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# Digital Platforms for Restructuring the Public Sector

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## Abstract

Many technological innovations have led to the emergence of the platform economy in recent years. This development is changing the entire landscape of business in the era of digitalisation. However, the impacts of the platform economy on public services and government are not well known. In this article we study the potential for the digital platform economy to help restructure the public sector. Firstly, central features of the new platform technology are explored, pointing to an algorithmic revolution, big data and cloud computing. Platforms are used in coordinating market transactions in an extremely efficient way. In order to apply the platform-concept to the public sector, an experimental approach is needed; public platforms cannot be built by transposing mechanical models of the private sector to the public sector, because the market logic of public services is quite different than open markets. To illustrate the challenges and possibilities of the platform economy we explored a few cases from Finland such as 'Suomi.fi' digital service platform and its background technology, which is based on a national architecture for digital services developed in Finland applying X-Road technology created originally in Estonia. As a special case, we studied the Finnish solution to the digital health care system. The case of 'Kanta Services' exemplifies the challenge to simultaneously develop open and secure data systems for health care. Finally, we point out the importance of citizen-centred approaches in developing platforms for the public sector.

## Introduction

In recent years, information and communication technology has taken considerable leaps towards a digital revolution of service systems in the public sector as well as in business (Zysman 2006). The issue is not only to reform services by applying digital technology but even more to create entirely new services. This is based very much on the emergence of digital platforms as a new way to co-ordinate actions of a great number of actors in society. A platform generates and orchestrates a marketplace where supply and demand meet in a transparent and effective manner. At the same time, three other new features have opened new applications of information technology. They are artificial intelligence, big data and cloud computing. Cloud computing, in particular, is liberating service producers from extra investments in infrastructure and software. Artificial intelligence makes it possible to analyse data and big data in a way that over performs human experts in many fields of expertise. These developments have made possible the emergence of the platform economy as a new phase of the economy.

In this article, we consider how the platform economy is changing public services and government. First we explain the need for restructuring government services. We point out that the platform economy might be the next big thing in public sector innovation. Then we explore the basic features of the platform economy, stressing how it will change the logic of business. We connect the platform economy to other recent developments of technology, especially cloud computing.

We also consider the sharing economy as a form of the platform economy. It is important for the public sector, because it is based on citizens' own activity and thus is a form a democracy.

The majority of this article is devoted to addressing the question of how to benefit from the platform economy in the public sector. In particular, the possibilities for restructuring public services by platforms are clarified via the chosen case studies. We have selected the new Finnish architecture for public services as an important case, because it is a complicated system exemplifying many features of the platform economy. Suomi.fi is a comprehensive service platform for almost all digital services of the Finnish public service and government. For health care, Kanta service is another comprehensive service platform in use in Finland.

Health care is a promising application of the platform economy, but it also presents a very complex and challenging task to secure the personal and very sensitive data of clients. Many of the current health care platform actors are doing business mainly in the self-monitoring, lifestyle or preventive healthcare sectors, and not providing clinical patient care (see e.g. Smedlund 2016). Therefore we analyse the issue of data ownership and stress the right of a citizen to own her own data (MyData principle). In the conclusion, we discuss the conditions for developing an effective and secure public sector using the platform as a central tool.

## The Need for Restructuring Government Services

Reinventing the form of government has been a global trend for some time. Phenomena such as privatisation or decentralisation have been tried at all levels of government. The promises of government reforms usually include enhancing efficiency, cutting costs, delivering better outcomes, and strengthening citizen choice. In practice, actions have often included steps such as simplifying the regulatory framework or introducing new commercial actors within the public policy fields. These changes are being driven by a variety of forces, including a more globalized and networked world, rising citizen expectations, new technologies, increasingly complex problems facing governments and – particularly since the 2008 economic crisis – tight budgets.

Governments are also seeking to innovate. Governments seek to innovate in how they work, in the services they provide and how they provide them; and in how they interact with citizens, businesses and civil society. Whatever the reason, the consensus seems clear: public sector organisations need new ways of working. (OECD 2015) The overall goal of government innovation is to deliver better outcomes, such as better use of public resources, more open and trusting societies, and strengthened justice and care for citizens from all walks of life (OECD 2017).

At the same time, the challenges facing governments are more complex due to technological and cultural changes, demographic changes, and the global movement of resources and people. Similarly, public sector innovation has several limitations; for example, there are substantial inherent structural barriers, limited investment for innovation and deeper cultural barriers blocking disruptive thinking. In addition, the open use of public data and knowledge remains challenging in many places. On top of this, the analysis of innovative government remains limited and fragmented. Harnessing creativity in the public sector requires developing a better understanding of what creates successful innovations where the mechanics of change and its enabling factors are understood, alongside an understanding of the particular challenges faced by

the public sector, and the needs and preferences of its users (IPP 2017). For example, the OECD has continuously called for a suitable framework and tools for measuring public sector innovation (IPP 2017).

