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# The Increasing Role of Digital Technologies in Co-production<sup>1 2</sup>

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## Abstract

There is a new wave of digital processes, applications and “mashups” of services emerging, driven by a growing digitization of society, ever-increasing computational power, social networking and related institutional innovations. Digital technology can empower individuals and substantially increase opportunities for collective co-production as well as enable more personalized and demand-driven public services. However, the conflicting interests and diverging values among stakeholders, the inability of algorithms to mirror the complexity of societies, unevenly spread technological capabilities and other factors make digital co-production a fundamentally ambiguous, open-ended and contested process. The chapter discusses how the major trends in digital technologies affect co-production and recent evidence on the topic, as well as the major risks and open issues associated with new technologies in co-production.

## Introduction

As the success of contemporary tech giants demonstrates, not only can modern information and communication technologies (ICT) provide ample new solutions and services with a high value to society, but the very basis of the success of the contemporary technology and other industries is fundamentally based on user co-production. Technologies and institutions that make it possible to transform the vast user-generated input into socially and economically valuable products and services has become the key ingredient of the economic and social change (Von Hippel, 2016).<sup>3</sup>

It follows then almost naturally that in the light of the rapid digitization of everyday life, coupled with increasing computational power and ongoing austerity policies, modern ICT is expected to change the way citizens are engaged with and provide input for public services, too (Noveck, 2016; Clark et al., 2013; Linders, 2012). Indeed, a new wave of technology-induced co-production practices has recently emerged around the globe. In Mexico City, which has one of the largest public-transportation systems in the world with 14 million rides per day, the citizens were able to co-produce the city’s first ever public transportation map within just two weeks by sharing their travel data through a mobile app (OECD, 2017). In Oxford, UK, citizens launched a flood detection network using water-level monitoring sensors and the Internet of Things to establish real-time monitoring and an advanced alert system that would complement the

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<sup>3</sup> According to McKinsey (2016) today the value of globally traded data exceeds the one of physical commodities.

existing public service (<https://www.oxfordsmartcity.uk/cgi-bin/oxflood-net.pl>). Applications like Firedepartment (<http://firedepartment.mobi/>) and PulsePoint (<http://www.pulsepoint.org/>) empower individuals to be part of the rescue operations, cooperating actively with paramedics when, for example, registered and competent users are alerted if someone nearby has a heart attack or needs medical assistance (Paletti, 2016). In Japan, citizens use their mobile phones as sensors to track litter in cities and enable local governments, using a mix of artificial intelligence, video and GPS technologies to automatically design quick and measured responses (OECD, 2017). These and numerous other examples imply that technology can change the way citizens contribute to public services, trigger entirely novel services and forms of co-production and even replace the traditional human-centric co-production with fully automated processes. As such, modern technologies can empower millions of citizens around the world and help them to enjoy a better quality of life (Noveck, 2016).

Yet, technological change never automatically creates “better life” – it is an open-ended process riddled with value and other conflicts that may create severe unintended and negative consequences (Jasanoff, 2016; Morozov 2013). Next to all the visible success stories, new technologies increasingly structure how and what citizens can co-produce, often diminishing their choices to actively participate in public-service provision (Kitchin, 2016; Ashton et al., 2017). And sometimes digital technologies may not only disempower citizens, but as “weapons of math destruction” amplify the real-world biases and discriminatory practices and thus directly harm them (O’Neil, 2016).

This chapter takes stock on the existing evidence and revisits the key technological issues relevant for public service co-production. The chapter will focus on ICT – the dominant technology of the current techno-economic paradigm (Perez, 2002) – which has arguably also had the strongest impact on co-production.<sup>4</sup> It will discuss what kind of impacts emerge from introducing new digital technologies into the context of co-production and what are the open issues related to technology and co-production.

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<sup>4</sup> The influence of technologies on co-production cannot be, of course, limited to digital technologies only. For example, as Ostrom and others (1973) have demonstrated, the emergence of patrol cars had a direct and significant impact on the ability of police to form productive relationships with the community. As another example, in many countries citizens do not sort household plastic waste anymore as due to changes in energy production technologies plastic waste is now simply burned together with other domestic waste.

