



MINISTRY OF FINANCE

# Glimpses of the future

Data policy, artificial intelligence and  
robotisation as enablers of wellbeing and  
economic success in Finland

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## Glimpses of the future

Data policy, artificial intelligence and robotisation as enablers  
of wellbeing and economic success in Finland

Kimmo Rousku (editor), Cristina Andersson, Sari Stenfors,  
Ilkka Lähteenmäki, Jarno Limnell, Kimmo Mäkinen, Aleksi Kopponen,  
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<p><b>Abstract</b></p> <p>Our society is moving into the 2020s in a situation where we are making more efficient use of services enabled by new technology to develop new services and business models in society and in business life. The 2020s is predicted to be a decade characterised by the clear breakthrough of artificial intelligence and robotisation in the same way as social media, cloud computing, smart phones, location and time independent working and digital services did in the 2010s.</p> <p>Finland has performed extremely well in international statistics in several fields of society. Finland's stability and security combined with high technology utilisation rate and education level provides an excellent platform for the creation and development of digital business. At the core of this development are citizens, businesses and data. The development of data policy and data management in a way that takes the different life situations of citizens into account is a unique innovation by global standards, and one which we believe will be a significant contributor to Finland's success in the 2020s.</p> <p>In this big picture, trust plays a key role. This is a major issue that emerges in the context of the personal data processing of private citizens and customers, new business model and service development, making society more resilient, and in national and international cooperation. Trust requires continues development work in different sectors, paying due attention to the threats and risks affecting the digital environment. Here, digital security serves as the enabler of trust and of services made possible by new technology.</p>			
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<b>Tiivistelmä</b>	<p>Yhteiskuntamme on siirtymässä 2020-luvulle tilanteessa, jossa olemme entisestään hyödyntämässä uuden teknologian tarjoamia palveluita niin yhteiskunnan kuin elinkeinoelämän osalta uudenlaisten palveluiden ja liiketoimintamallien kehittämisessä. Ennakoita 2020-lukua arvioidaan vuosikymmeneksi, jolloin tekoälyn ja robotisaation uskotaan tekevän selkeän läpimurron samalla tavalla mitä 2010-luvulla esimerkiksi sosiaalinen media, pilvipalvelut, älypuhelimet, ajasta ja paikasta riippumaton työskentely sekä yleensä digitaalisten palveluiden hyödyntäminen.</p> <p>Suomi on menestynyt loistavasti erilaisissa kansainvälisissä tilastoissa useilla eri yhteiskunnan osa-alueilla. Suomen vakaus ja turvallisuus yhdistettynä teknologian korkeaan hyödyntämistasteeseen ja koulutustasoon luo meistä erinomaisen alustan digitaalisen liiketoiminnan kehittämiseen ja tuottamiseen. Tämän kaiken kehityksen keskiössä ovat niin kansalaiset ja yritykset kuin tieto, data. Tietopolitiikan ja tiedonhallinnan kehittäminen kansalaisten elämäntilanteet huomioiden on globaalisti varsin ainutkertainen innovaatio, jonka uskomme olevan eräs merkittävä tekijä mahdollistaessamme Suomen menestystä myös 2020-luvulla.</p> <p>Tässä kokonaisuudessa luottamuksella on keskeinen merkitys. Se nousee esille niin kansalaisten kuin yritysten, asiakkaiden näkökulmasta heidän henkilötietojen käsittelyssä, uusien palveluiden ja liiketoimintamallien kehittämisessä, yhteiskunnan sietokyvyn kehittämisessä erilaisia häiriötilanteita varten ja kansallisessa sekä kansainvälisessä yhteistyössä. Luottamus edellyttää turvallisuuden eri osa-alueiden jatkuvaa kehittämistä digitaaliseen toimintaympäristöön kohdistuvat uhat ja riskit huomioiden. Tässä digitaalinen turvallisuus toimii niin luottamuksen kuin uuden teknologian mahdollistamien palveluiden mahdollistajana.</p>	
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<b>Referat</b>	<p>Vårt samhälle är på väg in i 2020-talet i en situation där vi i större utsträckning än tidigare utnyttjar de tjänster som ny teknik erbjuder både samhället och näringslivet i samband med att nya former av tjänster och affärsmodeller utvecklas. På förhand beräknas 2020-talet bli årtiondet då artificiell intelligens och robotisering tros göra ett klart genombrott på samma sätt som t.ex. sociala medier, molntjänster, smarttelefoner, arbete oberoende av tid och plats samt utnyttjande av digitala tjänster överlag gjorde ett genombrott på 2010-talet.</p> <p>Finland har klarat sig utmärkt i olika typer av internationell statistik inom flera olika samhällsområden. Finlands stabilitet och säkerhet kombinerade med att teknik utnyttjas i hög grad och en hög utbildningsnivå ger oss en utmärkt plattform för utvecklande och produktion av digital affärsverksamhet. I centrum för allt detta står såväl medborgarna och företagen som information och data. Att utveckla informationspolitiken och informationshanteringen med beaktande av medborgarnas livssituationer är globalt sett en tämligen unik innovation som vi tror utgör en betydande faktor när Finlands framgång möjliggörs också på 2020-talet.</p> <p>I denna helhet har förtroende en central betydelse. Förtroende blir aktuellt med tanke på både medborgarna och företagets kunder i samband med behandlingen av deras personuppgifter, utvecklandet av nya tjänster och affärsmodeller och samhällets förmåga att hantera olika störningssituationer samt det nationella och internationella samarbetet. Förtroende förutsätter att de olika delområdena inom säkerhet utvecklas kontinuerligt med tanke på de hot och risker som riktar sig mot den digitala verksamhetsmiljön. Den digitala säkerheten utgör här grund för de tjänster som möjliggör både förtroende och ny teknik.</p>		
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# Contents

<b>1</b>	<b>Technology as an enabler for new services and activities</b> .....	14
1.1	What to expect in the 2020s? .....	14
1.2	Examples of changes in technology performance over recent decades.....	15
1.3	Real-life examples .....	16
<b>2</b>	<b>Information policy and ethics – the future is known</b> .....	20
2.1	Current confusion.....	21
2.2	The future is in information.....	22
2.3	Decisions or deferral.....	23
<b>3</b>	<b>Finland smart and wise – how is AI shaping our society?</b> .....	26
3.1	EDP – ADP – IDP. Intelligent data processing is a game changer.....	26
3.2	The many aspects of AI.....	27
3.3	Finland and Europe as global superpower of human-centrism.....	28
3.4	Life event approach brings about change.....	30
3.5	DigiMe empowers individuals to utilise MyData.....	31
3.6	We must not allow a dystopic society to come about.....	34
3.7	From nuggets of information in the 2010s to ecosystems in the 2020s: towards a Government for the age of AI .....	36
1.1.1	Ecosystem Forum at the vanguard of digitalisation .....	37
1.1.2	In conclusion.....	39
<b>4</b>	<b>“Dude, where’s my robot?” or how to proceed with robotisation</b> .....	42
4.1	Introduction .....	42
4.2	Robots right now: a primer.....	43
4.2.1	Modern robots think, communicate, act and sense.....	44
4.3	Start a national AIRo programme in Finland, too! .....	45
4.4	Robotics applications and Finnish success stories.....	47
4.4.1	Wellbeing and healthcare.....	47
4.4.2	Case study: Rehabilitation robotics.....	47
4.4.3	Case study: Robotics in pharmaceutical services.....	48
4.5	The environment and the circular economy.....	50
4.5.1	Case study: the circular economy.....	50
4.6	Three observations about the future of robots.....	51
4.6.1	Autonomy .....	51
4.6.2	Reliability .....	51
4.6.3	Know-how.....	52
4.7	In conclusion.....	53

<b>5</b>	<b>New technologies – anything interesting in the pipeline?</b>	56
5.1	Blockchain technology development in the EU	56
5.2	Digital democracy, myth or reality? How do we foster Finnish values and wellbeing in the age of platform economy?	59
5.2.1	Everyday impacts of platform economy	59
5.2.2	Pressures on existing democratic administrative and governance models	62
5.2.3	How to exert an active influence in platform economy?	
5.3	Blockchains after the hype: what's up in blockchain technology and other distributed ledger technologies from a public administration perspective?	69
5.3.1	What are blockchains now? Clarifying features and potential	69
5.3.2	Reality check: where are we headed?	72
5.3.3	Blockchains, seriously: Are they of any use in public administration?	
5.4	Financial sector in transition: innovativeness of operating model now determines success	78
5.4.1	What has happened over the past two years?	78
5.4.2	About technologies	80
5.4.3	Ecosystems: adding a new dimension to business models	81
5.4.3.1	Innovation ecosystems	81
5.4.4	Innovators, collaboration between traditional actors and newcomers	82
5.4.5	The dilemma of management: how to update the road map to reflect actual terrain	83
5.4.6	What to keep an eye out for next?	84
5.4.7	Summa summarum	86
<b>6</b>	<b>Digital security – the enabler of trust</b>	88
6.1	Security and trust in the development of technology	88
6.1.1	Digital security as threat and competitive advantage	89
6.1.2	What is trust all about?	91
6.1.3	Comprehensive security through cooperation as Finland's strength	97
6.1.4	Education and resilience in Finland	100
6.2	Digital security fosters the development of activities and the retention of trust	101
6.2.1	What is digital security all about?	101
6.2.2	Human-centric digital security – digitally secure life – a new approach	104

## TO THE READER

The Ministry of Finance on 15 February 2017 released the publication *Glimpses of the future – possibilities of digitalisation and robotisation*<sup>1</sup>. The release was accompanied by a seminar and several workshops. The publication reviewed new administrative and technological possibilities for developing public administration and the whole of society by means of innovative digital services. The publication also provided recommendations on other tools for developing and utilising the functionalities provided by new technologies in public administration.

This publication picks up where the previous one left off. It describes new factors that are, to an increasingly important extent, likely to impact on our society in the 2020s. Some have to do with the possibilities provided by technology, others with the structural changes necessitated by those possibilities. In addition, the publication reviews the current situation in existing technologies, for example blockchains and blockchain-based technologies, as well as their evolution and impacts on service provision.

We are gradually starting to use new technological solutions, the full impacts of which we cannot as yet identify. Despite the huge advances made in technology over the past two decades, advanced technology alone is not sufficient. It must first and foremost be an enabler.

Finland continues consistently to rate high in international benchmarking, whether in information society development or the functioning of public administration. The most recent example of this comes from our first place in the Good Country Index<sup>2</sup> comparing 153 countries on a set of 35 distinct indicators. Such prominence would not be possible without broad-ranging and sustained development that encompasses all sectors and activities of society.

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1 <http://julkaisut.valtioneuvosto.fi/handle/10024/79260>

2 <https://www.goodcountryindex.org/results>

The introduction to the preceding report stated, *“Alongside the digitalisation of operations runs a second trend that is likely only to grow stronger in the coming decade. This change is spurred on by the rising prevalence of AI and robots, with which public administration already has its first experiences and pilots.”* Now, two years since that writing, we have to some extent moved on from pilots to actual service development. It seems that the 2020s will be expressly a decade of AI and increasing automation and robotics. This change will not occur overnight, nor will it become visible overnight. Such major paradigm shifts can best be observed over review periods spanning several years.

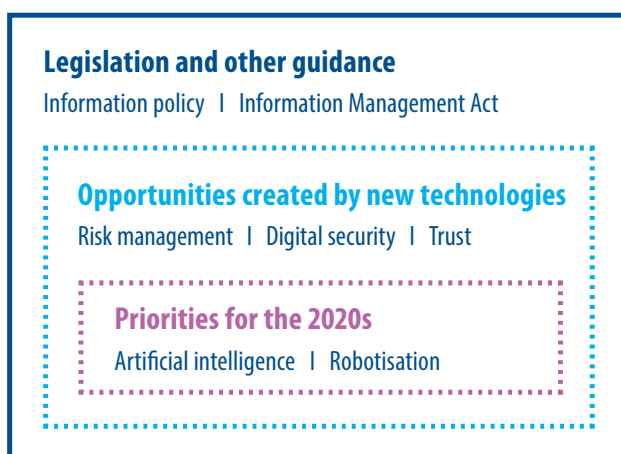
The three key observations I have personally made over the past two years are heightened AI enthusiasm and concern over the secure and ethical utilisation of new technologies in public administration in a manner that retains the trust of the population in general as well as customers and stakeholders. The third has to do with how the traditional technology perspective has been overtaken to an increasing extent by a user-driven approach to the development of services. All three will dominate in the 2020s and will also grow in global relevance, which will open up new opportunities for Europe and Finland to enhance competitiveness.

Have we succeeded properly in utilising the data collected from the population? International benchmarking would suggest that we are moving in the right direction in data utilisation but are still far from where we could be. This finding prompted the inclusion of AI, i.e. artificial intelligence, and information policy as new topics in this report. If information is an invaluable resource, should we not focus on its management? We now have a prime opportunity to enhance our activities in this sphere through the information policy and the Information Management Act under development at the Ministry of Finance. By leveraging and building on these two phenomena and the others described in this report, we can hopefully find in 2025 that Finland continues to rank high in international benchmarking and that we have successfully increased the degree of data refinement and data enrichment by means of new services to people that cater expressly to their specific life circumstances.

The previous report included a Chapter by futurist Risto Linturi, *“From technology revolution to government action,”* in which he introduced us to ten sectors of technological advances and the role of public administration in using and enabling these. If you have yet to read the report of the Parliamentary Committee for the Future, *“100 opportunities for Finland 2018–2037 – Radical technologies to reform society’s operating models”* produced by Linturi and Osmo Kuusi, it is wholeheartedly recommended that you do<sup>3</sup>.

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3 [https://www.eduskunta.fi/FI/tietoaeduskunnasta/julkaisut/Documents/tuvj\\_1+2018.pdf](https://www.eduskunta.fi/FI/tietoaeduskunnasta/julkaisut/Documents/tuvj_1+2018.pdf)



**Figure 1.** The sectors depicted are among those addressed in this report.

Harnessing new technologies for use in public administration calls for better identification of opportunities and higher risk-taking capacity. Finland, along with the other Nordic countries, has been criticised for being excessively security-seeking. If we are to grasp the opportunities afforded by new technologies, we must be better capable of assessing the threats and identifying the associated risks, and only then decide whether we have the capacity to manage and accept the ensuing residual risk. Or decide the kinds of action that we can take to reduce the threats arising from technology or the probability of their materialisation. Hardly anything can be accomplished with zero risk and instead risk is inevitably present. In other words, we need to balance our risk appetite and capacity.

One of the notions permeating this report is trust in society and the authorities, which is one of Finland's key success factors. This trust is constantly put to the test in the digital operating environment, be it through technical ICT malfunctions, human error or external influence. As we enter the 2020s, will we be able to retain the high degree of trust that counts among Finland's biggest 'selling points' and competitive advantages in the international arena? The final Chapter of this report examines in greater detail the importance of trust and digital security as well as the potential for enhancing these.

It is our hope that this, like the previous report, will generate interest in and new ideas on how to achieve balanced development in the various sectors of society, thus enabling the secure utilisation of new technologies and a smoothly-functioning society. At the same time, this should enable advances in the wellbeing and economic success of a secure Finland in the 2020s.

*Kimmo Rousku is Secretary General of the Government Information Security Management Board (VAHTI) set up by the Ministry of Finance. He has been actively monitoring developments in the various sectors and services of digital technologies since the mid-1980s.*



# Technology

as an enabler for  
new services and activities



# 1 Technology as an enabler for new services and activities

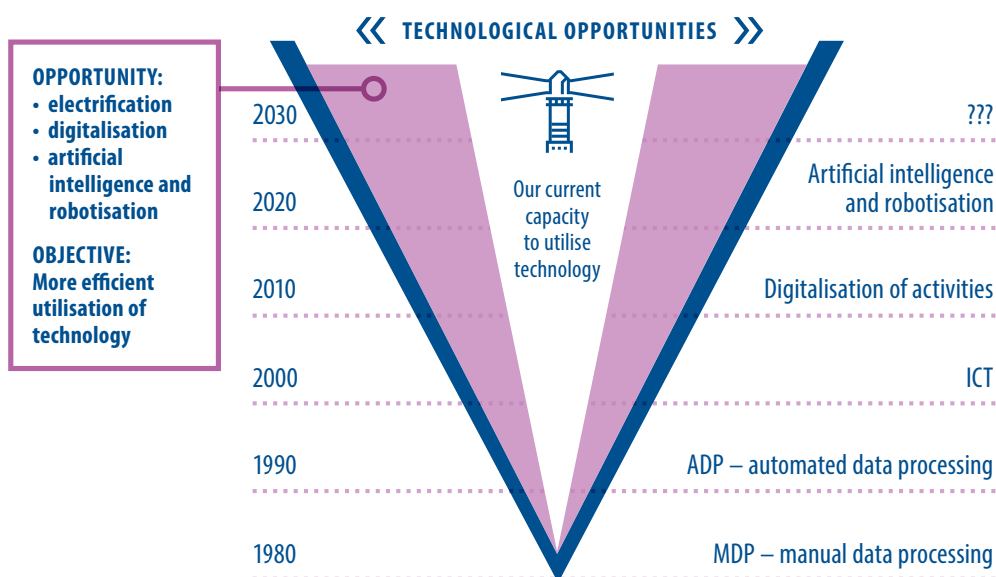
*Kimmo Rousku, Population Register Centre*

*We have been successful in introducing new kinds of services that enable better customer experiences and accessibility and that are also easy to use. Underlying this success is the increasingly rapid pace of technological progress, which in the 2020s will only accelerate and allow us to launch services and technologies that as yet are wholly unknown to us.*

## 1.1 What to expect in the 2020s?

The figure below was first published in our previous report and it has been updated to reflect the opportunities of the 2020s.





**Figure 2.** In the 2020s, we will be relying on automation and self-service to an increasing extent. We will make use of artificial intelligence and robots not only in industry but also in our daily lives.

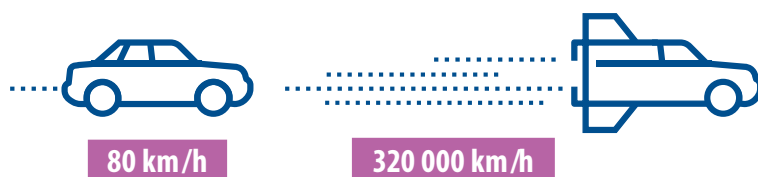
## 1.2 Examples of changes in technology performance over recent decades

To better understand why the next ten years will mean so much to technological advances, we should look back around thirty years and examine a case study involving the development of data storage media. Some readers may recall the launch of the first personal computers on the market in the 1980s. Back then, the computers featured a 360-KB, 5.25" disk drive. Towards the end of the decade, this was replaced by the 3.5" disk drive, the capacity of which increased first to 720KB and soon to 1.44 MB. The first computers equipped with a 5-MB hard drive also appeared on the market in the late 1980s.

Now, in the late 2010s, we have migrated to solid state drives, or SSDs, which for all intents and purposes are nothing more than memory chips. With no moving parts, SSDs are many times faster than traditional hard disk drives, or HDD. Over three decades, storage media capacity has increased by a factor of around 140,000 and performance by a factor of around 700,000 – while prices have fallen to a mere fraction. The same trend applies to the performance of computer processors (computing power), RAM and telecommunications.

The smartphone in your pocket has the same computing power as a supercomputer from the 1980s/1990s, based on billions of transistors in the phone's microprocessor. Add to this our regular home devices with microprocessors (smart TVs, WLAN routers, digital cameras

and other appliances) and every home has access to computing power equal to that of a major computer centre in the 1990s.



**Figure 3.** The advances in technology can be put into perspective by comparing how fast we could travel if transportation or one of many other services had evolved at the same pace (4,000x).

With the change described above taking place in less than thirty years, what can we expect over the next ten years? What will the 2020s bring? When performance continues to climb at the rate now projected (storage media capacity, computing power, data transmission speed), it will enable the development of increasingly power-intensive services and systems that are needed for e.g. (scientific) high-performance computing, advanced artificial intelligence systems and the development of augmented and virtual reality for a variety of applications. Driverless cars, for example, (self-guided vehicles) and all other autonomous or self-learning technologies require computing power of trillions of operations per second. If new devices and services are to be developed, the envisioned trends in the performance and prices of technology must be realised.

There is one significant threat associated with the knowhow required for the said development, both in qualitative and quantitative terms. Like other parts of the EU, Finland at present is woefully lacking in talent in many of the sectors described in this report. This shortage may hamper and retard our opportunities to develop new services. Our existing services also require ongoing maintenance and development, and despite efforts to put them on an automated footing to an increasing degree, humans are nonetheless needed to oversee the whole.

### 1.3 Real-life examples

What kinds of devices and services may we expect to have access to in the 2020s? Smartphones – a term that has already for long been misleading and, to my mind, has reached the end of its useful life – will become an even more important interface with services. Hands up – how many of us still use our smartphone to make more than one or

two calls a day – or to send text messages? A growing number of people are using their phone in other ways more than 40 times a day: to read news, watch films, interact on social media, do their shopping, pay their bills, etc., etc. All of this is made possible by the smartphone's services and applications.

So, why will we be needing even faster internet access when for the most part, mobile data transmission speeds at home are perfectly adequate for websites, emails and social media? More speed and more power will be needed when e.g. wholly new kinds of services making use of virtual and augmented reality are launched. The demands made by such services on all technology will be greater than ever, but will allow us to take photographs, video and also 3D images of ever better quality on our cameras and smartphones, provided that other sectors of technology see similar development.

Many devices to monitor personal wellbeing are currently being used in the form of watches, bracelets or rings. We can easily accumulate a growing volume of data of our own activity through the sensors in these devices on our skin – but how about devices based on subcutaneous or ingestible sensors? Such devices could collect data that would otherwise be unobtainable, at least by any easy or ongoing means.

Anyone who has ever flown a drone can easily imagine the vast potential for its use. If drone performance scales up at a similar rate seen in other sectors of ICT, there will be a drastic change in the payload capacity and flight time of these unmanned aerial vehicles over the coming decade.

The number of IoT (Internet of Things)<sup>4</sup> devices at present is estimated at around 25 billion and it is projected to triple, to 75 billion devices, by 2025. In future, there will be growing numbers of devices that access each other and the internet, not only in industry but also in our homes. They will make surveillance, remote control and management more commonplace (an example of this is the smart home) but at the same time, their manufacturers will gain better opportunities to monitor the operation of the devices and update their software, which in turn heightens not only the potential of such devices but also the associated threats and risks, not least to privacy.

We have clearly transitioned from buying and owning products to buying the benefits of products in the form of services. This trend is set to grow stronger and the sharing economy will grow increasingly prevalent in society.

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4 <https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/>

Besides technological implementation, all of the developments discussed above involve numerous other aspects that must be catered for as well. Will the devices and services described in the foregoing be safe, and also compliant with law? How can we ensure that laws and their evolution will enable the effective utilisation of technologies? How will we arrange the security of new devices and services so that we may give them access to our information without qualms? How safe will it be to ride in a self-driving car and how will it behave in the event of an impending accident? What if I want to use a DNA testing service to find about my genetic heritage – how can I be sure that my information will only be accessed in the manner specified in the agreement and not, for example through a corporate acquisition, end up with a third party that may misuse it? Citizens will surely wish to exercise more control and oversight on how their personal information is used. The development of MyData, as it is referred to, and the associated controls and services opens up also important opportunities for Finland from both a public administration and business perspective.