The newest and currently most pressing questions for reforming governments have been analysed by the OECD Observatory of Public Sector Innovation (OECD 2017). These questions include how to make the most of technology, how to work with citizens and draw on the abilities of society at large to address needs, and how to rapidly test new approaches and ways of working in a fast-changing world.

In answering these questions, the platform economy can play an important role. It can be said that the platform economy is currently and will continue to be the state-of-the-art in public sector innovation. Because platform economy disruption is generally seen as the beginning of something new, something different and something cutting-edge, it is also anticipated that it can transform how we make social and political choices (Vazquez Sampere 2016; Kenney & Zysman 2016).

## The ABCs of the Platform Economy - Algorithmic revolution, Big data and Cloud computing

The recent development of information technology has created possibilities for totally new solutions to many problems, which were difficult to manage earlier. We refer here to digital platforms, which are extremely effective ways to connect different actors of society. More specifically, the core problem that needs to be solved is the coordination problem. By this we mean the problem of coordinating actions of many actors who do not know each other. Typically, we face the coordination problem in a market, where sellers and buyers try to find each other and perform a transaction. In time before information technology, the coordination problem was solved by organising geographic (local) marketplaces for meetings and transactions. In local markets, trust was created through personal acquaintances. Business transactions are increasingly taking place in virtual spaces. Platforms however, are more than virtual marketplaces – the essence of platforms is in their ability to enhance the co-creation of value that results in systemic offering of products and services (Smedlund 2016). The conditions for trust are quite different in the platform economy than in a “meeting economy”.

It is interesting that the coordination problem has not yet been solved in a satisfactory way. To improve trust, several security improvements have been proposed. The newest approach is blockchain technology used in the Bitcoin money (cf. Owen 2015). Blockchain is a distributed database that maintains a dynamic list of ordered records, “blocks”[1]. Each block contains a timestamp and a link to a previous block. This architecture makes it difficult or even impossible to change blocks afterwards. What is important is that a blockchain database is managed autonomously and there is no need for supervising it.

The development of the internet, the growth of the calculating powers of computers, and software innovations opened the way for emerging digital platforms. Platforms are “software-based products or services that serve as a foundation on which outside parties can build

[1] https://en.wikipedia.org/wiki/Blockchain, accessed March 31, 2017.

complementary products and services" (Tiwana 2014, 5). Software platforms provide the core functionality shared by apps that interoperate with them together with interfaces, which they interoperate. Thus platforms are places where end-users can benefit from the offer of applications. They can be likened to department stores, where different brands offer their products and deliver them from a warehouse. Among physical products, department stores, also usually provide services such as barbershops and spas.

It is important to distinguish between platforms and single service providers. In a platform there are many service providers using the same platform. Therefore an ecosystem can emerge around the platform. An ecosystem on a platform is a combination of the platform and apps that interoperate with it (Tiwana 2014 6). In business, competition is now taking place between ecosystems. A noteworthy example would be the competition between Apple and Nokia, where Apple succeeded to create a viable ecosystem with hundreds of thousands of application providers and destroyed the business of the leading cell phone producers. The advanced technology of Apple phones was not the major reason for winning the battle. Instead it was the ecosystem approach.

In a platform economy, owners of platforms occupy a central position. They bridge end-users and app providers, making transactions easy to perform. Platform owners build the infrastructure and develop software, an interface for an app developer to enter the platform. The architecture of platforms is new and based on cloud computing, meaning that app providers or end-users are no longer in need to make their own investments of infrastructure, data storage, or even software. The Apple Store is a good example of this kind of development.

In recent years, a new kind of economy has been developing alongside the platform economy. It is the sharing economy, which refers to peer-to-peer based sharing of goods and services. A good example of this is Uber, which connects car owners and people in need of local transportation. Quite often the term sharing economy is used in a more general sense meaning just using an online marketplace for selling and buying products and services (like Zipcar, see Sandararajan 2013). But then all online business turns out to be in the sharing economy.

The core of the sharing economy is to provide ordinary people an easy way to benefit from their assets like apartments, cars, sports equipment, or even skills and knowledge. To be effective, digital platforms are needed for sharing. An important question is where does the profit come and whom does it benefit? Platform owners could earn a slice from each transaction and asset owners earn from rents and services. But it is important to note, that a sharing economy includes also voluntary actions and collaborative consuming without direct business implications. In this kind of social sharing, platforms are provided by non-profit organisations (Gore 2014)

The platform economy is connected to the general development of information technology. Especially important is an algorithmic revolution, by which John Zysman (2014) means that "tasks underlying services can be transformed into formal, codifiable processes with clearly defined rules for their execution". In the algorithmic revolution, activities are formalized and codified and therefore they become computable. An algorithmic revolution opens paths towards artificial intelligence: developing algorithms for analyzing data and making decisions.