## Main technological developments influencing co-production

Today there is an entire cluster of digitally enabled technologies emerging that potentially have a deep impact on how citizens contribute to public-service delivery. The majority of existing studies observing this relationship have so far focused on social media (Meijer, 2011; Linders, 2012; Nam, 2012; Mergel, 2016; Noveck, 2016; Paletti, 2016). In addition, the various technologies associated with the “smart city”, such as electronic sensors or urban control rooms (Townsend, 2013; Cardullo and Kitchin, 2016, as well as emerging technologies, such as blockchain, that enable peer-to-peer service delivery (Pazaitis et al., 2017a) are becoming more central to the ways citizens engage with public-service delivery.

Some of the new technologies affect co-production *indirectly*. Digital technologies can simply be useful for coordinating co-production by allowing for more efficient information flows and providing support functions (e.g. stakeholders can have real-time access to and exchange of information or use various digital products from digital signatures to electronic databases). Real-time data collection and provision can provide the governments with an opportunity to nudge how citizens contribute to public-service delivery (e.g. users can be notified of how their real-time energy consumption compares to their neighbours, consequently nudging them to change their behaviour and thus how they co-produce environmental protection, see Linders, 2012).

There is also a wide array of new technologies that *transform* what we know as traditional co-production. Some of these technologies create entirely new co-production practices, while some just add a digital layer on top of the traditional human-centred co-production. For example, assisted living technologies such as telecare (remote monitoring of emergencies through sensor devices and personal alarms) and telehealth (transmission of medical information over telecommunication) provide opportunities for elders to live independently at homes, while assuming a significant shift in co-production practices (Wherton et al., 2015). Hackathons and living labs can be considered to be closest to the idea of co-creation of new technologies (Cardullo and Kitchin, 2017a). Hackathons represent both a new method of co-production (e.g. government-sponsored weekend-long prototyping/coding events for citizens, often based on government-provided open data) and a source for new co-production initiatives (e.g. apps and other technical solutions enabling further co-production). Living labs are a bottom-up approach to test digital technologies with their users “in-vivo settings” and to solve local issues through community-focused civic hacking, various kinds of workshops and engaging with local citizens to co-create digital interventions and

apps (Cardullo and Kitchin, 2017b). A similar idea is behind technology co-design workshops, where in the format of participatory design users and designers express and exchange ideas to develop technology-intensive services (Wherton et al., 2015).

In addition, through various digital crowdsourcing platforms, governments can tap into the collective wisdom of the crowds by systematically collecting ideas, opinions, solutions and data from service users and citizens (Noveck, 2016).<sup>5</sup> Here the examples include not only social media harvesting (e.g. using Twitter for sentiment analysis for getting real-time feedback for implemented initiatives) or data-collecting through “fix-my-street” and 311-type solutions, but also engaging citizens to voluntarily contribute their personal data for developing new public services (see e.g. <https://www.decodeproject.eu/>). As a paradoxical twist, the widely spread crowdfunding platforms have made it also possible for government organizations to raise money directly from citizens to implement public projects such as acquiring school equipment or building public walkways (The Economist, 2013; Davis 2015).

Crowdsourcing and other digital co-production attempts are increasingly facilitated by gamification strategies, that is, by using game-thinking or game mechanisms in non-game contexts to incentivise citizens to participate and provide input for public service delivery (Mergel, 2016). For example, when co-producing the city’s first ever public transportation map, the citizens of Mexico City were allocated points based on their inputs, whereas the highest earners were given cash prizes and electronic devices as incentive to participate (OECD, 2017).

