssen, 2009). We therefore set out to understand how they approached the digital transformation and what the outcomes in form of public value are. Simply defined, public value in public sector digital transformation efforts can be defined as the implementation of "citizens' expectations from e-government" (Twizeyimana & Andersson 2019:167; Moore 1995). The types of value include citizen value by creating improved interactions with citizens, economic value through monetary and time gains as a result of improved administrative efficiency, or societal value, such as improved transparency (see, for example, Moore 1995, Panagiotopoulos et al. 2019; Twizeyimana & Andersson, 2019). So far, there are very few empirical studies that disentangle how public value is created in digital transformation efforts and this study aims to contribute to the emerging literature on public value creation in digital government (e.g.

Panagiotopoulos et al. 2019; Yu et al. , 2019; Juell-Skielse et al. 2017; Karkin & Janssen, 2013).

In order to understand how a national government was able to successfully create public value through its digital transformation efforts, we selected Denmark. According to the most recent indices, the country has successfully transformed its public services from an analogue to a fully digital service delivery model (e.g., European Commission, 2019). Online interactions between public authorities and citizens is high (90 %) and well above the EU average (64 %) (European Commission, 2018a, 2018b). As a result, according to the latest United Nations E-government Survey (2018), Denmark ranked first among the 193-member states of the United Nations concerning provision of online services and citizens' participation in government decisions and policy making. Our guiding research question is therefore: How can public administrations digitally transform public service delivery and create public value in the process?

In order to answer our guiding research question, we first develop a theoretical farmework. We then use it to guide the analysis of the data, consisting primarily of semi-structured interviewes complemented by secondary material (Saldaña, 2021). The findings show that co-production was a key element both in the formulation of digital policies and strategies and in the implementation of digital transformation of public administration services. The findings also highlight five different phases of co-production and four different types of public value generated by such digital transformation efforts.

Next, we will present the key concepts from the literature on digital trasformation, co-production and public value and explain our research design. Then we will present the findings of the empirical investigation. Lastly, we will discuss our findings in light of the existing literature and provide theoretical and practical implications.

2.   Theoretical Background

Digital transformation of the public sector has been studied for a few decades, but has increasinlgy gained importance during the last years with the changing needs of citizens and businesses to interact digitally with public administrations (e.g. Tangi et al, 2020; Mergel et al. 2019; Paskaleva & Cooper, 2018; Janowski, 2015). In a recent study, Mergel et al. (2019) extracted a definition of digital transformation from expert interviews that also guides our initial understanding of the term in the public sector: "*Digital transformation is a holistic effort to revise core processes and services of government beyond the traditional digitization efforts. It evolves along a continuum of transition from analog to digital to a full stack review of policies, current processes, and user needs and results in a complete revision of the existing and the creation of new digital services. The outcome of digital transformation efforts focuses among others on the satisfaction of user needs, new forms of service delivery, and the expansion of the user base.*" Along similar lines, Tangi, Janssen, Benedetti, and Noci (2020) argue that digital transformation includes the whole organization and not just invidual administrative services or processes. The most recent wave of using ICT in government focuses heavily on the involvement of users and aims to take into account how their needs on the demand side are changing (e.g. de Jong et al., 2019; Meijer 2014). However other authors include different stakeholders in the co-production of public services and conceptualize co-production as the involvement of citizens and other actors external to the public administration in the design, production, and provision of public services (e.g. de Jong, Neulen, & Jansma, 2019; Yu, Wen, Jin, & Zhang, 2019; Paskaleva & Cooper, 2018; Cordella et al. 2018). In this paper, we draw on the conceptualization of co-production developed by Nabatchi et al (2017) according to which *coproduction describes activities involving traditional and untraditional service areas, as well as activities that have nothing to do with service delivery but relate to other elements of public services and public policies. Such*

definition emphasizes a pluralistic model of public service based on inter-organizational relationships, networks, collaborative partnerships, and other forms of multi-actor policymaking and public action (Nabatchi et al, 2017). This last focus on policy making and public action is supported by Moore (1995) suggesting that public management strategies aiming at public value creation do not "only need specific organizational capabilities and resources to deliver services that fulfil social expectations but also need to be politically legitimate and sustainable (Moore, 1995 in Panagiotopoulos et al. 2019, p. 2).

By drawing on the above literature, co-production of digital transformation is therefore not simply a participation process, but may involve the re-organization of the relationships, the interaction and co-operation between different actors (Gawłowski, 2018; Mergel et al., 2019; Emerson & Nabatchi, 2015) not only at service delivery and organizational level, but also at policy and national strategy level (e.g. de Jung et al. 2019; Lember et al., 2019; Osborne, 2018; Osborne, 2020; Cordella &Iannacci, 2010). We therefore derive our first research question:

Research question 1: How did a national government succeed in the development of policies and strategies that has brought the country to the top of most digitalization indices?

Especially in cases where public administrations are aiming to fullfill the needs of citizens and businesses, these two stakeholder groups are included in the co-production phases of digital transformation. The existing co-production literature shows that there might be different phases that go beyond the consumption phase as the single point of interaction (Nabatchi et al., 2017). By focusing on the "Who, When and What" of co-production, Nabatchi et al.(2017) analyze different definitions and applications of co-production, and argue that the "co" side of the term captures who is involved, while the "production" side captures what occurs and when (see also Alford, 2014; Fugini, Bracci & Sicilia 2016; Sorrentino et al., 2018). In addition, Nabatchi et al. (2017) note that in some studies co-