An extremely interesting idea is to combine big data and artificial intelligence. IBM's Watson intelligent system has been the most successful application of this model. The system is over-performing many experts in medicine and other fields of high expertise. With Watson, one can analyse and interpret all data, including unstructured text, images, audio and video, utilize machine learning, and create chat bots[2].

Almost all platforms use cloud computing that delivers computing services such as data storage, computation and networking. Users will get the services at the time, to the location, and in the quantity they wish to consume, with costs based only on the resources used (Kushida et al. 2014).

Cloud computing architecture has three layers:

I. Application: Software as a Service (SaaS); e.g. Google Docs

II. Platform: Platform as a Service (PaaS); e.g. Windows Azure

III. Infrastructure: Infrastructure as a Service (IaaS); e.g. Amazon Web Services

As a whole, cloud computing makes it possible that a service provider does not need to invest in extra resources for computing. Cloud computing is transforming computing from scarce to abundant resources (Kushida et al. 2014). Kushida et al. (2014) argue that cloud computing is becoming the fundamental infrastructure of the global economy.

In summary, there are many parallel trends in modern information technology that together lead to the emergence of the platform economy. These trends include:

A. Algorithmic revolution and artificial intelligence
B. Big data and data analytics
C. Cloud computing

This "ABC" combination is the background for our analysis of restructuring public sector and public services by platforms. Often the platform economy is considered a phenomenon of the private sector, not directly affecting the way public services are organised. To better understand the impact of the platform economy in restructuring public services and governance, we can consider changes the platform economy is causing. First of all, we have to consider the platform economy from the viewpoint of economics, not so much as a bundle of technological innovations.

From an economic perspective, platforms are "two-sided markets" or "multi-sided markets" that facilitate the exchange between different types of consumers that could not otherwise transact with each other (Gawer 2014). The attraction of using platforms is based on network effects. One group of agents benefits from the size of other groups that join the platform. The network effect is the dominant view in analysing the economics of platforms. Sometimes the network effect works so cumulatively that ultimately some platform or its ecosystem will win and "take all" (Eisenmann et al. 2006). Amazon is an example of such a winner-takes-all scenario; it is clearly dominating the market of online bookselling. Currently the platform economy is also re-engineering journalism

[2] IBM. 2017. https://www.ibm.com/watson/, accessed March 31, 2017.

and publishing; the convergence between journalism and platform companies was recently charted by Bell and Owen (2017). In the span of 20 years, journalism has experienced three significant changes in business and distribution models: the switch from analog to digital, the rise of the social media, and now the dominance of mobile and platforms. This last phase has seen large technology companies dominate the markets for attention and advertising and has forced news organisations to rethink their processes and structures (Bell and Owen 2017).

The sharing economy is growing rapidly. It shows how effectively a platform economy is creating new markets for small producers and service providers. To provide some examples, Etsy (etsy.com) is a New York based platform for selling unique products made by private individuals. Etsy has 25 million items for sale, 1.7 million active sellers and 28.6 million active buyers. Etsy also offers a wide range of seller services and tools that help creative entrepreneurs start, manage, and scale their businesses. Etsy's business is large-scale and far-reaching but operated by only a thousand employees.

Another example is Loconomics (loconomics.com), which is a San Francisco based platform for local service providers. Loconomics is a worker owned co-operative, using no middleman. The services provided by their platform include e.g. home care, child care, pet care, self-care, transport, and catering. Services are easy to book on a 24/7-basis and payment is done via credit card. There is no commission and sellers have total control of their pricing.

## The Platform Economy and the Public Sector

Providing a common ground for innovation, collaboration and ecosystem construction has been recommended in numerous public sector development projects and processes. In practice the recommendations refer to various platforms and platform tools that can facilitate collaboration within individual organisations, across government and with the public. Approaches such as common platforms that enable people to connect at a central location can impact the ability of organisations to join forces in developing innovative solutions to common problems and to scale innovation (Daglio et al., 2014; OECD, 2017).

Developing public sector platforms is a part of the digitalisation of public service delivery. As the public sector is the world's largest service provider (PwC 2007), the development of the platform economy provides public sector means for transitioning towards better digital services. Generally, the goal is a deeper interaction between citizens and the state.

As the development of the platform economy is generally seen to increase the availability of globally produced services, it leads to rising expectations from the traditional public services and thus increasing the need for public sector platform development. Another stream in the development is the promotion for experimental culture within the public sector and the government (e.g. Annala et al. 2015).