In addition, much of the latest thinking about digitally enabled co-production is related to the idea of government as platforms (Linders, 2012). Fundamentally, platforms are “frameworks that permit collaborators – users, peers, providers – to undertake a range of activities, often creating de facto standards, forming entire ecosystems for value creation and capture” (Kenney and Zyzman, 2015). As platforms bring together different services, applications and technologies, as well as all types of stakeholders (Janssen and Estevez, 2013), they are believed to reorganize how value is created in society, who captures the value and control (Kenney and Zyzman, 2015). For example, in China, WeChat platform with 806,000,000 individual and 20 million company users combines multiple platforms into one app with multiple social media functions, big data maps, and integration of public service provision, investment services and

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<sup>5</sup> In comparison, when Elinor Ostrom and colleagues founded the co-production research in 1970s, a lot of effort was put on simply getting addresses and contacting people. This is immeasurably easier today.

mobile payment functions. These functions provide also many new co-production opportunities from the ability to make doctors' appointments to on-line reporting or paying a traffic fine online (OECD, 2017).

The development of platforms has evolved hand-in-hand with the advancements in the so-called big, open and linked data (Janssen and van den Hoven, 2015; Toots et al., 2017). This constitutes a new approach to every-day generated data, including on a meta-level, which should be made generally available (opened up) and linked in order to generate the full potential of the data. Using web-based interfaces, open-government data enables citizens and other interested parties to design and implement services based on data owned and stored by the government (Kornberger et al., 2017). This would not be possible without the user-generation of data, whether or not this happens knowingly (Janssen and van den Hoven, 2015). Platforms can also mash up different data sources, such as social media, sensors or geo-informational data. For instance, in Greater Jakarta, a tool called PetaBencana.id was created that combines data from hydraulic sensors with citizen reports over social media and civic applications and that allowed for the creation of real-time flood maps (OECD, 2017).

Finally, there are the new technologies that have the potential to **substitute** the traditional co-production practices. This means, on the one hand, that thanks to the digital technologies the co-production process can be fully or partly automated, changing the role of co-producing citizens from active to passive. Increasing use of remote health-monitoring sensors that can provide 24/7 real-time and automated feedback about the health conditions of the patient is one of the examples here. Another emerging trend is the use of algorithm-based decision-making models and the Internet of Things to monitor the behaviour of crowds and service performance. Here the mere presence and action of citizens in public spaces provides the governments potentially valuable feedback (Cardullo and Kitchin, 2017a) and makes it possible to build predictive governance models based on the actual behaviour of citizens without actively engaging them (Athey, 2017). This includes initiatives as varied as the management of public spaces (e.g. mega-stadiums; see, e.g., <https://dcu.asu.edu/content/smart-stadium>), predictive policing (algorithms predict, based on citizens' past behaviour, where the next crime will take place and correspondingly trigger the preventive actions by the police, see e.g. Hunt et al., 2014) and corruption surveillance (e.g. a recent study claimed that based on citizens-created social-media data it is possible to predict up to one year before the fact which specific politicians in China will later be charged with corruption, see Qin et al., 2017).

Simultaneously, there is also an increasing presence of technologies that give the full control of service provision to citizens without the need for direct or even indirect government participation. Here the citizens own and decide on the initiatives, choose the design and implementation methods, co-create the technologies and coordinate the activities from start to finish (Pazaitis et al., 2017b). The key here is the use of (open-source) digital technologies that enable the citizens to coordinate and deliver the peer-to-peer initiatives on a much larger scale than was possible before and without the presence of the central coordinating authority (e.g. the government). So, instead of top-down government or private-sector-coordinated initiatives we now have not only highly influential peer-to-peer produced solutions, such as Wikipedia or community-owned public taxi services such as in Austin (US), but entire eco-systems of user-driven innovators which are increasingly capable of coming up with bottom-up solutions for their communities (see also von Hippel, 2016). In other words, digital technologies may effectively substitute traditional service provision models with models of self-organization.