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production is limited to situations where a state actor and a lay actor work together on a specific service at the point of delivery (see also Alford, 2009), while in other studies co-production is applied across the phases of the public service cycle (e.g., Bovaird 2007; Bovaird and Loeffler 2013, 2016; Sicilia et al., 2016). In the latter studies, state actors and lay actors can work together at any stage to 'produce' something of value. In varying degrees of granularity, several authors show that there are in fact different co-production phases, including co-design, co-development or co-delivery (Brandsen & Honingh, 2016; Loeffler & Bovaird, 2016; Nabatchi, Sancino, & Sicilia, 2017). In the digital era, co-production then goes beyond citizen participation (e.g. de Jong et al., 2019) or crowdsourcing activities (e.g. Koch et al., 2011). For example, Blomkamp (2018) show the potential benefits of co-design, that occur throughout the whole production process of a digital product. Van Eijk and Steen (2014) show the potential of co-planning. Bradsen and Pestoff (2006) focus on how co-management can potentially be distinguished from other types of co-production, while others discuss the phase of co-assessment and the extraction or explication of the resulting value (Boivard & Löffler, 2013). We consider the above co-production activities as phases of co-production and assume that several or all of these phases might be existing in the co-production of digital transformation of public administrations. Our second research question is therefore:

Research question 2: What are the phases characterizing the co-production of public services in digital transformation of public administrations?

Finally, according to several authors (e.g. see Panagiotopoulos et al. 2019), what is not understood well so far is how digital transformation and co-production activities are creating public value (Panagiotopoulos et al. 2019; Twizeyimana & Andersson, 2019; Bannister and Connolly, 2014). While there are many different ways to conceptualize public value (for different definitions see for example Bannister & Connolly, 2014; Jorgensen & Bozeman

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2007; Alford & O'Flynn 2009), there are rarely any empirical studies available that operationalize the concept and provide guidance on how public value is empirically created (Panagiotopoulos et al., 2019; Andersen et al., 2010;). The existing inventories show how diverse the research streams are (e.g. Jorgensen & Bozeman, 2007; Bannister &Connolly, 2014) and that a lot of additional work is needed to derive actionable insights (Panagiotopoulos et al., 2019). Thus, when it comes to the digital government literature, public value is assumed to be an outcome that is created as a by-product of the investments into digital transformation (see, for example, Twizeyimana & Andersson, 2019), but it is rarely measured, as Panagiotopoulos, Klievink, and Cordella (2019) confirm in their most recent editorial. Therefore, empirically, public value in digital transformation of public services is still a relative underexplored concept (Panagiotopoulos et al., 2019; Sorrentino et al. 2018).

By drawing on Moore (1995) and Twizeyimana and Andersson (2019), we define public value in public administration as "the citizens' collective expectations in respect to government and public services" (as also stated in the introduction) and broadly refer to public value as "what is worth" (Bannister & Connolly, 2014). Citizens are defined as people in their different stakeholder roles, among which policymakers, public servants, users or customers of public services, tax-payers or entrepreneurs, and citizens as such (Twizeyimana & Andersson, 2019). Other authors have built on this seminal work and provide inventories of different types of public value (e.g. Jørgensen and Bozemen, 2007). By building on Jørgensen and Bozemen (2007)'s work, Bannister and Connolly (2014) frame the complex notion of public value by proposing a taxonomy of public sector values and argue about the impact of each value on digital government initiatives such as transparency, efficiency and inclusiveness. Twizeyimana & Anderson (2019) state that achieving "public value" in e-government should be understood as the ability of e-government systems to provide improved

efficiency in government, improved services to citizens, and social values such as inclusion, democracy, transparency, and participation. By drawing on the previous literature, (Twizeyimana & Anderson, 2019; Bannister and Connolly, 2014; Jørgensen and Bozemen; 2007) and for the purpose of this article, we synthesize the different types of public value into four categories: (1) economic value, expressed in form of cost savings through digital transformation, (2) administrative value, expressed as improvement of public service delivery, (3) societal value, expressed in terms of the rule of law, and (4) citizen value, expressed for example in form of transparency or privacy. Our third research question is therefore:

Research question 3: What is the public value generated by digital transformation of public administrations services?

In summary, our resulting conceptual framework for the subsequent data collection and analysis phases includes the following theoretical concepts:
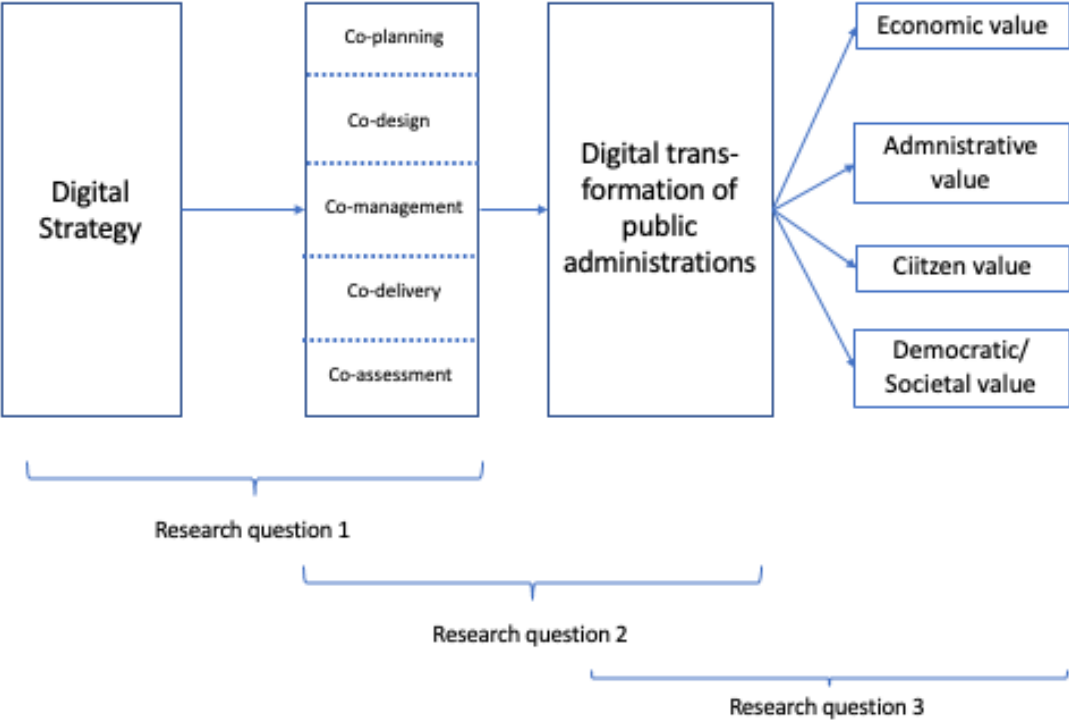