### Platforms for Experimental Government: Case Experimental Finland

Regarding experimental government, currently, one of the leading examples is found in Finland. One of the current Government's (2015–) key projects in Finland is to promote an experimental

culture. The aim is to find innovative ways to develop society and services, and the project falls under the scope of the priority area of digitalisation, experimentation and deregulation (Experimental Finland, 2017). In 2017, Finland is launching an online platform to crowdsource and crowdfund citizen-driven innovation and experimentation, thus combining the elements of experimentation and platforms.

Including experiments and behavioural approaches into policy design is not a new thing – for example the UK government has had the Behavioural Insights Team (BIT) using behavioural economics and psychology in policymaking since 2010 (BIT, 2017). In the Finnish case of experimental government, the goals have been similar: to incorporate behavioural approaches into governmental steering practices and, in doing so, to make policies more user-orientated and efficient (Sousa Lourenço et al., 2016). Developing an experimental culture can also lower cultural barriers for public sector innovation. As the OECD notes (IPP, 2017), the political context of public sector organisations, their highly visible activities and potentially high consequences of failure can reinforce a culture of risk aversion. The culture of experimentation on the contrary can even encourage failing, or at least it can mitigate the fear of failure (Breckon 2015).

The experimental platform for citizens developed by the Prime Minister's Office in Finland aims to generate practical ideas on how to improve Finland, and to develop the ideas into experimental proposals and scale the proposals if successful. This form of connecting with citizens engages people by giving them shared responsibility in the work and success of government (IPP 2017). The platform approach can also help in funding and diffusing the experiments. As a part of the well-regulated Finnish system, an experimenting platform provided by the public sector helps conduct the experiments in an ethical and sustainable manner.

## Platforms for Digital Public Services: The Suomi.fi Case

As a case study, we analysed the digital platform developed for public services in Finland in recent years. From 2005 to 2010, a considerable number of digital services were developed in the Finnish public sector and government. It is estimated that the Finnish government now has about seven hundred electronic services, and combined with municipalities, the number is even higher. The problem with this burgeoning development has been its decentralised nature: public institutions and organisations are autonomous and they have developed their services based on their own needs. In this situation, no one has been considering the compatibility of different information systems and so the sharing of data between different services out of network is very difficult and often impossible. As a solution to this, the government started to create a national architecture for digital services. It is based on concepts such as platform as a service and infrastructure as a service.

It is interesting to compare the Finnish service infrastructure to the X-road system of Estonia. Estonia has been very active in developing their X-road system into a general platform for public and private services. X-road is a service infrastructure, which connects different databases and opens access to information systems of different service providers. The Estonian interface to X-road is the eesti.ee portal. With this portal, citizens can access their health records and vote in elections. In Finland a similar platform has been in use since 2015 with the name *palveluväylä* ("Service Road"). It is a layer of data exchange on the internet. End-users do not have direct access

to *palveluväylä*, because it is infrastructure consisting of many different service applications and systems.

> "The main data exchange solution for the Finnish public sector organisations, Suomi.fi services, is based on X-Road technology. Suomi.fi *palveluväylä* was introduced in Finland as part of the programme implementing the National Architecture for Digital Services, and the public sector organisations have a statutory obligation to use it."[3]

Suomi.fi services are produced in the National Architecture for Digital Services programme. The programme is financed by the Ministry of Finance, and operatively managed by the Population Register Centre. Next we will take a closer look at the Suomi.fi services and platform.

The public sector was established a long time ago in many countries to develop information portals to provide information about public services and public government. In Finland that portal is called Suomi.fi (meaning Finland.fi). In the beginning these information portals were only for one-way communication channels, but later they became interactive, as is also the case with Suomi.fi. The idea of Suomi.fi is expressed in its slogan "One address for citizen services" (www.suomi.fi). Suomi.fi is the single access point to access public services in Finland. The majority of this platform consists of links to pages of different institutions and bureaus like ministries, Kela, museums, courts, etc. To find information, the content is divided by topics, the six most popular being: Migration, Teaching and Education, Family and Social Services, Health and Nutrition, Work and Pensions, and Taxation and Financing. Suomi.fi has been in extensive test use in years 2014-2017 and officially it started in the beginning of the year 2018.