Even though the future appears to hold great interest from a technology perspective, it is also overshadowed by several as yet unresolved or pending issues that cannot be addressed by means of technology alone. As an agile society in the global perspective, Finland will be capable of efficiently tackling these issues and also setting an example, which at the same time will foster the rapid and effective introduction of new services.

# Information policy and ethics



## 2 Information policy and ethics – the future is known

*Olli-Pekka Rissanen, Ministry of Finance,  
and other members of the preparatory group*

Looking into the future is growing ever more difficult because the pace of change escalates with the mutual reinforcement of innovations. With regard to information, a peek back into history may help us envisage our future course of action and our range of reasonable expectations.

Information and communication technology (ICT) continues to be referred to as a new industry. The government in Finland has been working with computers to a widening extent ever since the early 1960s. The Museum of Technology holds some mementos from this era, yet data from that time remains in ongoing use. A familiar example is the Finnish personal identity code, which ingeniously packed a vast volume of data into a few scant digits and capped it all off with a control character to minimise the chance of error. The decision was also taken to have all actors base their systems on this single code.

The personal identity code illustrates the long time horizon of information policy decisions, although at the time, even the term 'information policy' had yet to be coined. Our world of information continues to be defined by the personal identity code and many other decisions taken decades ago. The machines and networks may have been consigned to the history books but the data and the specifications remain very much present in our daily lives. Converted multiple if not dozens of times over, however. Much data have also been lost, but hopefully the most essential have been retained.

Does history support the conclusion that the data of today and the information policy decisions now taken will resonate decades ahead. This would be our best guess. In the past, data were accumulated sparingly and with deliberation. Some data lose all relevance within days, if not faster. The conclusion that all data would reverberate decades into the

future certainly cannot and should not be drawn. The set of data that has these properties is minuscule but all the more important. It is in respect of this data that we must act wisely.

## 2.1 Current confusion

The drawbacks of smartphones are discussed much more widely than their benefits. Smartphones are addictive, people rely much too much on them, they spread fake news, and they, too, may be used to commit crimes. While the problems are real, billions of people the world over did not start using smartphones just as a fashion statement. Smartphones are eminently useful and have put the knowledge of the world at our fingertips like never before. Not all the knowledge in the world, as must immediately be qualified, but compared to earlier decades, the difference is incomprehensibly vast.

Discussions fail to see the forest for the trees, the world of networked information on the smartphone. You hold the phone in your hand and the world is at your disposal, but the real revolution took place elsewhere, in the background. At the core of this revolution are fast internet access combined with data and computer capacity. It also involves fanciful solutions and information science that have taught us to process and integrate data in completely new ways. Technological innovation in smartphones has entered a period of latency, yet new innovations are constantly popping up in service and data integration. This revolution is far from over.

The volume of data is growing exponentially. The marginal cost of collecting and processing data is close to zero per data element. Which is precisely the opposite of what we have seen throughout the history of ICT to date. This allows us to be more reckless. The majority of the data collected today will be destroyed either knowingly or through negligence, with no one to look after it. As a rule, this is a good thing, but alarm bells should be ringing as to whether data of a sufficient quantity and appropriate quality will remain of these times.

Artificial intelligence represents the 'old kid on the block'. A multitude of innovations together with higher computing power are turning AI into a new force for change in the world of data. Although fairly limited in terms of features to date, AI creates entirely new opportunities for exploiting and understanding data. The value of structural data of good quality is again set to rise to a whole new level. We may already see glimpses of the coming revolution but we are yet to recognise its force.

## 2.2 The future is in information

Policies to promote the sound management and effective utilisation of data may be referred to by the umbrella term of **information policy**. Information policy promotes i.a. the collection, opening, integration, sharing and preservation of data and also strengthens privacy and information security in a way that respects human rights and freedoms. The aim of information policy is to promote and streamline data processing and utilisation for the common good, and to identify and prevent abuses. Competency verification and regulatory issues also call for information policy decisions. Information policy is a means of comprehending and managing the future.

We face numerous possible futures, from dystopia to utopia and all of the more probable scenarios falling in between. Whichever way the future leads us, information will only grow in value and significance. Our future course and our influence over it depend on myriad factors. The rational and efficient utilisation of information is the key to a better future. Putting ethical considerations front and centre in decisions will lead us to a future consistent with the European value system. Fake or distorted information creates intimidating visions of a future that is equally unpleasant to individuals and society at large.

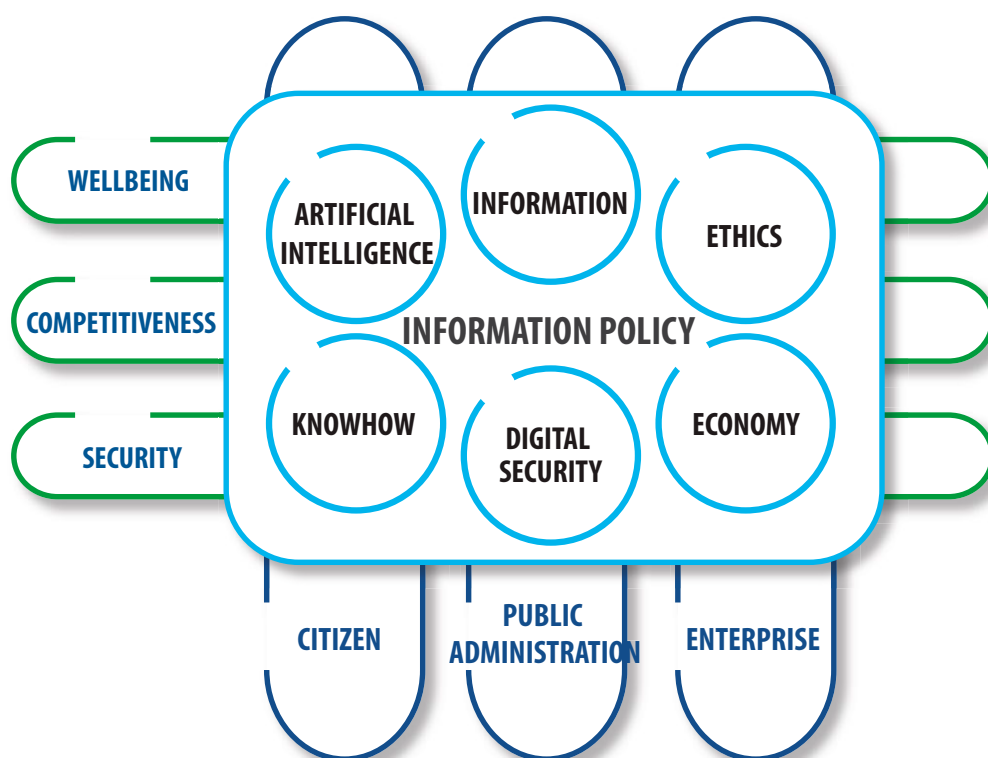


Figure 4. Key dimensions of information policy



Responsible information policy involves **establishing and catering to** a shared value system and **shared ethical principles**. Many of the legal, ethical and economic issues that we will face remain unclear as yet. The international big picture may still be hazy but within it, Finland and Europe need to discover their own particular roles, strengths and opportunities.

Information policy is a tool for building the future. It forces us to examine our decisions from multiple perspectives at the same time.

Information policy should be examined not only from the viewpoint of information management but also from the viewpoints of information utilisation conditions, value system and ethical guidelines, and economic impacts. With the advent of AI, information policy is faced with entirely new challenges. Security, wellbeing and national competitiveness, recognised as key objectives for society, are all impacted by information policy, and so is the citizenry. The information policy of the future must give equal consideration to differing views.

It may be easy to perceive the positive opportunities but the threats are also very real. Finland must prepare for an uptick in hostile hybrid influencing against us, in the form of e.g. cyberattacks, data theft and information operations. Hybrid influencing may involve actions such as data manipulation or the falsification of data origin. The mere suspicion of falsification undermines a key element in the success of management and all of society: mutual trust. Responding to hybrid threats calls for preparedness across all actors in society as well as coordinated efforts at the EU level.

## 2.3 Decisions or deferral

We always have the option of waiting to see which way the world turns. Of making decisions at a later date once this surge in the technology revolution has subsided. The unfortunate weakness in this strategy arises from the fact that lulls no longer exist, not in the transition from central computers to personal ones or landlines to mobile phones. Looking back, historians may be able to perceive such ebbs and flows, but we exist in the midst of ongoing, complex and multiform technological development. What makes change possible, now and in the future, is information.

Some of our information today and the associated decisions will pave the way forward for decades to come. While we are yet unable to look that far, a peek back into history shows us that making decisions trumps indecision. This is the case today as well.

Watching and waiting is by far the worst option. Decisions must be made in order to make information available for use and to strengthen Finland's competitiveness. A call to make decisions should not translate into a mad rush to rash decisions. All impacts must be comprehensively assessed, and this assessment must include a worst-case scenario. Peculiarities or outright mistakes in e.g. data specifications may live on for years to come.

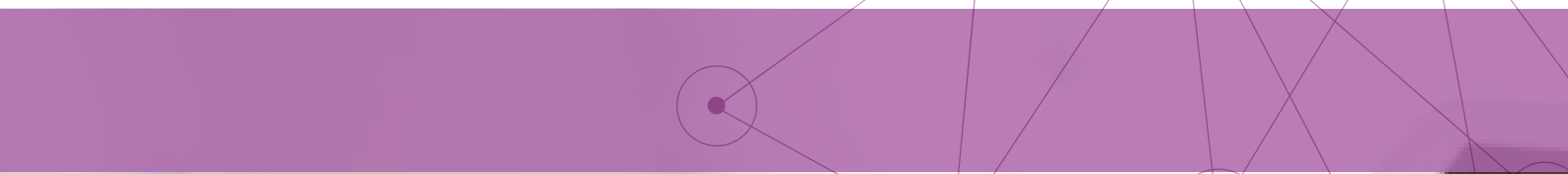
Identifying long-term solutions can prove difficult. A review of history may help here as well, as certain kinds of solutions have thrived while others have withered. Why should this not be the case in the future as well? Information and the technology to utilise it are two different things, however. One is subject to constant evolution and substitution, the other accumulates and appreciates.

Bad decisions are unavoidable, and decisions that once seemed wise may be overtaken by time. The same applies to information. The fix may be easy or it may be devilishly difficult, yet even this should not deter us from making considered decisions. The personal identity code was developed for a vastly different world. The discussion on how to replace it has only now started, and it is about much more than just another string of characters. Regardless, it may be stated that the decision was the right one in the 1960s and that its positive social impacts are unassailable.

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# Finland smart and wise

– how is AI shaping  
our society?



## 3 Finland smart and wise – how is AI shaping our society?

*Aleksi Kopponen, Ministry of Finance, and other members of preparatory group*

### 3.1 EDP – ADP – IDP. Intelligent data processing is a game changer

When people learned how to use electricity to carry information, too, the tool of choice became electronic data processing (EDP). The era produced reliable systems such as paper machines operated with relay panels. The next step in this evolution was the automation of data processing (ADP). Now we are entering an era where data processing becomes both intelligent (IDP) and learning. The world is currently transitioning into the age of artificial intelligence.

Finland is a part of this transition. Prime Minister Sipilä's Government initiated a national AI programme aiming to make AI a success factor for Finnish businesses and Finland a world leader in the application of AI. The programme views AI as the new electricity: a cross-cutting revolution that is set to become an increasingly important part of our daily lives.

Many everyday chores would indeed even today seem arduous without rudimentary AI and advanced computer software. We often make use of AI without even knowing it, for example when using search engines to look up information on the internet or taking family snapshots on our phone. The everyday applications of AI tend not to be particularly capable of learning. They handle routine tasks by means of pre-programmed recipes, i.e. algorithms. Nonetheless, they are illustrative of the wider force for societal change that awaits us.

In terms of productivity and economic activity, AI has been compared to e.g. the steam engines of the 1800s, with the distinction that AI systems are estimated to have

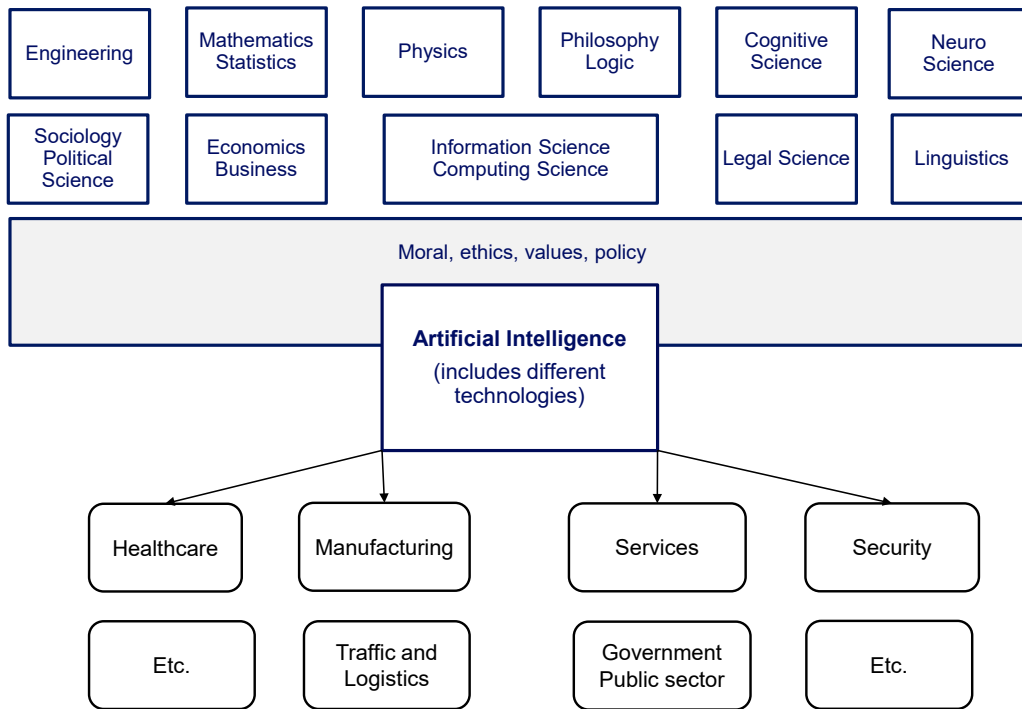
productivity potential four times higher than James Watts' revolutionary invention. The flip side of the coin typically reveals concern over the excessive promise of AI potential and the 'AI bubble'. The various forms of AI are nonetheless here to stay, that much is certain. Identifying and harnessing the potential of AI is an investment in the future.

### 3.2 The many aspects of AI

AI is a key technological driver in society and it leads not only to higher productivity in various sectors of society but also new processes, approaches and business models. Far from a monolith or a single entity, AI is a collection of technologies and applications ranging from data analysis to machine learning and robotics. The intelligent data processing properties of AI systems are based on the data and algorithms available to it as well as the system architecture, and AI is typically defined through the capacity of the system to operate in a flexible, purposeful and learning manner in a complex and partially unpredictable environment.

The key raw material in an economy based on the utilisation of AI is data, which the systems utilise and with the help of which they learn to act independently in a variety of situations. A society whose development hinges on the availability of data must be capable of addressing major challenges and ethical dilemmas relating to the collection, sharing and integration of data. Which actors control our data flows in society and what are the principles for sharing data? The age of AI puts data flow issues front and centre, as this new age is also characterised by a change in the way the economy works with regard to value chains. Instead of the earlier straightforward value chain, economic actors now seek out extensive ecosystems, consisting of a wide range of actors, that allow the achievement of important gains in terms of efficiency, costs and other factors through both sharing and integrating data and actions in order to benefit the overall wellbeing of individuals, businesses and society.

An economy based on AI utilisation and the management of such an economy thus call for a considerable volume of data and principles shared by all actors. In the age of AI, pace-setting is built on a foundation of human focus and trust, and this makes strong ethical knowledge economy principles a cornerstone of societal development. Data must be made mobile, and also brought under people's own control, while at the same time respecting individuals' right of information self-determination and other fundamental rights. The age of AI allows the overall wellbeing of people and their actual need for services to be put at the centre of all activity. AI is the key to a human-centric proactive society.



**Figure 5. Disciplines associated with AI and sectors utilising AI.**

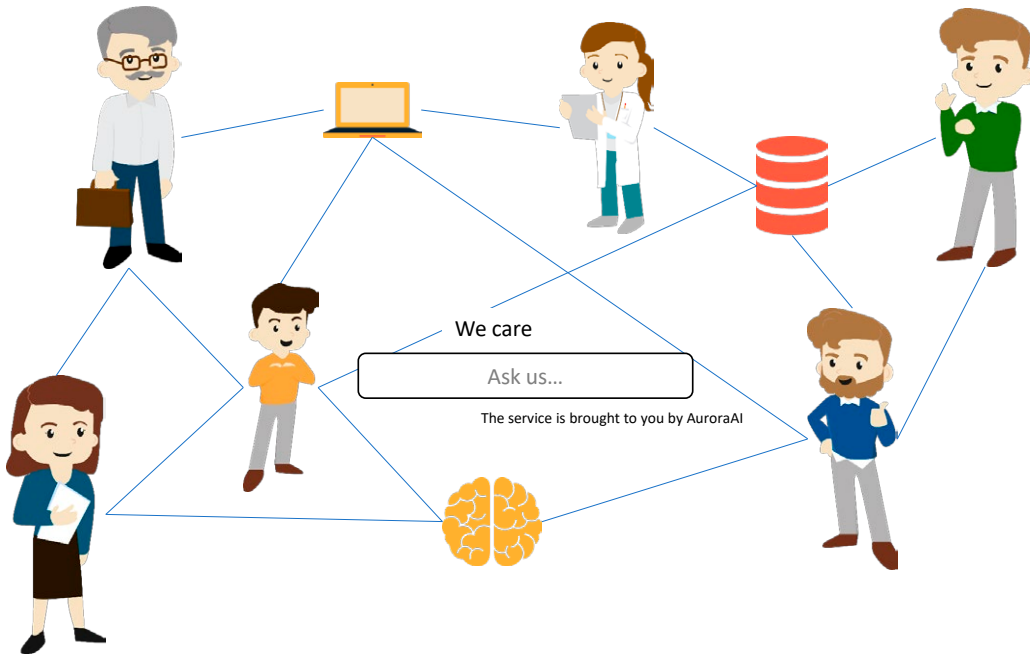
Publications of the Government’s analysis, assessment and research activities 46/2018, *Artificial intelligence and its capability assessment*

### 3.3 Finland and Europe as global superpower of human-centrism

As a part of the European community of values, Finland must ensure that our society will transition to the age of AI safely, ethically and in a manner respectful of the fundamental rights of people to control their own data within the framework of the EU’s General Data Protection Regulation (GDPR). Benchmarked internationally, for the time being Europe lags behind China and the United States, the two AI technology superpowers, on just about every meaningful AI readiness indicator: volume, diversity and quality of utilisable data, know-how and investments. Clearly there are differences within Europe in the degree of digitalisation and overall AI readiness of states. In the global frame of reference, Europe nonetheless holds one clear advantage that is estimated only to grow more important in the future: values. There is rising demand for human-centric, ethical and secure AI development, and Europe must be prepared to meet this demand. One important decision will be to build both national and continent-wide ecosystems to strengthen European AI capacities and capabilities. The development and use of AI must aim to increase human wellbeing on the basis of trust and ethics.

*The next Government will have a golden opportunity to take Finland into the age of AI in a human-centric and ethically sustainable manner.*

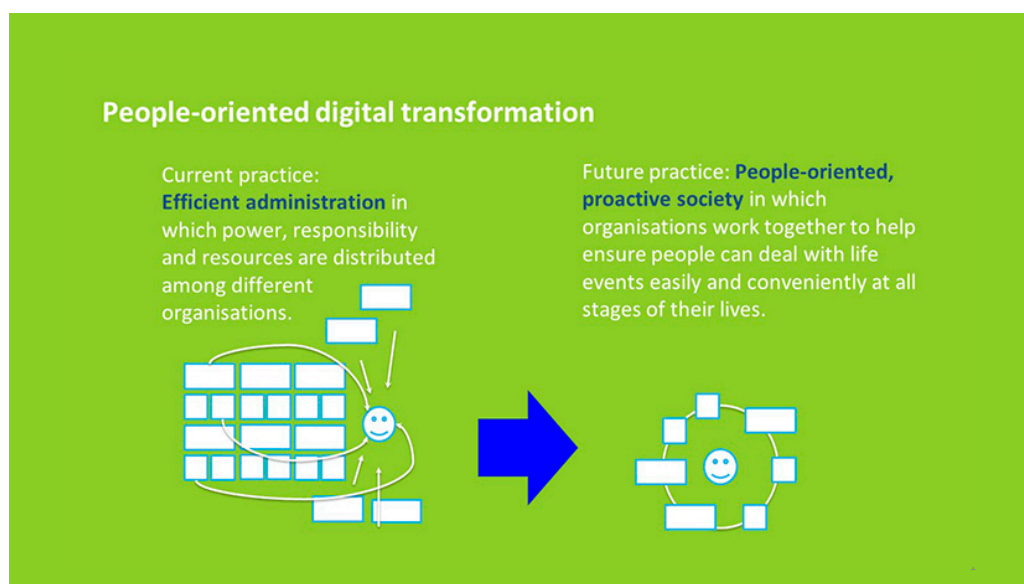
It is this transition in particular that the Finnish AuroraAI project seeks to accelerate. AuroraAI is a concept for a human-centric and ethically sustainable society in the age of AI. AuroraAI will build a decentralised, information secure and open network around the life events of people and the business events of enterprises to allow the mutual interaction of services provided by the public, private and third sectors in the pursuit of greater wellbeing in all life situations. From the service user perspective, AuroraAI has the objective of enabling seamless and smoothly functioning progressions of services from multiple service providers in various life situations and events. At the same time, AuroraAI will provide a platform to which organisations may connect to create value for people at their various life events. In other words, AuroraAI is poised to give momentum to an ecosystem that serves the needs of people and business and in which intelligent services are seamlessly operated in a human-centric and ethical manner.



**Figure 6.** AuroraAI will create an information secure and ethically sustainable network of services to fulfil the actual needs of individuals in the various situations and events of their lives.

### 3.4 Life event approach brings about change

The human-centric perspective also translates into a changed perspective of viewing the need of individuals for services as a whole that is to be provided on a joint basis. The life event approach in particular is revolutionising earlier ways of working and enabling the various societal actors to work smoothly together in order to serve people with an eye to their overall wellbeing. The life event approach is key to the human-centric society, as it steers the actors in society away from an organisation-centric perspective towards an examination of people's true capacity to support their own wellbeing and that of their loved ones with the support of the service provision network.