Figure 1: Conceptual framework

3.   Research design

To investigate the research questions we have chosen a case study research design. This choice is consistent with Yin's (2003) suggestion that three conditions should be considered to choose a proper research method: (1) the type of research questions posed; (2) the extent of control an investigator has over actual behavioural events; and (3) the degree of focus on contemporary, as opposed to historical, events.

The case of Denmark can be defined as an intrinsic case (Mills et al., 2009). A case may be intrinsically interesting because it is special and unusual among others and therefore we may be interested in investigating it due to its special nature. According to Taber (2014), intrinsic cases may be selected because they have been identified as special according to predefined empirical or theoretical criteria. Denmark was selected as an intrinsic case because of the Danish national government success in creating public value through the digital transformation of public services as reflected by the high ranking in most of the e-government indices such as the DESI index (European Commission, 2019, 2018a, 2018b) or UN surveys (United Nations, Department of Economic and Social Affairs, 2018). In addition, as Andersen et al. (2011) argue, Denmark is an interesting case due to its "strategic commitment to face challenges and formulate explicit milestones for the success of e-government strategies" (Andersen et al, 2011, p. 441).

We apply a qualitative research methodology in the interpretive tradition (Miles & Huberman 1994) and take the starting point in our theoretical framework acting as a guide and a source for inspiration in the understanding of the phenomenon investigated (Walsham, 1995). This interpretive approach to the phenomenon focuses on the qualities of the entities under investigation, the processes, and the meanings occurring naturally in the environment. With this approach, we aim to understand the actors, actions, and mechanisms and how the involved social actors interacted with each other to create the observable digital transformation and the value created.

Data collection

The data sources included primary and secondary data. The primary data consisted of 15 interviews. To answer our three research questions (see paragraph on Theoretical Background), eight interviews were conducted with national experts mostly responsible for digital policy and strategy development, but also involved in digital transformation projects of public administration and public services (RQ1), while seven were conducted with experts mostly responsible for digital transformation of a public administration unit, but also involved in digital policy and strategy formulation (RQ2 and RQ3). The public administration unit selected for our study was the Danish Business Authorithy (DBA). DBA is an outstanding example of digital transformation of public admnistration both in Denmark and in the European Union. As a result, for a long period DBA has given "GO&SEE" seminars to showcase and share experiences about their digital transformation with both Danish and EU representatives from the private and public sector (Danish Business Authority, 2016).

According to Bogner, Littig, and Menz (2009) experts are subjects with technical, process and interpretative knowledge in relation to their areas of expertise. Such knowledge is a result of their actions, responsibilities, or obligations within an organization. The experts interviewed in our study are key actors involved directly in digital strategy and policy formulation and implementation as well as digital transformation of public administration and public services and thus related in their real-life settings to the phenomenon under investigation (see table 1 for a full overview of interviewees, including positions and type of affiliation).

Table 1: List of interviews

Interviewes	Position	Type of Organization/Level of Government
Partner 1	Director	Public Sector Organization/State Government
Partner 2	Director	Public Sector Organization /State Government
Partner 2 (a)	Director	Public Sector Organization / State Government
Partner 3	Director	Public Sector Organization

Interviewes	Position	Type of Organization/Level of Government
Partner 4	Chief Technology Officer	Government and private consultancy
Partner 5	Head of Section	Government Agency / State Government
Partner 5 (a)	Head of Section	Government Agency / State Government
Partner 6	Deputy Director General	Public Sector Organization
Partner 7	Director	State Government / Danish Business Authority
Partner 8	Vice Director	State Government / Danish Business Authority
Partner 9	Chief Advisor	State Government / Danish Business Authority
Partner 10	Special Advisor Special Advisor	State Government / Danish Business Authority
Partner 11	Head of Department	State Government / Danish Business Authority
Partner 12	Office manager	State Government / Danish Business Authority
Partner 13	IT development manager	State Government / Danish Business Authority

To reach out to the interviwees we used a snowball sampling method (Biernacki & Waldorf 1981). Snowball sampling is a sampling technique for gathering research subjects through the identification of an initial subject who then refers to other actors. These actors may then open possibilities for expanding the sample. We started by contacting and interviewing two of the most publicly well-known actors of digital transformation of the Danish government scene. They referred us to other respondents that satisfied our selection criteria. Snowball sampling is a very good technique for conducting research with a specific and relatively small population that is hard to identify or locate (Lewis-Beck et al., 2004). Even though the number of interviews in our study is relatively limited, given therespondents' unique and central role in digital policy formulation and digital transformation of public administration, they have provided us with unique and exhaustive data to understand the phenomenon under investigation.

The interviews were conducted between March 2018 and May 2019 and lasted on average one hour each, were tape-recorded and fully transcribed. Most of them were conducted face-to-face at the working place of the respondents, a few were conducted over teleconferencing systems, Skype or telephone.