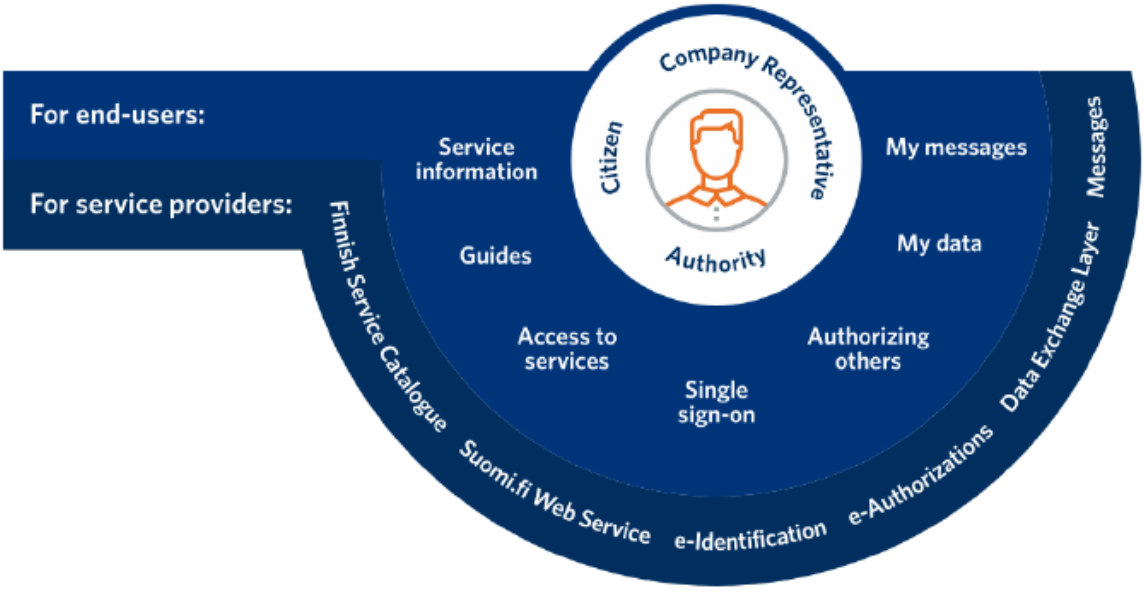


*Figure 1. Suomi.fi Services (Population Register Centre 6.3.2017, esuomi.fi)*

[3] Ministry of Finance, Finland. 2017. Finland and Estonia set up a joint institute to develop X-Road technology, http://vm.fi/en/article/-/asset_publisher/suomi-ja-viro-perustavat-yhteisen-instituutin-kehittamaan-x-road-teknologiaa, accesses March 28, 2017.

The most interesting part of the Suomi.fi platform is its e-services. On this platform, citizens and firms can establish e-transactions with authorities with the help of e-services and forms in Suomi.fi. A typical procedure involves selecting a form, filling it out and submitting it along with the application included. Then the authority will process the application and finally the decision will be sent back in electronic format or post. The identification is completed by using online bank identifiers, a mobile certificate or a certificate card. Citizens can save the forms they have used in the My e-services application. Citizens can open their own account in which they can receive official decisions and notifications concerning the services that are linked to a citizen's account electronically instead of by post. Communications between services and users are encrypted against intervention by outside parties using SSL encryption.

Suomi.fi also contains a link to a general information web site *Public Service Info,* which will guide users to the right public service providers. It is not for communication with authorities like submitting forms. In 2017, a service portal for enterprises, *Yrityssuomi.fi* ("EnterpriseFinland.fi") was integrated into the Suomi.fi site. Yrityssuomi.fi is a comprehensive site for many kinds of services important to businesses, like knowledge about legislation, taxation and funding possibilities. There an enterprise can fill out forms and send them to authorities. Yrityssuomi.fi is developed and updated by the Ministry of Employment and the Economy. Suomi.fi also contains a toolkit site for civil servants for official collaboration between authorities: *Suomi.fi/workspace* – Information and services for authorities.

## Platforms for Health Care – Case Kanta Services

For citizens, access to health care is one of the most fundamental services and rights. In this area, benefits from digitalisation are considerable. In Finland, a comprehensive service system, called *Kanta Services* ("Base Services") was developed and has been in use since 2010. Kanta is the national data system services for healthcare services, pharmacies and citizens. The services include the electronic prescription, Pharmaceutical Database, My Kanta pages, and Patient Data Repository. It has two parts, one for citizens and one for professionals. The most used service so far is electronic prescriptions.

> "An electronic prescription is a prescription for medicines issued and signed electronically by a doctor. It is entered into a centralized database called the Prescription Centre. The Prescription Centre register is controlled by Kela. The national Prescription Centre contains all electronic prescriptions and the dispensing records entered on them by pharmacies. Based on the information held in the Prescription Centre, any pharmacy can dispense your medicines."[4]

The Patient Data Repository is a service in which healthcare units enter patient records from their own data systems in a secure manner. This data repository includes in 2017 data about 5.4 million persons. It offers citizens the opportunity to examine their own medical records on their computer and grants the right to health care professionals to see them.