### **Preliminary evidence and open questions**

In spite of the rapid technological change in recent years, the knowledge how digital technologies actually impact the very nature of citizen engagement and co-production is still limited (Meijer, 2012; Clark et al., 2013; Noveck, 2016). While the overall mood is highly optimistic and the preliminary evidence demonstrating the positive influence is seemingly stockpiling, one should be aware that the technological change can influence co-production in many different ways. While some of the gains are often quickly visible and easy to understand (e.g. reporting apps provide citizens with a convenient and effective means to contribute to safety and environmental protection), many of the drawbacks tend to have long-term impacts and take years to become visible (e.g. disempowerment of citizens as digital platforms re-allocate control in society). As digital technologies are never neutral to social acts (Jasanoff 2016), new technologies may significantly change the very nature and meaning of what and how citizens co-produce with the public sector (Meijer, 2012). In other words, while technologies can seemingly give citizens more opportunities to contribute to public-service delivery, they simultaneously structure for good or ill how and when they provide input (see e.g. Kitchin, 2016). What follows is a short overview on the impact the digital technologies have had on co-production and related open issues.

## ***Empowerment***

The central argument for using digital solutions in co-production is that these technologies can considerably empower citizens as they enable shared sovereignty and responsibilities (Noveck, 2016). Consequently, the digital technologies can create new social interactions and practices (Townsend, 2013), where citizens not only contribute to public-service delivery in novel ways, but can do it more collectively (Bovaird and Löffler, 2010). Although many of the examples outlined in this chapter and elsewhere (see e.g. GovLab 2013; OECD 2017) seem to indicate that this has indeed been the case, there is yet no systemic evidence available about the impact of digital technologies on citizen empowerment.

Moreover, the increasing reliance on digital governance may paradoxically also marginalize the role of citizens as co-creators of public services. When observing the recent developments in the context of smart cities, Kitchin (2016) has stated that:

Such automated management facilitates and produces instrumental and technocratic forms of governance and government. That is, rote, procedural, rule-driven, top-down, autocratic means of managing how a system functions and how it processes and treats individuals within those systems. Algorithmic governance is the technical means to manage a city understood in technical terms: wherein there is a belief that the city can be steered and controlled through algorithmic levers.

The code underlining digital solutions for co-production always entails normative assumptions and values that in the end structure how citizens can provide input for co-production; yet the normative assumptions of digital solutions are seldom debated openly, especially when proprietary technologies and commercial secrecy are applied (O'Neil, 2016). If to delineate between communication, consultation and co-production as the main citizen-engagement and -participation forms (Martin, 2005), it seems that the emerging technological advancements mostly emerge around communication, consultation and minimal co-production practices, and far less around what Bovaird (2007) has labelled full co-production. This tendency is visible, for example, in the so-called global smart-city movement, where the recent advancements cluster predominantly around top-down technologies, such as dashboards, smart meters, sensor networks, centralized control rooms and various applications that foremost cater to the needs of governments and provide opportunities for markets rather than enabling truly co-creative practices (Cardullo and Kitchin, 2017a). In other words, growing digitalization and related engineering mentality increasingly structures how citizens pro-



vide input through co-production without citizens being always able to influence how this is structured and to hold the technology provider accountable.

### ***Participation and inclusiveness***

It is also expected that digital technologies lead to higher-level citizen participation and engagement and thus contribute to more inclusive policy-making as well as create more trust in society and towards the government (Meijer, 2012). Indeed, in many ways the ability of citizens to contribute to public-service delivery has never been easier – mobile apps provide opportunities to co-produce 24/7 and no matter your location, reporting a problem can take just a few second, and finding the right citizen expert to solve a policy challenge can be swiftly done by algorithms. Many studies have confirmed these expectations demonstrating that new media and online networks can boost coproduction and information exchange between citizens and their government (Meijer, 2011) and without necessarily neglecting vulnerable social groups (Clark et al., 2013).

Still, many other studies have argued that technology does not make co-production or participation in general more representative or inclusive (Smith et al 2009; Clark et al., 2013). Digital technologies provide governments with opportunities to simply load off their functions and leave the costs to be borne by the most vulnerable people (Townsend, 2013). Accessibility to new technologies is unevenly distributed in society, where the educated professionals have more skills and time to engage with technology-induced co-production than many other social groups (ibid.; Mergel, 2016). The regressive nature of digital co-production is especially strong when citizens are expected to co-create digital public services, while technologies such as crowdfunding provide opportunities for re-privatizing many traditional public services. Preliminary empirical evidence shows also that often the citizens co-producing via digital means remain not only small group but also anonymous (Kornberger et al., 2017).