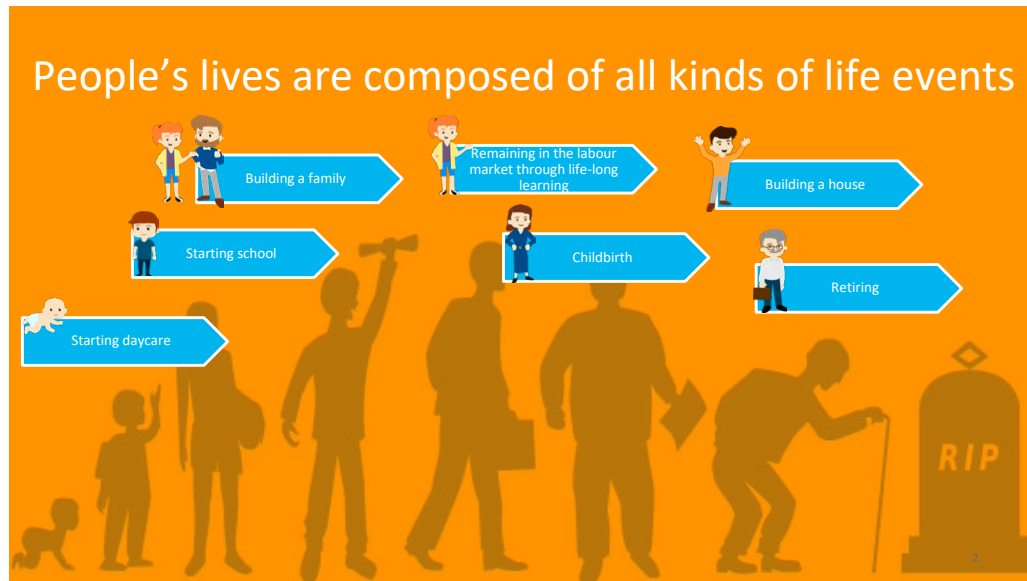


**Figure 7.** The age of AI provides government with new capabilities to strengthen the human focus in its activities through cross-sectoral collaboration and the utilisation of intelligent applications.

Life consists of a series of life events which bring about changes of varying degrees to an individual's life. Life events may be large or small, of short or extended duration, expected or unexpected, but what is common to them all is a need for various services. Many, if not most, life events involve some degree of connection with the public sector, and services provided by the private and third sectors in support of each life event can be integrated into life events involving the public sector. Open, cross-sectoral collaboration at the level of society which focuses on the overall wellbeing of people and its enhancement at the various junctures of life also translates into the implementation of a new approach and commitment to the PPPP model (Public – Private – People – Partnership) as the fundamental blueprint for a human-centric society. The linkage between life events and the services, structures and activities envisioned is from all aspects a reasonable point



of departure for the human-centric society of the future. The utilisation of MyData that will become possible in the future may also be presumed to grow the knowledge-based service market for life event support in all sectors.

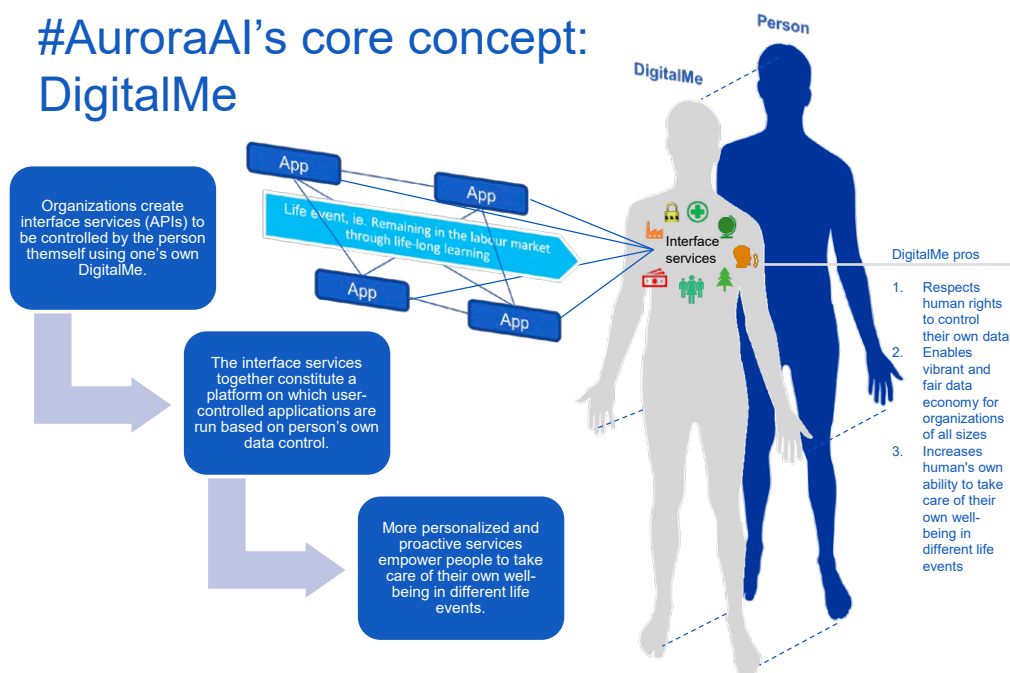


**Figure 8.** The life of an individual comprises numerous life events that are unique to each individual. In a human-centric society, interaction with intelligent applications may be targeted to life events.

### 3.5 DigiMe empowers individuals to utilise MyData

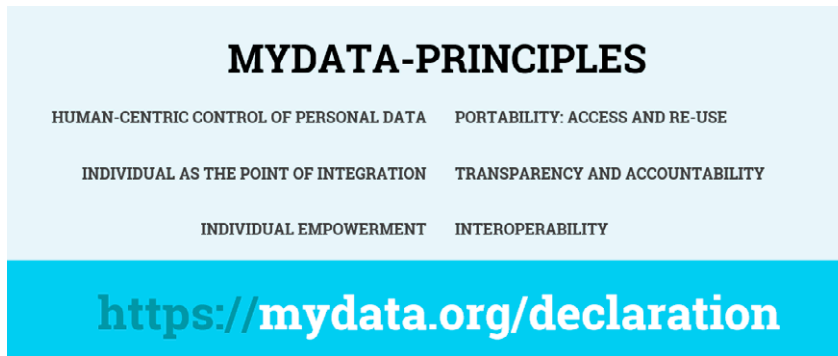
At the core of AuroraAI is the notion of human-centric utilisation of personal data that marries strong data protection and privacy principles to the opportunity to utilise data collected about and by individuals themselves. AuroraAI enables individuals to make use of tools and means to manage their personal data in person in accordance with the principles of MyData. The MyData concept refers to a paradigm shift in which the control and processing of personal data shifts from the current organisation-centred approach to a human-centred approach, giving individuals themselves the opportunity to control and utilise their data. The MyData designation is appropriate when individuals have the right and the practical opportunity to control their own personal data and data collected about them, to freely use such data and, when they so desire, to make the data available to third parties for their utilisation. The MyData approach is based on the notion of an individual's fundamental right to control their personal data and the reconciliation of the rights of the individual with high data protection and privacy requirements in order to promote the availability of data. At the same time, the approach also stimulates the development

of the data economy and the development of open, human-centric service ecosystems building on strong data protection and privacy. In the AuroraAI project, this approach is described using the 'DigiMe' concept.



**Figure 9.** DigiMe is a concept that describes a new way for individuals to utilise their personal data for their own benefit.

Correspondingly, AuroraAI also strives to empower individuals to manage, utilise and understand the flows of their personal data. In the AuroraAI network, individuals make the decisions on the utilisation of the personal data controlled by them in order to personalise the service offering available to them and to obtain personalised advice, recommendations and instructions through the use of intelligent methods. Data control is based on consent management and individuals thus uses permissions to decide which services may make use of their personal data. Individuals compile their data into situational and temporary collections or summaries that may use the services in the AuroraAI network also anonymously and in a manner that cannot be linked to individual users. The services in the network interact in order to respond with maximal and optimal effectiveness to the services needs of the DigiMe, i.e. a given set of data. Data about the user is utilised anonymously whenever possible, in accordance with the user's needs. Where the data are required in their original format, the data are utilised in observance of the MyData principles that allow the individual to decide whether or not their data are to be utilised.

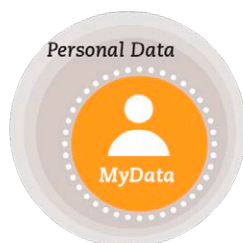


**Figure 10. Principles of MyData.**

Source: Poikola et al. 2018 <http://julkaisut.valtioneuvosto.fi/handle/10024/160954>

Personal data that are central to enabling a human-centric society are held by e.g.

- the registers of the authorities into which the various authorities compile data and maintain them within the framework of specific purposes and on the basis of valid laws and decrees
- the customer and membership registers of private actors such as major grocery trade groups, financial institutions or non-commercial third sector actors
- services and applications that automatically monitor and record certain data about their users, such data being either knowingly generated by the user when logged into the service (e.g. social media platforms) or generated through the actions of the user (e.g. health and exercise applications that collect data about the user’s vital signs, locations and movement).



- Right to know what personal information exists.
- Right to see the actual content of personal information.
- Right to rectify false personal information.
- Right to audit who accesses and processes personal information and why.
- Right to obtain personal information and use it freely.
- Right to share or sell personal information to third parties.
- Right to remove or delete personal information.

**Figure 11. MyData and rights.**

Source: Poikola et al. 2018 <http://julkaisut.valtioneuvosto.fi/handle/10024/160954>

In AuroraAI, people can basically use all of this data to create more than one DigiMe for themselves, i.e. compilation profiles, on the basis of which the AuroraAI network provides

service progressions and recommendations for action that as precisely as possible match the actual service needs and life events of people. The intelligent application ecosystem in the AuroraAI network thus reaches out to the DigiMe controlled by the individual to offer and provide services in a situational and proactive manner to meet the individual's various needs. In order for the AuroraAI network to function, users must voluntarily have taken the service into use and they must also control their data in person and permit the applications of the service providers that have joined the AuroraAI network to utilise their data.

DigiMe building on strong privacy protection is a concept that protects the personal data of individuals against abuses while also empowering individuals to utilise the data about them that has already been collected by various organisations. The potential of data utilisation can be maximised and the erosion of privacy can be minimised by providing individuals with tools for the access, reuse and sharing of personal data.

Human-centric personal data management must be compliant with the General Data Protection Regulation (GDPR). One of the privacy issues relating to the aims of AuroraAI is indeed compliance with the purpose principle. Article 5 GDPR requires personal data to be collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes. Requirements vital to compliance with the purpose principle are enumerated in the Recitals of the GDPR. Recital 50 states that in interaction with the authorities, even the consent of the individual does not automatically justify processing that has materially departed from the original purpose, while Recital 43 reads, "In order to ensure that consent is freely given, consent should not provide a valid legal ground for the processing of personal data in a specific case where there is a clear imbalance between the data subject and the controller, in particular where the controller is a public authority." What is critical for AuroraAI is the manner in which it is implemented, respectful of both data protection principles and their objectives.

### **3.6 We must not allow a dystopic society to come about**

When the digital compilation profiles of individuals serve as the basis for a government service such as AuroraAI, this automatically opens up the opportunity for government to monitor and seek to influence individuals if the government responsible for maintaining the service lacks proper respect for the fundamental rights and freedoms of individuals and instead seeks to steer their lives and choices on political, ideological or economic grounds.

The data profile of an identified unique individual can also, in principle, create the technological foundation for the kind of social scoring system that is already in place in China. Such activities would be in violent conflict with Finnish and European legislation and the view of human beings having inalienable physical and mental rights and freedoms which are wholly independent of the government in power and which are expressly safeguarded and protected by public authority. The principle of equality and the legislation to enforce it must also be strictly adhered to.

It is for these reasons that AuroraAI must be built on an ethical code prepared in multidisciplinary collaboration by privacy and fundamental rights specialists, technology experts and representatives of the social, political and behavioural sciences. It should be noted that the tentative code and associated materials prepared during the preliminary study on the Aurora national artificial intelligence programme are based on our current understanding of the vision for the project, and updates to the code and in particular the associated requirements can be presumed to become necessary at subsequent phases.

Legislative foundation for ethical code in Aurora AI

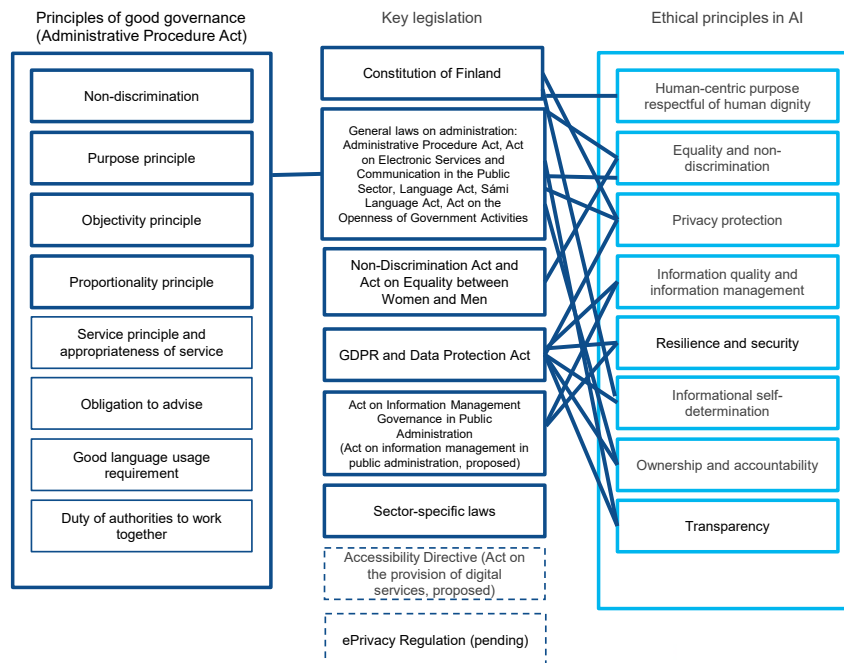


Figure 12. Legislative foundation for ethical code in Aurora AI.

### 3.7 From nuggets of information in the 2010s to ecosystems in the 2020s: towards a Government for the age of AI

*Matti Kuivalainen, Prime Minister's Office*

Digitalisation means not only the better utilisation of new technology but also a change in practices made possible by the technological shifts. In respect of AI in particular, that shift is still in its nascent stages. It is easy to be distracted by recent accomplishments, such as the national service architecture, even though of much greater importance is the work done for future generations. Such work to an increasing extent is taking place across the boundaries of administrative branches, in cooperation among the public, private and third sectors, and in the form of collaborative governance. Besides better utilisation of information flows, this also necessitates the dismantling of the silos of government and a re-definition of activities.

Traditionally, silos have been what has allowed society to survive. Farmers stored their harvest in silos in order to make it through the winter, or the crop failures of the next year. Organisations, too, have squirrelled the nuggets of information that they have accumulated into silos for retention and safekeeping. Administrative silos have come into being when each individual actor has been steered to maximise its own efficiency. As the operating environment grows increasingly complex, old approaches are no longer sufficient to respond to the challenges presented.

The availability, mobility and interoperability of information are becoming more important than ever. Technological advances also make it possible to generate more and more value added by integrating information flows. Making information mobile creates the conditions in which better services and new business models can arise, thus generating new value for humankind. Likewise, it is of prime importance that the methods of government be reformed to meet the requirements of the age of AI. Successful change hinges on the continued trust of citizens and enterprises.

A digital trust society comes about most organically within ecosystems where government, citizens, enterprises and researchers can come together to exchange views and jointly develop solutions in order to embrace the potential of technological change. With this approach, the action taken is determined in open dialogue that allows a mutual understanding to be reached at an early a stage as possible. Dialogue-based policy formulation strengthens the commitment of the various actors to subsequent policy measures, as they have had the chance actively to participate in the formulation of those measures. The Government should support the arising of such ecosystems.<sup>5</sup>

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<sup>5</sup> Futures review by the Prime Minister's Office, Prerequisites for the national capacity for renewal, pp. 18–19. Finnish Government Publication series 11/2018.

Ecosystems are a way of working that is more structured than a network but less rigid than traditional line management. Ecosystems usually centre on the resolution of a shared challenge, for example generating new business models or streamlining a given life event of an individual. The party responsible is charged with facilitating the actors towards achievement of a common goal. Vital aspects of ecosystems include creating networks and supporting teams. Building trust, a shared identity and an empowering operating environment are crucial to the creation of networks and teams.<sup>6</sup>

### 1.1.1 Ecosystem Forum at the vanguard of digitalisation

The Ecosystem Forum was established in April 2017 with an eye to grasping the potential of the ecosystem approach. The aim of the forum has been to accelerate the arising of ecosystems in service of management and customer needs through cross-sectoral collaboration and thus to create the conditions for the creation of a human-centric and proactive society. The approach enables the development of services around the life events and business events of individuals and enterprises. The following ecosystems were selected:

- Information as an enabler of business and research (social and healthcare services information)
- Smart city for individuals and enterprises
- Gaining a foothold in working life through lifelong learning
- Mobility as a service
- Utilising data on wellbeing for the benefit of the people

The Prime Minister's Office has served as the coordinator of the project with the support of the Ministry of Finance. Public administration representation from each ecosystem has been invited to join the core group of the Ecosystem Forum.

The Ecosystem Forum has adopted as its primary approach the one-day solution workshop where government, enterprises, researchers and NGOs have come together to define the key challenges concerning the ecosystems and to innovate solutions to these. The aim has been to create a setting where the participants could innovate free from the constraints of their respective roles and obligation to advocate the views of their respective organisations. While the Prime Minister's Office has headed the preparations, the facilitators have been drawn from the ecosystems themselves, thus giving the work a strong link to and impact on service development. The workshops have given

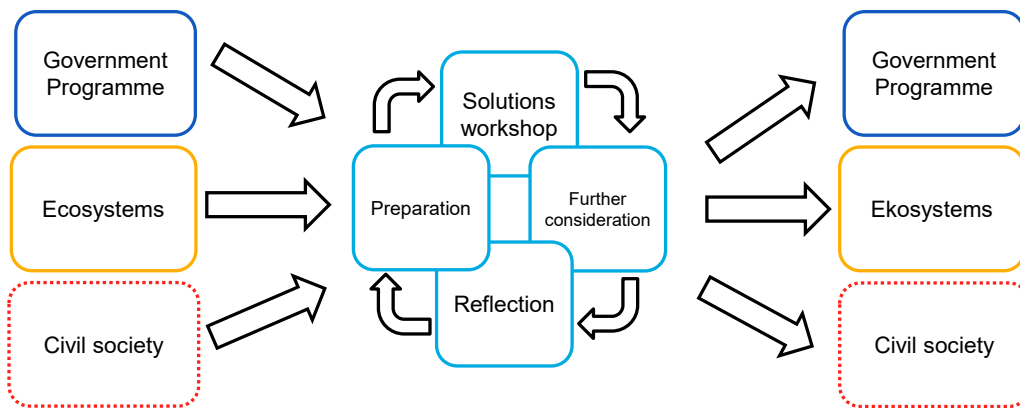
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<sup>6</sup> Hwang Victor W. & Mabogunje Ade: The New Economics of Innovation Ecosystems. Stanford Social Innovation Review 17.10.2013. [https://ssir.org/articles/entry/the\\_new\\_economics\\_of\\_innovation\\_ecosystems](https://ssir.org/articles/entry/the_new_economics_of_innovation_ecosystems)

the participants a comprehensive situational picture of the topics addressed and thus provided inputs for the decision-making process.

The challenges to the ecosystems have mainly consisted of the availability of data, the regeneration of knowhow, business models, and trust and the ethical use of data. The workshops have brainstormed concepts such as a ‘Cyber Swan Label’ for a fair data economy and the ‘digital twin’ to streamline the use of AI in services, both of which have become established as a part of ambitious development projects such as Sitra’s IHAN – Human-Driven Data Economy project as well as the life event pilots and preliminary study of AuroraAI coordinated by the Ministry of Finance. A cross-cutting topic for all ecosystem forums has been AI, and in particular its ethical utilisation.

Most of the events were particular to each ecosystem. All ecosystems came together on two occasions: in January 2018 to address information policy and in October 2018 to discuss paths to Europe’s digital leadership. In digitalisation, the Forum has served as a ‘network of networks’. The maritime policy workshop demonstrated that this participatory and effective approach can successfully be applied to boosting progress with other phenomena as well.



**Figure 13.** Ecosystem forum process. The agenda of the forum has been derived from the Government Programme and the accordant ecosystems. Going ahead, we should consider how to usher in also NGOs and civil society in a structured manner and how further to develop this approach.

Ecosystem-based collaborative governance is perceived as a more inclusive and faster way than traditional working groups for reaching conclusions, formulating policy and streamlining implementation across administrative and sectoral boundaries. The approach



is recommended to the coming Government as well.<sup>7</sup> The approach also aligns well with recent OECD suggestions for enhancing the activities of its member states' centres of government. According to the OECD, traditional line management must be joined by new frameworks, capabilities and mechanisms for planning and monitoring. The centre of government should adopt an advisory capacity and act as a facilitator between branches of administration in order to address challenging issues and achieve common goals. Participatory approaches to gain a broader range of views as a basis for decision-making processes are also necessary if the work of the Government is to be made more well-rounded.<sup>8</sup> In this respect, Finland is clearly a forerunner.

### 1.1.2 In conclusion

The Ecosystem Forum has performed well as a solutions platform and catalyst for development. Towards the end of the government term, digitalisation steering has been allocated to four ministerial working groups<sup>9</sup>, which proves that the phenomena have been a success in all sectors. The age of AI and the human-centric society enabled by it are farther away in time than a single government term, however, and continuity is key to a rapid progress. A possible tool for ensuring that future efforts are in line with ones to date could come from stronger reconciliation of measures at the level of permanent secretaries at the ministries<sup>10</sup>, or in a special monitoring group for coordinating the digitalisation of society<sup>11</sup>. The appointment of a dedicated minister for information policy and digitalisation has also been floated<sup>12</sup>. Policy measures must not only be coordinated, however, but also the planning and implementation of such measures requires improvement. As spring is upon us, we would do well to ask ourselves how the nuggets of information stored in silos could be converted into winning ecosystems. What would Ecosystem Forum 2.0 look like? How could we take the leap from the pursuit of a unified Government to a **Government of collaborative governance**?

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7 Recommendations of the project to develop strategic leadership instruments in government, pp. 41–42. Publications of the Finnish Government 2019:2.

8 Centre Stage 2 – The organisation and functions of the centre of government in OECD countries, p. 43. OECD 2018.

9 Ministerial working group for reforming operating practices, ministerial working group for employment and competitiveness (ministerial committee on economic policy), ministerial working group for reforms and ministerial working group on information policy and artificial intelligence. For more information on ministerial working groups, please see <https://valtioneuvosto.fi/sipilan-hallitus/ministryoryhmat>.

10 Recommendations of the project to develop strategic leadership instruments in government, p 44. Publications of the Finnish Government 2019:2.

11 Statement of DigiNyt monitoring group to Parliament at Finnish Futures Day, 1 March 2019

12 Joint statement of the Finnish Software and E-business Association, Service Sector Employers Palta, the Federation of Finnish Enterprises and Technology Industries of Finland, 3 September 2018.

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# Dude, where's my robot?

How to proceed with robotisation?



## 4 “Dude, where’s my robot?” or how to proceed with robotisation

*Cristina Andersson, Develor Productions Oy*

### 4.1 Introduction

The world faces no shortage of big problems. We have climate change, the rapid rise in the ageing population who need support and heightened security concerns, not to mention the need to provide people with an increasingly higher standard of healthcare. To name but a few. AI enables solutions to all of these challenges, but intelligence alone will not carry the day – we need hands and deeds if we want the world to really take a step towards a better future.