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[4] Electronic prescription in the Kanta service, http://www.kanta.fi/en/eresepti-esittely, accessed March 28, 2017.

My Kanta (*omakanta*) is an online service for citizens where they can browse their own health records and their medication recorded by healthcare services. So far about two million people have checked their health records there. In My Kanta service a citizen can see her electronic prescriptions, records related to their own treatment, laboratory tests and X-ray examinations, and health records of dependents under 10 years of age. In My Kanta service one can also request a refill of a prescription, save her living will and organ donation forms, and consent to or refuse the disclosure of her personal data.

To evaluate the national architecture of digital services in Finland we have to remember that the programme to create this architecture was created quite recently and Suomi.fi portal has been in use since 2015, although the testing started some years before. In any event, this architecture is a good example of the usefulness of a new platform technology. The Suomi.fi system can be approached from two perspectives: from the point of view of the end-user and of the service provider. In Figure 1, both these perspectives are present. For end-users, the amount and usefulness of web services is important as well as management of own data (MyData). For service providers, the service catalogue and services needed for building and running applications (identification, authorisations, data exchange, etc.) are critical factors. According to the Population Register Center the basic structures for digital services are now established and are the most advanced in the world (Viskari 2017). Note however that the data exchange layer uses X-gate technology developed in Estonia.

The usefulness of Suomi.fi Services depends on the scope of the service. According to Henry Chesbrough (2011) the economies of scope means lowering the average cost of a firm to produce two or more products. Although the cost of producing a service is not the first question asked by public organisations, still the incentives of benefiting from service provided by "joining" Suomi.fi portal might depend on the average cost. Public sector organisations have a "*statutory* obligation" to join Suomi.fi Services, like we quoted above. The issue is, however, that so many systems developed by autonomous public organisations are incompatible and expensive to convert. It takes years to renew basic information systems. Another problem is allowing a combination of data from different sources and registers. This is needed in order to guarantee the usefulness of public services (one interface for many services), but the data security and protection of identity are serious problems and challenging to solve.

Economies of scale refer to increasing the size of operations (Chesbrough 2011), which also relevant in evaluating Suomi.fi. The amount of operations or transactions is dependent on how citizens benefit from using services of Suomi.fi. Also, if the portal is difficult to access and use and provides no user support services, the danger is that many people will drop out. Here we think about older people who do not have computers and smartphones or limited knowledge in using this technology. Since the expenditures of public services like health care, family and social care, migration, work and pension, etc., is proportional to the success of e-services: how much citizens are using digital services instead of personal services. The data of Suomi.fi shows that the number of different users has grown from 2013 to 2015 from 176,788 to 242,502. Still these figures are modest in a country with a population of 5.5 million. But the situation is better in health care systems: currently, with over one million visitors per month to My Kanta service (Ikävalko 2017).

There are two processes supporting the benefits of platforms (Hautamäki & Oksanen 2015). Commodification involves the move from special services towards elementary services and scalability is the transfer from expert organisations to self-service. We are not saying that there is no need for special services like consultation with medical experts or expert organisations like specialised hospitals. The point is that to successfully manage the costs of public services, it is not possible without massive use of digital services by citizens. For this both economies of scale and scope are critical.

Finland has an outstanding opportunity to take a substantial leap in enhancing Suomi.fi services because the entire structure of health and social care systems is changing. Now the basic health care is provided by municipalities. The structure of health and social services will be reformed in a way that the responsibility for providing public healthcare and social services will be assigned to 18 autonomous regions that are larger than municipalities[5]. This means among others that these 18 regional providers are much bigger than present over 300 municipalities. Another new feature is that public services might be generated by private companies and NGO's along with public service producers. Both of these reforms allow for coordinating digital service development and opening the Suomi.fi platform to private producers, thus enlarging the scope of the platform.

## Artificial Intelligence and Big Data in the Public Sector

The platform economy is rapidly being adopted as a guiding principle for developing the public sector, in Finland and elsewhere. Our analysis of Suomi.fi services shows that basic architecture of digital services uses platform technology, like X-gate data exchange technology. Similarly, tools and resources for service providers are available, making it easier to enter into service platforms. So far so good, but what is lacking is the application of artificial intelligence to big data available in huge registers and data collected in the public sector. It is known that artificial intelligence has been used in military and security affairs (cyber wars, Owen 2015) as well as in management of energy production and consuming (smart grids). However applications, for example, in health care, are still in their infancy, although potential benefits are considerable.