Secondary data complemented the data gathered through interviews. These data included official Danish policy and strategy reports, press releases published on key governmental web sites such as the Danish Digitalization Agency, reports written by other international organizations such as OECD (e.g. OECD, 2010) and European Commission (e.g. European Commission, 2018b) as well as internal reports and powerpoint presentations provided by the DBA employees (e.g " (Danish Business Authority, n.d, 2016) or found on the Internet. The policy and strategy reports covered the period from 2000-2018. This timeframe was chosen for two reasons: 1) Around year 2000, the Danish government started the digital transformation of the Danish public sector and therefore these reports allow us to understand digital policy and strategy formulation and implementation from the beginning up to present; 2) the time period from 2000-2018 roughly includes four legislative periods. In searching for these documents, we focused on existing and successive digital agendas. These agendas represent a formal articulation of the Danish digital policies and strategies. The combination and triangulation of these types of data has contributed both to increase the level of knowledge and to gain an understanding about the phenomenon under investigation from different perspectives (Lewis-Beck et al., 2004).

3.2 Data analysis

The data analysis broadly followed a deductive thematic analysis approach (Crabtree, 1999). Deductive approaches in thematic analysis involve the identification in the data-set of themes identified in other research or the use of existing theory as a lens through which to organise, code and interpret the data (Crabtree, 1999). Thus, this form of data analysis is interpretative and shaped and informed by pre-existing theory and concepts. The thematic analysis of our data was guided by our theoretical framework (Fig. 1) and our research questions and broadly searched for ongoing action and interaction taken in response to

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situations, or problems, often with the purpose of reaching a goal or handling a problem (Saldana, 2013), thus identifying how the digital transformation experts in the Danish government defined the value propositions of their work.

Case description

Denmark belongs to the high-performing cluster of countries and is a leader in digitization in the world (European Commission, 2019, 2018a, 2018b; Andersen et al., 2011). Denmark is a relatively small country with a population of 5.8 million inhabitants and has a relatively low unemployment level and a well-educated population (Statistics Denmark, 2018). It is a constitutional parliamentary monarchy with legislative power held by a single-chamber parliament. Parliamentary elections are usually held every four years (Statistics Denmark, 2018). The current Head of the State is Queen Margrethe II. The Government, headed by the Prime Minister holds the executive power, while the monarch appoints the Prime Minister based on recommendations from the leaders of the political parties.

Denmark has three levels of governance: central, regional and municipal. Prior to 2007, the Danish territorial organization consisted of the state, the counties and the municipalities. A major reform in 2007 resulted in the dissolution of counties, the creation of five regions and the reduction of the municipalities from 271 to 98. It also modified the division of powers among the different levels of government. Only municipalities are considered local authorities. Municipalities and regions are represented before the central authorities by the associations Local Government Denmark (*Kommunernes Landsforening* – KL) and Danish Regions (*Danske Regioner*) respectively. The three levels of government collaborate closely on tasks and obligations laid down in the legislation adopted by the Danish Parliament (OECD, 2010).

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Within the central government, the Danish Business Authority (DBA) is an authority organizationally embedded under the Ministry of Industry, Business and Financial Affairs and funded through the Finance Act with a yearly budget of about 600 million DKK. It is responsible for business registrations including registration of VAT and the Register of Foreign Service Providers. DBA is providing a range of digital services including Virk.dk, the main digital portal for licenses and company registrations in Denmark and CVR, the Central Business Register containing data on all companies in Denmark (Danish Business Authority, n.d). DBA has a large number of stakeholders that include the ministries, the 40 Danish authorities, and the Confederation of Danish Industry.

DBA's digital transformation started in 2009 due to old legacy IT systems that created several problems. For example, DBA had difficulties to implement changes in the IT systems to comply with the law changes, had problems to meet customer demands concerning digitalization and had inefficient operations. It is a business-driven digital transformation that has taken the starting point in both DBA's customer needs and employees' knowledge. The result is that DBA has changed from being an "organization focused on cases and inwards; with limited ability to change and legacy IT and traditional IT development organization" to an organization which is "customer centric and with digital solutions based on a stable and constantly evolving platform; agile culture with a focus on continuous improvements; data driven insights" and "digital laws, regulation and process" (Danish Business Authority, n.d, 2016).

4.   Findings: Public value creation in digital transformation of Danish public administration

In this section, we first present the background findings in relation to the changes in administrative, political and legislative context as our analysis shows that these context

factors were essential for the success of the digital transformation of Danish public administration. Then we present the findings relative to the three research questions posed in the theoretical background section.

Context- The administrative, political and legislative structure

The administrative, political and legislative structure of Denmark has been changed over the years to adapt to developments of digital transformation of public administration and make its implementation possible (Scupola 2018; Henriksen and Andersen, 2004). This need emerged at the end of the 1990's. Due to the small size of the Danish country, each single public administration unit was too small to solve the problems arising from digitalization by itself, therefore a need for change emerged. An important example is the structural reform of the local government in 2007, which by reducing the number of regions and municipalities has simplified the political structure by simultaneously increasing the size of each single administrative unit, thus also increasing the budgets that each municipality or region has available for the implementation of digital transformation. In addition, in order to implement the national digital strategies, the existing legislation had to be simplified, made more flexible, and agile to accommodate digital transformation demands and challenges. Policies and regulations did not necessarily fit with what is required to digitally transform Danish public administration, therefore the need to formulate them in such a way that they can facilitate the process arose:

> *"For digital transformation to be successful you have to also think about agile and digital legislation and digital policies." (Interview Partner Partner #3, Director, Public Sector Organization)*

There was a need for new legislation at state level. An important step to accommodate this need is the Danish Government's "Agreement on digital-ready legislation" that established that new legislation must be digital-by-default from 1 July 2018. In order to fulfil this goal,

the agreement stipulates seven principles, which must be followed in new legislation. One principle, for example, deals with prevention of fraud and errors establishing that the legislation must be worded in such a way to allow effective IT application for control purposes (Agency for Digitalization, 2018).