Authors and scientists remind us that despite all of these major challenges before us, the world is constantly changing for the better. Throughout history, people have developed tools and technologies that help them build a better world. It would be implausible to believe that the path towards an even better future would now suddenly be cut off, especially as we are finding increasingly effective assistance in the world of technology. New technologies might seem scary at first, but once we get to know them and bravely embrace them, for gain or for pleasure, we find that our fears were unwarranted.

Technology is a driver of change. Man invented the fulcrum and was suddenly able to shift heavy weights as if by magic. The fulcrums of today are under development through science at laboratories and innovation centres operated by universities and businesses. Amazing technologies start out as science and research, transition to engineering theory and practice, and ultimately end up as products capable of benefitting all of humankind.

Society and political decision-making only enter the stage when technology emerges from the ivory towers of academia, yet the work carried out in those towers occupied by futurologists and other scientists is what produces the innovations that, going ahead, will

help us take a quantum leap towards a better and brighter future. Investment in research and development thus always pays off, even when the investor cannot comprehend the subject matter.

A quantum leap, yes. That quantum leap in development is currently being made by quantum technology, which makes it possible for us to solve increasingly complex and multifaceted problems and to locate optimal responses to broad-ranging challenges. In recent years, states have started pouring immense resources into quantum technology, thanks to its 'engineerisation,' i.e. the capacity to create practical applications.

Even quantum technology alone will deliver no extra hands to care for the elderly or to repair damage done to the environment. Where are we to turn?

The help we need of course already exists – robotics. Robots can provide the sorely needed hands to attend to just about all problems facing the world, whether in the sectors of care, transportation, government or the climate.

One of the benefits of robotics is how it restores work back to the country from which it was originally outsourced. Reshoring, as the phenomenon is called, has already occurred even in Finland but especially in the US, where companies such as Apple have returned their manufacturing operations to their country of origin. Even though most of the work at e.g. assembly plants is carried out by robots, there is also work that must be done by humans. Design, infrastructure, management, training provision and many other forms of work needed to keep a factory operational are still fields dominated by man, not machine. Let alone tasks that cannot or should not be done by robot, as demonstrated by the winning concept of the Uusikaupunki auto plant.

## 4.2 Robots right now: a primer

The first robot introduced in Finland was an industrial robot built by Asea, the current ABB. The robot was imported in the late 1970s from Västerås in our neighbouring Sweden to do welding at a Fiskars plant. Bright orange in colour, this robot could not easily be converted into performing other kinds of welding than originally programmed to do. It was also unsafe for humans, it was kept in a cage at all times and powered down for any maintenance work. It worked hard at the tasks assigned to it but did nothing else. For many this robot, now on display in the Museum of Technology, continues to define robotics as something not fit to serve people.

As things now are classified, that orange welding machine from the 1970s was not a robot but an automaton, a machine that performed a single task over and over until someone stopped it. It could not learn, communicate or take heed of people.

#### **4.2.1 Modern robots think, communicate, act and sense**

The modern robot is an entirely different creature. Modern robots have knowhow and are capable of learning, thanks to artificial intelligence and machine learning. For the ability of robots to communicate, we have artificial intelligence linked to the internet to thank. At its most rudimentary, a robot's communication is limited to its own circumstances, such as pending issues or work completed. At their most complex, robots communicate with people on topics of importance to people by means of an intuitive user interface. Robots are also capable of perceiving their surroundings, learning by doing, and collecting data through their sensors and sight (machine vision). The sensors that allow robots to perceive their surroundings and recognise how to act are what allows robots to be set free from their cages. Sensors also allow the movement of a robot to be restricted or its speed to be adjusted according to specific settings. Sensors moreover make it possible to protect the robot's surroundings and the people in its vicinity.

Modern robots are surprisingly mobile and thanks to the technologies mentioned above, also capable of adjusting their motions to accomplish their tasks. To date, robot mobility has mainly been accomplished on wheels or continuous tracks but recently, their 'legs' have improved considerably and thus also their agility, as demonstrated by a Swiss robot that is quite the accomplished ice skater.

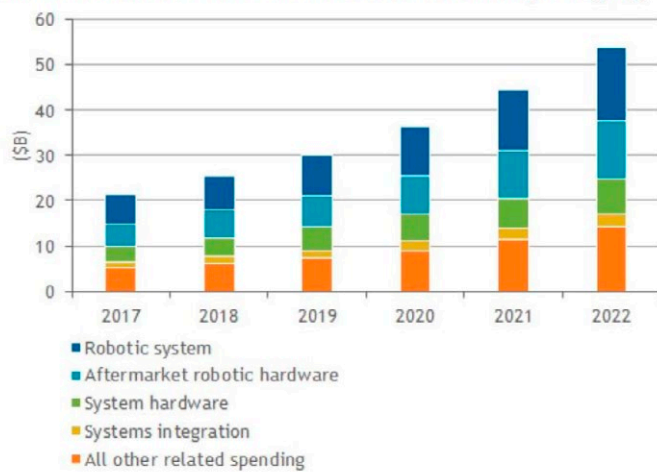
A further development that warrants mention is gripper technology, or a robot's 'hands'. In the era of the aforementioned bright orange machine, grippers were primitive compared to current applications that allow robots e.g. to sort tomatoes, which may sound like an easy task but in fact is not. With machine vision, grippers can adapt to the many shapes and sizes of tomatoes and grasp them without causing the slightest bruising.

The diverse uses of robots are also fostered by the advances in 3D printing technology. A new gripper can be printed for each new task, for example. Thanks to this adaptability, robots need not stand around doing nothing as they wait for their next task and, instead, they deliver constant high productivity. Nonetheless, there are many who believe that the 1970s robot, an excellent servant at its time, is pretty much the same as today's robots, and is therefore simply unsuited to come into contact with actual people.

### 4.3 Start a national AIRO programme in Finland, too!

Now that robots are growing skilled at performing a variety of tasks, the international market for robots is growing at a staggering pace. The market for cobots – robots that collaborate with people – is alone estimated to grow by nearly 70% by 2023 when compared to 2018, when the market was valued at around USD 300 million. Similar figures are projected for robotics in the sectors of rehabilitation and the tourism industry.

**Worldwide Commercial Service Robotics Revenue by Category, 2017-2022**



Source: IDC, 2019

**Figure 14. Estimated development of service robotics revenue 2017–2022.**

*“Research firm IDC this week published a forecast for the commercial robot space, predicting the market could surpass \$53 billion by 2022 at a more than 20% compound annual growth rate. For the purposes of the company’s study, commercial service robotics is defined as robots “outside of the traditional industrial manufacturing industries.”*

To date, there are very few robotics manufacturers in Finland, but the rapidly growing market on the one hand and our own national challenges on the other are turning robotics into a truly attractive, yet for Finland, a virtually virginal sector of business. This poises Finland to establish itself in an entirely new industry capable of generating much employment and exports.

Robotics, and service robots in particular, requires a dedicated national programme to promote the sustainable introduction and use of robots, to foster innovation and entrepreneurship as well as exports in the industry, to create pioneer markets and to raise awareness and knowhow in robotics and its utilisation. Since robots must have a 'brain,' i.e. artificial intelligence, such a programme could well be called the national AIRO programme.

In other parts of the world, robotics is a key element in national strategies for success. The government of South Korea in its policy directions for the nation's robotics industry (February 2018) outlined its plans to enhance the robotics market and technologies (2/2018):

*“The four action plans are geared towards enhancing industrial competitiveness and creating a ‘smart country’ where humans and robots co-exist. The action plans call for accelerating market expansion with collaborative robots and service robots while enhancing the industry’s supply and demand capabilities by means of parts development assistance and proactive system improvement.”*

The four action plans are:

- Projects for Development and Popularization of Collaborative and Service Robots
- Enhancement of Innovation Capabilities of Robot Industry
- Market Creation and Establishment of Support System
- Enhancement of Social Awareness of Robots

The announcement was preceded by a release specifying the industries where a particular emphasis will be put on the utilisation of robotics:

*“The Ministry of Trade, Industry and Energy (MOTIE) announced on May 6 that it is investing 110 billion won (\$98 million) in 12 stepping stone projects by 2017. A stepping stone project refers to the commercialization of interim R&D results in the form of technology and product. For this year, a total of 31 billion won will be invested in plastic auto tuning parts, fishfinder drones for deep-sea fishing and logistics robots for hospitals and warehouses. Plastic tuning parts can either be used on high-performance cars and but before the development is completed, they can be used on premium micro cars for children. Fishfinder drones are a high-speed vertical take-over and landing aircraft that can be used to find schools of fish in the air. They can also be used in various areas, such as monitoring illegal fishing, military surveillance and disaster monitoring. The logistics robots can be used both at the hospitals and warehouses for public health and safety. The plan is to employ the robots in domestic and overseas hospitals and nursing homes, before using them at hotels and large warehouses. The ultimate goal is to develop robot nurses and remote medical robots. MOTIE expects to create 3 trillion won market by 2017 once the interim R&D results are commercialized through the stepping stone projects.”*

Can Finland afford not to take a slice of a market that generates new wealth and new vitality for business and society alike? Robotics development is more resource-intensive than the development of digital products, but the investment pays off. As stated, robotics



has a wide range of applications and as the prices of the technology required for robots fall, robots will become affordable for an ever broader section of society. Many innovations are still out there waiting to be discovered and with our tradition of high-tech knowhow, Finns are well poised to be among the successful explorers.

## 4.4 Robotics applications and Finnish success stories

### 4.4.1 Wellbeing and healthcare

Healthcare offers prime examples of the new and diverse applications for robotics. Finland has in place programmes that seek to enhance quality, increase efficiency and improve customer experience in the sector. The nationwide programme **Well-being and Health Sector Artificial Intelligence and Robotics Programme**, or (**#hyteairo**), launched by the Ministry of Social Affairs and Health in 2017 to speed up the sustainable introduction and utilisation of robotics and AI, has the aim of taking a leap forward in national wellbeing through robotics and AI.

**The programme covers robotics and AI:**

- at hospitals and in logistics
- in pharmaceutical service
- in rehabilitation and wellbeing coaching
- at home and in assisted living

The support processes in the programme comprise software robotics, AI and information systems.

### 4.4.2 Case study: Rehabilitation robotics

The programme has delivered many cases and studies on how robotics has provided considerable advancement to the wellbeing and recuperation of persons in need of care. Robotic rehabilitation, for example, has delivered outstanding results compared to traditional rehabilitation methods.

*“Advances in the technology have made rehabilitation robots a worthy option and today make it possible to deliver rehabilitation in an entirely new way. A hemiplegic patient can be helped up into the standing position by means of a walking robot that helps the patient take thousands of steps per hour – each step activating the plasticity of the brain. With robots, the numbers of repetition are phenomenal. The amount of information entering and exiting the brain is vital to the formation of new neural pathways and to learning.*

*There is not a single form of traditional physical therapy that allows e.g. stroke patients to regain a biomechanically perfect gait, the one learned in early childhood. Children, too, learn how to walk through thousands upon thousands of attempts and repetitions. If a child learning to walk would only have one hour per day – the usual duration of a physical therapy session – to practice leg flexion and extension, the child’s walking would surely be retarded. And here we are talking about a person with an undamaged brain.”*  
(Laitilan terveyskoti rehabilitation centre)

Rehabilitation has vast economic effects, as persons successfully rehabilitated back into employment or independent living mean significant savings in social and healthcare costs, not to mention the wellbeing and quality of life of the individual and their near and dear ones.

#### 4.4.3 Case study: Robotics in pharmaceutical services

Excellent results have been obtained in pharmaceutical services with a robot that directs home care clients – usually elderly persons – to take their medications as prescribed: the right dose of the right medicine to the right person at the right time.

*“Designed in Finland, the medicine dispensing robot is one of the first #hyteairo innovations geared to elderly persons receiving home care. The service improves patient safety and the quality of medicinal therapy by reducing the chances of human error. It allows home care processes to be streamlined by reducing the need for medicine dispensing visits by home care workers as well as the morning and evening rush periods associated with medicine dispensing. The City of Oulu, for example, has estimated that the medicine dispensing robot improves the quality of medicinal therapy for nearly one in two home care clients, where in terms of cost efficiency improvement is seen among around one fifth of all clients. The KymSote joint municipal authority for social services and healthcare calculates that the medicine dispensing robot delivers savings of around EUR 1.5 million annually in home care services. Users heap praise on the medicine dispensing robot: home care clients appreciate the greater degree of autonomy and independence of home care workers’ schedules, while home care workers feel less rushed and stressed.”* (Evondos Oy)

The Hyteairo programme is one of a kind even in an international setting. Many programmes, like the aforementioned one in South Korea, approach AI and robotics as a general technology whose applications are mentioned within the programme, with a focus on specific sectors. The starting point in the Hyteairo programme is the needs of healthcare, and the programme seeks to place robots in service of concrete needs. All told, the programme consists of 32 specified measures, of which e.g. the ‘home robotics piloting environment’ has already been initiated.

Hyteairo innovations also comprise minimally invasive surgical robots. Microscopically small robots that travel inside the body to the surgical location and perform the surgery without no external trauma whatsoever represent the new wave of the future. In terms of wellbeing, these robots are of great significance when considering the speed of recovery and the minimal extent of trauma – aesthetic trauma included – not to mention affordability and democracy in care: more and more people will receive the care they need at precisely the right time. A company that is developing surgical nanorobots counts tech guru Bill Gates among its investors.

In 2030, it will be commonplace to have robotic home helpers, multifunctional robots capable of performing a variety of tasks in taking care of the home and its occupants. Such robots will be of particular aid to people who need support in their everyday lives, for example people with disabilities and the elderly. While multifunctional robots have been developed and tested, they are yet to make their breakthrough. Might this present Finland with an opportunity?



**Figure 15.** Medicine dispensing robot in action. (Photo: Evondos Oy)

## 4.5 The environment and the circular economy

Our world continues to hold many mysteries and unexplored locations and the information obtainable from these could markedly improve our chances to combat climate change. There are places such as the ocean beds where people cannot enter to explore, let alone to take corrective action. But robots can. Robots can study the various phenomena of the Earth and transmit to us data that AI is capable of converting into useful information – which in turn can be transformed into action likewise taken by robots. The Dutch-developed Ocean Cleanup machine cleans the world's oceans of plastic waste. It uses ocean currents for energy and is thus maximally environmentally friendly.

The Waste Shark is a smaller robot, also developed in the Netherlands and often referred to as the 'water drone', and it is used to remove plastic from waters in e.g. ports and near coastlines.

In Finland, we have the ideal ocean governance testing ground all around us: the Baltic Sea. Marine resources management could well give rise to a major robotics venture. Despite the Dutch beating us to the punch, plenty of work remains to be done.

Unmanned aerial vehicles or drones have helped search and rescue find lost hikers in woods. Could they not also locate environmental risk sites or prospect for new mineral deposits? Robots can freely roam forests, glaciers, tundra and deserts. At a seminar held by DIAK University of Applied Sciences in spring 2018, researcher Katri Saarikivi observed that the problems of humankind are an endless resource. Both people and robots will find their hands full in solving these problems. New data will reveal new challenges, which in turn will only add to the 'to do' list. The future will be an improvement on today.

### 4.5.1 Case study: the circular economy

The robots of the Finnish company Zenrobotics Oy are designed to sort rubbish and waste. The first versions of the robot dealt with construction waste, rock, wood and cement.

In August 2018, Zenrobotics unveiled a new robot, the Fast Picker, a fast lightweight material sorter that operates autonomously around the clock at 4,000 picks.

*“ZenRobotics Fast Picker is powered by ZenbrAI, the unique Artificial Intelligence software that analyzes the data and controls the robots. ZenbrAI is constantly learning, enabling operators to quickly react to changes in the waste stream. Thus, ZenRobotics Fast Picker is not purpose-specific but can be readily updated for performance-tuning or new fractions. This kind of flexibility has not been available in waste sorting before and it's possible thanks to years' of industrial experience and research by ZenRobotics.”*



Figure 16. Picker robot in action (Photo: FastPicker, ZenRobotics)

## 4.6 Three observations about the future of robots

### 4.6.1 Autonomy

The multifunctional home robot mentioned in this article can only become reality when a sufficient degree of autonomy is achieved. On the robot car autonomy scale of levels one to five, with five being fully autonomous and requiring no human input, a multifunction robot serving the elderly, for example, must be rated at level 3.5–4 at least.

Thanks to navigator technology, cars can already drive themselves, although human vigilance is required. There is still a way to go to autonomy. Home robots, such as vacuum cleaners, can move about independently thanks to sensor technology.

But the actual leap to autonomy will only be taken when the robots are released from navigation systems. This will allow the multifunctional home robot to move about the home safely and with sufficient agility. The French “AntBot” navigates with an optical compass and may represent a major innovation towards autonomous robots.

### 4.6.2 Reliability

The key determinant to any growing prevalence of robots is their reliability. Robots must be ethically sustainable. They must perform their duties safely and accurately. Robots must be able to maintain their ability to function even in unexpected situations, or at the very least be able to power down safely.

The ethics of AI is a hotly debated topic. The same ethical considerations also apply to robots, only taken one step further, because robots are physical agents and can cause harm and damage to our physical environment.

One of the technology trends predicted by the consultancy company Gartner is edge intelligence / portable intelligence. In order for a robot (including a robot car) to be a truly reliable assistant, it must possess intelligence at least to the extent that it can complete its task safely and purposefully even if it loses contact with the cloud or it detects a hacking attempt. In the event of the latter, it must be able to sever contact with the cloud on its own and continue to function in reliance on its edge intelligence.

Edge intelligence is also important in terms of privacy. By means of their sensor, machine vision and speech recognition robots can collect a wealth of data from their surroundings, but while the transmission of all of this data to other parties, for example health care providers, may not be necessary, the data collected may prove useful to the holder of the robot in other ways. Edge intelligence allows the holder of the robot to determine which data may be passed on and to which parties, which data have relevance in everyday life, and which data are to be stored for later use. The robot of the future is a mobile data centre and the owner or holder of the robot should have rights of ownership to the data produced by it.

### 4.6.3 Know-how

It's often been said that 'Finland lags behind in robotisation'. Regrettably, this is true, but the good news is that we will be able to close the gap before long.

Why are we lagging behind? One of the reasons may be our focus on digital and AI products, which has left robots by the wayside.

Finland has an excellent standard of technological know-how and our universities have the capabilities to develop new expertise. While we might be unable to build the Atlas-type robots that move about nimbly on two legs, high-tech robots could be made in Finland if we only made it our business to do so.

Is Finland ready for robotisation? The answer is yes. Yes, we are – despite the oft voiced fears of robots taking our jobs. The Finnish people have a vast capacity for learning and invention, and over time we will embrace robots just like we once did mobile phones.

One of the reasons for the slow pace of development may be a lack of investment know-how, which is yet to be updated to an age where the business model or the whole of society includes robots that act purposefully and are capable of learning and performing multiple tasks. The biggest savings delivered by the medicine dispensing robot, for

instance, may not arise from a decline in the need for human resources, but the from the re-scheduling of home care workers' visits. Not needing to attend to all of their clients at the same peak hours saves time, money and nerves. The resources thus made available can be put to good use to the client's advantage in providing the attendance and human touch that everyone clamours for whenever robotic care is discussed. Broad-ranging impact assessments should be introduced in order to identify the true effects of robots – financial effects included – to serve as a basis for investment.

## 4.7 In conclusion

So dude, where is your robot? It's already here. Perhaps not in Finland yet, but out there in the world for sure.

What is needed now are bold roll-outs and programmes to enable also the innovation and manufacture of Finnish robots.

What we also need is popular science, which is what this article attempts to provide. Robotisation will affect everyone living in Finland and it is important for people to learn about robots before meeting one in real life, lest the first encounter prove intimidating.

What we need is a national programme that, like the one in South Korea, vigorously advances the AIrO technologies to create new business and new vitality in our nation.

## Links

Robotics plan in South Korea <http://www.businesskorea.co.kr/news/articleView.html?idxno=24394> and <http://roboticsandautomationnews.com/2018/02/19/south-korean-government-to-expand-robotics-and-automation-sector-to-6-billion/16123/> and [http://english.motie.go.kr/en/pc/pressreleases/bbs/bbsView.do?bbs\\_cd\\_n=2&bbs\\_seq\\_n=331](http://english.motie.go.kr/en/pc/pressreleases/bbs/bbsView.do?bbs_cd_n=2&bbs_seq_n=331)

Robot teaches self to skate: <https://mashable.com/video/robot-taught-itself-to-ice-skate/?europe=true&fbclid=IwAR0o3RsEiN76g30sSmPstsZUDQzvwRwLkKzt5lbSFUTYx-mE6Hw4jSMoHIU#oXFvzNA3Rgqu>

Cobot market growth: <https://www.prnewswire.com/news-releases/global-collaborative-robot-cobot-market-2018-2023-283-7-mn-market-is-anticipated-to-grow-with-63-95-cagr-300697447.html>

IDC: <https://www.roboticsbusinessreview.com/news/idc-predicts-53b-market-for-commercial-robots-by-2022/>

Hyteairo programme: <https://stm.fi/hyteairo>

Laitilan terveyskoti rehabilitation centre: <http://terveyskoti.fi/lokomat/tutkimukset/>

Evondos Oy: <https://evondos.fi/>

Nanorobots: <https://futurism.com/surgical-robotics-virtual-reality/amp/>

ZenRobotics: <https://zenrobotics.com/news/news/introducing-zenrobotics-fast-picker/>

Ocean Cleanup: <https://www.theoceancleanup.com/>

WasteShark: <https://www.ranmarine.io/home>

AntBot: <http://robotics.sciencemag.org/content/4/27/eaau0307>

Atlas robot: <https://www.bostondynamics.com/atlas>

Gartner Tech Trends for 2019: <https://www.forbes.com/sites/steveandriole/2018/10/22/gartners-10-technology-trends-for-2019-the-good-the-obvious-and-the-missing/>

Investing in Robots: <https://hackernoon.com/investing-in-robots-the-emergence-of-global-hardware-unicorns-b02d0496cdf>

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# New technologies

– anything interesting  
in the pipeline?



## 5 New technologies – anything interesting in the pipeline?

The 2020s will feature technologies and services that are as yet under development and wholly unfamiliar to us both conceptually and empirically.

One of the sectors highlighted in the previous report had to do with blockchains. The past few years have demonstrated that blockchains will enable new kinds of services and offer potential applications that we have yet even to identify. In this Chapter, we delve into the current status of these and their impacts extending into the 2020s. Additionally, we wish to draw attention to other trends and phenomena which we believe will be impactful on society and business in the 2020s, and which should be taken into account when developing these.

This Chapter demonstrates well how the topics raised in the previous Glimpses report have taken off, as have in part the plans and international cooperation discussed there as well. As is usually the case with the introduction of new technologies, short-term forecasts tend to be excessively optimistic while long-term forecasts are typically exceeded. Technologies building on and otherwise derived from blockchains have survived the worst of the hype cycle and now, in the 2020s, we will truly see the effects of their change on services provided and thus also their impacts at the level of society, both nationally and globally.