We take health care as a special case for potential applications of artificial intelligence and big data analysis. As a recent report shows, the architecture of a digital health care is quite well defined and all components needed to implement it are available (Hautamäki 2017). These components include *sensors* that sense changes in patient's condition and send signals to *computers* or *smartphones*. These computers send data to a *cloud service*, in which artificial intelligence system (analytics) makes analysis of data based on big databases. After this analysis, the results are integrated into an information system for health care authorities. In addition, the results are transmitted back to a patient in a suitable form (Figure 2).

[5] About the health and social services reform see http://alueuudistus.fi/en, accessed October 20, 2017.

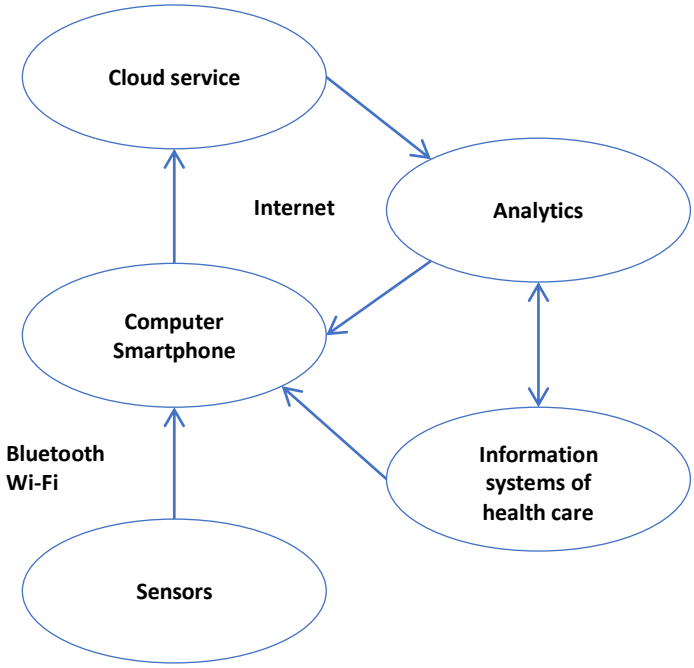


*Figure 2. The architecture of client-centred digital health care*

This architecture is implemented partly in so-called self-care systems, which help people manage their wellbeing using many kinds of measurement instruments. Especially in athletics and exercise training, self-monitoring devices are in extensive use. These devices are provided by many brands, like Apple (USA), Polar Electro (Finland), Samsung (South Korea) and Suunto (Finland). We can divide the use of self-monitoring devices into two different groups (Hautamäki 2017). One group consists of voluntary use of devices for wellbeing and illness prevention. The other group consists of official medical uses controlled and funded by health care institutions.

In group 1 people, pay for these self-care devices by themselves and use them to follow their activity, training, dream intensity, heart beat count, walking activity, etc. The quality control of these devices is not rigorous and appropriate use of them is the sole responsibility of the user. Self-care is now a big trend and wearable devices are selling well.[6]

In group 2 the control of devices is extensive and rigorous: they must to pass several tests before they are accepted for medical use. The health care system has been using these devices as an integrated part of their system. For example, new devices like glucose meters and control programmes have been developed to help diabetes patients control their blood sugar levels.

Our analysis of self-care services is that while the market of the devices of group 1 is vast and growing, a greater benefit will be attained when these devices are integrated into the entire health care system (Hautamäki 2017). Then the data produced by sensors and smartphones could be evaluated and analysed through big data and high-level analytics. This would allow using artificial intelligence in analysis and help develop new care for even rare diseases.

[6] http://www.fiercehealthcare.com/it/self-care-med-devices-market-to-hit-16-8-billion-by-2019, accessed April 2 2017.

The Kanta Service in Finland will provide a platform to implement the architecture of digital health care. There are two important elements being developed now. On the one hand data produced by citizens, say by self-monitoring, must be embedded into official patient data to form a unified database. On the other hand, the database must be open to different applications so that a citizen can use the applications she likes to analyse the data. We call this system the open architecture of digital health care (Figure 3). This system is not has not yet been implemented, but its principles are accepted by authorities.