Finding 1: Co-production of Danish digital strategies

The three Danish government levels , central government, local government and the five Danish regions have co-produced over the years the digital policies and strategies (OECD, 2010). The main idea of such co-production is to decrease costs, improve communication among public administrations as well as between the public administrations, the public authorities and other stakeholders including the citizens and businesses and improved efficiency.

This co-production has been accomplished, supported and coordinated through governmental agencies under the umbrella of different ministries. Task forces lasting several years and spanning several strategic agendas as well as a number of more temporary commissions have also been established. Such commissions and task forces have changed according to the plans and needs of the moment. A recent example is the digital growth panel (OECD, 2019).

In addition, a combination of centralized and decentralized co-production of digital policy and strategy has been key to digital transformation of public administration in Denmark. At first, a centralization of co-production took place with the involvement of a few key authorities, agencies and ministries. Lately many ministries (up to 13) and other types of organizations such as the Confederation of Danish Industry and NGOs got involved in the co-production of digital strategies and policies:

> *"What is called a digital government, the way you do that is through, iterative collaborative involvement and engagement of end user citizens, but also of partners and suppliers and internal staff, and other parts of government" (Interview Partner 3, Director, Public Sector Organization)*

Some actors such as the Ministry of Finance and the Ministry of Industry, Business, and Financial Affairs have continuously been involved in the co-production of digital policies and strategy since the beginning of the digitalization program at the end of the 1990's. A few actors have changed name over time but kept the same responsibilities or have merged with other actors. Thus co-production evolved as a result of multi-actor engagements. The Ministry of Finance has a central position in the co-production of digital strategies, since it is responsible for public sector digitalization in Denmark and has been historically in charge of the annual budget, the modernization program (including digitalization) of the public sector, and the yearly negotiations with the municipalities and regions.

Co-production is implemented through cross governmental committees, task forces and agencies that have the purpose of breaking down silos between the different government levels and public versus private sectors. For example, when the digital agenda started to roll out in 2001, a digital taskforce comprised of a team of 25 young people from different ministries, local, and regional government, as well as the private sector organizations was put in place by the Minister of Finance to co-produce Danish digital policies and strategies. The members of the task force were high-level representatives, such as director generals from central ministries and representatives from Danish Region and Local Government Denmark (LGDK), representing the interests of their respective members. These committee members have great administrative, budgetary, and decision-making authority within their organizations and the ability to execute policies and advise politicians. The task force co-produced a cross-governmental, jointly agreed-upon strategy, with a shared decision-making forum. Such digital strategy envisioned co-sharing of experiences, financing and risk among different actors and governmental levels in the digital transformation of public administration and public services:

> *"Of course, there's a lot of things that the municipality has to do on their own. But we co-share a lot of experiences and help each other as far as we can." [.... Let's see if it's good enough, you co-finance so you're a part of the risk." (Interview Partner 2, Director, State Government)*

In addition, substantial co-production has been taking place with the private sector including companies and banks:

> *"That has taught us that we have to ...cooperate with the private sectors, in another way than just having the solutions built by the private sector." (Interview Partner 2, Director, State Government)*

This co-production across all levels of government (central, regional, and local) and with other actors has had a focus on benefit realization and has been important to ensure data exchange and a high degree of interoperability across different levels of government and authorities thus ensuring the overall digital transformation success. The funding scheme being complex as all authorities and government levels co-finance their own digitalization as part of continuous business maintenance and development. The main idea is that the state government provides seed money that has to be supplemented by economic resources invested by all actors involved. The joint public efforts (e.g., joint solutions) get allocated separate funding.

Similarly, co-production of broadband goals and policies has been strictly linked to digital transformation of public administration and supported and co-financed by a number of political initiatives at central, regional, and municipality government levels aiming at nation-wide fixed and mobile broadband coverage.

Finding 1a: Centralization and user involvement in digital transformation

While the co-production of the digital strategies and policies has involved mainly governmental and other types of stakeholders such as businesses, business organizations, and NGOs , the co-production of digital public services has focused on human-centered design perspectives taking citizens' and businesses' needs into consideration:

> *"The way that you study their needs, that you understand the daily life of the citizens, how can we then use technologies to provide services to them, so their lives get easier, digitalization of the public sector is that, it makes it easier to be business or citizens in the country." (Interview Partner #2a, Director, State Government)*

The co-production of digital policies and strategies has been characterized, in fact, by a high degree of centralization aimed at "evolving people" towards a digital mind set. The idea is that citizens might not by themselves be prone to think of or are interested in big changes in the way they interact with the public administration, but they may be interested in the co-production of public administration services:

> *"So, the question you have to put forward for the citizen is not necessarily, do you want to change, but, how can we make this a successful experience for you, how can we do the services that we direct towards you, make it more easy for you to be citizens." (Interview Partner #2a, Director, State Government)*

Thus, the Danish co-production approach has involved businesses and citizens in the co-prodution of digital services (See Table 3) but not necessarily in the co-production of digital strategies and policies:

> *"The digital products need to be designed so that they are meaningful to them as well, that is meaningful to citizens." (Interview Partner #3, Director, Public Sector Organization)*

An analysis of the main press releases in the period 2017-2018 shows a shift in focus on user engagements and co-production with users in designing, testing and delivery of public services. For example, for digital public services to become mandatory and be launched at full scale they have to comply and pass a user test. Such tests include fulfilling 26 user requirements including user friendliness and accessibility and require the active involvment of the users in testing the services:

> *"We have for our mandatory services in our strategy pyramid, they have to comply (to) and pass a user test." (Interview Partner #5, Head of Section, Government Agency).*

However, citizens can also be involved early in the co-production of the public services :

> *"We have invited a small group of users to a workshop, where they can give their feedback on the ideas that we are working with, or that is the common way of using users." (Interview Partner #6, Deputy Director General, Public Sector Organization)*

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Finding 2: Decentralized digital transformation of public administration-Different co-production phases

The co-production of DBA's digital transformation has involved multiple actors from the public and private sector, including the Ministry of Finance, the other circa forty Danish authorities, the employees, businesses and business organizations such as the Confederation of Danish Industry as well as the end users of the digital services and the IT managers. This co-production is characterized by five main phases including co-planning, co-design, co-management, co-delivery, and co-assessment (see table 3). For example, DBA is involved in the co-production of digital strategies and policies concerning public service delivery by participating, among other activities, to cross government work groups responsible for the co-production of a joint vision of demands for public service delivery. These digital strategies have been the starting point for DBA's digital transformation which started with co-planning between DBA and the Ministry of Finance. Such co-planning also included co-financing according to the overall co-production approach to digital transformation of public admistration involving co-financing and risk sharing among different actors and levels of government (see above). For example, the idea of the CVR, the Danish state's master register of information about businesses, was firstly conceived by DBA, and then co-planned and co-financed by the Ministry of Finance. The CVR gives now the possibility to start a new company, change all the registered info about a company and close the company completely online.

Another example is provided by DBA's co-production of the first version of the single point of contact "Virk.dk" , which initially was a joint public-private partnership between DBA and a Danish digital front-runner "Krak.dk". Krak.dk providedgratis online access to telephone numbers and driving directions. In Virk.dk, co-production entailed co-planning, co-design, co-management, co-delivery and co-assessment of the service between DBA and Krak.dk.

Later DBA decided to get out from such partnership and being the only provider of Virk.dk because the users showed more trust in a fully public digital service without private commercials, which instead was the case during the partnership with Krak.dk. The idea of Virk.dk, however, was conceived by DBA on the basis of the customer wishes to find all the information needed in one place. The idea was presented to the finance minister, who decided to co-finance it and support its implementation.

Examples of activities in the co-delivery phase include the use of CVR and Virk.dk by businesses or co-provision of services by other authorities on Virk.dk. Finally, co-assessment takes place through activities such as the improvement forum, an internal online platform where DBA's customer service employees register customers' wishes and complaints and the coordination forum, where DBA discusses digitalization issues including the status quo of the portal "Virk.dk" and future possible changes with other actors, including the other authorities:

"Then we have ..a cooperation forum, where we sometimes,. right now it's… 4 times a year, we…discuss all kinds of matters that relate to public digitization." (Interview Partner #10, Special Advisor, DBA)

Another example of co-assessment activities is the Business Forum for Better Regulation, a forum where businesses meet and discuss needs and wants and provides important inputs for change to DBA. Based on these inputs, DBA is currently working on providing personalized services on "Virk.dk", where the users are presented only with the content that is relevant to them.

 The analysis shows, therefore, that a variety of tools, activities and organizational set ups are used in the different phases of co-production. These vary from design tools such as user stories, personas, customer journeys, user tests, prototype tests and workshops in the co-design phase, to the use of tools for the transformation of paper forms into digital forms such the blanket engine in the co-delivery phase. Other tools include Public-Private partnerships and contracts with IT vendors and consultants (See Table 3 for more details about activities

and tools in different co-production phases). Human-centered design was essential in DBA's co-production of its digital transformation:

> *"So, it was very valuable for us to have them (citizens-businesses) involved during the way because, we could change things, and we could make it better for them. And we don't always know what they want. We think we do. And we do in some cases, but we don't know it all. So, it was very valuable for us to get their input along the way." (Interview Partner #12, Office Manager, DBA)*

Our analysis shows that co-production of digital transformation of public administration is not problem free. A number of challenges emerged during DBA's digital transformation. Examples include distribution of budgets among the different stakeholders in the co-planning phase, establishing collaboration in co-management and sometimes co-delivery phase, citizens' reluctance to invest time in co-design phase, quality of feedback in co-assessment and an overall resistance to change at organizational level.

Table 3: Co-production phases in DBA's digital transformation and relative tools/activities

Co-planning	Co-design	Co-management	Co-delivery	Co-assessment	Co-production Challenges
Strategizing and participation to work groups for national digital strategies (e.g. joint vision of demands for public service delivery); ; Business Forum for better regulation; Cooperation Forum	User stories; personas; workshops; customer journey; user tests; prototype tests	Public-Private Partnership (e.g. Krak.dk), Contracts (e.g. with with 10 consultancies and 10 IT vendors)	Blanket Engine Use of Digital Services (e.g. CVR; Virk.dk)) Data input by users Co-Provision of services and data from authorities	Cooperation Forum; Business Forum for better regulation; The Danish Executive Board for Business Development and Growth; Improvement forum (indirect); Web site surveys	Co-budgeting, collaboration with and among different authorities, users reluctance to invest time, feedback quality, internal organizational resistance.