### 5.1 Blockchain technology development in the EU

*Kimmo Mäkinen, Ministry of Finance*

The year 2018 was an eventful one for European cooperation in blockchain technology. February 2018 saw the launch of the EU Blockchain Observatory & Forum, a body to which the Commission has appointed leading European blockchain technology experts from

both the private sector and academic research organisations. The Forum implemented a map service to which each EU Member State can add initiatives that make use of blockchain technology. <https://www.eublockchainforum.eu/initiative-map>

The Forum has also generated numerous research reports on topics including

- the challenges of reconciling blockchain technology and the GDPR
- the role of public administration in the application of blockchain technology
- digital identity
- legislative challenges in smart contracts

In 2019, the Forum may be expected to deliver several further interesting studies to describe i.a. the amalgamation of the Internet of Things, AI and blockchain technology. The societal impacts of digital wealth and tokens will also be subjected to in-depth analysis.

In April 2018, at the EU Digital Day, the ministers of the EU Member States signed a declaration to create the EU Blockchain Partnership (EBP). Pursuant to the declaration, each Member State designated a representative to a working group tasked with describing and coming to a mutual understanding on the governance model and functional and technical specifications of a common European blockchain infrastructure. The aim was to locate, by the end of 2018, the first jointly approved use cases with which swiftly acting results could be achieved. The aim was reached and the start of 2019 saw four projects launched within the EBP framework:

- SEED and VAT ID (taxation)
- Registry of audit-related files (European Court of Auditors)
- Certification of Diplomas / Qualifications
- Building a European Self Sovereign Identity Framework (eSSIF) for Public Services linked to eIDAS

EBP has set the objective that by the end of 2019, every EU Member State takes part in the maintenance of the European blockchain infrastructure by means of at least one national node that works together with the nodes in other Member States in maintaining trust. The establishment of the International Association of Trusted Blockchain Applications (IATBA) is taking place concurrently with the work of the EBP. IATBA links together private sector actors and it is envisioned to take on the role of partner and interlocutor also vis-à-vis the EBP.

The European Parliament resolution of 3 October 2018 on distributed ledger technologies and blockchains: building trust with disintermediation (2017/2772(RSP)) raises several

opportunities for utilising blockchain technology in e.g. increasing governance transparency in monitoring the use of EU subsidies and in the secure processing of EU citizens' personal data. The resolution also calls on the Commission to study the utilisation of blockchain technology in electronic voting systems.

Finland has had a governmental blockchain network in place for 18 months. The network currently has around 60 individual members from the various ministries and agencies and membership continues to grow steadily. A comprehensive futures report on the potential of blockchain technology to impact on various sectors of government has been prepared within the network under the title, '**Distributed trust technologies in enabling a human-centric society**'.

The governmental blockchain network has come together to consider themes such as identity management and issues relating to information security and cryptocurrencies. The network has also held a joint workshop with private sector organisations.

The year 2018 in blockchains may be described as a year of pilots and studies. The latter were published i.a. by the Ministry of Transport and Communications, Traficom, the Bank of Finland and the Government's analysis, assessment and research activities (blockchain utilisation potential in regional government reform). Pilots reported in the media concerned housing trade and trade in the shares of unlisted companies, which can both now be accomplished online with the help of blockchain technology. Spring 2019 will see the completion of the report prepared by the Government's analysis, assessment and research activities on the potential for utilising blockchain technology and programmable money in the taxation of earned income.

The blockchain network in Finland has also inspired our neighbouring Sweden, where a network of authorities to monitor the utilisation of blockchain technology, similar to the one in Finland, was set up in January 2019. In Sweden, the key actor and blockchain network engine has been the Land Registry, whose pioneering pilot projects have attracted interest also in the international arena. Talks have also been initiated on establishing a Nordic cooperation forum and at the time of writing, it is set to kick off with a joint meeting of Nordic experts in May 2019.

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## 5.2 Digital democracy, myth or reality? How do we foster Finnish values and wellbeing in the age of platform economy?

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Digital marketplaces and ecosystems, or platforms, comprise both economic, social and societal activity. They have become a part of the structures of society. Platforms include administrative components and operational logics that today, for the most part, have been programmed within the code of the platforms. They have an impact on the economic opportunities, rights and wellbeing of individuals, and as a result the rights of individuals are in flux in the era of the digital economy. The democratic systems of the state have been unable to guarantee for their citizens the protection to which they have grown accustomed. The platform economy as a societal phenomenon is unprecedented, and we are yet properly to grasp it from a wellbeing perspective.

Major digital platform enterprises generate vast revenues that are on par with entire state budgets. Most of the value created is generated by data, algorithms and associated revenue models. Digital platforms are global actors that often are taxed only in specific geographical locations. No major platform has yet made Finland its home and thus Finland is estimated to receive little tax revenue from any platform giants in the future. However, new technological solutions and opportunities have now arisen for the development of new administrative and governance models that could further platform models consistent with Finnish values for safeguarding wellbeing and fairness. This section provides an introduction to platform economy mechanisms and proposes new ways of actively influencing these.

### 5.2.1 Everyday impacts of platform economy

**What is the platform economy?** Any discussion on the platform economy usually makes reference to major digital corporations such as Facebook, Google, Apple, Uber, Airbnb, Alibaba, eBay, and Amazon. However, in terms of operating logic, enterprises may be divided into three main types:

**Marketplace platforms** are places where demand meets supply. Platforms often lower the hurdles to entrepreneurship by offering a chance to do business on a smaller scale. Many Uber drivers, for example, only take fares in the evenings and at weekends to supplement their day job income. Platforms also make it easy to package a service or product into a saleable item and to deliver it to the buyer. Posting a free guest bedroom on the Airbnb website takes only ten minutes before talks with potential paying customers can begin. For buyers, platforms offer consistent marketing and smooth transactions. They also guarantee the transparency of trust vis-à-vis service providers who may be total strangers.

Marketplace platforms generally charge a commission of 15–30% for providing the marketplace and the trust.

**Innovation platforms** offer a technical platform and standard for third parties to develop products and services and to offer these to their customers. Examples of innovation platforms include the app markets of Apple and Google. In other words, anyone can design an app and make it available to users on the innovation platform, which guarantees a certain technical standard and the transparency of trust. Apple has led the way in the development of innovation platforms and charges a commission of around 30% of the app purchase price.

**Ecosystems** are platforms for information, interaction and communication, such as Facebook and Wikipedia. Platform users obtain the services provided by the platform against e.g. consenting to advertisements or disclosing their data to third parties and for use by algorithms. The business models of ecosystem platforms are based on third-party income, mainly advertising revenue. In 2018, for example, Facebook generated nearly USD 50 billion in advertising revenue, while Wikipedia is a non-profit organisation that relies on donations.

**Several platforms nowadays employ more than one operating logic** and have developed many kinds of novel hybrid operating models. Most platforms operate on the basis of the network multiplier effect that starts out with the platform's revenue generation. The value of the platform is determined by the data available and the algorithms that filter that data. An effective platform ecosystem requires people to use the service in a way that creates value for them. Purchase decisions in platform economy are largely based on algorithms, which filter the data into targeted information making up personalised recommendations. The social recommendations of other users also play an important role on many platforms. This is what constitutes the network multiplier effect. The more users, the better the recommendations. The aim of recommendations is to increase the platform's revenue and the algorithms are optimised accordingly.

**Most platforms are indeed businesses** whose decisions on governance and operation can only be influenced by their shareholders acting through the business' board of directors. Platforms are global giants used by millions of people who are not shareholders. In Europe, for example, Facebook has 307 million users (Zephoria, 2019) but Facebook founder Mark Zuckerberg continues to hold 53.3% of all voting rights in the company (Investopedia, 2018). In other words, while the platform economy impacts on the lives of millions, only a select few usually have any say in how the platforms operate.

**Benefits and drawbacks of the platform economy.** At the early stages of the digital platform economy, researchers reported on the positive effects of platforms, including

higher production efficiency, lower prices, marketplace efficiency, creation of new markets, flexibility and accessibility for workers, availability even from remote locations, and new opportunities for individuals to make a difference in communities. Recent years have seen reports on negative societal impacts as well, such as unemployment rising due to technology, new forms of precarious work, falling tax revenues, political brainwashing, the personal data of people being treated as a commodity, depression and emotional distress, hate mongering and community breakdown. When assessing these impacts, it is important to note the many kinds of platforms in existence and their different governance systems. Not all platforms are the same. Besides, adjustments to existing administrative and governance systems could have a positive impact on societal development. The year 2014, for example, saw the launch of the social media platform Tsu, whose algorithm shared advertising revenue with the platform's users. Users found it hard to import their friends from Facebook onto the new platform, however, as Facebook banned links to the Tsu platform. Tsu folded in 2016. The administrative and governance systems of platforms may vary greatly but the fairness of the platform is far from the critical factor in their success.

**Table 1. Home continents of platform enterprises.**

Continent	No. of platforms	Market size (EUR bn)	No. of employees (m)
Europe	27	159	109
Asia	82	817	352
North America	64	2,744	820
Africa and South America	3	52	27

Source: The Center for Global Enterprise (2015)

**Enhancing the rights or wellbeing of Finnish people** is of little interest to platforms, as they are located mainly in the US and Asia. In 2015, only 27 platforms were established in Europe and they had a combined market size of only EUR 159 billion. For the sake of perspective, in 2015 Finland had a GDP of EUR 210 billion (Statistics Finland, 2018), whereas in the same year the 64 platforms established in North America held a market sized at a whopping EUR 2,744 billion. The leader in platform numbers is nonetheless Asia, with its 82 platforms, yet the size of the market there was only EUR 817 billion (See chart. The Center for Global Enterprise, 2015). The figures are from a few years back and the overall platform market is already estimated to exceed EUR 6,310 billion (KMPG, 2018). The pace of growth has been vast and the growth is presumed to continue.

## 5.2.2 Pressures on existing democratic administrative and governance models

The expansion of the platform economy has coincided with a change in the political climate, which has grown increasingly tense and is marked by a decrease in people's trust in politicians. Developments in digital technologies, globalisation, the change in the global order and platform economy have shifted power from both individuals and national governing bodies to multinational corporations and organisations. Concern over the effects of climate change is weighing on the population. They feel politically frustrated (Prime Minister's Office, 2019) and existing democratic, mainly non-digital administrative and governance models are subject to pressures for change.

**We in Finland have agreed on a system of representative democracy**, where government is elected from among the people to implement the will of the people. The legitimacy of Western democratic institutions is founded on the participation of the population through representative democracy, i.e. on their voting. Voter turnout in the West has continued to decline throughout the 2000s, however. Researchers are in disagreement as to the real causes and consequences of the decline, yet it has been established that the reasons are economic (e.g. challenges in reaching the economically less advantaged), demographic (e.g. young voters' passivity), cultural (e.g. lack of minority representation), technological (e.g. voting methods) or institutional (e.g. societal system for voting).

**In order to improve their personal living environment and circumstances**, people are increasingly turning to direct civic participation. Alongside traditional political participation, people in Finland are seeking to influence society by means of petitions, purchase decisions and NGO activity. Among the ten options provided, the next most popular one was contact with decision-makers (Finnish Election Study Portal, 2015, and Grönlund & Wass, 2016).

Citizens' initiatives and civic discussion forums are among the new innovative participation opportunities discovered by the Finnish people. The citizens' initiative was introduced in Finnish government in 2012. The spectrum of democratic innovation at the municipal level is broader and allows people to participate in decision-making through e.g. referendums, citizens' initiatives, advisory councils, citizen panels and online participation channels (Publications of the Ministry of Finance 2019:X). Systems that allow direct participation have been developed to augment representative democracy, and governance systems in general have seen much reform.

**Same trend the world over.** Forms of direct civic participation, or democracy innovations, have not grown more commonplace only in Finland but the world over in recent decades (Smith, 2009; Jäske & Rapeli, 2018). Democracy innovations have been shown to increase trust in political institutions even among those who do not actually make use of such innovations. They may, for example, facilitate brainstorming, locating various alternative



approaches, assessing outcomes, weighing different viewpoints and setting agendas. Digitalisation has made the use of democracy innovations easier and also made them more approachable and transparent for citizens, politicians and governance professionals alike. Nearly 90% of Finnish people aged 16-89 use the internet and online services (Statistics Finland, 2017). Digitalised versions of participatory budgeting, referendums and citizens' initiatives, various social media groups and virtual groups, feedback collection methods and discussions in fact reach the vast majority of Finnish people. Globally, voting platforms have been built using blockchain technology, while AI is used to analyse civic feedback. New technologies are making direct democracy easier to adopt.

**Our governance system is facing a challenging situation.** Politicians and other participants in representative governance systems often find forms of direct civic participation challenging, as these force them to operate in a space between two different and competing institutional operating logics (Adenskog, 2018). On the other hand, people also become frustrated if they feel that their efforts make no difference. Decision-making authority in our representative democracy is nonetheless vested in the democratically elected government. With the decrease in decision-making powers within the country, this is now also coming under pressure. The march of globalisation and platform economy mean that any number of things are no longer solely up to local decision-making. We should indeed locate new tools to make a difference on an international scale if we are to foster Finnish values and Finnish wellbeing.

### 5.2.3 How to exert an active influence in platform economy? New initiatives in administrative and governance systems

**Administrative and governance systems encoded into digital platforms** and based on new digital business logics present a challenge to our democratic systems. The notions of good and fair governance on technology platforms do not necessarily align with Finnish values and conventions in governance. The rights of individual users – or lack thereof – are encoded into the global application platforms. For users, or even states, for that matter, any negotiation with platform economy actors may prove rough going. An example comes from the recent Facebook scandals of the data of individuals being used for political profiling and users being targeted for political propaganda masquerading as news items. Despite intervention by both the US administration and the European Commission, there can be no guarantee that Facebook will mend its ways.

**States have two avenues of influence over the platform economy:** control mechanisms or new and innovative initiatives. The modus operandi of innovative initiatives is not to ban the activities but to introduce on the market new alternatives that change market mechanisms. Most such innovative initiatives take the form of code or another

innovative technology. The most efficient way of addressing deficient technology is often technological innovation. The Table below shows a list of various mechanisms of influence:

**Table 2. Mechanisms to influence the platform economy.**

Control mechanisms	New initiatives
taxation	'active' opening of market
regulation, e.g. competition legislation	new forms of taxation
standards	innovative regulation, e.g. 'sandbox'
market closure	new digital standards
	new commodity classes: Universal Basic Assets
	new multimodal forms of cooperation to build positive platforms
	creation of digital identity
	controlled greater mobility of data
	ethical AI that safeguards wellbeing
	blockchain platforms
	open source code
	reduction of adverse impacts of platforms
	new governance mechanisms

**The control mechanisms available to states** to turn the impacts of platform economies into a positive for society are taxation, regulation, standards and market closures. Many states have already experimented with these mechanisms, alone and in various combinations. In this context, market closure refers to banning market access from various national and international rival actors. However, in the long term, openness is believed to enable ongoing innovation and economic competitiveness. The government of Estonia, for example, opened up its taxi service market to Uber and other competing actors and agreed with them on the automatic reporting of drivers' income and tax details (Reuters, 2016). A location-based automatic condition was encoded into the platform. In the same way, the City of San Francisco and the Airbnb platform have agreed on a hotel tax that is charged directly to the platform's users as well as on a maximum number of days that city residents are allowed to rent out their permanent residences.

**Regulatory opportunities.** The EU's General Data Protection Regulation (GDPR) is an example of regulation that applies especially to platform economy governance systems and bolsters the rights of European citizens in the domain of personal data. In the US, the state of California has similar data regulation in the pipeline. Many countries have had positive experiences also of providing 'sandboxes' exempt from regulation to allow innovative digital platforms to be piloted under controlled circumstances. The necessary regulation is only formulated once the true effects of the pilot are understood in practical

terms. This allows clear objectives to be set for the new platform and influence to be exerted over the development of its administrative and governance mechanisms.

**Stricter application of competition law.** In the 1900s, companies got together in various industries to form cartels that allowed them to set their own prices. The US in particular responded with antitrust legislation to safeguard fairer benefits to citizens and to preclude such concentrations, which resulted in less polarised income creation. To date, platform economies have operated largely outside the constraints of competition law. If competition law were to be made effective vis-à-vis platform economies as well, the US and Europe would need to work together on the issue.

**Implementation of taxes, new taxes and assets.** Platform economies have been less than willing taxpayers. Underlying Amazon's early success in business was its avoidance of value-added tax. Customers would buy from Amazon because its prices did not include VAT. Existing taxes and their fair reporting and payment can be encoded directly into platforms nowadays, however. In technical terms, there is nothing to prevent this, yet tax innovations are also required if the tax base is to be expanded. One such innovation is the recent California proposal on a data dividend (San Francisco Chronicle, 2019). The new kind of tax base approach originated in Alaska and its annual oil dividend paid to all residents from oil revenues. The idea is based on the theory of Universal Basic Assets promoted by the California think tank Institute for the Future. The theory examines the re-distribution of private, public and open assets in a manner more reflective of the needs of the age of technology. The theory views data as a public asset that belongs to the residents of the state, much like oil. The same deliberation could apply to rights of ownership in e.g. data aggregators, processing power, robots, 3D printers and algorithms. Major platforms have also been active proponents of robotics. Uber, for example, has long been testing self-driving cars. However, the Universal Basic Asset theory would call for a discussion on whether it would be fairer for self-driving cars to constitute basic assets that could be used by anyone, subject to certain conditions – much like bridges that anyone can take to get from point A to point B.

**Potential of standards to promote wellbeing.** International standards have grown more commonplace with the advent of globalisation. Several communities and enterprises are developing standards for themselves and for their peer organisations in order to grow their markets and increase the usability of their products and services. One such body developing standards for its membership, and anyone else who wishes to adopt them, is the IEEE (Institute of Electrical and Electronics Engineers). Its P7010 standard, for example, establishes metrics to standardise the use of AI technology in applications to promote wellbeing and ethics. While major platform economy enterprises were involved in the drafting of this particular standard, no states took part in the project. Several technology standard projects also have active Finnish involvement.

**Reduction of adverse impacts of platforms.** The various new platforms have brought in their wake entirely new challenges relating to security, wellbeing and accessibility. Besides cybersecurity challenges, platforms are also associated with challenges including threats, fraud, bullying, disruptive behaviour, addiction and depression. Enterprises to address such challenges, such as the Finnish Someturva.fi that provides AI-based legal assistance, are needed not only in Finland but the world over. Accessibility for various population groups, the right to data and the right of influence also present a challenge in the platform economy. In Finland, for example, some building management companies rely entirely on Facebook to communicate with the occupants of the buildings they manage, yet the visually impaired cannot read their notices set against colourful backgrounds even with the help of assistive devices. One step in addressing such adverse impacts would be to develop a Finnish strategy to minimise the adverse impacts of platforms. Addressing the adverse impacts of platforms represents a huge market to which the Finnish technology industry could have much to contribute.

**Positive platforms** (IFTF, 2017). Another approach to platform economy issues comes from building new technology platforms that are designed from the outset to support the rights and wellbeing of people. Positive platforms are designed to address the challenges facing society. An essential component of such platforms is the generation of open, good and fair digital administration and governance. Human-centric administration models are thus already embedded in the coding, and the code of the platforms is often freely available under an open licence. The challenge in the development of positive platforms lies in paying the people involved for their efforts: the platforms operate on a non-profit basis and are thus often ineligible for financing from the open market. The innovation programmes of the European Union contain funds earmarked specifically for these kinds of development projects, yet the long-term funding potential of the programmes remains unclear.

**Dedicated state, city and local government platforms.** Several public administration organisations have taken up service platform design for themselves and are e.g. developing innovative forms of services in collaboration with enterprises and communities. A prime example of a new kind of platform economy service and innovative co-use of technologies in Finland is the artificial intelligence project AuroraAI, headed by the Ministry of Finance and building on the MyData approach (Ministry of Finance, 2018). The platform is intended to provide new types of services tailored to life events. AI will be made not only an ethical element but also one that enhances the wellbeing of the population. The development of positive platforms calls for cooperation across organisational boundaries, as evidenced by the involvement of various ministries, public actors and private enterprises in the AuroraAI project.

**Data mobility.** Platforms tend to hold on to their data in a bid to hold on to their customers. Article 20 GDPR guarantees personal data portability for individuals, yet in

practice only some platforms are capable of exporting data from their systems in any readily readable form. If data were to be able to move freely, its price would also be lower and we would be able to set up data aggregation systems. The quality of data would also improve because it would have to be governed by standards. This would play an important role in the development of more advanced AI. Improving data mobility would, in fact, have a material effect on the operations of platforms. Sitra, for example, has launched its IHAN project to advance the establishment of standards relating to the mobility of personal data.

**New governance mechanisms for innovative technologies.** Blockchain technologies and other distributed technologies, for example, can be used to build new platform economy actors based on logic that is more supportive of people and society. One of the major benefits of such technology is to encode the trust between the transactional partners into the very structures of the technology platform. The first pilot project using blockchain technology – Bitcoin – has brought about the perception that blockchain technology would have the aim of eliminating central administration. However, the development and various pilot projects of blockchain technology have demonstrated that the applications work well within a democratic administration. The administrative approach chosen for the platform through technology choices is what becomes the important question (De Filippi & Wright, 2018). Graglia & Mellon (2018a) have studied the administrative implications of different kinds of blockchain platforms in cadastral registers. The administrative and governance impacts of e.g. the pilot project in Finland involving data on limited liability housing company shareholders should also be carefully scrutinised. The pilot transfers governance control to banks and this would warrant consideration of what would happen if e.g. a bank ceased to operate and its data had not been federated, or of how to prevent the possible biased pricing that a banking cartel would enable. Blockchain architecture is about transferring power, and it is important to review the practical implications of such transfer before the fact.

**Electronic identity.** Reliable electronic identity is the starting point for positive platforms. Current email-based identities for individuals and enterprises represent the weak link in the security of the platform economy and open up the potential for abuses. National identity schemes fall short of the requirements on supranational platforms. Reliable distributed electronic identity systems where the owner of the identity can control their personal digital identity (Self Sovereign Identity, SSI) can be implemented by means of blockchain technology. SSI identity technologies, such as Sovrin and Everest, are currently at the pilot phase (Graglia & Mellon, 2018b). Instead of personal data being stored in the blockchain, the blockchain and cryptographic identifiers are used to allow the recipient of the data by other means to verify the correctness and validity of the data provided. The organisation MyData Global established in Finland considers self-sovereign global identity to be a key technical enabler of the MyData approach (MyData, 2018). More than one SSI

pilot is currently underway in cooperation with states and local government. In the US, for example, the state of Illinois has in place a digital birth certificate and identity pilot with the self-sovereign identity of the Sovrin Foundation.

**And what now?** In the digital economy, the fundamentals for wellbeing can be encoded into digital platforms. We are currently living in a time of flux that is bursting with new experiences. AI, blockchains and other new technologies can be harnessed to promote our wellbeing and democracy, but this requires coming up with novel ideas, locating alternative approaches, evaluating outcomes, weighing up different viewpoints and setting agendas. What is essential to the continued existence of Western democracy is for the digital platforms used by the population to have in place good administrative and governance policies. New technologies have the capacity to take platform impacts in a positive or a negative direction. It is vital that we move ahead with pilots and then review our experiences in order to make improvements. The list above should provide ideas for initiating debate and designing the pilots.

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## 5.3 Blockchains after the hype: what's up in blockchain technology and other distributed ledger technologies from a public administration perspective?

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The tech hype around blockchains peaked in the autumn of 2018. Now that pilots are already up and running around the world and we have a better basis for examining the suitability of blockchain and distributed ledger technologies (DLT) in public administration, it's a good moment to stop and take stock. What have we accomplished and where are we now? When will blockchains prove actually useful and what will they be used for?