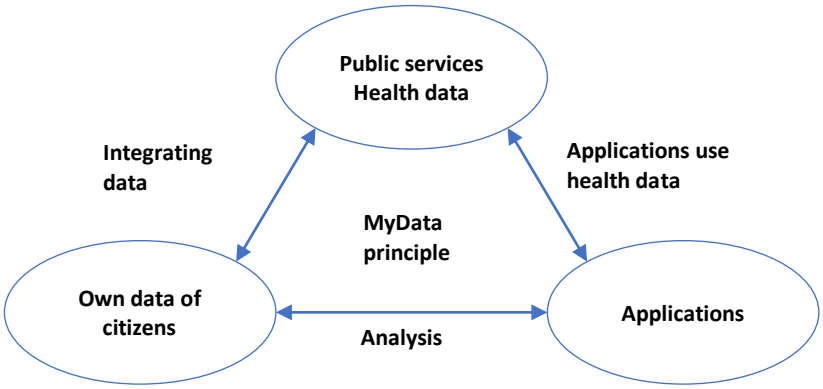


*Figure 3. The open architecture of digital health care*

## MyData

An important element of platform architecture adopted in Finland is MyData principle. MyData is a Finnish initiative presented in 2009 in order to develop rules of using personal data in government and business. The core of MyData allows individuals to control their own data. "This simplifies data flow and opens new opportunities for businesses to develop innovative personal data based services while preserving privacy." (https://mydatafi.wordpress.com).

Alex Pentland has developed a similar approach to personal data calling it a "New Deal on Data" (Pentland 2014). The idea is to give individual citizens the rights to control their own personal data: citizens own their own data. Pentland explains the content of the "New Deal on Data" based on three principles:

1. You have the right to possess data about yourself.
2. You have the right to full control over the use of your data.
3. You have the right to dispose of or distribute your data.

MyData principle and a new deal on data are the precondition of successful development of digital services in the public sector as well as in business. There is also a need to build and enforce trust in these new digital platforms. Especially, if public services are adopting the open architecture described above, the legitimation of the system is a critical issue. Still we think that the MyData principle is easier to accept in the public sector than in business, because the public sector is under strong political control and all systems are transparent, in principle. But private business companies that own platforms have free access to all data produced by users. Global platforms, such as Google, Facebook, and Twitter, benefit from the data produced tacitly by users of their services. Users do not know how and for what purposes their "own data" is used in business.

These platforms apply artificial intelligence and sophisticated algorithms to analyse data and conduct business based on the results (Pentland 2014).

Another important aspect of the MyData principle is data security. All sharing of data and opening it to privately-owned applications involves a certain risk. In Finland, the National architecture of digital services contains many features necessary for security, like e-identification and e-authorisations. In communication between end-users and service providers SSL encryption is used. In the future, blockchain-technology might be a useful tool for data security in public services like health care.

Pentland (2014) proposed devising "trust networks" for data sharing, involving "a combination of a computer network that keeps track of user permissions for each piece of personal data, and a legal contract that specifies both what can and can't be done with the data, and what happens if there is a violation of the permissions" (Pentland 2014, 182). In this system all personal data have attached labels specifying what one can do with the data. Trust networks are used in the interbank money transfer system, but they have not been available for general use.

## Conclusion

The platform economy is dramatically transforming the business environment. The more services are digitalised, the more they will be produced and distributed on digital platforms. The owners of platforms are in a privileged position to earn substantial profits (compare Apple Store and iTunes). Also the data collected from transactions is extremely valuable (Google, Facebook). Notably, the application of artificial intelligence to big data will lead to many innovations unattainable so far (IBM's Watson system). Cloud computing allows service providers the freedom to concentrate on their core business. In summary, the development of new digital technology has created a rich toolbox to develop new kinds of services.

The platform economy is becoming an important tool for transforming the public sector and government. All new technologies are available and mostly well developed and tested in business, but the application of a new technology in the public sector is not a direct or certain process. There are special requirements concerning security, accessibility, affordability and availability. All people must be in an equal position regarding public services. The goal of "going digital" is not enough; people must also have the skills, capacity and tools to fully utilize digital services.

The most promising application of the platform economy is a unified, single platform for all digital services provided by the government. A Finnish public portal, Suomi.fi, is an example of such an approach. Although the palette of services is wide, the number of potential users is relatively small. The 'network effect' has not yet been fully realised, thus the digitalisation of services has not yet resulted in savings, which was anticipated. The general impression about the development of digital public services is that they are mostly created from the system's viewpoint. Therefore the services are not easy to use and not as attractive as they should to be in order to reach the critical mass of citizens.

The experimental approach and the adoption of design thinking (Brown 2009) are right steps towards public digital platforms, which are citizen-centred and largely accepted as a viable alternative to traditional services. In the experimental approach, service design is becoming one of

the major tools to develop public services (Annala et al. 2015). Solutions are increasingly produced by co-creation of authorities, citizens and companies, via the so-called Public-People-Private Partnership. These steps are even more important if the aim is to develop and use public platforms owned by public organisations. The technology and systems needed are usually provided by private companies, but the design of systems can be in public control. We argue that algorithms behind the public platform economy should not be business secrets - this way the anticipated algorithmic and artificial intelligence revolution will not be out of control. Perhaps, we need a principle comparable to the MyData principle related to algorithms: OurAlgorithm demands that all algorithms used in public services be transparent and open to changes arising from experiences.

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