Finding 3: Public value generation through co-production of digital transformation of public administration

The co-production of DBA's digital transformation has generated four types of public value (see table 4). The first, economic value, consists of decreased government expenditures due to the decreased costs in human resources needed to accomplish the same tasks, increased efficiency, a cost-effective digitalization program, improved business contact with public administrations, enhanced use of digitalization and new business models in Denmark, as well as decreased expenses to both update the ICT systems and the information stored in them such as for example company's laws:

> *"For the government, the value will of course be that we don't use as much money ... we don't have many employees to do that as we used to." (Interview Partner #12, Office Manager, DBA)*

> *"Then the third (value)) is to enhance and… make possible new business models and the use of technology in businesses...in Denmark" (Interview Partner 7, Director, DBA)*

In DBA, the economic value is for example measured by the number of calls to the support center that has substantianlly decreased after the digital transformation, the reduced internal employee training time from an average of 5 to 0,5 months per employee, 20 % less human resources to do the same type of work. In addition, the economic value includes time saving for the authorities and businesses, as for example time savings generated by the use of the form builder, which in turn can be translated into money savings:

> *"Form builder. ..allowing them to save money on building digital forms. .... Different projects try to measure the value of this and that, for example, a report on the value created by using this form builder. Where they concluded that this saved the companies for 15 million Danish Crowns a year. At that point in time. " (Interview Partner #10, Special Advisor, DBA)*

The administrative value, reflected in the automation of the back end, is operationalized in terms of a more effective public administration that can translate into business self-sufficiency, one common platform or one stop shop (Virk.dk), data sharing among different authorities, personalized public service delivery, single line of communication with the different authorities and governmental bodies, better coherence between different authorities:

> *"The other (value) of course is that we also digitalize the back end. So it's also a matter of making administration more effective. Automating our case handling. .. and we've had quite some success with that as well." (Interview Partner 7, Director, DBA)*

In addition, for DBA an important administrative value generated by the digital transformation is the potential for digital transformation phase two based on Machine learning (ML). This should especially make it easier to check companies' compliance with rules and regulations:

> *"So, something that is very important now when we look back on the first digital transformation is... that an important value creating of the first transformation is that ...we are ready to join the next transformation, to be part of that." (Interview Partner 8, Vice-director, DBA)*

The democratic value includes an increase in trust in the public sector and its productivity, making life easier for businesses, making the customers happier, decreasing company fraud through increased control, and potential to increase societal wealth by using less citizen taxes on public administration tasks, thus increasing the overall wealth of the society as the statements below show:

> *"Easier, quicker, faster... Easier, quicker, faster. Easy to do business, then business can make more money, so we can tax more money, so we all become richer, but it is a political decision to redistribute the value or not"." (Interview Partner #11, Head of Department, DBA)*

> *"I think part of the trust thing is actually about trusting that what is done as a public sector is efficient. Trust is about a lot of other things that you're smart, that you're responsive as a public sector. That you have a service that you can see and understand." (Interview Partner #2, Director, State Government)*

> *"The digitalization efforts have been conducted first and foremost in the hope of achieving productivity gains." (Interview Partner #3, Director, Public Sector Organization)*

Finally, the citizen (or business) value includes the minimization of the administrative burden, one stop shop, better public service provision and increase in number of services provided, personalized overview as well as transparency:

> *"A single line of communication to the customers, that all the different government agencies and authorities can use. So, that's the main value I think." (Interview Partner 10, Special Advisor, DBA)*

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In fact, company registration time has decreased from 6-8 weeks prior to the DBA's digital transformation to about 3 minutes after the digital transformation if the company applying for registration does not have problems with tax authorities:

> *"For the companies, the value of course is that they get their CVR number very fast. They can make a registration very fast. They don't have to wait 6 to 8 weeks for us to do it for them, and they can just carry on doing what their business is supposed to do, and not wait for us. "(Interview Partner 7, Office Manager, DBA)*

Table 4: Public Value of digital transformation

Economic Value (Output of PA)	Administrative Value (Procedural Perspective)	Democratic Value (Societal Perspective)	Citizen Value (Individual Perspective)
Less government expenditure; less human resources; increased efficiency; cost effective digitalization; better contact with public administration; enhance the use of digitalization and new business models in DK; time saving for the authorities and businesses	Possibility for digital transformation phase 2 (ML); easier business compliance with rule and regulation; business self-sufficiency; common platform; personalized public service; single line of communication; better data coherence among different authorities; data sharing among different authorities	Make life easier for businesses; happier customer; stronger companies control; using tax money in a better societal way	One stop shop; better services due to quality standards; personalized service delivery; minimization of administrative burden; transparency.

Summary of findings

Our findings show that co-production was essential in the digital transformation of Danish public administration and public value creation. Our findings show that co-production was applied at digital policy and strategy formulation level as well as in the digital transformation of services at decentralized public administration level. Therefore the answer

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to RQ1 "How did a national government succeed in the development of policies and strategies that has brought the country to the top of most digitalization indices? " is that the Danish government co-produced its digital policy and strategies by engaging a different group of actors from different levels of government, private sector and NGOs to ensure that such policies and strategies were formulated by taking into consideration the needs and wants of the key actors impacted by such strategies. The findings also show that co-production was essential in the digital transformation of public adminitration services and the answer to RQ2 "What are the phases characterizing the co-production of public services in the digital transformation of public administrations? " is that co-production of public adsministration services consisted of five phases:co-planning, co-design, co-management, co-delivery, co-assessment. Different actors were involved in different phases. For example, in the co-planning phase, DBA and the Ministry of Finance together laid the foundation for the digital transformation of DBA and agreed on co-financing, while users were included in co-design, co-assessment and co-delivery. A number of tools and activities were used in these co-production phases varying from forums for discussion of online service improvement (in co-assessment), to strategizing groups in co-planning, to personas and user jouneys in co-design, to the use of specific software such as the blanket engine in co-delivery. The answer to RQ3 "What is the public value generated by digital transformation of public administrations and its public service" is that the digital transformation of public administration has produced four types of public value: economic, administrative, citizen and democratic value. Such types of public value have been operationalized and measured through different qualitative measures such as employeeing less human resources for the same task (economic value), easier business compliance with rules and regulation (administrative value), happier customer (democratic value) and minimization of administrative burden (citizen value). Finally, the very short answer to our guiding research question "How can public administrations digitally

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transform public service delivery and create public value in the process? " is that co-production is essential and has to be practiced at digital policy and strategy level as well as decentralized public administration and public services level in order to succeed. In addition a broad set of actors from different governement and public adminsitration levels, private sector, NGOs and final users have to be involved in the co-production phases and activities in a mix of centralized and decentralized modes. Some of them may change over time, but the central actors remain the same over time.