### ***Efficiency and effectiveness***

The attempts to overcome the fiscal pressure in public service delivery is arguably the most powerful driver behind co-production (Nabatchi et al., 2017). The potential of technology-enabled co-production to substitute traditional public-service delivery is appealing to many, especially under the current austerity paradigm (see e.g. Wherton et al., 2015). Also, digital technologies can be the catalyst that enables participatory user engagement leading to inclusive and user-driven innovation processes

and providing better products and services (Townsend 2013). Both markets and governments have considerable limits in understanding the emerging needs of citizens, which are often too scattered and latent to be noticed (von Hippel, 2016). By designing new social technologies citizens are not only best positioned to use the existing knowledge on articulating specific needs and novel ideas, but also providing quickly effective solutions through either individual initiatives or collective ones (e.g. hackathons, app contests, crowdsourcing) (Townsend 2013). By adopting digital co-creative and collaborative problem-solving strategies “government agencies can crowd-source their way out of problems” (Nam, 2011).

Indeed, as shown in the case of Mexico City’s public transportations system above, digital technologies can provide both extremely efficient as well as effective tools to co-produce public services. Also, studies have shown that new digital technologies can sharply decrease the costs of “old” co-production practices (e.g. citizens’ reporting systems that are based on internet or smart-phone apps can cost as much as 80-90% less than phone-based systems, see Clark et al., 2013). Do-it-yourself services that became possible because of digital technologies (e.g. changing one’s driving licenses online) have significantly reduced costs for public service providers and saved considerable amount of time for service users (see also Linders 2012).

Nevertheless, the existing evidence also points towards important limitations. Sometimes technology-mediated solutions designed to increase efficiency can undermine service effectiveness or just fail to produce expected impact. For example, meetings with relatives over on-line video as opposed to on-spot meetings is a great way to increase service efficiency in prisons, yet over a longer time period video chats weaken the social ties compared to face-to-face meetings and thus increase the likelihood for re-offending or misconduct (Smith, 2016). In several recent studies on England it was found that in spite of increasing policy focus and investments into assisted living technologies for the elderly, these technologies are seldom co-created, rarely fit for purpose, fail to trigger new co-production practices and have no significant effect on care efficacy or cost reduction (Wherton et al., 2015). Another issue is that the spontaneous and organic bottom-up technology-induced co-production has proved difficult to sustain over a longer period of time, either because initiators just lose their interest or because micro-solutions are often difficult to up-scale (Townsend, 2013). For example, an app was launched in Chicago that enabled citizens to register and adopt fire-pumps in order to keep them clean from snow (storms), and although many registered and adopted one, most fire-pumps were quickly abandoned (ibid.). Thus,

although promising, the existing evidence on the impact of digital technologies on the efficiency and effectiveness of co-production still seems to be mixed.

### ***New tasks and capabilities***

It has been argued that technology-facilitated co-production leads to a change in government tasks. Rather than being a service provider (traditional public administration paradigm) or purchaser (New Public Management paradigm), the government's core tasks would include those closer to a mediator (New Public Governance): it becomes a framer, sponsor, mobilizer, monitorer and provider of the last resort (Linders, 2012, see also Townsend, 2013). The idea of government as a platform best epitomizes this claim, where government is expected to be mainly responsible for developing and providing access to its e-infrastructure and data, and where the role of citizens is to develop services based on this infrastructure (e.g. by developing community maps or apps for public transportation time-tables).

However, so far the systemic impact of digital technologies on the task reallocation within public sector and between citizens and government has been limited. As it became evident in a recent case study on Vienna, if there is a strong resistance to co-production or limited capacity to engage with citizens, technology is likely to lead to a selective behaviour and re-produce the existing routines rather than facilitate substantive participation and co-production (Kornberger et al., 2017). Mergel (2016) has noted that the use of social media has not brought about radical changes in public organizations, rather, "overall, the traditional information paradigm is replicated on social media." Similarly, Clarke and Margetts (2014) have observed that so far the open and big data movements have largely failed to deliver more citizen-centric governments. Also, the global quest for smart cities is yet to produce examples of truly co-creative initiatives (Cardullo and Kitchin, 2017a). Therefore, technology is sometimes applied by governments in co-production just to look "cool" rather than with the aim to radically change the task allocation (Nam, 2012; Townsend, 2013).