Blockchains continue to rank high in technology forecasts as the technology of the future in public administration (e.g. Gartner, 2018). They are expected to deliver efficiency and value added and to change the way society works. While studies have yet to uncover clear and measurable impacts, these are presumed to become visible in public administration as early as in the current year (Stanford University, 2018) or over five-year horizon at the very latest.

### 5.3.1 What are blockchains now? Clarifying features and potential

#### 5.3.1.1 Out with the hype and in with the everyday

In 2016, I wrote an introductory article on blockchains for the first Glimpses report. The opportunities of blockchain technology were written in bold and enthusiastic letters at the time. Today, reports on blockchains have become more mundane and many in fact feel that they have had their fill of news items detailing fortunes made and lost with cryptocurrencies. The blockchain hype was especially fevered in 2017 and it peaked in autumn 2018 (Gartner, 2018). The reality turned out exactly as is so often the case when

evaluating a major paradigm shift in technology. In the short term, the pace of change was overestimated while the long-term effects of paradigm shifts tend to be underestimated. This may well prove the case with blockchains as well.

### **5.3.1.2 So many reports, so many ideas, so many pilots**

In the past two years, numerous countries have conducted studies of blockchains in public administration focusing on a wide swath of activities from healthcare to identity and elections to central banks. There is no shortage of ideas or reports, and no lack of pilot projects either. Finland has put in place its share of pilots, such as the credit card for immigrants and a housing trade application. Excellent collaboration plans and agreements are also in place. All of this is for the good, because things are exactly as they should be at this point. It has been a time of introduction. What all the studies boil down to is that blockchain technology in theory is basically a chain of time-stamped data blocks held in more than one location at the same time. In practice, however, the technology is so nascent that its applications have left much to be desired, and evolution takes time. There does nonetheless appear to be a consensus that blockchains are believed to hold vast potential.

### **5.3.1.3 Terminology**

In a manner typical of technological innovations, complex terminology is used to describe the details and actions relating to blockchains. The jargon has done little to foster communication and faith in the technology. For this article, I have compiled a brief vocabulary appearing in two separate Tables, the first of these on the following page. In the same breath, I must admit that in this article I tend to use the term 'blockchain' its broadest sense, giving it the same meaning as it has in everyday parlance – to refer to any distributed trust technology in general..

### **5.3.1.4 Something old: trust and a new accounting system**

Despite the considerable progress made in blockchain technologies, their original promise continues to hold:

*Blockchain technologies are database architectures in which trust is automated by a protocol. Blockchain technology not only eliminates any need for supervisory third parties, but it also provides a secure solution for the most important resource in our digital society, data. The manner in which trust and data are governed and by whom has a material impact on power structures, business opportunities and the operating models of society.*



This makes distributed trust technologies especially important from the public administration perspective, because one of the main missions of public administration is expressly to serve as a supervisory third party in advancing the wellbeing and interests of the population. The volume of data and the number of transactions in public administration are constantly increasing and this ongoing trend will also boost the need for an automated trust protocol.

**Table 3. Blockchain vocabulary, part I.**

Term	Explanation
Distributed ledger technology, DLT	Database architecture in which the transaction register storage is distributed among multiple servers or nodes. Blockchain is a DLT but there are also others.
Blockchain	Distributed ledger architecture designed in 2008 by a person or group using the pseudonym Satoshi Nakamoto. A blockchain is a database in which different actors produce and maintain a transaction register jointly in a distributed manner. Transactions are time-stamped and recorded in the register, or the blockchain, in order of time, and all actors in the distributed ledger hold the same blockchain on their server. The data are recorded in a way that prevents them from being falsified or altered, in addition to which the parties validate acceptable data. Public key encryption is used to authenticate confidential data. In other words, blockchain is a method of storage, validation and encryption. Its first application was the Bitcoin cryptocurrency.
Cryptocurrency	Medium of exchange similar to money and based on DLT, however not legal currency issued by a central bank. Under Finnish law not a security but a commodity.
Stablecoin	Cryptocurrency designed to minimise volatility in price. Pegged to a currency or commodity, e.g. gold.
Initial coin offering, ICO	An ICO is similar to an IPO in that it is a type of funding using cryptocurrencies. In an ICO, the company hands over pre-mined cryptocurrency instead of the shares that change hands in an IPO.

### 5.3.1.5 Blockchain properties

It has also become increasingly clear which technologies satisfy trust requirements and which do not. The aim of the blockchain is to increase trust through the database being maintained by more than a single administrator. However, not all distributed ledger architectures are blockchains, as these must have four essential properties:

**Tamper proof:** Everyone has access to inspect the contents of the blockchain and every transaction is verifiably and securely recorded in the blockchain. The data are also traceable and part of the transaction history, and cannot be altered after the fact.

**Collaborative:** This means that every actor is motivated to be involved and the trust between them is pre-programmed.

**Distributed:** The advantage of the blockchain lies in that the database is distributed across several locations at the same time, making it difficult to falsify. The data are automatically backed up.

**Disintermediated:** This is the greatest advantage of the blockchain. Blockchain operation is divided among multiple actors that may represent highly differing interests. Transactions may be approved within an independent process among multiple actors, in which case the blockchain serves as a consensus mechanism and ensures that all actors are in sync. Disintermediation guarantees the correctness of the blockchain and enables trust in activities without the involvement of any third party.

These properties bring about more efficient transactions and allow parties that are unknown to each other to transact with trust. They are at the core of blockchains.

### 5.3.2 Reality check: where are we headed?

#### 5.3.2.1 Blockchain fatigue

The hype has permeated the media, who have dedicated many column inches to DLT cryptocurrencies and the ICOs of blockchain enterprises. In 2017, the bitcoin appreciated by a factor of 15, only for its value to plummet back down in 2018. Many other cryptocurrencies followed suite. Over the same time frame, many blockchain enterprises raised millions of euro through ICOs, many of which were nothing more than pump and dump schemes. The value of the ICO was artificially inflated, for example by giving huge discounts to initial investors who then sold off their tokens immediately at the conclusion of the ICO, before prices could fall. There were also technical mishaps and many investors were left with their token holdings in locations from which they could no longer be exchanged. A further black mark against the technology came from the DAO investment fund, part of whose funds were siphoned off by cybercriminals and which was rescued by creating a new fork in the Ethereum blockchain.

Ventures such as these have given blockchains something of a cowboy reputation. However, they are not proof that the actual blockchain technology, on top of which the ventures were coded, would not work. The blockchain community is now trying to salvage its reputation in the financing business through means such as stablecoins. However, this article will not delve further into cryptocurrencies and the financial side of the business, because although they may have a mental impact on the credibility of the technology, in technical terms these are irrelevant to public administration blockchain systems.

### 5.3.2.2 A realist point of view

Professor Arvind Narayanan of Princeton has studied distributed ledger technology and calculates that the current incarnation represents the third attempt at its wider dissemination. His studies reveal that the previous two attempts failed because the importance of implementing social values trumped the magnitude of the practical challenges. His fields of study include personal data control, where the data stored on users' computers provides control but makes the users responsible for updates, backups and security standardisation of the software on which the system runs. Narayana's conclusions on the weaknesses of distributed ledger technology:

- Distributed ledger technology requires the installation of software
- Control over data adds to the user's burden
- Failure to install software and update it may give rise to security threats
- Distributed ledger technology lacks economies of scale
- Lesser network reliability and slower to use
- Data management and aggregation challenges, e.g. data searches and fraud detection

All of the aforementioned challenges are real ones but solutions have already been developed to address some of them. All in all, moving forward they must nonetheless be taken into account.

### 5.3.2.3 Issues with blockchains in general

Various pilot projects have pointed out considerable shortcomings in blockchains, including slow transaction speeds, lack of interoperability, electricity consumption and its cost, lack of legislation and regulation to support the technology, lack of cooperation. Blockchains themselves are also blissfully unaware of what is true and must instead be told this from the outside. Even smart contracts have loopholes and inconsistencies with legislation. Moreover, the GDPR raises thorny situations when personal data have been stored in a blockchain. On the upside, we do have a list of clear issues that the blockchain community has set out to address and, in many instances, has also already managed to solve.

### 5.3.2.4 Onward and upward

The current generation of blockchains is number three and the fourth is in the pipeline:

- First-generation blockchains, for example the Bitcoin blockchain since 2008, were simple proof-of-work consensus chains. In these chains the nodes that mined the most also held the power.

Blockchains were simple payment processors of sorts (see vocabulary below). First-generation blockchains also include several closed centralised blockchains.

- Second-generation blockchains, starting around circa 2015, no longer all operate on the basis of proof-of-work consensus. The additional functions introduced in this generation were the most important change, however. One such blockchain is Ethereum, with which smart contracts and distributed online applications can be designed.
- Third-generation blockchains started to develop in early 2017 and are no longer blockchains per se. Their aim is to address the issues seen with earlier blockchain in terms of energy consumption, centralisation, slow transaction speed and cost of use. The distributed architectures of third-generation blockchains above all provide economies of scale. Examples of such blockchains include IOTA (Tangle), Nano (Block Lattice) and Skycoin (Web of Trust).
- The design and piloting of fourth-generation blockchains remains ongoing. For the most part, they are solutions similar to third-generation blockchains but incorporate AI components. Their nature and benefits still remain to be seen

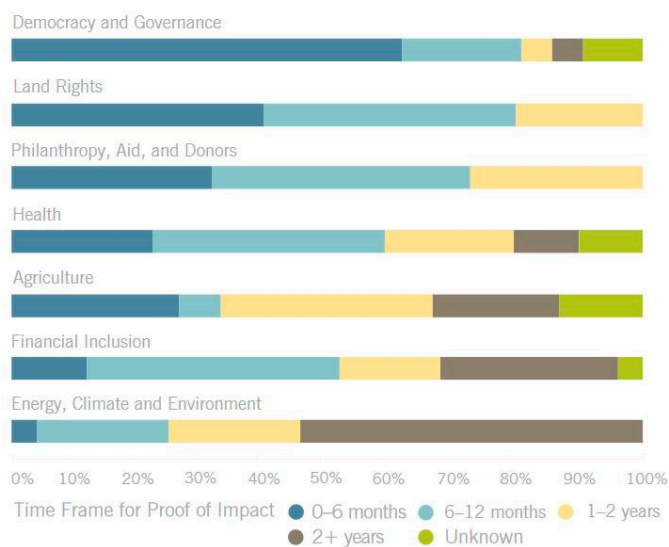
**Table 4. Vocabulary, part II.**

Term	Explanation
Decentralised application, DApp	Application located in a peer-to-peer network and not controlled by any individual organisation.
Proof of Work Proof of Stake	The original blockchain mining verification mechanism, the Proof of Work, is based on network calculation capacity. Many more recent blockchains use the Proof of Stake, in which possession of coins entitles to a stake in the mining network, and the coins held thus deliver a dividend of sorts on the rewards from mining.
Consensus	The consensus algorithm is responsible for creating new blocks and enforcing compliance with the rules. It allows all participants to make changes to the database but only within the confines of certain pre-determined rules.
Node	Every server or computer in the blockchain with a copy of the distributed database constitutes a node.
Hash, hashing	Hashing is the cornerstone of reliability in blockchains and it ensures the integrity of the database. A hash value is calculated for each block in the blockchain and copied to the following block. The data and hash copied to the second block are then hashed again to form a new hash that is copied to the third block, and so on.
Smart contract	Smart contracts are self-executing authenticated coded logical processes done in advance that are capable of enforcing not only agreement execution and conclusion but also compliance and, when necessary, they are also capable of imposing sanctions. Smart contracts are computer programs located in a blockchain.

### 5.3.3 Blockchains, seriously: Are they of any use in public administration? And if so, how?

#### 5.3.3.1 Are blockchains of any use?

Evaluation of blockchains and block projects. Ordinary technology evaluation methods are ill suited to the evaluation of blockchain technology and blockchain pilots because of the complex ecosystem effects. In Japan, the Ministry of Economy, Trade and Industry developed a dedicated evaluation framework for blockchain projects (METI, 2017). No clear measurable effects have yet been verified in public administration. The Stanford University report (2018) on the social impacts of blockchains expects these to become visible already in the current year. Gartner (2018) estimates a time horizon of less than five years. The Stanford report moreover observes that blockchains are the closest to having real social impacts expressly in the field of government. The same report notes that Estonia is the country farthest along in government blockchain application impacts when compared to the other countries studied.



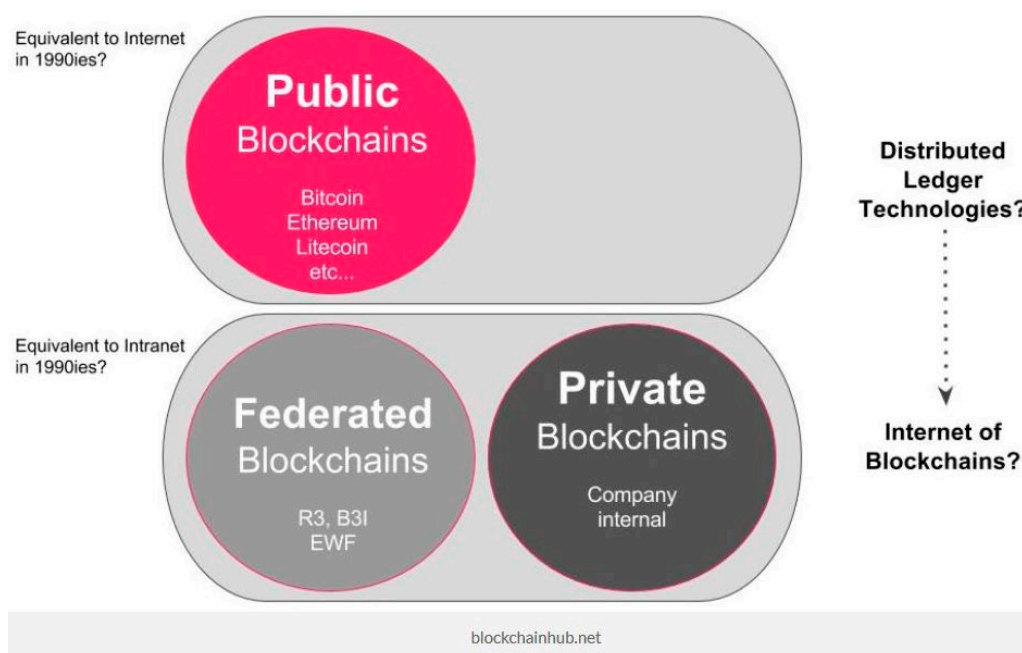
**Figure 17. Presumed time frame for impacts of social blockchain applications.**

Source: Stanford Graduate School of Business, Blockchain for Social Impact (2018)

#### 5.3.3.2 How to boost impacts?

Public blockchain applications of maximum openness bring about great change, whereas closed and private applications are more suited to incremental efficiency and security solutions. The different degrees of blockchain openness have been compared to the impact of the internet and intranet in the 1990s. The majority of current public administration

projects remain somewhat closed or federated applications. Graglia & Mellon (2018a) have compared blockchain applications in cadastral registers in various countries as well as their differing openness structures and impacts, while De Filippi and Wright (2018) also speak in favour of public and open solutions to boost impacts. Earlier on, more open applications were challenged by technology challenges and transaction costs but these issues have been addressed with the advent of third-generation blockchains.



**Figure 18. Differences between public and private blockchains**

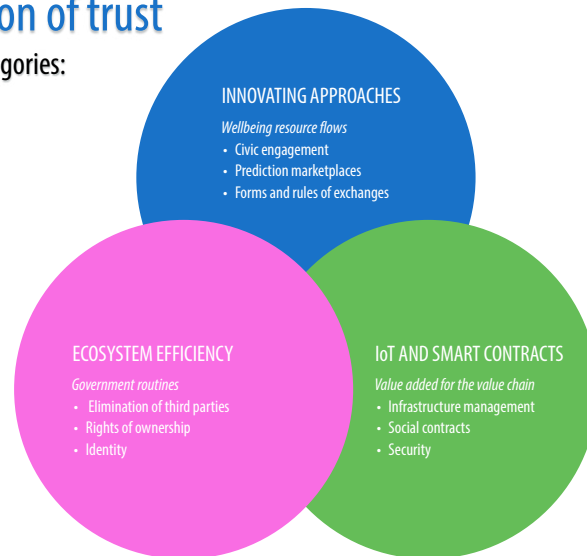
Source: [Blockchainhub.net](http://Blockchainhub.net)

### 5.3.3.3 What kind of applications should we be focusing on right now?

In my introduction to blockchains in the first Glimpses report, I divided applications into three distinct categories: ecosystem efficiency, value added to the value chain, and innovation of structures and operating models. Most of the applications currently in operation can be found in the area of ecosystem efficiency, which is indeed the easiest point of departure, as impacts can easily be verified and participants can fairly easily be motivated into collaboration. Some applications have been launched in the area of value added to the value chain, driven by IoT in particular, but much remains to be done in this sector. Any appreciable savings and changes will only come about from the innovation of operating models, however. At the top of the agenda in this regard is the determination of 'oracle' functions, i.e. who gets to decide what is correct data. Current public administration units could well be trained for these duties and new kinds of business models could be developed.

## Automation of trust

Application categories:



**Figure 19.** Development categories for government applications.

### 5.3.3.4 So now what do we do?

- Just get to it in designing and piloting applications
- Take into account the motivations of the various groups in design. Consider all parties that need to become involved.
- Consider the target and the genuine need. Where best to win impacts on the various parties? What are the KPIs?
- Which and what enablers are needed to join in (communities, legal aspects, technology)?
- 10x, or how is this service ten times better for end-users than the current situation?
- Focus.

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## 5.4 Financial sector in transition: innovativeness of operating model now determines success

*Ilkka Lähteenmäki, Aalto University*

### 5.4.1 What has happened over the past two years?

In our Glimpses article on finance two years ago, we noted that financial technology (fintech) is a driver that is changing the dominance between service providers and customers in particular, i.e. tipping the scales for the benefit of the customer, and we argued that blockchains and distributed ledger technologies would “let us see new kinds of business models where the primary objectives of the customer in particular are taken into account when designing the services and their processes”.

Since January 2019, Finland has had in place the digital housing trade platform DIAS that integrates and automates several home-buying processes. DIAS is an example of applying distributed ledger technology to allow ‘smart contracts’ where a self-executing computer program built on programming code (for more detail, see Etna 2016) replaces traditional written deeds of sale and conveyance. DIAS represents the first generation of distributed ledger technology and large actors remain quite dominant in both its development and distribution. However, it is foreseeable that at the time of reading the Glimpses report following this one, a few years hence, many traditional banking and insurance services will have migrated to platforms produced purely by third parties, and that customers have a wide range of choices as concerns the platform used as the distribution channel. Over the same time frame, platform services such as DIAS and its successors will transition more into actors which award contracts to service providers rather than the holding their current role of distribution channel.



In 2017, we also observed that technologies, in particular IoT, blockchains and distributed ledger technologies, would be a significant but slow (years-long) force for change in the in-depth processes of finance. In February 2019, JP Morgan unveiled the first in-house cryptocurrency of a US bank, the JPMCoin, to the bank's major institutional customers. JPMCoin has very little to do with Bitcoin or the entire category, yet the launch is illustrative of how blockchains and distributed ledger technologies can effect change in the aforementioned in-depth processes, for example international payments between major institutions, by making these take place in real time, or replacement of the euro- or dollar-based treasury services used by major corporations. Whether the JPMCoin is actually a cryptocurrency or another 'digital thing' will spark many an interesting conversation. In any case, we reiterate our opinion that the time horizon for banks' internal systems to be replaced by blockchains is a very long one. The regulated equity token, on the other hand, may quite quickly allow a wholly digital issue of securities of various kinds. The Master's thesis of Olli Taka-Anttila at Aalto University is one of the first scientific approaches to ICOs, i.e. the blockchain-based way of obtaining corporate financing. Even though the ICO model in and of itself will not be the game changer that will allow e.g. a small start-up to finance its growth, the bigger picture shows us how technology is bringing about changes in traditional institutional structures and approaches. Where a few years ago technologies themselves were believed to revolutionise finance, we have now moved on to a phase where business model innovation is considered to be the site for the actual revolution.

Are the status and operations of traditional actors such as banks and insurance companies thus under threat from new actors? If research is capable of replying to this question, the answer would be 'no'. New actors, from smaller technology-enabled start-ups to major international platform enterprises, will markedly change both internal industry processes and the consumer experience visible to customers, not only through competition but also collaboration between the various actors. This will not wipe traditional banks off the map, however. New technologies (some of which are less than 50 years old), on the other hand, will play a major role in developing the business of traditional actors, either through internal efforts, with the assistance of third parties (e.g. fintech enterprises) or in broad ecosystems, such as the joint development efforts of several European banks with distributed databases (e.g. Corda and Hyperledger). With regard to enhancing efficiency in finance, compliance and reporting constitute a sub-sector of technology. Regulatory technology, or RegTech, is indeed among the research areas into which we have only recently ventured and which gives finance sector actors an opportunity for shared technology utilisation.

During the huge tides of changes in finance, we in Europe fail sufficiently to comprehend and analyse the significance of Chinese actors. Their service platforms and they themselves may, in many senses, still be far removed from our Western ideas in terms of i.a. information security and personal data protection, yet a prime example of a service

entity in which nearly all services needed by the average user are integrated under a single main application can be found expressly in China: the WeChat multipurpose platform developed by Tencent. Chinese 'BAT' actors (Baidu-Alibaba-Tencent) will in other respects as well have a major impact, in one way or another, on the service offering experienced by us. In our research genre, we have already taken a major step forward in understanding the forces of change blowing from the East.

### 5.4.2 About technologies

A few years ahead, we may well have self-guided cars based on the use of AI. Could we therefore also have AI-based self-guided financial services? And which will we have first?

Underlying the positive customer experience in online shopping are often AI and data analytics of a high calibre. As consumers doing online business with national and international traders on a daily basis, we grow accustomed to a standard of service that becomes the de facto expected standard in financial services as well. In principle, financial actors have huge volumes of data on their customers' interactions with them and this data can be utilised in the development of financial services. A major consideration, and one that many will find hard to comprehend, will be the role of financial services in an increasingly integrated service entity in terms of value generation to the customer. What is the **primary** value of financial services to their customers? How often would you use a nifty payment app just for the fun of it? On a conceptual level, we have been clearly able to demonstrate the subordinate role of financial services relative to other services we use. Financial services have no primary and intrinsic value. There is always a higher-priority reason for using financial services, one that has to do with the customer's activities and one that is enabled or supported by the financial service. This being the case, any objectives relating to the use of AI (and other technologies as well, of course) regarding the efficiency and seamlessness of processes do not, in fact, apply intrinsically to the financial process itself but rather to the manner in which the service relates to and is integrated with the customer's primary process. It is this aspect that determines the customer experience with the financial service and its potential capacity to generate value.