5. Discussion and conclusions

We set out to understand how public administrations can digitally transform public service delivery and create public value in the process. To investigate this, we developed a theoretical framework and chose Denmark as an intrinsic case of a national government that was able to successfully create public value through its digital transformation efforts.

Our study makes several contributions. First, this study empirically investigates how a national government created public value through the digital transformation of public administration thus contributing to fill the gap highlighted by several authors on the need to disentangle how public value is created in digital transformation of public administrations (e.g. Panagiotopoulos et al. 2019). Second, the study theoretically connects the fields of digital transformation, co-production and public value into a framework that has guided the analysis of the data. In the best of our knowledge, this is the first study doing so, as previous studies either focus at digital government level (e.g. Janowski, 2015; Juell-Skielse et al., 2017), at public administration level (e.g. Klievink and Janssen , 2009; Tangi et al., 2020) or at the impact of digital technologies on co-production (e.g. Lember et al., 2019). Our results show that co-production was key in the success of such digital transformation. In addition, our study shows that for Denmark to successfully develop and implement digital transformation

of public administration, co-production was a key element in all the phases and levels of the digital transformation starting from strategy and policy formulation at governmental level to implementation at decentralized public administration level. Our results show that co-production involved the central, local, and regional government as well as private sector actors and NGOs in the formulation and implementation of digital strategies and policies in different multi-actor co-production activities and set ups. They vary from permanent to ad hoc task forces, committees and agencies. Our study also shows that an important co-production instrument in the implementation of the digital transformation of public administration was co-financing. The funding scheme of the digital tranformation of the Danish public administration, in fact, has been set up in such a way that the state government makes available seed money that need has to be supplemented by economic resources contributed by all the parties involved. Thus, all public administration units at all levels of government are responsible for their own digitalization as part of continuous business maintenance and development.

Third, this study identifies different phases of co-production, thus empirically contributing to understanding the implementation in practice of co-production in digital transformation of public administration. Most of the previous literature on co-production of digital services focuses either on co-production as crowdsourcing activity (e.g. Koch et al., 2011) or citizen participation (e.g. de Jong et al., 2019) and in general looks at co-production as taking place at the end of the digital transformation process, when the citizens finally use the digital services (Panagiotopoulos et al., 2019; de Jong et al., 2019). The empirical insights provided by the interviewes with DBA experts show five phases of co-production of the digital transformation at public administration level including co-planning, co-design, co-implementation, co-delivery and co-assessment. In each phase, different stakeholders such state government, citizens and businesses are involved and co-production methods such as

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personas or user journeyes are used. In addition, the study shows that co-production of digital transformation of public services presents a number of challenges that have to be carefully handled in order to succeed.

The fourth contribution of our study is to empirically extract four types of public value that digital transformation of public administration in Denmark has created as well as to show how such values are measured in terms of output, outcomes or impact. Previous literature, in fact, provides relatively little empirical evidence of how to measure public value or how it is empirically created. This is the case especially in the context of digital transformation as argued for example by Panagiotopoulos et al. (2019) and Sorrentino et al. (2018). The existing studies provide overviews of different types of public value (e.g. Jørgensen & Bozemen, 2007), develop taxonomies of public sector values in digital government initiatives (e.g. Bannister & Connolly, 2014) or take a normative stance (e.g. Twizeyimana & Andersson, 2019). The four types of public values identified in our study include democratic value (societal level), economic value intended as output of public administration, administrative value, and citizen value (the individual perspective). The extracted value measures in terms of outputs, outcomes or impacts depend on the type of value under consideration and the beneficiary of the value and can range from increased productivity of public administrations to savings of citizen taxes to increased employee flexibility.

In conclusion, we add to the existing literature (e.g. Panagiotopoulos et al., 2019; de Jong et al., 2019; Twizeyimana & Andersson, 2019; Osborne, 2018; Sorrentino et al., 2018) insights from a highly prominent and advanced case of digital transformation of public administration and open the blackbox of how digital tranformation occurred and what the outcomes are. Others might seek to quantitatively verify our case analysis by evaluating through a large-n study the impressions of cross-agency and cross-level co-production we identified in the digital transformation of public administration in Denmark. In addition,

future research can use the extracted phases of co-production and types of public value and test their prevalance in other types of digital service delivery cases.

Finally, future research could extract from the study some practical, applied set of activities that could constitute a handbook for co-production of value in public organizations.

Limitations

Our study has provided unique empirical insights about how a national government was able to successfully create public value through the digital transformation of public administration.. Our study is however not without limitations. First of all, being a single case study, our results are context-bound and therefore subject to limited generalizability (Yin, 2003). Nevertheless, we claim that other national governments and public administrations may gain useful insights from our study about how to go in the digital transformation of public administration . In addition, it could be interesting to test the transferability of our results to settings and nations with similar socio-economic and political structure as Denmark and as well positioned among the top countries according to different indices such as the DESI index (Yin, 2003). Second, we only conducted a relatively small number of interviews. However, we feel confident that the key role of the respondents in the Danish digital transformation scene has provided us with a unique and rich data set to understand the phenomen under consideration. In addition, the use of Danish key policy documents and digitalization strategies covering the last two decades and recent press releases has contributed to gain an understanding of the phenomenon under investigation from different perspectives (Lewis-Beck et al., 2004).

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