It is still very much open in which directions the digital technologies will push the evolution of co-production and thus the reallocation of tasks between the government and citizens. In some areas the significance of citizens as co-producers of public services is likely to increase (e.g. assisted living or health-care). In many other occasions such as sharing your personal data with the government, claiming documents and benefits, filling in tax declarations or providing feedback – all of which tradi-

tionally involve active co-production elements – it is the machine-to-machine interactions that increasingly take over the roles of citizens as active service co-producers and even make co-production redundant in many fields. Yet in other cases, it is the role of the government that is being substituted, as citizens are increasingly able to organize and coordinate services on their own.

New technologies for co-production are proposed, justified and introduced with many competing or hidden goals. When adopting new technologies, governments need to strike a balance, e.g., between economic development, citizen empowerment and political and administrative control goals as well as related interests (Kornberger, 2017), and these interests and goals are not always mutually reinforcing (Townsend, 2013). In fact, technological or not, innovation by its very meaning always creates winners and losers, thus also political opposition and lobbying (Taylor, 2016). In this inherently political process stakeholders such as technology companies or bureaucrats often possess better information as well as technological, political and organizational capabilities than citizens. As such, the digital discourse often hides the inherently political nature of organizing societal processes in a narrative of innovation and progress and thus puts those questioning the digital advancements in the laggard or anti-progress categories. Consequently, the use of technological applications may also re-allocate control and power away from citizens and towards specific groups in society.

Digital technologies do not only challenge the existing authority relationships and governance models, but also government capabilities (Ashton et al 2017). Instead of simply reacting to external technological changes, the public sector needs to proactively develop a new set of technological capacities to explore, develop and/or adapt new technological solutions in (co-)producing public services (Lember et al., 2017). This still seems not to be the case today (Kronberger et al, 2017; Mergel, 2016; Noveck, 2016). As a response, many governments around the globe have not only started to experiment with different services, but have launched dedicated innovation, technology and living labs to accelerate technological innovations in the public sector (Tõnurist et al., 2017; Cardullo and Kitchin 2017b). All these approaches aim at putting user experience at the centre of the public sector innovation processes, however, these experimental units and methods are still far from becoming an organic part of the public sector and its change. Thus, understanding the institutional and organizational mechanisms behind the public-sector technological capacities remains one of the central questions to be tackled by both practitioners and the research community.

## Conclusion

What the previous short overview emphasizes is that digital technology plays an increasingly central role in co-production. To summarize, we can see at least three trends emerging: first, technology as changing traditional co-production; second, technology as enabling new forms of co-production; and third, technology as replacing traditional (human-centric) co-production with automated and self-organizing processes. These trends create new opportunities for co-production while potentially empowering citizens, reallocating tasks between citizens and professionals, increasing the participation of citizens, and the efficiency and effectiveness of public-service delivery.

But there is also a great deal of ambiguity involved in how digital technologies shape co-production as they also frame it and at times reduce it, thereby diminishing the bottom-up potential of co-production. In spite of great expectations and promising preliminary evidence, it may be the case that open data, crowdsourcing and other technologies may not be capable of providing deep understanding on real-life developments and citizen needs (see also Fountain, 2014). The current state-of-affairs seems to indicate that in many fields the direct interactions between professionals and service users as well as the use of “good old” methodologies, such as observatory participations, are to remain integral parts of co-production. In order to understand better the potential as well as limits of digital technologies on co-production, we need not only theoretically more critical thinking and long-term empirical investigations on the issue, but also quite different technological capabilities in the public sector to facilitate the process. Meanwhile, co-creating the technologies underpinning the co-production processes as much as possible may be a useful suggestion to follow (Kitchin 2016).

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