In our institutional mindset, where we have come to see banks as central societal actors, adopting the above approach may prove challenging. However, real-life examples have already demonstrated how the development of financial services must be viewed as part of the wider and dynamic activities and achievement of goals by the customer and not as the accomplishment of banking as a discrete action having intrinsic value. The AI application NOMI of the Royal Bank of Canada, for example, is splendid at streamlining the customer's banking and it makes proactive use of data without any effort on the part of the customer or any contribution to the service provision by bank personnel, yet it also works traditionally in the sense that it has only been designed from the banking

perspective instead of being linked to the wider and higher-priority process of the customer. The French insurance behemoth AXA has in place the Fizzy compensation service for delayed flights. Fizzy uses application programming interfaces (API) to access data relating to the customer's air travel and when the conditions for compensation are triggered (flight delay vs. terms of policy), the system automatically pays to the customer the compensation specified in the contract. Fizzy is an example of how technology enables a contextual approach, the primary function in this instance being the customer's travel and the success of which is supported by the financial service.

API, distributed ledger technologies (in some instances even blockchains), AI and platform models are examples of technology that make it possible for services to be integrated and automated, allow multi-directional platform services to be created and enable comprehensive (wide-ranging) services that are of relevance to the customer. In terms of financial services development, individual technologies or even the sum total of technologies do not hold the key to success; the bigger picture arises from the change in the industry's business models.

### **5.4.3 Ecosystems: adding a new dimension to business models**

The concept of ecosystems has climbed high on the hype scale of business functions in recent years. The earlier way of describing links beyond an organisation's own boundaries by means of relationships and networks was found insufficient and was supplanted by the concept of ecosystems, originating in the field of biology. There is nothing wrong per se in using the new concept, provided that it is defined with sufficient precision in its context and its relationship to earlier concepts with similar meanings is described. The ecosystem has already been well and appropriately described (see e.g. Kuivalainen in this report), yet in the context of financial services development it is important to understand its systemic significance, as implied by the word alone.

Whereas networks earlier described (and of course continue to describe) a specific, fairly precisely defined (sub)group of actors, the description of ecosystems comprises an entity that must independently generate an outcome. In this sense, networks can be a part of ecosystems but the ecosystem itself as a whole must be made up of modular and complementary elements linked by a system of coordination.

#### **5.4.3.1 Innovation ecosystems**

At the HICSS 2019 conference (Still, Lähteenmäki, Seppänen, 2018), we presented a description of the way finance actors make use of the ecosystem model of distributed ledger technology application in developing new services. We gave as examples the Corda platform of R3 and the Linux-based Hyperledger platform. Three of the largest banks

in Finland are involved in these example ventures. The most interesting observations in the presentation data had to do with the rate at which major European banks have joined in innovation ecosystems that are developing the utilisation of distributed ledger technologies. The ecosystems have accelerated the banks' own learning and innovation speed, while at the same time the resources employed in the development are partly owned by third parties. Shared resource use included, data resources are indeed one of the most interesting subjects of research in digitalisation development, business models, governance models and management. The new kind of ecosystem management differs radically from customary models and know-how requirements, and even though at first glance one might think that more traditional networks within a single business area would provide a sufficient basis for know-how and management in the systemic approach required by ecosystems, unfortunately this will not be the case. In ecosystems, the collaboration between e.g. competitors on the one hand and the balancing of competition on the other calls for an understanding of the bigger picture and the governance model that produces the best end result.

#### **5.4.4 Innovators, collaboration between traditional actors and newcomers**

Finance innovations are no longer made solely within the confines of the industry as traditionally perceived. Newcomers to the industry have often been small 'fintech' start-ups, whose innovation efficiency is based on open-mindedness and the desire to design services that differ substantially from what is customary in the industry with regard to e.g. speed of service or degree of automation. Only a few years ago, fintech enterprises were still perceived more as rivals to traditional actors than partners to them.

The biggest achievements in innovation in the industry have nonetheless been made through cooperation between the two. 'Open banking projects,' for example, have combined the investing capabilities of traditional actors with the innovation capabilities of smaller ones. Open banking projects are less about new technology and more about a new business model in banking services. Information-sharing and cooperation between institutions and third parties can broaden the range of services available to customers while allowing each actor to focus on their core expertise.

The innovativeness of small actors is counterbalanced in the finance industry to an increasing extent, by major platform enterprises referred to by two umbrella terms based on geographical location: GAFAM refers to Google, Apple, Facebook and Amazon in the West, while BAT stands for the Chinese Baidu, Alibaba and Tencent. Without going into specific detail on the particulars of these actors in the development of financial services and competitive industry innovations, their significance in shaping especially consumer expectations with regard to standard of service must be noted.

Cross-over recruiting between finance sector actors and major platform enterprises is brisk both ways. Platform enterprises are hiring experienced developers from the finance sector to provide their own financial services while banks are looking to the platform enterprises to hire data specialists and programmers in particular. One might predict that within a few decades, banks and major platform enterprises will bear remarkable similarities to one another in terms of their business models. Perhaps it will be only then that we see the true meaning of finance and technology integration – which, as stated, is likely to be something different from the current concept of fintech.

The Master's thesis prepared by Lauri Lassila at the Department of Industrial Engineering and Management at Aalto University examined the threat posed by technology-utilising enterprises (both small fintech start-ups and established leading platform enterprises such as Amazon, Facebook or Alibaba) to traditional banking actors. The thesis firstly concluded that digitalisation has enabled a new kind of competition and also made it possible for traditional actors to retain their considerable tool kit for building entry barriers for the new market entrants. Access to the distribution channels consisting of traditional actors and the industry protection afforded by regulation remain substantial entry barriers, yet the change brought about by competition is also influenced by the conservative attitudes of customers to banking service providers, the high threshold for switching banks, and trust-related issues. In his thesis, Laurila discovered 17 distinct entry barriers in all. The thesis further covered differences in the entry barriers to two different categories of actors.

Small fintech enterprises encounter a wide range of barriers while “leading platform enterprises are capable of overcoming most barriers thanks to their ample resources, strong technological capabilities, and established distribution channels” (Lassila 2018). This reinforces the view of smaller fintech enterprises being more of an opportunity than a threat to traditional banks, whereas the threat posed by major platform enterprises, in both the East and the West, will only grow. Platform enterprises whose expansion into finance has been technology-driven are capable of providing highly cost-effective banking and insurance services that are organically linked to the other processes of the customers served by them.

#### **5.4.5 The dilemma of management: how to update the road map to reflect actual terrain**

Around five years ago, our research community was roused to ponder the challenge of management at traditional finance sector actors with their operating environment undergoing powerful changes. Several change factors have been defined: not only the pressures for change arising from new technologies but also the challenge posed by customers to provide them with better services, the tightening innovation race with new competitors (from small fintech enterprises all the way to international tech giants), along

with regulatory changes such as PSD2 (second Payment Services Directive that requires banks, with the customer's consent, to make their customer data accessible to third parties). Amid all this change, the challenge to management manifests in particular in the ability to grasp the change taking place in the operating environment. Mental models are a way of making sense of that environment, and if the model is rigid or warped, the change will not be expected nor examined or responded to appropriately. The finance sector in particular, for a number of reasons, has been an institutional sector and this shows in the mindset of both customers and service providers: "this is how we have always done things". Legislation as well has supported the immutability of the industry to these days. In this sense as well, PSD2 represents a break with the past, since unlike before it expressly seeks to open up the industry to parties beyond traditional industry boundaries and thus to increase competition. The authorities, too, have finally woken up to the fact that the finance sector (in the case of PSD2, the banking industry) has been slow to innovate new services. PSD2 is indeed a prime example of how highly regulated industries are being opened up to competition, and the idea underlying e.g. the IHAN project headed by Sitra is an 'industry-independent' PSD2 that enables not only the fair use of data but also the creation of better services by promoting competition.

It is interesting to observe how the decades-running digitalisation continues to focus on the automation of existing operating models rather than on innovating new operating models that favour consumers. Besides the development of traditionally distributed services (e.g. stand-alone mobile applications), the market entry of new actors has boosted also the utilisation of distribution channels other than those of the finance sector actor itself in reaching customers and especially in integrating financial services with the customer's primary process and with the other actors whose services are also used by the customer. When the challenge of management is combined with a need for real-time service processes and lean, silo-free organisations, this way of thinking is only a hop and a skip away from understanding the status of financial services within the customer's systemic service needs and the relevance of the customer's own dynamic operating environment to the type of banking or insurance services required from time to time.

#### 5.4.6 What to keep an eye out for next?

The Financial Brand on 6 February 2019<sup>8</sup> an article entitled "8 Technology Trends the Banking Industry Must Act On In 2019". These trends were:

1. using data and AI for personalisation at scale
2. voice-first banking
3. open banking
4. digital-only banks
5. cybersecurity

6. the threat of Big Tech
7. blockchain tipping point, and
8. cloud-based solutions.

In terms of research, such a list is worse than useless, and in terms of business development it may in fact prove dangerous. There are of course technologies and other matters that become drivers of change, yet the technologies may, especially when considered in isolation, point in the wrong direction in the terrain of business development. As individual route markers, they have their benefits but only when all material markers are taken into account to formulate an overall view of the situation and the direction in which business development should next be heading.

#### **5.4.6.1 Faster financial services, or different ones: from technology to open business models and contextual overall services**

As noted above in this article, new technologies are major change drivers in financial services. The technologies themselves and a focus on them are not key in terms of business development, however. Technology has been used to improve financial services for at least 60 years. To date, the work has mainly been carried out with an institutional approach, i.e. retaining a traditional and therefore actor-driven basic principle and processes in finance. The institutional approach also entails the notion that many aspects are a given and beyond anyone's control ("this is how it's always been"). The approach further carries the idea that any individual actor is a 'market taker' that has little or no opportunity to influence the market (cf. Storbacka and Nenonen, 2015), its essential concern only being to react and respond to challenges posed by the market. New actors or the platform-based approach favoured by them may not necessarily alter this attitude towards the market but for some reason, the ongoing changeover to platform models, service integration and modular service complementation, as well as a powerful understanding of the customer's own value creation with the help of customer data, have provided the moment where progressive actors in financial services, too, have realised that they are able to 'script' the market, i.e. to re-work it. Socially constructed entities in the form of ecosystems have made it possible to innovate operating models instead of focusing development efforts solely on services or processes. Innovative operating models in turn have enabled a leap forward in industry competition. This has been the case with tech giants in the Chinese market; the Chinese Tencent has grown into one of the largest financial institutions in the world. The greatest challenge to traditional actors along this evolutionary path is the rigid adherence to the traditional way of thinking described above, with innovative thinking confined to a narrow consideration of own operations.

### 5.4.7 Summa summarum

There is no doubt that we are living in times of fast-paced change, and the finance sector is no exception. The utilisation of digitalisation and modern technologies has wrought substantial change among industry actors. JPMorgan Chase, the largest bank in the US, has grown its market cap by USD 150 billion from 2016 to 2018 (USD 235bn v. USD 385bn) while over the same period slashing its staff from 245,000 to 165,000. Without comment as to whether this is a positive or negative development, it is nonetheless illustrative of the huge changes taking place in the finance sector.

Technologies are powerful drivers. In terms of business management, however, it must be understood that actual changes take place at the level of business models in enterprises and not in the technologies themselves or in the services relying on them. The path of fine-tuning old business models through the introduction of technology is coming to an end. At the same time, this change has become a mental challenge for traditional actors. Changing operating models also involves concepts that are deeply rooted in the organisations, structures, indicators, processes, skills and corporate cultures of those long established in the industry. The old industrial-era notion of organisations' economies of scale has, in the new approaches, been traded for external resources, network influence and ecosystemic structures. The 'legacy' of management poses a greater risk to actors than the old systems ever. On a positive note, it's nice to know that we have work ahead of us!

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# Digital security

– the enabler of trust



## 6 Digital security – the enabler of trust

Maintaining trust will be one of the key challenges of the 2020s. Knowledge, data, will only further grow in importance in the coming decade. How will we ensure the security of existing services and enable the secure deployment of new technologies?

### 6.1 Security and trust in the development of technology

*Jarno Limnell, Aalto University*

Advances in technology are bringing about increasingly intense digitalisation and interdependence and these are moreover constantly expanding to new sectors. Along with artificial intelligence, the Internet of Things, robotisation and new service models, they will change both society and the way we live, act and work. As a result, the services and processes required by public administration, enterprises and individuals will become increasingly dependent on the operation of the digital environment. It is thus clear that moving forward, the importance of digital security will become heightened in Finnish society and business (every company is already a digital company) as well as in the daily lives of people.

Technology is a double-edged sword: it both adds to insecurity and holds the key to a Finland that is more secure and functions better. Whatever we may think about it, in the future we will have to learn to live in ever closer quarters with technology. We must be able to turn the seemingly unstoppable, accelerating and increasingly radical advances in technology to the advantage of Finnish society and the Finnish people.

At the same time, political decision-makers and citizens alike find it hard to keep up with the pace of change. Even though in the present we often overestimate the force of change, futurists estimate that over the next thirty years, humankind may see more change than over the past three hundred years combined. When it comes to Finland, to the future and to security, advances in technology are a topic that must be addressed.

The acceleration in the pace of technological development is set to deliver more than one surprise in the near future and estimating the effects over a horizon of even five years poses a genuine challenge.

**This development must centre on two things: people and trust.** Each of us. If technology is a game-changer, how will it change people and the building of trust?

There are two keys to this solution. Firstly, we must make sure that technological progress is perceived as a positive phenomenon that offers opportunities. Increased awareness and understanding of the developments are key here. Unwarranted fears and misconceptions will dissipate as awareness increases. With technology seen to exert an increasingly visible effect in all sectors of life, keeping up is vital to life management skills and faith in the future. Finland is now emphasising media literacy and cybersecurity skills as basic civic skills, yet we need to augment this skill set with a further addition: the ability to understand technological development and its impacts on society, learning, work, the economy and life. It is essential for people to be given the opportunity and the awareness to keep up with technology. There is a strong correlation between education, security and trust, which is why particular attention must be paid to reinforcing education in technology while, at the same time, keeping in mind that the business of the future, for example, may not necessarily focus on production, but rather on increasing human happiness and wellbeing.

Secondly, besides traditional measures and approaches, technological advancements also require a wholly new and innovative approach to the maintenance and reinforcement of security. At the same time, rapid technological, social and cultural change is challenging the Finnish trust based on shared values and predictability.

### 6.1.1 Digital security as threat and competitive advantage

Each year, just before its meeting in Davos, the World Economic Forum publishes its Global Risks Report assessing the key risks and threats to the world in the current year. This report makes for interesting and useful reading also from a Finnish security perspective.

What threats does the WEF assess the world to face in 2019? There are several, but two are likely to feature in the top five of the listing: environmental threats and cyber threats. Extreme weather events (such as floods and storms), failure to combat climate change and major natural disasters are assessed to be the most likely threats. It is interesting to note how threats relating to natural phenomena in particular are highlighted in the 2019 Report when compared to earlier years.

Wide-ranging cyberattacks and major data theft and fraud are also assessed to be more likely threats in the world of 2019. We are living amid a data explosion and both societies and businesses rely to an ever-deepening extent on information systems and telecommunications. It is therefore only natural that cyber threats rise in significance, as the digital operating environment is becoming a playing field for increasingly active and aggressive state and criminal activity. The WEF Report emphasises in particular the technological vulnerability of critical infrastructure as a rising national security concern. The observation is well warranted, with regard to Finland as well.

Another point of interest in the WEF Report is its strong emphasis on social stability, i.e. the notion that the stability of society, or the deterioration thereof, is at the heart of numerous threats. The same logic is reflected in hybrid influencing that seeks specifically to undermine stability and trust in society.

The threats ranked highest in the WEF Global Risks Report 2019 may be estimated to remain fairly similar in the 2020s as well. With the march of digitalisation, the emphasis on cyber threats may become even more pronounced. Security should not be examined solely from the viewpoint of threats and risks, however. Moving forward, having and ensuring digital security will to an increasing extent be perceived as a competitive factor.

The Confederation of Finnish Industries EK and Aalto University conducted an extensive survey of enterprises on their views of Finland's security, its importance for business and the development of security. In the survey, the majority of enterprises felt that Finland was a safe place for their business, and as many as 95% of respondents considered Finland a good location from a security point of view. It was also positive to see how security issues were perceived as an important and essential issue in everyday business.

Large enterprises in particular feel that security confers competitive advantage on them. In the views of the enterprises, establishment in Finland provides a competitive edge expressly for the reason of security. In this analysis, enterprises are examining security as a component of the enterprise's reputation and brand in particular. Security was perceived to enhance trust in the enterprise's business and was estimated to be beneficial both on the market and in recruiting. Enterprises also widely felt that the security of Finland and Finnish enterprises should be more widely communicated to the world in order to attract international investment. In other words, Finland should engage in active security communications to gain more competitive advantage. We should have the courage to speak openly about security and we should make use of its potential.

From the viewpoint of business competitiveness and Finnish society, trust is likely to become a crucial issue in the 2020s. The question the world is asking already today, to an increasing extent, is who and what to trust when it comes to technology and related security. To such

questions, it is nice to be able to reply, "Well, I'm from Finland." **Finland is a country with strong international trust capital that we should be able to make better use of.**

## 6.1.2 What is trust all about?

### 6.1.2.1 Young people and trust

Children are the future, people say, and with good reason. Because of this, we need to understand the significance of the digital world and security to young people, a topic a professor colleague and I examined in an extensive youth survey.

Young people feel that much is well with Finland's security at present. The strongest foundation for security raised by young people was trust, which they rated to stand in good stead. Among young people, trust is perceived as a kind of glue for Finnish society, and as a rule young people have trust both in society working and in other people. The unity of both Finnish society and Finnish people are issues which young people believe should be taken care of. From the security perspective, young people perceive Finland as a society of trust, which is something they appreciate and believe should be maintained. **Retaining trust in the functioning of the Finnish society as well as in other people and the fundamental structures of the welfare society was, in the views of the young people surveyed, the most important security consideration.**

Young people had surprisingly little to say about the digital world and its security in the survey, and for a simple reason. For them the internet and e.g. digital channels and services of various kinds are such a matter of course in everyday life that they merit no special emphasis alongside the physical world. For young people, it is about 'one security whole' where the digital world is both an inseparable and very essential part of security and the perception of security. We of the older generations, perhaps to too great an extent, tend to differentiate between the physical and the digital when we think about security, when in reality both are equally present in Finnish security.

Discussion about technology is also discussion about the future of Finland and the Finnish people. With advances in technology impacting just about every industry and approach familiar to us, it is important to include young people in the discussion about the direction of technology and the future. Young people have a desire to participate and make a difference in order to strengthen their sense of security, and we must be able to offer them such opportunities. **In terms of security, young people should be activated to take part in deliberations about the future.** The future should not be made on the terms of technology but on human terms. When humankind as a species and humanity are evolving with developments in e.g. AI and robotics, everyone must have the opportunity – perhaps even an obligation – to contribute to deliberations on the future. The solutions

and impacts of e.g. advances in AI and robotics in the coming decades alone may well define the future of all of humankind. Young people in Finland included.

This discussion is also one about values. The values central both to society and to the individual influence the kinds of technologies that are being developed. The stronger trust that young people are calling for as a foundation for security is based on strong values – in technological development as well. The values defined by people are at the heart of reflections and solutions in the security and technology of the future. These values largely determine the direction of technology development and the associated security.

Technology allows us to increasingly better include young people in our shared security efforts. Solutions can be put in place to engage young people and to bring the activities of the security authorities closer to everyone in Finland. The authorities must also be present in places where young people to an increasing extent congregate, the internet for example. Including young people in security efforts may allow us to discover new kinds of technology-enabled positive solutions to security enhancement. As technology and digitalisation advance, security efforts of the future and in particular the tools for influencing sense of security among the Finnish people may differ quite markedly from those of today. Developments in technology also call for traditional measures and thinking to be joined by a completely new and innovative approach to strengthening the sense of security among young people. The authorities must be able to make use of new technologies and actively keep abreast of new developments.

#### **6.1.2.2 Trust in the authorities in the age of hybrid threats**

If you were attempting to undermine the stability and social order of Finnish society – which is the aim of hybrid influencing – by means falling short of war, what action would you take? This is the question that we need to ponder more and more frequently, and also with a more open mind. Understanding the means of influence is the first step in preparing for these threats.

There is more than one answer to the question. Influence in elections, a core element of democracy, is one form of hybrid influencing, and concerns over election influence are justly a focus of attention in the West today. The many forms of cyber influence and information operations are of particular concern with regard to election influence. A second answer would be data manipulation, the risk of which is assessed to rise. It would be extremely unfortunate if, for example, we could not trust our health data recorded in digital format. And the tools of influence need not even be that radical now that we are moving towards a society where everything can be accomplished with maximum ease and smoothness. In this setting, 'technical malfunctions' in e.g. the login services widely used in Finland, online banking services or the information systems in the power grid or

healthcare could have wide-ranging effects on the functioning of society and on people's sense of security. Especially if the perpetrator of such acts went for a domino effect. Hybrid threats are true to their name: they are hybrids of means of influence applied simultaneously.

An element that is central to the functioning and security of our society is often overlooked when assessing hybrid threats – our very strong trust in the security authorities. Internationally speaking, it is highly exceptional for over 90% of the population to trust e.g. the police, defence forces and rescue authorities. Despite the revelations of occasional official misconduct – and a good thing that such occurrences do come to light – the ensuing proper investigation has helped shore up public trust. Trust in the authorities is a long-running tradition among people in Finland irrespective of their background, gender or wealth. While this is an important strength to us, it is a trait that we must purposefully nurture. The trust perceived must be earned over and over again, every single day. The intentional undermining of trust in the security authorities may be a key target for hybrid influencing.

In the Finnish mindset, the security authorities are integrally linked to security and social stability. Studies indicate the wider trust held by Finns in the functioning of the rule of law and in the state's fairness and pursuit of justice. This trust is an invaluable asset in Finland's security. Its true significance will likely only be understood when – or if – it is gone. People seldom think about trust or security when they have them, but if a powerful deterioration in these were to take place, this could have dramatic consequences.

What if we could not trust our security authorities or our legal system? If our emergency number 112 stopped taking calls, or a long-running skein of corruption came to light in our legal system? If the police consistently afforded people in Finland different treatment depending on their gender, colour of skin or wealth? Or if it were to be revealed that our politicians had widely manipulated election results to suit their own agendas? How about if we could no longer trust that our funds were safe and secure in the world of ones and zeros, or if our health data was being used improperly? The most unfortunate situation would arise if more than one of the cornerstones of our trust in society were to crumble – or were made to crumble – at the same time. If the Finnish people were to lose their trust in the authorities and the rule of law, the consequences of such a loss on the security of Finland and the Finnish people would be dire. It is precisely this outcome that a malicious operator might seek to achieve, both through concrete action and powerful psychological operations. In other words, intentionally and through multiple means to undermine the stability of our society, the impartiality of the authorities and their actions, and our internal cohesion. To undermine trust.

The intentional undermining of trust – or a severe deterioration of trust in our society without any external influence agent – is one of the most serious security threats faced by Finland.

### 6.1.2.3 We must be worthy of trust

The simplest questions are often the hardest to answer. Trust falls squarely into this category. Trust and trustworthiness are words that roll easily off the tongue, but what do they actually mean? How can trust be measured? We must take a moment to reflect on the meaning and substance of trust.

Trust can be seen as an invisible glue that is omnipresent in our everyday lives and society in Finland. Trust is present in the family, workplace, society and politics, and it is always capable of use and abuse. We have learned and continue to learn to trust or to mistrust. Of course, this is not about black-and-white thinking, the extremes of trust or mistrust, because the degrees of trust in other people, for example, may vary. In any case, regardless of whether we are aware of it, trust is always present but in differing degrees.

But what if trust were absent? If we could not trust a single person, a single service, a single piece of information? A seemingly impossible situation. Human life would hardly exist without trust.

Although trust has been defined in many ways in the world of academia, when talking about security we must be able to address the concept in as down-to-earth terms as possible. The word may start to ring hollow when bandied about repeatedly. **Trust can be taken as the ability and the will to work together. In other words, trust consists of both thought and deed, but also tolerance of uncertainty and a striving for good.**

Trust is about the desire and the will to act in a way that does not disappoint or fail. We must understand that trust and trustworthiness are a matter of decision. We can each decide to act and think in a way that engenders and reinforces trust. Trust is often based on experiences and perceptions of others, which means that it is something to which we can all contribute. It is about taking care of others, of leaving no one behind.

Correspondingly, an enterprise can decide to have safety as a built-in feature in its products and services. This signals a knowing desire to retain the user's trust. It is precisely for this reason that economics tends to examine trust as a rational choice, and the significance of this choice extends to the wider creation of trust. The shortest path to trust is to be trustworthy and worthy of trust. Personal actions have a huge multiplier effect in reinforcing trust. If we so decide.



Trust is about a conscious striving for good. Emotion is a powerful component of trust, as is experience-based knowledge. Emotions and earlier experiences give people assurances that someone can be trusted, or that someone or something will not fail them or intentionally let them down. 'Good intentions', i.e. a sincere desire to do and think good, are an inseparable part of trust. Trust multiplies through sharing, when a person who has been trusted and empowered by that trust pays that trust onward. Trust, and you will be trusted. This brings about a virtuous circle of trust.

Building trust is a worthwhile investment, because trust adds depth and power to collaboration. People who share trust will want to work together and trust is reinforced by shared positive experiences. Even the most demanding joint efforts, as history proves. Trust multiplies through sharing, which is why trust also can never be outsourced. Everyone needs to contribute to its creation. Trust may be viewed as an infinite natural resource that brings about goodness and happiness in life.

Trust is not only about the predictability of the world and other people. **Trust must be understood as not only the desire but also the ability to set out into an uncertain future.** The pace of change in circumstances, the unpredictable instability and the increasing complexity and interdependency of matters that impact on security are likely to continue to characterise Finland's internal and external security environment. Amidst all this uncertainty, the practical significance of trust is only underscored.

What is the ability of the Finnish people and of Finnish society to ensure trust? Expressly their ability. According to a study on the status of civil security in Finland, an emphatic component of security is trust in one's own ability and the ability of one's community and of society at large to protect against various threats and to restore the level of security after crisis events. What is at issue here is accepting uncertainty and acknowledging that our trust will be sorely tested. From the security perspective, maintaining trust strongly manifests as resilience, the mental and functional capacities of people and society to face up to highly unpredictable situations while at the same time ensuring that trust and the ability to function are maintained. The trust felt by people is built on our advance knowledge of how to respond to such exceptional and emergency situations, both personally and as a society. We trust that the individual and society will cope, and that we will have the wisdom and the capabilities to do so.

In his book *Oppi luottamuksesta* [The Doctrine of Trust], Risto Saarinen writes about 'informed trust'. When internationality and the global playing field made available to us through e.g. the internet become a natural part of our everyday lives, this spotlights our ability to encounter both the familiar and the unfamiliar with an open mind. This, too, is a component in modern trust. An informed person does not take on unnecessary concerns and instead is possessed of reasonable fundamental trust and self-confidence towards

what is new. The capacity for empathy and openness also come into play here. Informed trust may be estimated to increase in significance in the coming years.

Two further material aspects need to be considered when maintaining and reinforcing trust. Firstly, the perception of each individual in Finland regarding the functioning and security of society will only become more highlighted as we move ahead. Their perception, expressly. Emotions and perception only grow in importance when we live in an information society. At times, our perception of reality may differ quite radically from what reality (how things really are) might suggest. Tireless, multi-channel communications based on genuine information will become an increasingly important cornerstone of the trust society in the future.

Secondly, even though trust manifests as emotion and experience-based knowledge, the old adage of actions speaking louder than words is integrally linked to trust-building. Trust – and security – take work, and this needs to reflect in the form of action. Politically proclaiming the objective that "Finland will be the safest country in the world for living, working and entrepreneurship" is laudable and ambitious, yet at the same time the objective must translate into visible significant investment and action to enhance security.

The security authorities naturally abide by the decisions taken by our elected leaders, but if the authorities are denied sufficient resources to carry out their duties, the pursuit of ambitious security objectives even in the political arena makes little sense. Correspondingly, false expectations arising from unrealistic service promises may also compromise trust.

At the same time, we must be aware of how very difficult it is to regain a lost sense of security and a forfeited societal climate. The many demonstrations seen in Finland in recent times have shown that Finland is creeping towards a climate of social disruption where people are ready to turn their hate speech into action and bring violence to our streets and squares. Such action and the underlying reasons should be dealt with so that the situation does not spiral out of control. Once it does, control is difficult if not impossible to regain, as remarked by National Police Commissioner Seppo Kolehmainen.

Recent studies give cause to ponder what might be the central issue relating to digital security, or security in general. Instead of seeking out means to enhance security, we should be asking ourselves how we could enhance trust. Security, both today and in the future, is about trust, maintaining trust and reinforcing it. Security and trust go hand in glove. Trust is a powerful value for both communities and business.

Digital security/cybersecurity education at Aalto University today uses the framework depicted in Figure 20 below to respond to threats and opportunities arising in the modern

security environment. It is worthy of note that the word at the centre of the framework is not 'security' but 'trust'.



Figure 20. Trust at the centre of activities.

### 6.1.3 Comprehensive security through cooperation as Finland's strength

We live in a security environment characterised by rapid change, unpredictable instability and complexity. This 'new normal' will continue to prevail. At the same time, we are more dependent on – and more vulnerable to – the functioning of the digital environment than ever before, both its reliability and its security. In this respect, the future would appear to be written. The digital environment is set to become more and more dominant and strategic in all aspects of society and security in Finland.

Digital security may be seen as the poster child for the need for overall security. It touches everyone, and the various actors in it must be intimately included in cooperation. **The cooperation model for comprehensive security is a major strength for Finland.** It is therefore no wonder that in recent years, the importance of the 'whole of nation' and 'whole of government' principle has been underscored in many Western countries in relation to preparedness against modern cyber threats and hybrid threats. They are

adopting the Finnish model of comprehensive security, with each country putting its own twist on it. The Finnish model is nonetheless garnering prominent international attention to an increasing extent.

Our society is subject to increasingly complex threats against which we must be able to prepare more effectively than ever. Hybrid threats, information operations and cyberattacks have become more and more impactful. They are now a part of the nature of the beast we call the cyber domain. An insecure information society permits social exclusion, extremism and violence to abound, which decreases internal security, and this in turn reduces society's ability to function and its crisis resilience.

Various states to an increasing degree of activeness are using the cyber domain to further political agendas, and cyber operations of various kinds are rising to the forefront in assessment of hybrid threats. Non-governmental actors, such as cybercriminals, are also constantly honing their craft. Cyberattacks and cyber action by states already have an impact on political relations and power structures the world over. International research today indeed emphasises 'cyber-politics' and the primacy of the cyber domain as a political playing field in particular. One of the sectors of Finnish cybersecurity where further effort is required is our political and strategic analysis capabilities to allow us better to assess both current and future trends within 'the big picture'.

Cyber threats should be viewed as a component of hybrid influencing. What is essential to understand is that in the world of today – and that of the near future as well – the global superpowers in particular will attempt intentionally to blur the line between war and peace. This demonstrates an awareness of the target state's legislation built largely around dichotomies (such as war-peace or digital-physical). In the future, influence will gain new elements in the cyber domain in particular, the aim being not to cross the boundary into war. By maintaining intentional instability through non-kinetic operations, a superpower in particular may justify its presence and influence in a given region. The justification for the actions is declared to be peacekeeping, keeping the balance, protecting one's own interests and those of citizens, or supporting allies – in fact, any seemingly acceptable activity. The digital environment has provided a new arena for exerting influence in the territory of another state by using military and non-military leverage of various kinds to achieve political and military objectives.

Owing to their complexity, preparing for hybrid and cyber threats encompasses wide terrain and requires a holistic and interdisciplinary approach in both theory and practice. Looking to the future, we should raise five central preparedness principles that must be strengthened in Finland if we are to retain our standing as the poster child for combating hybrid threats.

With the tools of hybrid and cyber influence undergoing constant evolution and innovation, defence against them must adopt the same tactics. **This underscores the requirement of proactiveness.** What tools will be next deployed, and what will the motivation for this be? If we cannot see the 'next wave' of influencing with sufficient clarity, we lag one step behind in preparedness. We are fortunate in Finland to possess solid know-how and research capabilities for such proactive thinking and also the resilience to deal with the tools of influence that may catch us unawares. As threats – and the whole of the world – grow more and more complex, we may presume that the likelihood of unforeseen events and circumstances will rise.

In practical terms, the changing security environment and the blurring of dichotomies will force the 'different securities' and the different security actors into closer and closer cooperation. This cannot be avoided, and neither can international cooperation. The future of the security environment and of threats is forcing us in Finland to let go of dichotomies to an increasing extent. **The importance of comprehension beyond the traditional dividing lines of security is heightened in the present** and it is one of vital foundations for understanding the threats of the future.

Responding to threats calls for **strong and centralised capabilities in observation–situational picture–leadership.** Enhancement of situational picture and situational understanding as well as analysis capabilities is crucial to safeguarding the security of Finland and her people in an increasingly complex world of threats. Strategic security management calls for situational understanding, clearly drawn leadership roles and responsibilities, and seamless flows and sharing of information.

**Legislation must in all respects support the process of national preparedness and resilience enhancement.** Finnish society must be prepared for a multitude of hybrid and cyber threats that may have severe repercussions on the functioning of society. From the security perspective, legislation becomes a key issue that should be able to keep up with the developments in technology and the cyber domain.

However, security should not be perceived solely as threats and preparedness. Going ahead, security will, to an increasing extent, constitute a competitive advantage factor both for societies and enterprises – in other words, something positive and an enabler of e.g. reliable technology. Therefore, when preparing for threats, it is important to bear in mind that at the same time we are also both creating a growing competitive advantage for Finnish society and enterprises as well as enterprises established in Finland, and reinforcing our national trust-based climate. Security and trust go hand in glove. Communications should also cater to this as, in future, security will become increasingly reliant on communicational elements. Both for Finland and her people, security manifests both as a strong value and a fundamental pillar of society. As it should be, now and going

ahead. In the words of President Kyösti Kallio, "I hope from the bottom of my heart that the solidarity that has held us together through our trials will only grow stronger, because the prosperity and future of our people depend on it." **Reinforcing a national sense of togetherness and trust are thus essential considerations to the future security of Finland and her people – against a myriad of increasingly complex threats.**

#### 6.1.4 Education and resilience in Finland

One thing is for certain: the provision and pursuit of education pay off. The words of J.V. Snellman, "Education is security for a small nation," will resonate even more intensely in the future. An educated population is the security and success factor of future Finland. It is essential for us to keep up with the pace of technological advancement. Far from discouraging technology, we should embrace it in an open-minded pursuit of new solutions to reinforcing security for the society and people of Finland and for maintaining trust.

There is one highly vital consideration that runs through all of the development, futures and security marked by technology, and this consideration is resilience. Both Finnish society and the Finnish way of life already depend on technology and the functioning of the digital environment, and this dependency will only grow stronger in the future. We have become accustomed to the constant availability of things, services and e.g. information in the digital environment. But what will we do when the digital environment and all of its amenities go on the blink? When we no longer have power or internet access? In the future, security will involve increasingly likely unforeseeable incidents. Things will happen that neither we as a society nor as individuals are capable of fully anticipating. There is only one thing we can say for certain about the future: it will surprise us. The future – and technology – have many surprises in store for us. From the security perspective, this underscores the importance of resilience.

In security attitude education, resilience will play an important role in the future. There are two sides to resilience. One is functional, i.e. our ability to act when things do not go as expected. What tangible preparedness measures have we taken e.g. to survive a 48-hour power outage that puts the lights out, stops us from flushing the toilet and starts to chill our electrically heated homes? Despite technology and digitalisation being increasingly central to our lives in the future, it is also important to prepare for situations where technology fails or the digital environment becomes unavailable. Absolute security cannot be provided in technology and digitalisation, and therefore people must be educated on how to act when they no longer have access to technology and the digital world. Such eventualities must be considered in advance and appropriate preparations must be made.

Alongside the physical aspect of resilience there is also the mental aspect, which is perhaps even more important. Mental resilience. Understanding that there is the

possibility of things not working helps us to put advance thought into the situations in which we may find ourselves when technology or the digital society fails. Human mental endurance in the digitally dependent and information-intensive world will be subjected to only harder trials in the future, and because of this as well, the importance of the humanities in developing mental resilience and perseverance must be catered for in education. Technology-dependent people living in a digital world must – from the security perspective – possess strong mental capacity to cope with situations that may markedly differ from their daily lives, situations where technology suddenly becomes unavailable.

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## 6.2 Digital security fosters the development of activities and the retention of trust

*Kimmo Rousku, Population Register Centre*

### 6.2.1 What is digital security all about?

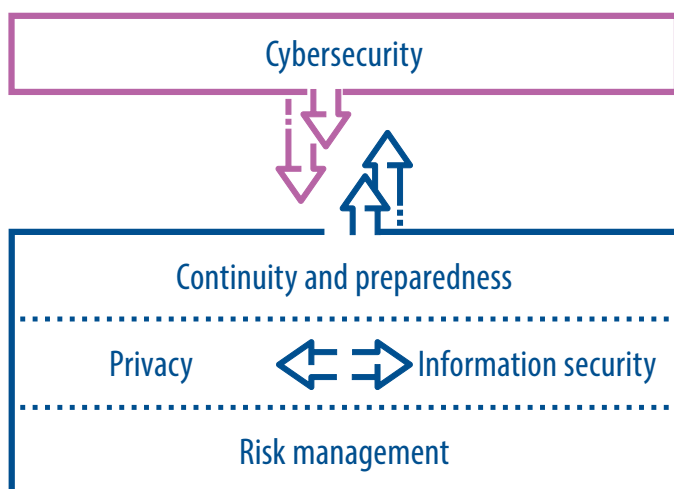
The Government Information Security Management Board (VAHTI) set up by the Ministry of Finance serves as a cooperative, preparatory and coordinative body for organisations responsible for developing and steering digital security in public administration. The Ministry of Finance has assigned to the Population Register Centre responsibility for the operational activities of VAHTI and for implementation of the Development Programme for Digital Security in Public Administration<sup>13</sup> in the years 2018–2021 (JUDO project<sup>14</sup>).

In this duty, the development of security in public administration (in organisations) is viewed as part of the digital security framework consisting of the following sectors:

1. Risk management
2. Continuity and preparedness
3. Information security
4. Cybersecurity
5. Data protection

<sup>13</sup> <http://julkaisut.valtioneuvosto.fi/handle/10024/161218>

<sup>14</sup> <http://www.vrk.fi/judo>



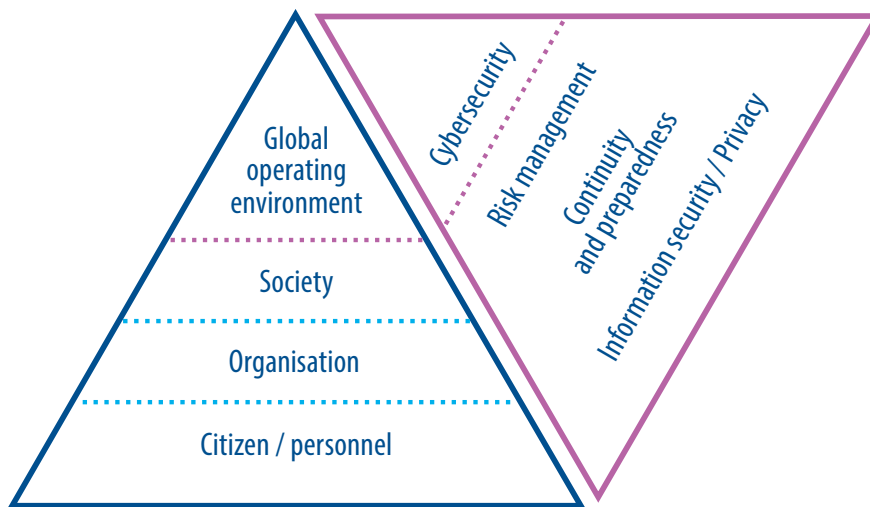
**Figure 21.** Digital security framework for government organisations; continuity and preparedness, information security, risk management and privacy are also components that enable cybersecurity. All of this furthermore requires a new kind of centralised management of the whole.

These terms are difficult and to a certain extent impossible to assign precise definitions to because they may be examined from multiple viewpoints depending on e.g. what it is they are desired to protect. **Cybersecurity**, for example, is perceived as an important sector in safeguarding functions of society that are vital to the security of society, but operations against cybersecurity are also used as a tool for hybrid influencing that integrates various means of influence, including but not limited to political, economic, technological, humanitarian and military means. Correspondingly, the media easily tend to treat all digital environment incidents and breaches as being related to cybersecurity.

The accomplishment of cybersecurity with regard to the availability, integrity and – in the case of confidential information – confidentiality of information requires the accomplishment of their secrecy (**information security**). However, protecting the whole also requires proactive advance preparedness and, in the event of incidents or breaches, active measures in compliance with plans prepared in advance (**continuity and preparedness**). The information process may consist of personal data, in which case **data protection** must also be catered for. All of the foregoing should be based on a model that builds on the identification of threats, the assessment of risks, and the systematic **risk management** performed on the basis of the two. In the same context, especially when organisations aim to develop their own core activities or business, new **opportunities** relating to the development of activities must also be identified.

The above sectors can also be divided differently, into four distinct viewpoints: the global environment, society, organisation and citizen/personnel.





**Figure 22.** The components of digital security are also visible in the global operating environment where disruptions as well as opportunities are reflected in our society, organisations, personnel and citizens alike.

Cybersecurity thus manifests as the only sector among these having a clear and significant global impact. Cybersecurity has also evolved into an important cyber-political concept. The implementation of cybersecurity at the national level requires the implementation of the other sectors of digital security as well at the level of society, but above all at the levels of organisation, personnel and citizens. Even today, there are organisations and individuals who believe cybersecurity to be something that is no concern of theirs. As our operating environment, made up of myriad and partly unknown interdependencies, grows increasingly networked and complex, the efforts of every one of us are needed to safeguard the whole.

A fundamental requirement for the activities and service provision of public administration is the retention of trust in everything that public administration does. As the operating environment goes more and more digital, an increasingly all-encompassing model to implement the security needed to maintain that trust is required. Consequently, the security of public administration organisations is now being developed by using the digital security development model depicted in the Figure above. At the same time, this is a requirement to and enabler of us being able in the coming decade as well to ensure the reliable and secure operation of the services we provide, which is a condition also to retaining the **trust** that occupies such a central role in this report.

## 6.2.2 Human-centric digital security – digitally secure life – a new approach

It is often said that, 'the weakest link in information security | data protection| pick one| is you'. To a certain extent, this is true: studies have shown that many digital security incidents and breaches come about as a result of user action. Usually undertaken in a hurry.

In practice, our biggest problem is not digital security issues but rather malfunctions of various kinds in ICT systems. Development of digital security allows us better to prepare also for such malfunctions, however, and to address the effects and duration of the malfunction by taking appropriate action.

How can we influence our own actions in the digital operating environment? The Population Register Centre is preparing a digital security learning environment in public administration that will include novel methods for providing education and enhancement in awareness and expertise. The education centres on the individual who acts in a variety of roles in society. By enhancing the expertise of everyone we are better empowering people to promote the integration of digital security into the cultures of organisations and into personal attitudes, at work and at leisure.

The starting point for it all is a **digitally secure life** that is divided into different sub-sectors, for example childhood and youth, basic and higher education, employment and senior citizenship.

How is digital security present at these stages of life? In practice, nearly all five sectors of digital security can be connected to these life stages.

A section on the **digitally secure working life** for public administration employees will be created first in the new learning environment:

- working in the workplace / distance working / commuting, and
- activities at leisure



**Figure 23.** We must cater for the various sectors of digital security at work, in the workplace, remotely at home or when commuting, for example, and also in our free time. Identify the threats and assess the risks that may be taken. (Photos: Kimmo Rousku)

Whether in the workplace, commuting, distance working or at leisure, we should all consider how to bring about the five sectors of digital security. Each of us should have a built-in model for identifying threats and acting in instances involving risk. Every day, we make numerous **risk management decisions** both at home and at work, but are we even aware of them, and do we communicate them to anyone, in the workplace for example? Do you know what to do if you receive a suspicious email? Will you go and click on an attachment or link that may be suspect but seems interesting? If you see someone in the lobby of your offices without any name tag or other identification, will you stop them to ask their business? Or will you notify maintenance if you notice that the front door to your workplace fails to lock?

Personnel are instructed in **information secure working methods** both in the workplace and in distance working when it comes to e.g. email, browsing or credentials management. Likewise, most of us have been given guidance as to inappropriate work topics to discuss on public social media or in public. Are these not ideas that we should apply in our free time as well?

In reality, we all process **personal data** to some extent, at the very least our own data in e.g. healthcare or at work, when dealing with payroll information or tracking time worked. In public administration in particular, depending on sector of course, many people also process the personal data of others. This behoves them to comply with the instructions concerning the processing of personal data as part of the realisation of **data protection**. And we all certainly wish that the personal data we ourselves have disclosed in the course of our leisure pursuits is handled in accordance with equivalent obligations.

Some of us also have additional digital security roles in the workplace in e.g. **continuity management and preparedness** development, while we all have personal responsibility for continuity and preparedness in our own homes and our own time. Have you ever stopped to consider how you would cope at home and in your own time if your water supply, power supply or internet access went out? This sector, too, extends into our leisure hours and falls under the umbrella of the home emergency supply kit (<http://www.spek.fi/Suomeksi/Turvatietaa/Onnettomuudet-ja-hairioutilanteet/Kotivara>).

In the digital operating environment, we are constantly receiving and sharing information in its various forms at an ever accelerating pace. Have you paid any attention to how people might be trying to influence your ideas, attitudes and decisions, sometimes by entirely new means? This is an element of information operations, which to a certain extent are linked to **cybersecurity** via hybrid threats. An excellent social media example is sharing a news item, article or link simply on the basis of its heading, without even reading the full message. These days, without reading the full message there is no way to be sure that the contents match the heading and thus the opinion and position that you espouse. Accordingly, **media literacy** is an increasingly important skill. It is likewise important to acknowledge that attempts to influence us by increasingly sophisticated means are a given in the digital environment. Just as cybercriminals try to pry from us data in order to gain financial or other advantage, information operations pursue the same aim to a certain extent but accomplish this by directly manipulating our behaviour and ideas.

Digital security is omnipresent in our daily lives, at work, home and school, in our free time and at all points of our lives. The responsibility for digital security resides in us all as individuals and as members of organisations and society. Digital security is what allows us to maintain and build on a powerful central theme of this report: **trust**. The importance of retaining trust will only be further underscored in the 2020s and we all have important parts to play in this effort, in our work and leisure alike.



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